

the HP diet (HP+VZ=32.4% vs. HP=31.5%, P=.001). Flock uniformity was improved when comparing respective diets with and without VZ. In conclusion, feeding diets containing 95%-105% industry average CP levels plus VZ improved broiler performance as denoted by increased BW and aFCR at lower CP and breast meat yield at higher CP. Benefits of VZ were optimized in low CP diets which indicate improved protein availability and a potential for feed cost savings.

Key Words: Versazyme™, Broiler performance, Enzyme, Protein, Breast meat

S134 Enzyme-based protein digestibility (IDEA™ kit accurately predicts poultry *in vivo* amino acid digestibility for fishmeal. C. Schasteen¹, J. Wu*¹, M. Schulz¹, C. Parsons², ¹Novus International, Inc., ²Department of Animal Sciences, University of Illinois.

IDEA™ is a patented enzyme-based assay designed for rapid determination of amino acid digestibility of poultry feed ingredients including soybean meal, meat and bone meal, poultry byproduct meal, and feather meal. The objective

of this study was to evaluate the applicability of IDEA™ technology to predict digestibility of fishmeal produced for animal feed. An autoclave experiment was conducted to assess the effect of processing (heat and moisture) on amino acid digestibility of fishmeal. Increasing autoclaving times from 0 to 120 min at 120°C, 16 psi of a commercial Menhaden meal (n=4) resulted in decreases in true lysine digestibility determined in the precision-fed cecectomized rooster assay (Fernandez & Parsons, 1994). IDEA analysis of these samples indicated a strong correlation of IDEA values with the true lysine digestibility determined in roosters (r² of 0.97). Next we evaluated 9 US commercial fishmeal products collected from the field. True amino acid digestibilities were varied over a wide range, particularly for Lys (66.5% to 94.8%) and Cys (37.4% to 87.2%). IDEA analysis of these samples yielded results correlated well with those of the rooster assay (r² of 0.69 and 0.75, respectively). Results of this study suggested that variations in amino acid digestibility existed among US commercial fishmeal products. IDEA™ provided a good prediction of *in vivo* poultry digestibility of fishmeal. Extension of IDEA™ testing with fishmeal from other world areas is underway.

Key Words: IDEA, *In vitro* assay, Fishmeal, Amino acid digestibility, Poultry

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S135 Withdrawn.

S136 Molecular characterization of avian influenza viruses isolated in Texas. B. Lupiani¹, P. Suchodolski¹, K. Turbyfill¹, J. El-Attrache*¹, J. Linares², C. Cardona³, S. Reddy¹, ¹Texas A&M University, ²Texas Veterinary Medical Diagnostic Laboratory, ³University of California Davis.

Avian influenza (AI) virus represents an important threat for the poultry industry and human health. Wild birds are reservoirs of AI viruses and an important source of virus infection that affect commercial poultry. In Texas, different subtypes of AI, including a highly pathogenic virus, have been isolated. However, there has not been a comprehensive phylogenetic characterization of these isolates. In the present study we report the phylogenetic analysis of AI viruses, from different subtypes, isolated in Texas from 1979 to 2002.

Key Words: Avian influenza, Phylogenetic analysis

S137 Evaluation of a defined competitive exclusion product upon *Salmonella enterica* serovar *enteritidis*. horizontal transmission in Leghorn chickens. M. A. Juarez-Estrada*, J. A. Molina-Hernandez, Department of Animal Production: Poultry, FMVZ-UNAM.

This experiment was carried out in order to evaluate a defined competitive exclusion product (DCE). First at all, 240 male Leghorn chickens were divided in three groups of 20 birds each one with four replicates by group, they were placed at floor pens with wood shaving litter. The groups were identified as follow A) At first day chickens received PBS, after that at 3 days old, they were challenged *per os* with 1x 10⁸ CFU of *Salmonella enterica* serovar *enteritidis* (SE PT13^A)/bird. B) At 1 and 3 days old these chickens received PBS. C) Chickens received DCE at first day old, they received PBS at three days old too. Two replicates from each group were euthanized at 13 and two replicates at 15 days of age. SE PT13^A was recovered from liver-spleen (LS) and cecal tonsils (CT). At 13 days of age group C showed up the lowest SE PT13^A isolates (7.5%)^c (p<0.05) from LS than B (27.5%)^b and A (75.0%)^a groups. SE PT13^A isolates from CT into the group B (57.5%)^a apparently was lower (p<0.05) than group A (100%)^a but it was higher than group C (25%)^b. At 15 days of age SE PT13^A isolates from LS for the B (10.0%)^b and C (12.5%)^b groups were lower

(P<0.05) than group A (57.5%)^a. SE PT13^A isolates from CT into group B (27.5%)^b and group C (42.5%)^b were lower than the group A (87.5%)^a. DCE reduce horizontal transmission and diminish SE PT13^A from LS and CT into the chickens that they received DCE at first day of age, but into negative control chickens without DCE, SE PT13^A isolates were diminished too. In fact, this percent reduction into group B was clearly showed up at 15 days of age, possibly the group B were receiving DCE from group C by horizontal way. The defined competitive exclusion products are a good option upon SE control at chicken growing up in Layer Farms.

Key Words: Probiotics, Salmonella control, Breeder Leghorn Hens, Salmonella infection, Layer hens

S138 Fowl cholera vaccination in laying hens: local and systemic humoral immune response. R. Merino*, L. Avina, Departamento de Produccion Animal: aves, FMVZ, UNAM, Mexico.

Fowl cholera is an infectious disease that affects the egg production; vaccination is useful in order to reduce this effect. However, to measure the local immune response is not common. The aim of this study was to use an ELISA test to detect both IgA and IgG in vaccinated laying hens. A commercial flock of laying hens was vaccinated against *Pasteurella multocida* at 4, 10 and 17-wk of age. Serum samples and Harderian gland (HG) extract were taken at different ages in the period between the first vaccination and the laying peak. The humoral immune response was evaluated 12 times for IgG (serum samples) and 8 times for IgA (Harderian gland) using the same ELISA test (Synbiotics Co.). The manufacturer's directions were used to test the serum samples; for IgA detection in the HG samples, the same ELISA plate was used, but one anti chicken IgA - HRPO conjugate and TMB as substrate were used. Prior vaccination all tested sera were negative for IgG and IgA. The ELISA titers were the following for IgG: For the 5, 9, 10, 11, 12, 13, 18, 19, 21, 22, 23, 25 wk of age the antibody titers were 2204, 1878, 2131, 1262, 1708, 2397, 3707, 2636, 1856, 2525, 1796 and 2175 respectively. The ELISA titers for IgA at 12, 13, 14, 18, 19, 21, 22, 23, 25 wk of age were 685, 106, 390, 3755, 1178, 1591, 2359, 548 and 566 respectively. The highest titers from both IgG (3707) and IgA (3755) were gotten at 18 wk of age, 1 week after the last vaccination. This study shows the relationship between IgG and IgA in laying hens immunized against *P. multocida*. A similar investigation on IgA antibodies against fowl

cholera in laying hens has not been found in the literature so far. Further studies are required in order to avoid the sacrifice of birds to obtain antibodies from the Harderian gland. It is suggested to test lacrimal fluid, saliva and tracheal fluid for IgA detection quantification

Key Words: *Pasteurella multocida*, Vaccination, Harderian gland, ELISA

S139 Recovery of *Clostridium perfringens* from poultry transport crates after different holding times and disinfectant regimens. B. A. McCrea*, K. S. Macklin, O. A. Oyarzabal, R. A. Norton, J. B. Hess, S. F. Bilgili, Auburn University.

Poultry transport crates can be a source of contamination with pathogenic bacteria. Research has been performed on cleaning and transmission with regard to *Salmonella* spp. and *Campylobacter jejuni*. *C. perfringens* is another important food borne pathogen that can also cause diseases such as necrotic enteritis and gangrenous dermatitis in poultry. Confining birds for extended periods has been associated with an increase in the rate of bacteria shedding. This study examined *C. perfringens* recovery after various cleaning and disinfection regimens as well as after an extended holding period prior to slaughter.

A total of 24 (3 replicates/cleaning regimen) plastic transport crates (35 in x 23.5 in) were utilized in this experiment. Six 43 day old broilers were placed in each crate and transported for one hour to simulate transport conditions. There were two holding time treatments; the AM treatment was processed 2 hours after transport while the PM treatment was held for 8 hours. Four cleaning and disinfection treatments, consisting of: power washing alone, power washing and sun-drying, power washing and (5% v/v) sodium hypochlorite dip, and power washing and quaternary ammonium dip were applied. All crates were swabbed before and after the application of treatments.

There was no difference ($p > 0.05$) in the recovery of *C. perfringens* from crates in the PM treatment ($0.5 \log_{10} \text{cfu/ml}$) versus the AM treatment ($0.7 \log_{10} \text{cfu/ml}$). The level of *C. perfringens* was $1.9 \log_{10} \text{cfu/ml}$ prior to the application of cleaning and disinfection treatments. All cleaning and disinfection treatments resulted in a significant ($p > 0.05$) reduction of *C. perfringens* ($< 0.4 \log_{10} \text{cfu/ml}$). Pressure washing alone was effective in reducing the *C. perfringens* load in transport crates.

Key Words: *C. perfringens*, Transport crate, Disinfection

S140 Chicken immunization against *Salmonella enteritidis* with periplasmic proteins and supernatant proteins of *Salmonella enteritidis* biovar Issatschenko. V. Uribe-Torres, G. Gomez-Verduzco, O. Urquiza-Bravo*, National University of Mexico (UNAM).

Poultry production is one of the most susceptible to economic losses by sanitary problems. One of these problems is represented by avian salmonellosis. It is a world-wide disease due to egg consumption and/or *Salmonella* contaminated chicken meat. Control programs include vaccination because they confer immunity and reduce *Salmonella* excretion in feces. There are experimental vaccines with some bacterial components like *S. gallinarum* outer membrane proteins (OMP), or enterotoxins related to OMP. It has been observed re-isolation reduction from feces in challenged birds or the ability reduce *S. enteritidis* linking to intestinal mucosa, suggesting the possibility of these proteins could be potential immunogens to reduce *Salmonella* colonization in birds. Due to mentioned before the objective of this work was: to evaluate the use of supernatant proteins (SP) and periplasmic proteins (PP) of *Salmonella enteritidis* biovar Issatschenko as immunogen for the control of *Salmonella enteritidis* infection in broiler chickens. Five micrograms of SP and PP were inoculated by oral route in one day old chickens. 15 days later were challenged with $10^6/\text{ml}$ chicken of *Salmonella enteritidis*. There was no signology, neither mortality, nor bacterial feces elimination during all the time of the study. No seroconversion was seen at 15 days postinoculation with *Salmonella enteritidis* biovar Issatschenko SP neither PP in challenged groups. There was no re-isolation of *Salmonella enteritidis* in challenged groups. These results do not reflect if *Salmonella enteritidis* biovar Issatschenko SP and PP could serve as immunogens for the control of *Salmonella enteritidis* infection in chickens, due to

Salmonella enteritidis behavior and also the use of the heterologous antigen in the agglutination rapid plate test.

Key Words: *Salmonella issatschenko*, *Salmonella danysz*, *Salmonella gallinarum*, *Salmonella enterotoxins*, *Salmonella enterotoxic activity*

S141 Infectious bursal disease virus full length sequence analysis. D. Petkov*, E. Linnemann¹, D. Kapczynski², H. Sellers¹, ¹Department of Avian Medicine, College of Veterinary Medicine, University of Georgia, ²Southeast Poultry Research Laboratory, USDA.

Full length sequence analysis of infectious bursal disease virus (IBDV) may help to identify regions involved in pathogenesis. Segments A and B of field isolate 9109, Lukert, Edgar cell-culture adapted (CCA), and Edgar chicken embryo-adapted (CEA) strains were sequenced. The amino acid sequences were aligned with previously published sequences followed by phylogenetic analysis using recently reported cleavage sites and RNA-dependent, RNA-polymerase (RdRp) motifs. Our analysis revealed the VP2 predicted conserved antigenic sites are located outside of the previously proposed major and minor hydrophilic peaks. In addition, no predicted antigenic sites were observed within the minor peaks. Extensive amino acid substitutions in the VP2 processing site were observed in Edgar CCA and CEA strains. Lukert, Edgar CCA and CEA have a substitution within the VP2 carboxyl domain which plays a role in VP2-VP2 and VP2-VP3 interactions. Determinants for tissue culture adaptation were conserved in Edgar CCA and Lukert. Amino acid determinants for US variants were observed in isolate 9109. Lukert and Edgar CCA and CEA strains have substitutions in VP3 self- and dsRNA-binding domains at position 31 and 238, respectively. Motif I within VP4 has substitutions in 9109 at 541 and 547, whereas, Lukert, Edgar CCA and CEA have 541. Segment B (VP1) has 881 amino acids in Lukert and Edgar CCA and 879 in 9109 and Edgar CEA strains. RdRp in Lukert have substitutions at 479 and 528 and 9109 has at 546. Edgar CEA substitution at 46 is part of the Ser-phosphorylation motif. Phylogenetic analysis of the polyprotein demonstrated that 9109 is closely related to variant E. The VP2 antigenic sites include only partially two of the previously suggested hydrophilic peaks. VP2 processing site may not be important for the tissue specificity. VP1 or RdRp demonstrated the same clustering pattern. The very virulent and classical strains (serotype I) formed two distinct clusters with serotype II strains more closely related to classical serotype I strains.

Key Words: IBDV, Sequence, Analysis

S142 Prediction of reovirus sigma C protein epitopes by bioinformatics. H. Wu*, Y. Williams¹, K.-S. Gunn¹, N. Singh², R. Locy², J. Giambrone², ¹Alabama State University, ²Auburn University.

Epitope-based vaccine prototypes can stimulate protective immune responses against viruses. Identification of protective epitopes by traditional methods such as phage display are time and labor intensive. Such methods rely upon activity of epitope regions through empirical means for identification. Bioinformatics enables researchers to apply predictive approaches to identify protective epitopes. Software programs predict epitopes by computer-driven pattern matching algorithms or analysis of conserved protein sequences for homology with known epitopes. Such database services are expensive and limited to mouse and human pathogens. We developed a protocol for epitope prediction for an avian virus. Avian reovirus (ARV) σ^C protein is the main immunogenic surface protein of ARV. We expressed recombinant σ^C protein in yeast and plants. Epitope predictions are based upon: (1) 2D and 3D structural analysis, (2) PROSITE glycosylation patterns, (3) protein sequence homology and alignments, and (4) hydrophobic index. Using this approach, we predicted 3 regions within the σ^C protein that harbor putative protective epitopes. Future studies will involve vaccination of birds with predicted epitope-bearing σ^C peptides, cell proliferative analysis, and protection against challenge.

Key Words: Reovirus, Sigma C, Epitopes, Bioinformatics

S143 Duration of scratches related to occurrence of inflammatory process in commercial broiler flocks. M. Alfonso^{*1}, B. Hewat², J. Barnes¹, ¹North Carolina State University, ²Tyson Foods, Inc.

Inflammatory process (IP), or cellulitis, is an important cause of economic loss in the broiler industry due to increased condemnations, downgrading at processing, and higher labor costs to process affected flocks. IP has been associated with the presence of scratches in live chickens. In this study, the gross changes in skin scratches detected in broilers before processing were evaluated and correlated with IP in the carcasses. A total of 90 fast-feathering male and female broilers reared in three commercial flocks were studied. In each flock, 10 birds showing fresh, naturally-occurring scratches 6 days before processing, 5 birds showing fresh scratches 3 days, 1 day, or <5 hours before processing, and control birds with no scratches were identified. Scratches were monitored in each bird on a daily basis. All birds were processed at the same time and carcasses were traced individually. After USDA inspection, 44% of carcasses with 6-day-old scratches, 31% of carcasses with 3-day-old scratches, and 18% of carcasses with 1-day-old scratches were hung on the salvage line and reprocessed for IP. Carcasses with scratches <5 hours and control birds without scratches passed inspection without requiring reprocessing. While the healing pattern of the scratches was similar among birds, development and severity of IP lesions were different. The characteristic subcutaneous caseous plaques in IP were not found in any of the carcasses in this study indicating that a period of time longer than 6 days is necessary for them to develop. IP causing carcasses to be reprocessed can occur when broilers get scratched within 1 day prior to slaughter. However, the incidence of IP increases with the age of the scratches up to 6 days before processing. Preventing scratches before processing is essential to achieve satisfactory carcass quality in broilers.

Key Words: Broilers, Inflammatory process, Cellulitis, Scratches

S144 Withdrawn.

S145 Withdrawn.

S146 Effect of monensin on the microbial ecology of the avian intestine. T. Liu^{*}, J. Lu, C. Hofacre, B. Harmon, M. Lee, *The University of Georgia.*

The intestinal microbiota is part of a complex ecosystem that is intimately involved in the development and maintenance of intestinal health. In order to study the effects of a common feed additive, monensin, on the composition of the avian intestinal bacterial community we used 16S ribosomal DNA community analysis to evaluate the development of the ileal community. Diets that were corn or wheat-based were found to produce similar ileal bacterial communities in chickens while monensin, an ionophore antimicrobial, produced a bacterial community rich in clostridia. None of the diets appeared to adversely affect the intestinal health of the birds.

Key Words: Monensin, Intestine, Microflora

S147 Humoral immune response (IgG and IgA) in broiler chickens vaccinated against Infectious Laryngotracheitis. C. Rosario, R. Merino^{*}, *Departamento de Produccion Animal: aves, FMVZ, UNAM, Mexico.*

Infectious Laryngotracheitis (ILT) has arisen recently in some areas in north Mexico. Some poultry companies have decided to vaccinate to control it, however some veterinarians in that area are low familiar with the measure of the immune response. The aim of this study was to establish the ELISA titer of IgG and IgA antibodies in chickens vaccinated against ILT. Two groups of 10 3-w-o commercial broiler chickens were vaccinated by either the ocular or the oral route, there was an unvaccinated group. At 5, 10 and 15 days post vaccination (PV), serum and tracheal swab (in 0.5 ml PBS) samples were taken and tested by ELISA (Synbiotics Co.). The ELISA test for IgG was carried out as established by the manufacturer, however, for IgA detection the tracheal swab was tested undiluted and one anti chicken IgA - HRPO conjugate and TMB as substrate were used. At vaccination day, samples from all groups were negative. In the ocular vaccine, the titers at 5, 10 and 15 days PV were 0, 1771 and

2625 for IgG, and 505, 1573 and 3208 for IgA. The oral vaccine results at 5, 10 and 15 days PV were 0, 1024 and 2739 for IgG, and 88, 1165 and 2285 for IgA. Control group was always negative. There was not statistical difference in titers between vaccination routes. IgA was detected as early as 5 days PV, meanwhile IgG was detected at 10 days PV and forward. Results show that tracheal swab samples can be used to detect local immune response against ILT. However, a further study carrying out the same test in laying hens and broiler breeders is needed in order to clarify the response of ILT vaccination in those birds.

Key Words: Infectious Laryngotracheitis, ELISA, IgG, IgA, Broilers

S148 Efficacy of recombinant subunit vaccines in protection of mice against challenge with *Pasteurella multocida*. H. K. Shieh^{*}, J. R. Wu, P. C. Chang, *Department of Veterinary Medicine, National Chung Hsing University.*

Fowl cholera, caused by *Pasteurella multocida*, remains one of the most important infectious diseases that lead economic losses in the poultry industry. The purpose of this study was to develop subunit vaccines for the control of fowl cholera. A total of 6 candidate vaccine antigens of *Pasteurella multocida* were expressed in *E. coli*. After purification, these recombinant antigens were used as vaccines to protect mice against challenge with *Pasteurella multocida*. The 6 vaccine antigens tested were: the Pasteurella filamentous hemagglutinin B1 and B2 (Pfh1 and Pfh2), the fibril-associated protein (Flp), the pertactin-like protein, and the Hsf-1 and Hsf-2 like proteins. Western blot analysis showed that all mice receiving subunit vaccines gave antibody response to the antigens they received. However, only the mice receiving vaccines containing both Hsf-1 and Hsf-2 were partially protected against the challenge of *Pasteurella multocida*. This result showed the potentials of using recombinant Pasteurella Hsf-1 and Hsf-2 as a component of a multiple antigen vaccine.

Key Words: Fowl cholera, Pasteurella multocida, Subunit vaccine, Mice, Protection

S149 Pathological findings in the digestive tract of birds experimentally exposed to two different immunosuppressive virus. J. Ramírez¹, N. Calderón^{*1}, T. Fehervari¹, Y. López², ¹Faculty of Veterinary Medicine, National Autonomous University of Mexico, ²Faculty of Medicine, National Autonomous University of Mexico.

The present study was designed to evaluate the effect of Marek Disease Virus (MDV) (vaccinal strain) and Avian Infectious Anemia Virus (AIAV) (field strain) on the digestive tract of broilers as determined by histological, virological and PCR test. The earliest isolation of MVD was at day 5 post vaccination from duodenum and caecal tonsils. All the samples gave positive isolations but the jejunum was positive only at day 28 post vaccination. Earliest isolations of AIAV were at day 14 from duodenum, jejunum, Meckels diverticulum and caecal tonsils, however, the ileum was also positive at day 21. Histological evaluations of birds vaccinated against MDV, revealed lymphoid proliferation in proventriculus and caecal tonsils. In the case of AIAV inoculated birds, lymphocytic necrosis and apoptosis were found in all the organs sampled. It is important to emphasize that MDV used was vaccinal strain and therefore evidence suggests that vaccination against this disease might cause lesions in the lymphoid tissue associated with the digestive tract. AIAV has not been associated with damage of the digestive tract, however, the present findings suggest a disseminated moderate damage of lymphoid tissue of the digestive tract of inoculated birds.

Key Words: Pathology, Marek Disease, Avian Infectious Anemia, Digestive tract

S150 Specific blends of essential oil compounds in broilers vaccinated or not against mixed *Eimeria spp.*: 49 day production period. E.O. Oviedo-Rondón^{*1,2}, S. Clemente-Hernández^{1,3}, P. Williams⁴, R. Losa⁴, ¹Stephen F. Austin State University, ²Facultad de Medicina Veterinaria y Zootecnia, Universidad del Tolima, Colombia, ³Universidad Autonoma de Chihuahua, ⁴Akzonobel/Crina S.A..

This study evaluated the effects of two specific blends of essential oil (EO) compounds (Crina[®] POULTRY and Crina[®] ALTERNATE) in broilers vac-

nated or not against coccidia. In one floor pen trial, 1,728 Cobb-500 male chickens were distributed in 48 pens with used litter top-dressed with fresh wood shavings and were raised to 49 d of age. Seven treatments were randomly distributed: Unmedicated, and antibiotic plus ionophore (BMD[®]+Coban[®]) control treatments, two EO blends, and three treatments vaccinated with attenuated live viable oocysts of mixed *Eimeria* spp. (Advent[®]) at 1 d of age. Cocci-vaccinated treatments include a group without feed additives and two with the EO blends. The EO blends were added to starter, grower, finisher, and withdraw basal diets at 100 ppm. Antibiotic and ionophore was added to all but the withdraw diets. Lesion scores and blood samples were obtained at 37 d of age. Pen means were used as the experimental unit. Data were analyzed as a completely randomized design. No significant differences were observed for BWG and FI in the starter period. Non-cocci-vaccinated chickens fed Crina[®] POULTRY had better FCR than the control treatment, although this was not significantly different from other treatments. Crina[®] POULTRY also improved significantly FCR in vaccinated treatments in the finisher period (42 d). No significant differences were observed in the withdraw period. The total FCR at 49 d of cocci-vaccinated and non-vaccinated broilers was not significantly affected by EO blends. The antibiotic+ionophore combination consistently had the best BWG and FCR in each period and during the whole grow-out. However, chickens supplemented with Crina[®] POULTRY did not perform significantly different. Therefore, Crina[®] POULTRY can be used as an alternative feed additive to replace antibiotics and ionophores in feeds.

Key Words: Essential oils, Feed additives, Coccidia vaccination, Broiler chicken, Antibiotics and ionophores

S151 Study on pathogenesis of haemorrhages in avian influenza, Newcastle disease and infectious bursal disease. N. Calderón*, T. Fehervari, F. Galindo, G. Ramírez, A. Lima, L. Paasch, *Faculty of Veterinary Medicine, National Autonomous University of Mexico.*

Specific tests for extrinsic coagulation, sequential thrombocyte counts and histological evaluations of vascular endothelium and bone marrow were conducted on birds experimentally infected with avian influenza (AIV), Newcastle disease (NCD) and infectious bursal disease (IBD) viruses aiming to shed some light on the pathogenesis of haemorrhages frequently found in these diseases. For each viral inoculation, 25 specific pathogen free birds were used and further 5 birds were inoculated as controls for each disease. All birds were serologically tested as free of antibodies against the viruses to be employed. All viral strains used were previously titered. Birds infected with H_{5N2} strain of AIV suffered thrombocytopenia starting 24 hpi, however prothrombin studies of bone marrow revealed haematopoietic hyperplasia starting at 48 hpi. Birds infected with Chimalhuacan strain of NCD virus, suffered thrombocytopenia starting at 72 hpi. Studies in bone marrow revealed focal necrosis and severe cellular depletion starting at 48 hpi. Also damage of vascular endothelium and haemorrhages were detected in bone marrow, lung, proventriculus, brain and kidney. Birds infected with 73688 IBD virus suffered mild thrombocytopenia at 96 hpi, however prothrombin time increased significantly (p<0.01) after 72 hpi. No lesions were detected in bone marrow. The findings of the present study indicate a different pathogenic mechanism for the causation of haemorrhages in the diseases under consideration direct damage to the thrombocytes and thrombocyte precursors in the bone marrow is highly probable in AI and NCD despite that the bone marrow lesions are not the same in both diseases. By the other hand, haemorrhages in IBD are most likely associated with alterations of extrinsic coagulation mechanisms.

Key Words: Avian influenza, Newcastle disease, Infectious bursal disease, Pathogenesis, Haemorrhages

S152 Detection of *Salmonella enteritidis*, *Campylobacter jejuni*, and *Campylobacter coli* in broilers naturally exposed. A. Gutiérrez^{*1}, L. Paasch², N. Calderón², Y. López³, ¹Faculty of Veterinary Medicine of Autonomous University of State of Mexico, ²Faculty of Veterinary Medicine of National Autonomous University of Mexico, ³Faculty of Medicine of National Autonomous University.

Increase in clinic human cases caused by *Salmonella enteritidis*, *Campylobacter jejuni* and *Campylobacter coli* is related by the consumption of animal meals,

water and pets consequence of contamination by asymptomatic bedders. Actually salmonellosis and campylobacteriosis are the most notified zoonosis in developed countries. While in developing countries the report of these diseases is limited due partly to difficulty that involves *in vitro* isolation of these agents, specially campylobacter. The present study was designed to detect the frequency of *Salmonella* and *Campylobacter* in broilers. With the isolations obtained in farm broilers, specific pathogen free (SPF) chickens were inoculated to evaluate the possible lesions caused by the three agents. The samples were obtained by cloacal swabs of developing broilers and organs obtained in the necropsy of chickens. The samples were processed by traditional methods of isolation and by PCR test. It has been done sampling in farm, isolation and serotyping of *Salmonella*. With isolated stocks of *Salmonella enteritidis* and *Salmonella typhimurium* were challenged SPF chickens, the same were sampled by 4 to 7 weeks of age. Inoculated broilers were clinically healthy and at the necropsy did not show evident lesions. However at histological study have been observed compatible lesions of *Salmonella* stocks inoculated from liver, ileum and cecum. By the other hand the samples taken from market chickens obtained for bacteriological isolation of *Campylobacter* were positive to *Campylobacter jejuni* and *Campylobacter coli*.

Key Words: *Salmonella enteritidis*, *Salmonella typhimurium*, *Campylobacter jejuni*, *Campylobacter coli*, Broilers

S153 Immunity and macrophage nitrite production in broilers are affected by selenium and its different forms. K. Gowdy*, F. Edens, *North Carolina State University, Department of Poultry Science.*

Selenium has been recognized for many years as being essential for the avian immune system. When organic selenium was approved for use in poultry diets, it became important to compare the effects of both inorganic and organic forms of selenium on immune endpoints in broiler chickens. Diets supplemented with 0.3 ppm of sodium selenite, organic selenium (Sel-Plex[®], Alltech, Inc., Nicholasville, KY), a combination of both, or a control diet with no supplemental selenium were fed to male broiler chicks from hatching until 3 weeks of age. The effects of inorganic and organic selenium on antibody production and elicited nitrite production from LPS-stimulated abdominal exudate macrophages were examined. The anti-sheep red blood cell (SRBC) antibody titers after an intravenously injected 7% SRBC suspension were increased numerically with selenium supplementation. The IgG response was significantly higher in organic selenium-fed broilers, but the IgM response was greater in the inorganic selenium-fed broilers. All selenium-supplemented groups maintained higher anti-SRBC antibody titers longer than controls. The resting nitrite production from abdominal exudate macrophages was higher in the control groups suggesting that cellular redox properties of selenium-fed broilers was improved. However, when macrophages were stimulated with LPS, Sel-Plex[®]-fed groups had nitrite production intermediate to the lower production from controls and to the highest production from selenite-fed groups. Cutaneous basophil hypersensitivity in response to intradermal PHAP injection was greater in selenite-fed broilers than in organic selenium-fed broilers. These observations indicated that the pro-oxidant sodium selenite had modified both cell mediated and humoral immune responses in broiler chickens and support the conclusion that dietary organic selenium supplementation resulted in a heightened immune response that is more controlled than in the inorganic selenium-fed broilers.

Key Words: Selenium, Immunity, Antibody, Nitrite, Antioxidant

S154 Determination of cross-reaction of an immunocapture system for *E. coli* O157:H7. N. Chrysti*, R. Merino, C. Rosario, *Departamento de Produccion Animal: aves, FMVZ, UNAM, Mexico.*

Escherichia coli O157:H7 is an important zoonotic pathogen that causes hemorrhagic colitis and hemolytic uremic syndrome in humans. The aim of the present study was to determine the specificity of an immunocapture system to detect *Escherichia coli* O157:H7. Different bacteria such as *E. coli* O116:H10, *E. coli* O7:K1, *Enterobacter* spp., *Enterobacter cloacae*, *Salmonella* spp., *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Citrobacter* spp., *Citrobacter freundii*, *Yersinia* spp., *Vibrio cholerae*, *Salmonella typhi* and *E. coli* O157:NM, were used in the trial; additionally a strain of *E. coli* O157:H7 was used as positive

control. Bacterial suspensions from each strain were prepared to contain 10^1 to 10^8 CFU/mL, those suspensions were inactivated in a microwave oven, and tested in the immunocapture system. Results show that the system possesses a high specificity since only O157:H7 and O157:NM were positive in the 10^1 CFU/mL to 10^8 CFU/mL, whereas all other strains were negative even at concentrations as high as 10^8 CFU/mL. Indeed, serotypes of *E. coli* such as O116 and O7, which have been linked to cross-reacting with O157:H7 were also negatives. However, despite non-motile strains of *E. coli* O157 have been isolated sporadically in EHEC outbreaks, its participation has not been assessed; consequently, they are not considered members of EHEC group. Thus, if an *E. coli* O157 presumptive positive is found, confirmation of the result must be carried out.

Key Words: *Escherichia coli* O157:H7, Immunocapture, Cross-reaction

S155 Effect of amprolium, ochratoxin A, and urea on broiler skin pigmentation. M. Juarez¹, V. Petrone¹, A.R. Garcia¹, J. L. Vicente², X. Hernandez^{*1}, ¹DPA: Aves, FMVZ, UNAM, ²Department of Poultry Science, University of Arkansas.

Pigmentation is one of the most important aspects considered in the broiler Mexican-market because it is related with a good healthy status of the flocks. The aims of this study were to evaluate the effect of Amprolium (AM), Ochatoxin A (OA), and urea (UR) in both pigment absorption and skin deposition. Two hundred and forty one-day of hatch broiler chicks were randomly divided into 4 treatments with two replicates each one holding 30 chicks per pen. The treatments were: a) control diet, b) OA (1.5ppm), c) AM (1.2g/L water), and d) UR (5%). All chicks received a commercial free of both coccidiostat and xanthophylls (Xa) chicken starter diet during the first 21 days. Grower diet was served at day 22 but at day 27, xanthophylls were added (80ppm) in all the groups. OA and UR were mixed on the feed and AM was given in the drinking water from day 28 to the end of the experiment. At days 10 and 20 posttreatment, skin pigment deposition and concentration of Xa was measured in the intestinal content, mucosa, and plasma. Xa-concentration ($\mu\text{g/g}$) in intestinal content was significantly reduced ($P < 0.05$) at day 20 in groups where OA, AM, and UR was given (OA 213 ± 46.26 ; AM 231 ± 46.26 ; UR 189 ± 70.36) compared to the control (75.88 ± 12.5) but no difference was observed between the control and the OA at day 10. On plasmatic-Xa ($\mu\text{g/mL}$), there was a reduction ($P < 0.05$) in all three treated groups (OA: 0.972 ± 0.231 , AM: 11.1 ± 0.78 , UR: 12.3 ± 1.15) compared to the control group (16.6 ± 1.52) at day 10 but at day 20, AM was similar to the control group. Xa-deposition was measured using a Chromo meter (Minolta CR-300) in delta units and a significant reduction was observed ($P < 0.05$) in both live birds and after chilling only by OA at both day 10 (2.21 ± 0.33 and 11.32 ± 5.3 respectively) and 20 (1.54 ± 0.27 and 10.13 ± 4.21) compared with the control group (9.89 ± 0.88 and 12.45 ± 1.53 respectively). The reduction of skin deposition of Xa in the OA group was due to the diuresis induced by the toxin that reduced the Xa availability in the intestine to be absorbed and this was correlated with a decrease in plasma concentration and further deposition.

Key Words: Ochatoxin A, Amprolium, Urea, Xanthophylls, Broilers

S156 Evaluation of xanthophylls in plasma, skin pigmentation, intestinal lesions, and coccidia intestinal levels in broilers challenged with *Eimeria maxima*. M. Juarez¹, V. Petrone¹, A.R. Garcia¹, J. L. Vicente², X. Hernandez^{*1}, ¹DPA: Aves, FMVZ UNAM, ²Department of Poultry Science, University of Arkansas.

An experiment was conducted to evaluate plasmatic levels of xanthophylls, skin-pigment deposition, intestinal score lesions, and number of oocysts on feces and intestinal mucosa in broiler chicks challenged with *Eimeria maxima* (Em). Two hundred and forty one-day of hatch broiler chicks were randomly divided into 4 treatments with two replicates each one holding 30 chicks per pen. Treatments were: a) control, b) xanthophylls (Xant) on diet; c) Em challenge, and d) Xant on diet + Em challenge. All chicks received an unmedicated commercial and free-Xant chicken starter diet during the first 21 days. Grower diet was served at day 22 and Xant (80ppm) were added in the grower diet for group b and c at day 27. At day 37, chicks on groups c and d were orally gavaged with Em (1.0×10^5 oocysts/ml). Skin pigment deposition was evalu-

ated at days 0, 7, 14, and 21 post-challenge (pc) by using a Chromo meter Minolta CR-300 (delta units). Plasmatic level of Xant, intestinal lesions score, and quantification of oocysts on intestinal mucosa and feces were evaluated at day 0, 3, 8, 13 and 18 days pc. On skin pigment deposition, at day 7, 14, and 21 pc group d (11.2 ± 1.96 , 11.4 ± 3.46 , and 12.14 ± 1.98 respectively) had the lowest level ($P < 0.05$) in live birds comparing to the control group (-0.56 ± 1.22 , -0.81 ± 1.76 , and 0.54 ± 1.39). In plasmatic level ($\mu\text{g/mL}$) of Xant, groups a and c were similar during all the experiment. On score lesions, c and d had lesions from 1+ and 3+ at 3d and 8d pc. Mucus concentration in the intestine was higher in group d compared to the other groups. In oocysts quantification, no difference was observed between groups challenged with Em. Our results suggest that reduction of Xant absorption and further skin deposition in market broilers was affected due to the high concentration of mucus on the intestine that is associated with lesions in the intestinal mucosa during the schizogony and gametogony state of parasite development.

Key Words: *E. maxima*, Broiler, Xanthophylls

S157 Microbicidal activity of tripotassium phosphate and lauric acid towards spoilage and pathogenic microorganisms associated with poultry. A. Hinton, Jr.*¹, K. Ingram, Russell Research Center.

Microbicidal activity of tripotassium phosphate (TPP) and lauric acid towards microorganisms associated with processed poultry was examined. TPP solutions were prepared by dissolving TPP in distilled water, and mixtures of TPP and lauric acid were prepared by dissolving lauric acid in TPP solutions. Gram negative bacteria (*Campylobacter jejuni*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Salmonella Typhimurium*), Gram positive bacteria (*Listeria monocytogenes* and *Staphylococcus aureus*), and yeasts (*Candida ernobii* and *Yarrowia lipolytica*) were used in the study. After suspending cultures in TPP or TPP and lauric acid, colony-forming-units (cfu)/ml were enumerated. Bactericidal activity of TPP towards Gram negative bacterial isolates was examined by suspending cultures of *C. jejuni*, *E. coli*, *P. aeruginosa*, and *Salmonella Typhimurium* in separate tubes of 0.1% peptone water (PW) or 2.0% TPP. Bacteria were recovered from PW, but no bacteria were recovered from TPP suspensions. Cultures of *C. ernobii*, *Y. lipolytica*, and *L. monocytogenes* were suspended in PW, 2.0% TPP, and 2.0% TPP with 0.5% lauric acid. Significantly fewer cfu/ml were recovered from 2.0% TPP than from PW; however, no viable cells were recovered from TPP-lauric acid mixtures. The most resistant isolate, *S. aureus*, was suspended in PW; 2.0% TPP with 0.0, 0.5 or 1.0% lauric acid; 3.0% TPP with 0.0, 0.5, 1.0, or 1.5% lauric acid; or 4.0% TPP with 0, 0.5, 1.0, 1.5, or 2.0% lauric acid. Significantly fewer *S. aureus* were recovered from solutions of 4.0% TPP than from PW, and no viable *S. aureus* were recovered from any mixtures of 4.0% TPP and lauric acid. Findings indicate that TPP and lauric acid possess microbicidal activity against several microorganisms associated with processed poultry. Solutions of TPP are bactericidal against Gram negative bacteria, while mixtures of TPP and lauric acid are also microbicidal against Gram positive bacteria and yeasts. The solutions may be useful as microbicides to reduce populations of microorganisms associated with poultry processing.

Key Words: Tripotassium phosphate, Lauric acid, Microbicide, Poultry processing

S158 Effects of strain, plane of nutrition, and age at slaughter on performance and meat quality traits of broilers. H. L. Santiago^{*1,2}, D. M. Denbow², D. A. Emmerson³, C. Denbow², P. Graham², W. Hohenboken², ¹University of Puerto Rico, ²Virginia Polytechnic Institute and State University, ³Aviagen Corporation.

A study was conducted to investigate the effects of strain, plane of nutrition, and age at slaughter on performance and meat quality traits of broilers. A total of 2,160 broilers from two commercial lines selected either for rapid growth (BODY) or breast meat yield (BREAST) were fed two diets formulated to provide a low (LPN) and a high (HPN) plane of nutrition. Body weight was measured at hatch, 19, 42, and 53 d of age. Broilers of the BODY line were significantly heavier at hatch, 19, and 42 d, but were not different from the BREAST line at 53 d. The HPN diets significantly increased BW in both lines at 19 and 42 d, but there were no diet effects at 53 d.

To evaluate carcass and meat quality traits, 108 birds were processed at 42 and 53 d. Breast muscle samples were taken at .25, 4, and 24 h postmortem (PM) for pH and R-value determination. At 24 h, breast fillets were harvested and evaluated for color (L*, a* and b* values), water holding capacity (WHC), and expressible moisture (EM). There were no significant strain or diet differences in live or carcass weights. However, breast muscle weight (BMW), breast meat yield (BMY) and carcass yields were significantly greater for the BREAST than BODY birds. The HPN significantly increased BMW and BMY in both lines, but no differences in carcass yields were observed. Breast fillets of the BREAST strain had lower pH (24 h), higher R-value (24 h), greater L*, a*, and b* values, lower WHC, and higher EM than those of the BODY strain. Breast fillets from birds processed at 53 d exhibited higher water holding properties than those processed at 42 d, even though no significant differences in pH, L*, and R-values at 24 h PM were observed. However, pH values at .25 and 4 h PM were significantly lower in birds processed at 42 d, resulting in reduced protein functionality and water holding properties of fillets. There were no significant effects due to plane of nutrition on any of the meat quality traits evaluated.

Key Words: Broilers, Breast Meat, Meat Quality, Plane of Nutrition, Strains

S159 The effects of strain and gender on performance and quality characteristics of broiler pectoralis muscles. H. L. Santiago^{*1,2}, D. M. Denbow², D. A. Emmerson³, P. Graham², W. Hohenboken², C. Denbow², ¹University of Puerto Rico, ²Virginia Polytechnic Institute and State University, ³Aviagen Corporation.

An experiment was conducted to investigate the effects of strain and gender on performance and breast muscle quality of broilers. Chicks of six crosses of broilers were grown to 56 d under typical commercial diets and conditions. The sexes were reared separately with three replicate pens of 50 birds per strain and gender combination. At 56 d of age, 12 birds of each sex and strain cross were processed to evaluate carcass and meat quality traits. Muscle pH was measured on the P. major muscle at .25, 4, and 24 h postmortem. Both pectoralis muscles were harvested after chilling the carcasses for 24 h. Muscle quality was assessed by pH, color (L*, a*, and b* values), water holding capacity (WHC), and expressible moisture (EM). In addition, live body weight (BW), eviscerated carcass weight (CW), P. major and P. minor weights were recorded and yields expressed as a percentage of live BW. The strains differed significantly in live BW, CW, P. major, and total breast meat weights. Differences in yield of carcass, P. major and total breast meat were also observed. However, no differences in the P. minor weight or yield were observed among strains. Average breast meat yield varied among strains from 19.2 % to 21.1%. Male broilers had higher live BW (P < .01), CW (P < .01), and total breast muscle weight (P < .01) but lower P. minor (P < .01) and total breast muscle (P < .01) yields than females. However, there were no differences in carcass and P. major yields between sexes.

There were no significant differences among the broiler strain crosses with respect to any of the muscle quality measurements evaluated. Differences in meat quality of the P. muscles between sexes were observed. P. major muscles of female birds had lower pH and higher L*, a* and b* values, and lower WHC than males. Likewise, the P. minor muscles of females had lower pH, lower WHC, and higher EM than those of males. However, there were no differences in meat color due to sex. No significant strain by gender interactions that affected performance and meat quality traits were detected.

Key Words: Broilers, Breast Meat, Meat Quality, Strain, Gender

S160 Consumer perceptions of meat quality and shelf-life in commercially raised broilers compared to organic free range broilers. D. Greene^{*1}, E. Wenger², C. Alvarado¹, L. Thompson¹, S. O'Keefe³, ¹Texas Tech University, ²Toulouse University, ³Virginia Tech.

Consumers are increasingly interested in both free-range and organic chicken. The objectives of this research were to compare eating quality and shelf-life of meat from organic free-range broilers or commercially raised broilers. Analytical data from the two treatments were subjected to ANOVA as a completely randomized design, and means were separated using Duncan's multiple range test (P<0.05). No significant differences in breast fillet tenderness or proximate composition were noted between the two treatments. Free-range chicken

breasts were significantly larger (153 g) than commercial chicken breasts (121g). Breast fillets from the free range birds had higher pH values (5.96 vs. 5.72) and were darker (L* values 49.14 vs. 53.46, respectively) than fillets from the commercially raised birds. Initial TBARS (Day 0) were significantly higher for the commercially raised broiler breasts fillets (4.95 vs. 3.07 mg malonaldehyde/kg), but by day 3 of refrigerated storage the level of oxidation was similar. Free range fillets had significantly higher APC and coliform counts and exhibited signs of spoilage earlier than commercial fillets. Consumers evaluated breast fillets, using a ranking test (1-least intense to 5-most intense) and the resultant data was analyzed using Kruskal-Wallis, a nonparametric test. Consumers found no differences in fillet juiciness, tenderness or flavor (P>0.05). Commercially produced fillets, however were preferred over the free-range fillets (P<0.05). Trained panelists evaluated chicken legs (drums) finding no differences in tenderness or flavor, but meat from free range birds was juicier and had stronger attachment of the meat to the bone. Commercial and free-range chicken had many similarities in meat quality and sensory attributes, but meat from free-range poultry had a shorter shelf life than meat from commercially raised birds.

Key Words: Free range, Organic, Shelf-life, Sensory, Tenderness

S161 The effect of dietary L-carnitine on semen traits of White Leghorns. W. Zhai^{*1}, C. D. McDaniel², S. L. Neuman³, M. A. Latour¹, P. Y. Hester¹, ¹Purdue University, ²Mississippi State University, ³Astra Zeneca.

A previous dosimetric study conducted in our laboratory during cooler weather (fall months) showed that White Leghorns consuming 125 mg/kg (ppm) of carnitine for 8 wk as compared to controls showed an increase in sperm concentration (P < 0.05). The current study also examined the effect of feeding different levels of L-carnitine on semen traits of White Leghorns; however, the experiment was done in the spring and summer months. A 17 wk trial was conducted with 96 White Leghorn roosters when they were 46 to 63 wk of age. Feed was formulated to contain 0, 125, 250, and 500 ppm of carnitine, with analyzed values of 0, 129, 267, and 611 ppm, respectively. Diets were fed ad libitum to 24 birds/treatment with the semen of two roosters pooled per replicate per treatment creating 12 experimental units per treatment. Data were analyzed using ANOVA with repeated measurements using the mixed model procedure of SAS. Feeding dietary carnitine for 8 wk did not affect feed consumption, body weight, sperm concentration, semen volume, and semen viability. Sperm concentration of roosters fed 125 ppm of carnitine was significantly higher (P < 0.05) than the controls only at 11 wk post-treatment. A trend for higher sperm concentration among roosters consuming 125 ppm was evident (P < 0.07) with reduced sperm oxidation (P < 0.08) from 11 to 17 wk post-treatment. Circulating levels of total carnitine measured at 8 wk were elevated in roosters supplemented with carnitine as compared to controls (P < 0.006). It is concluded that White Leghorns consuming 125 ppm of carnitine as compared to controls showed an increase in sperm concentration at 11 wk post-treatment. The summer heat may have prevented carnitine from showing an improvement in sperm concentration prior to 11 wk post-treatment. This work is supported by the U. S. Poultry and Egg Association & Lonza, Inc.

Key Words: L-carnitine, Semen traits, Sperm concentration, White Leghorn, Dosimetry

S162 Broiler breeder genetics, age, and thyroidal status affects cardiac index, body weight, thyroidal hormone levels and thyroid weight of chicken embryos. L. E. Guzmán-Osorio¹, A. Hernández-Vásquez², E. O. Oviedo-Rondón^{*1,3}, ¹Facultad de Medicina Veterinaria y Zootecnia, Universidad del Tolima, Colombia, ²Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional de Colombia, ³Stephen F. Austin State University.

Alterations in T₃ and T₄ hormone secretion and/or receptor activity in broiler breeders and embryos might be related to metabolic disorders and embryo mortality. This research measured the thyroidal weight and function, cardiac response, and growth of chicken embryos from eggs of two genetic lines of broiler breeders which were laid at 36 and 60 weeks of age. Thyroidal hormones, T₃ and T₄, were evaluated by RIA from broiler breeders and embryo plasma. Fertile eggs were classified into three categories of weight, 52-57, 59-64 and 70-77g. 15,000 eggs were placed on setters. Thyroid function, cardiac index (CI), and embryo body weight (EBW) were evaluated at 14, 16, 18, 20,

and 21 d of incubation. Significant differences in thyroidal status of broiler breeders were observed between genetic lines and age. Younger breeders had higher $T_3:T_4$ concentration ratios. No significant difference was observed in T_3 concentrations of genetic line B. The heaviest embryos and thyroids were observed in embryos from the heavier group of eggs, 70-77 g, from 60 wk-old breeders. Embryos showed right-cardiac hypertrophy (RCH) and this changed according to genetic line and embryo age. Genetic line A had the highest RCH at 16 d, while genetic line B was at 18 d. CI diminished close to hatching in both genetic lines. Egg weight had no effect on CI after 14 d. Genetic line, breeder age, and egg weight influenced $T_3:T_4$ ratios in embryos. Variations in T_3 concentration were observed during the incubation process, between the two genetic lines, and according to egg weight. After 16 d of incubation, embryos from genetic line A had up to three times more T_3 secretion than those from genetic line B. After hatch, it was observed that chickens from genetic line B had higher incidence of RCH. We concluded that genetic lines differed on thyroidal function; these traits are transmitted to progeny affecting embryonic and post-hatch growth. These physiological findings help to understand field observations and to develop management practices to reduce metabolic disorders.

Key Words: Embryo development, Thyroid function, Broiler breeders, Heart, Ascites

S163 Effects of broiler breeder genetics, age, egg weight, feed restriction and housing environmental conditions over cardiac index, thyroidal function, and live performance of growing broilers. L. E. Guzmán Osorio¹, A. Hernández-Vásquez², E. O. Oviedo-Rondón^{*1,3}, ¹Facultad de Medicina Veterinaria y Zootecnia, Universidad del Tolima, Colombia, ²Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional de Colombia, ³Stephen F. Austin State University.

Thyroidal function is linked to energy metabolism, growth rate, and metabolic disorders in growing broilers. This research observed the effects of altitude, house brooding temperature, and early quantitative feed restriction over thyroidal hormone secretion and morphology, cardiac index, live performance, and carcass traits of chickens coming from broiler breeders from two genetic lines and ages. From chickens hatched in a previous experiment, 4,800 one day-old males from two genetic lines were divided into 32 pens at two research facilities located at 300 and 2,638 meters above sea level. Baby chickens were classified according to genetic line and egg weight origin. Chickens located at higher altitude were divided in two groups with or without environmental temperature control. The same lighting program of 14L: 10D was used in both locations. Chickens were fed the same commercial starter and grower diets in both locations up to 42 d of age. Quantitative (50%) feed restriction was applied to half on the chickens in each location between 6 and 12 d of age. Thyroidal plasma hormone concentrations measured by RIA, thyroidal histological morphology, cardiac index (CI) and body weight were evaluated weekly. Final live performance and carcass parts yield were evaluated at 42 days of age. CI and actual mortality caused by ascites helped to predict pulmonary hypertension syndrome (PHS) incidence. Significant differences were observed in CI according to breeder age and egg weight in genetic line B chickens placed at higher altitude since 14 d of age. PHS increased in this genetic line by ad libitum feeding and lack of brooding control. Birds from older breeder and heavier eggs had less incidence of PHS independent of housing and management conditions. Genetic line B had more propensity to develop PHS due to management and housing conditions, which is linked to thyroidal function. Factors evaluated affect significantly thyroidal physiology and live performance.

Key Words: Broilers, Pulmonary hypertension syndrome, Thyroid, Triiodothyronine thyroxine, Cardiac index

S164 Hypobaric hypoxia in ascites resistant and susceptible broiler genetic lines influences gut morphology. F. Solis^{*1}, G. Tellez¹, J. Balog², N. Anthony¹, B. Hargis¹, A. Donoghue², ¹Dept. Poultry Science, University of Arkansas, ²PPPSRU, ARS, USDA.

Genetic selection based on rapid growth rates, better feed conversion and heavy body weight for broilers has led to a predisposition to ascites in broiler popula-

tions. Sire-family selection was applied to a commercial elite line to produce divergent lines of ascites resistant (<22% ascites mortality, RES) and ascites susceptible (>86% ascites mortality, SUS) broilers by the 7th generation. One objective of this research was to determine the effects of hypobaric hypoxia on gut morphology in these genetic lines. In two separate trials, four hundred eighty vaccinated, pedigree broiler chickens (40 groups of 12 birds) were randomly assigned to cages in a hypobaric chamber (simulating 2900m above sea level) or a matching local altitude chamber (390m above sea level). On day 42, two-cm sections of the mid-point duodenum and distal ileum were collected from five chickens in each line at each altitude in each experiment. The sections were fixed in 10% formalin for 72 h and then they were stained with haematoxylin and eosin. From these stained sections, 20 measurements of villus height, villus base, lamina propria and crypt were made at random from different parts of each section. Under hypoxic conditions duodenal surface area was higher ($P<0.05$) in the RES line (181.3 ± 16.8 and $219\pm 16.8\mu\text{m}$) compared to the SUS line (130.1 ± 10.5 and $134.3\pm 10.5\mu\text{m}$, Trials 1 and 2, respectively). Hypoxic conditions also reduced the surface area approximately 60% ($P<0.05$) in SUS birds compared to SUS birds at local altitude. No differences in ileum morphology was observed for any of the parameters measured. The reduced surface area in the duodenum of birds selected for ascites susceptibility suggests reduced enteric function and may provide clues as to why these birds cannot compensate under hypoxic conditions.

Key Words: ascites, gut morphology, genetic lines, altitude

S165 Chicken specific primers reveal endogenous retroviral elements in Guinea fowl. S. Nahashon^{*}, L. Payne, A. Amenyenu, N. Adefope, D. Wright, Institute of Agricultural and Environmental Research, Tennessee State University.

Endogenous virus (ev) genes that code for components of a retrovirus are present in all cells of virtually all vertebrates. A broader range of infection in avian species has resulted in random distribution of ev genes throughout the avian genome. In poultry, these genes exhibit a Mendelian fashion of inheritance and may be linked with other genes of economic importance, such as growth, egg production, and disease resistance. The presence of ev genes in poultry would, therefore, provide a genetic selection tool for traits of economic importance. More than 20 endogenous viral elements have been identified in most avian species, including chickens and geese, however, the occurrence of ev genes have not been reported in the guinea fowl (*Numida meleagris*). Presence of ev genes in guinea fowl and their linkage with production traits would be beneficial to guinea fowl improvement programs that are underway. The objective of this study was to ascertain the occurrence of ev genes in the genome of the guinea fowl. Five guinea fowl varieties, Pearl grey (PG), French (Fr), White, and Royal Purple (RP) were evaluated. Blood was collected in EDTA by brachial venipuncture and DNA was extracted using Dr. GentLE(TM) DNA isolation kit (Takara, Japan). The Polymerase Chain Reaction (PCR) was employed in amplification of DNA using oligonucleotide primers specific for chicken ev-1, ev-15, and ev-21. Among guinea fowl varieties tested, ev-1 was detected in both RP and Fr, while ev-15 was detected only in RP variety. These and possibly other ev genes will be utilized for future studies to assess their association with production traits, and ultimately as a tool for improving guinea fowl production performance.

Key Words: endogenous retroviral elements, guinea fowl, polymerase chain reaction

S166 Time and dose response for induction of plasma haptoglobin as a measurement of inflammatory responses in broiler chickens. A. L. Hoffman^{*}, E. A. Koutsos, California Polytechnic State University.

Broiler chicks were examined for the optimal dose of lipopolysaccharide (LPS) and time course post-LPS to induce a readily measurable systemic inflammatory response. Plasma haptoglobin was examined as a reliable and economic marker of the acute phase response and systemic inflammation. A 3 x 4 factorial design was used; 3 levels of LPS (0, 1 or 2 mg LPS/kg bw, intra abdominally) were administered, and plasma haptoglobin was analyzed at four time periods post-LPS administration (12, 16, 24, and 48 h). Five to six day old

broiler chicks were fed a standard starter diet and housed in a Petersime Battery with 10 birds/pen, and 3 pens/LPS treatment. A commercially available colorimetric haptoglobin assay was used to determine haptoglobin levels (Tri-Delta Diagnostics, NJ). There was no effect on haptoglobin levels when birds were treated with 1 mg/kg LPS ($P > 0.10$). Additionally, there was no change in plasma haptoglobin levels when samples were taken at 12 or 16 h ($P > 0.01$). However, administration of 2 mg/kg LPS resulted in a significant increase in plasma haptoglobin ($P = 0.05$). This response was detectable at 24 and 48 h post-LPS ($P < 0.001$), but was greater at 24 h (mean = 8.17 mg/ml) than at 48 h (mean = 5.58 mg/ml). These data demonstrate that the optimal dosage of LPS to induce a plasma haptoglobin response is at least 2 mg/kg, and the optimal time to detect changes in plasma haptoglobin is at 24 h post-LPS treatment.

Key Words: Haptoglobin, Broiler chick, Immune response, Inflammation

S167 Withdrawn.

S168 Withdrawn.

S169 Withdrawn.

S170 Withdrawn.

S171 Evaluation of the efficacy of a commercial hydrated sodium calcium aluminosilicate to reduce the toxicity of aflatoxin and ochratoxin in broiler chicks. A. Casarin¹, M. Forat¹, E. Soto², M. Contreras^{3*}, D. Zaviero³, ¹Instituto Internacional Investigacion Animal, ²Avimex Labs., ³Special Nutrients.

Two experiments were conducted to study the efficacy of a low inclusion commercial HSCAS (Myco-Ad[®]) in preventing the deleterious effects of Aflatoxin B1 (AFB) and Ochratoxin A (OCA) in broiler chicks. Arbor Acres broiler males individually caged were used in both experiments. The feed was experimentally contaminated with synthetic AFB or OCA from Sigma Labs, USA. In Experiment 1, 96 4-day-old chicks were randomly assigned four dietary treatments with 24 replications each. T I was a sorghum-soybean meal control diet, T II control + 2.5 kg/mt Myco-Ad[®], T III control + 7.5 ppm AFB, and T IV control + 7.5 ppm AFB + 2.5 kg/mt Myco-Ad[®]. At 24 days of age, birds fed 7.5 ppm AFB contaminated diet showed severe macroscopic liver lesions, higher mortality, lower body weight, poorer feed conversion, and higher liver weight than chicks fed the control diet. The addition of Myco-Ad[®] significantly prevented the impaired performance (BW 609 v 447 g; FC 1.62 v 1.92) and the gross liver lesions observed in chicks fed AFB. In Experiment 2, 64 7-day-old chicks were randomly divided into four dietary treatments with 16 replications each. T I was a sorghum-soybean meal control diet, T II control + 2.5 kg/mt Myco-Ad[®], T III control + 2 ppm OCA, and T IV control + 2 ppm OCA + 2.5 kg/mt Myco-Ad[®]. Feeding OCA contaminated diet plus Myco-Ad[®] resulted in statistically significant heavier (770 v 706 g) and more efficient (FC 1.65 v 1.78) broilers, with markedly reduced macroscopic kidney lesions than those fed 2 ppm OCA at 28 days of age. In both experiments, the addition of 2.5 kg/mt of Myco-Ad[®] to chick diets did not show any statistical difference in performance compared to the control diet, demonstrating its lack of interference with the absorption of nutrients. These results indicated that Myco-Ad[®] at 2.5 kg/mt was effective in preventing the toxic effects of AFB and OCA in broilers chicks.

Key Words: Myco-Ad, Aflatoxin, Ochratoxin

S172 Withdrawn.

S173 Effects of alfalfa based molt diets on cortical, cancellous and medullary bone qualities using pQCT. W. K. Kim^{*1}, L. M. Donalson¹, J. L. Stallon², S. A. Bloomfield², L. F. Kubena³, D. J. Nisbet³, S. C. Ricke¹, ¹Department of Poultry Science, Texas A&M University, ²Department of Health and Kinesiology, Texas A&M University, ³USDA-ARS, Southern Plains Agricultural Research Center.

A study was conducted to evaluate effects of alfalfa based molt diets on bone qualities using peripheral Quantitative Computed Tomography (pQCT). A total of 36 Single Comb White Leghorn hens (approximately 84 wk of age) were used for this study. There were six treatments: pretrial control (PC), full fed (FF), feed withdrawal (FW), A90 (90% alfalfa/10% layer ration), A80 (80% alfalfa/20% layer ration), and A70 (70% alfalfa/30% layer ration). For the PC, hens were euthanized by CO₂ gas, and femurs were collected before molt started. At the end of the 9-day molt period, hens were euthanized, and femurs were collected to evaluate bone qualities using pQCT (Stratec XCT Research-M). Three slices 13 mm apart were scanned at the midshaft of femur and 2 slices 1.5 mm apart scanned 12 mm from the distal end. Scanning resolution was 70 microns. Total bone densities of the PC (553 mg/cm³) and FF (540 mg/cm³) were higher than the FW (457 mg/cm³) and A90 (460 mg/cm³) ($P < 0.05$). There were no significant differences in total bone density among the PC, FF, A80 (492 mg/cm³), and A70 (483 mg/cm³). Medullary bone density of the PC (225 mg/cm³) were significantly greater than other treatments. The medullary bone densities of the A90 (87 mg/cm³), A80 (120 mg/cm³), and A70 (107 mg/cm³) fell between values for the FF (162 mg/cm³) and FW (72 mg/cm³) groups. There were not significant differences in cortical bone densities, total, cortical, medullary bone areas, and cortical thickness among the treatments. Cancellous bone densities of the PC (287 mg/cm³) and FF (220 mg/cm³) groups were significantly higher than the FW (136 mg/cm³) and A90 (126 mg/cm³) while there were no significant differences among the FF, A80 (166 mg/cm³), and A70 (158 mg/cm³) groups. These results suggest that medullary and cancellous bones are labile components of hen bones for bone resorption during molting, and alfalfa-based molt diets reduce medullary and cancellous bone resorption, decreasing overall bone loss during molting.

Key Words: Alfalfa based molt diets, pQCT, Cortical bone, Cancellous bone, Medullary bone

S174 A practical method for induced molting of caged layers that combines full access to feed and water, dietary L-thyroxine or thyroactive protein, and short day length. R. F. Wideman, Jr.¹, W. J. Kuenzel¹, M. E. Chapman¹, C. Golden¹, D. M. Hooge^{*2}, ¹Center of Excellence for Poultry Science, University of Arkansas, ²Hooge Consulting Service, Inc.

Levothyroxine (L-thyroxine; T4) rises in the circulation of caged laying hens during 10-d feed withdrawal molt and is associated with cessation of egg production (EP), feather loss, and BW reduction. McDonald's, AVMA, and the egg consuming public increasingly consider feed withdrawal unacceptable. With a grant from United Egg Producers (Alpharetta, GA), 4 small-scale caged Hy-Line W-36 laying hen trials were conducted in 2 rooms to confirm the effect of injected T4, to examine the interaction of feed additive T4 with photoperiod (17 vs 8 h), and to evaluate iodinated casein with T4 activity as a feed additive to induce molt. In Exp. 1, daily (1330 h) i.m. injection of L-thyroxine-Na pentahydrate (0, 250, 500, or 1,000 µg/kg BW) to 50 60-wk-old hens (24° C, 17 h light) resulted in EP after 7 d of 80, 30, 5, and 0% (with 15 to 25% BW loss). Additionally, 2,000 to 4,000 µg/kg BW T4 daily injected hens had 0% EP by d 5 and 6, respectively. Oviducts and ovaries regressed in T4 groups. Feather loss in T4 groups began after -9 d and virtually all were shed in 7 to 10 d more. Feed intake decreased with increasing T4. In Exp. 2, 60 101-wk-old hens molted at 55 w were fed diets with 0, 10, 20, or 40 ppm T4 (L-thyroxine-Na pentahydrate; 24° C, 17 h light) for 6 or 10 d. No mortality occurred. The hens fed 40 ppm T4 shed most feathers in 7 to 10 d, reached 0% EP in 10 d, lost 21% BW, had decreased % shell (6.6 vs 8.6% in control), but egg weight was unaffected. In Exp. 3, 90 96-wk-old hens molted at 80 wk were fed diets with 0, 20, or 40 ppm T4 for 10 d and given 17 or 8 h light. The 8 hr light decreased feed and T4 intake, weakening the response. In Exp. 4, iodinated casein prepared in the lab (T4 not assayed) induced molting with the same qualitative results as pure T4. A successful, patent pending T4 molting method was developed.

Key Words: Iodinated casein, Laying hen, Molt, T4, Thyroxine

S175 Results of commercial laying hen field trials using dietary *Bacillus subtilis* C-3102 spores (Calsporin®) with emphasis on egg shell quality. D. M. Hooge^{*1}, M. Kato², K. Nishimura³, ¹Hooge Consulting Service, Inc., ²Calpis Company, Ltd, ³Quality Technology International, Inc. (QTI).

Bacillus subtilis C-3102 spores (*Bs*), in direct-fed microbial Calsporin®, are added to poultry feeds to maintain normal intestinal microflora and support live performance. The proposed mode of action is that *Bs* spores vegetate and use oxygen, creating a more anaerobic condition which promotes proliferation of lactic acid producing bacteria (e.g., Lactobacilli). Besides inhibiting certain pathogens (E. coli, Salmonella), this condition appears to increase utilization of calcium. U.S. Patent 6,660,294 (Dec. 9, 2003) was awarded to this "Poultry Eggshell Strengthening Composition", and trials cited in the patent application showed +5.2% average shell thickness improvement. Caged Hy-Line W-36 hen field trials were conducted in the U.S. midwest with 0 or 0.003% *Bs* spores (Calsporin®, 0.05% level) in feed, and microbes in fresh feces and egg breaking strength (EBS) or shell thickness (60 eggs/sampling) were determined. In Exp. 1 (~140,000 hens/flock) at Site 1 (57 wk old), EBS was 3.26 kg (5 wk, 8 samplings) "before" and 3.33 kg (7 wk, 9 samplings) "during" *Bs* addition, with 3.20 kg expected (linear regression); est. +0.13 kg with *Bs*. At site 2 (94 wk old, molted), EBS was 3.08 kg (8 wk) "before" and 3.23 kg (7 wk) "during" ($P < 0.01$), with 3.09 kg expected; est. +0.14 kg increase. In Exp. 2 (~84,230 hens; 57 wk old), shell thicknesses in microns were: "before" 321 (5 wk), "during" 331 (7 wk), "*Bs* removed" 313 (2 wk), and "added again" 324 (9 wk). In some fecal samples prior to *Bs* supplementation, Lactobacilli/Total Anaerobes (cfu Log10/g) ratio was considerably below 50%, the desirable threshold level. The *Bs* improved shell quality.

Key Words: *Bacillus subtilis*, Calsporin, Direct-fed microbial, Laying hen, Shell quality

S176 Enhancement of pre- and post-hatch development of turkeys by in ovo feeding. P. Ferket^{*1}, Z. Uni², O. Foye¹, ¹North Carolina State University, ²Hebrew University of Jerusalem.

The pre- and post-hatch period is critical for the development of turkeys because they have limited body reserves to fuel the hatching process and sustain them until they are adapted to utilizing external dietary nutrients. During this critical period, mortality may exceed 5% because of poor energy status, and they are highly susceptible to enteric disease. These problems may be alleviated by in ovo feeding, which administers exogenous nutrients into the amnion of turkey embryos at 22-23 days of incubation. Since the amniotic fluids are swallowed prior to pipping, the in ovo feed components may stimulate development to occur earlier than in conventional poults. Several experiments were conducted to test our hypothesis. In each experiment, eggs were injected with 1.5 to 2 ml saline in ovo feeding solutions into the amnion at 23 days of incubation and compared with controls (100 eggs/treatment). In experiment 1, 2 ml of the in ovo feeding solution, containing carbohydrates (maltose, sucrose, and dextrin), resulted in a 7.5% increase in body weight at hatch over controls (71.4 vs 66.4, $P < .01$); however, this positive effect was not sustained past 3 days post-hatch. In experiment 2, the in ovo feed, containing egg white protein, increase body weight at hatch through until 12 days post-hatch by about 4% over controls. In experiment 3, 1.5 ml in ovo feed, containing egg white protein or dextrin, increased hatch weight by 6% and 7.5% ($p < .05$), and increased breast muscle weight relative to body size by 22% over controls (3.3 vs 2.7% of body weight, $p < .05$) and 11% (3.0% vs 2.7% of body weight), respectively. In ovo feeding of protein increased total liver glycogen by 158% at hatch and 56% at 7 days post-hatch ($P < .05$). In contrast, in ovo feeding carbohydrates increased liver glycogen by 29% at hatch and 57% ($p < .05$) at 7 days post-hatch. These results demonstrate that the enhanced development by in ovo feeding can improve early growth and energy status of poults. In ovo feeding saline solutions containing egg white protein helped sustain the positive effects during the post-hatch period.

Key Words: In ovo nutrition, Turkeys, Body weight, Glycogen, Breast muscle

S177 Evaluation of the efficacy of a commercial hydrated sodium calcium aluminosilicate to reduce the toxicity of toxin T-2 in broiler chicks. A. Casarin¹, M. Forat¹, E. Soto², B. Fazekas³, J. Tanyi³, D. Zaviezo^{*4}, ¹Instituto Internacional Investigacion Animal, ²Avimex, ³Institute Veterinary Medicine, ⁴Special Nutrients.

Two experiments were conducted to study the efficacy of a low inclusion commercial HSCAS (Myco-Ad®) in preventing the deleterious effects of Toxin T-2 (T-2) in broiler chicks. Feed in both experiments was experimentally contaminated with synthetic T-2 from Sigma Labs, USA. In Experiment 1, 75 1-d-old Arbor Acres straight-run broilers individually caged were randomly distributed into three dietary treatments with 25 replications each. T I was a corn-wheat-soybean meal control diet, T II control + 1 ppm T-2, and T III control + 1 ppm T-2 + 2.5 kg/mt Myco-Ad®. At 40 d of age, birds fed 1 ppm T-2 contaminated diet showed significant lower body weight, poorer feed conversion, smaller bursa and severe macroscopic oral lesions than chicks fed the control diet. The addition of Myco-Ad® significantly prevented the impaired performance (BW 1840 v 1381 g; FC 2.02 v 2.12), bursa damage and the severe oral lesions observed in chicks fed T-2. In Experiment 2, 32 5-d-old Ross male chicks were randomly divided into four dietary treatments with 8 replications each. T I was a sorghum-soybean meal control diet, T II control + 2.5 kg/mt Myco-Ad®, T III control + 1.25 ppm T-2, and T IV control + 1.25 ppm T-2 + 2.5 kg/mt Myco-Ad®. Feeding T-2 contaminated diet plus Myco-Ad® resulted in statistically significant heavier (1837 v 1563 g) and more efficient (1.89 v 2.19) broilers, with substantially reduced gross oral lesions and microscopic organs lesions (tongue, gizzard, thymus, bursa, spleen, liver, kidney) than those fed 1.25 ppm T-2 at 38 d of age. The addition of 2.5 kg/mt of Myco-Ad® to chick diets did not show any statistical difference in performance and bone ash compared to the control diet, demonstrating its lack of nutrients absorption. These results indicated that Myco-Ad® at 2.5 kg/mt was effective in preventing the toxic effects of T-2 in broilers chicks.

Key Words: Myco-Ad, Toxin T-2

S178 Effect of egg yolk antibodies on broiler performance. J. S. Moritz¹, A. S. Parsons¹, N. P. Buchanan¹, J. L. Pimentel^{*2}, ¹West Virginia University, ²Anitox Corp.

Past research has demonstrated that antibiotic feeding decreased urease and ammonia concentration in the gastro-intestinal tract and improved animal performance because less ammonia needed to be "detoxified" therefore saving energy for growth. Also under-processed soybean meal contains the anti-nutritional factor trypsin inhibitor. The objective of this study was to determine the effect of feeding egg-yolk antibodies against urease in combination with antibodies against soybean trypsin inhibitor. The antibodies were collected from the eggs of hyper-immunized Leghorn hens and fed to broilers as spray dried whole egg. A total of 2016 day-old straight run broilers were randomly assigned to 4 treatments. Each treatment was fed to a pen of 21 broilers and replicated 24 times. The treatments were 1) Control, 2) Control plus 50 mg BMD (bacitracin methylene disalicylate)/kg diet, 3) Control plus 100 mg anti-urease antibody/kg diet plus 100 mg anti-trypsin inhibitor antibody/kg diet and 4) Control plus 150 mg anti-urease antibody/kg diet plus 100 mg anti-trypsin inhibitor antibody/kg diet. Three-week body weight was significantly improved in the antibodies and antibiotic fed groups when compared to the control. In addition, 0-to-3-wk feed conversion (feed/gain) was significantly improved compared to the control when broilers were fed the combination of 150 and 100 mg/kg anti-urease and anti-trypsin inhibitor respectively. Overall 0-to-6-wk performance showed a numerical improvement in body weight (+2.4%) and feed conversion (3.5 points improvement) when broilers were fed the combination of 150 and 100 mg/kg anti-urease and anti-trypsin inhibitor respectively. Thus, the use of egg-yolk antibodies appears to be beneficial to broiler performance particularly in the starter feed.

Key Words: Egg yolk antibodies, Urease, Trypsin inhibitor, Growth, Feed conversion

S179 Activity of phytase in poultry excreta. F. Yan*, C. A. Keen, P. W. Waldroup, *University of Arkansas*.

Phytase has been shown to be effective in releasing a portion of the organic phosphorus from the phytate molecule of the plant feedstuffs, rendering it available for use by the chick, therefore reducing the excretion of phosphorus by the chick after proper adjustments are made for the released phosphorus. However, it has been suggested by some that supplementation of poultry diets with phytase might exacerbate the eutrophication problems by increasing soluble P contents in the excreta, possibly by continuing to work in the litter. This study was conducted to examine the phytase activity in the ileal contents and excreta of broilers fed diets containing various levels of phytase. A nutritionally adequate diet was fortified with phytase to contain 0, 600, 1,200, 2,400, 4,800, and 9,600 FTU/kg. Samples of the diets were assayed for phytase activity. Each of the six test diets were fed to four replicate pens of five 42-d-old male broilers. After a four-day acclimation period, excreta were collected from each pen for two days. At the end of the two-day collection period, birds were sacrificed and the ileal contents were removed from each bird and pooled by pen. The excreta and ileal content were freeze-dried and analyzed for phytase activity. No significant differences were observed between dietary treatments for ileal and excreta phytase activity. Minimum phytase activity was detected in these samples, and was actually considered undetectable by the laboratory. The results of the study indicates that dietary phytase, even in abnormally high levels, is almost totally degraded in the digestive tract of poultry and very unlikely to continue to work in litter during storage. Nutritionists should not hesitate to use phytase in programs designed to reduce phosphorus excretion by the chick.

Key Words: Phytase, eutrophication, broilers

S180 The effect of the combination of probiotics, prebiotics and cell-fragments (Biomina C-EX and Biomina IMBO) on broiler performance. R. Beltran*, G. Schatzmayr, A. Klimitsch, K. Sacherer, *Biomina International Animal Nutrition GmbH*.

Background: Due to the near ban of antibiotic growth promoters in the EU and increase consumer demands to minimize prophylactic use of antibiotics; the need to find replacements is evident. Probiotics used to enhance intestinal health has shown great potential in poultry and livestock production. Probiotics are defined as viable microorganisms that have a beneficial effect in the prevention and treatment of specific pathologic conditions when consumed. Prebiotics are nondigestible food ingredients that benefit the host by selectively stimulating the growth of beneficial bacteria. Cell wall fragments are used to prevent pathogen adherence by blocking specific receptor binding sites in the gut. It has been known that the efficacy of probiotics can be generally measured through observing body weight gain, feed conversion ration, as well as mortality.

Objective: To test the effect of Biomina C-EX and Biomina IMBO (probiotic, prebiotic & immune substances) on the productivity of broiler chickens under field conditions.

Design and Setting: 77,800 broilers of Strain Ross 308 were obtained. The birds were divided into 3 groups placed in different houses. Group 1 contained 26,300 broilers and group 2 contained 27,500 broilers. No additives were given in groups 1 and 2. Group 3 contained 24,000 broilers given Biomina C-EX and Biomina IMBO. The manufacturer's recommended dose consisted of the following treatment: C-EX spray application day 1, and day 2 and 3 C-EX was given via drinking water at 20g/1000 birds. Biomina IMBO was mixed directly in the finished feed at 1 kg/ton. All animals were kept on dry litter and water and feed given ad libitum. Body weight, feed intake, feed conversion ratio, and percent mortality were recorded. The length of the experiment was 42 days.

Results: By using a combination of probiotics, prebiotics and cell wall fragments, improvements in BWG, FCR, and mortality were observed. **Conclusions:** Our findings suggest by applying Biomina C-EX and Biomina IMBO under field conditions improved the health performance in broilers.

Key Words: Probiotic, Prebiotic, Antibiotics

S181 Effect of synthetic lysine on performance of commercial Leghorns in phase II and III (second cycle) while maintaining the methionine+cysteine/lysine ratio at 0.75. G. Wu*, Z. Liu, M. Bryant, D. Roland, *Auburn University*.

Two experiments of similar design were conducted to determine the influence of synthetic lysine on performance and profits of commercial Leghorns while maintaining a 0.75 Met+Cys/Lys ratio. In Experiment 1, a 3 x 4 factorial experiment with three protein levels (16.01, 14.86, and 14.42%) and four added synthetic lysine levels (0.000, 0.030, 0.059, and 0.088%) was conducted with Hy-line W-36 laying hens (n = 1440, 85 wk old) for 8 weeks. In Experiment 2, a 3 x 3 factorial experiment with three protein levels (14.87, 14.44, and 17.52%) and three added synthetic lysine levels (0.000, 0.030, and 0.059%) was conducted with Hy-line W-36 laying hens (n = 1080; 98 wk old) for 12 weeks. Results of Experiment 1 showed that the addition of synthetic lysine while maintaining a 0.75 Met+Cys/Lys ratio had no significant effect on egg production, egg mass, feed intake, feed conversion, egg specific gravity and final body weight. Results of Experiment 2 showed that the addition of synthetic lysine while maintaining a 0.75 Met+Cys/Lys ratio had significant effects on egg production, egg mass, feed intake, feed conversion, and egg specific gravity. In conclusion, when protein level of a corn-soy diet is below 15% (< approximately 15 g protein/h/d) or lysine intake is less than 720 mg/h/d, the addition of synthetic lysine while maintaining a 0.75 Met+Cys/Lys ratio can significantly improve performance of laying hens. Although adding synthetic lysine to diets containing less than approximately 15% protein improved performance and profits, these results give no indication as to whether or not diets containing less than 15% protein would be economical.

Key Words: Synthetic lysine, Hens, Met+Cys/Lys ratio

S182 Performance comparison and nutritional requirements of five commercial layer strains in phase IV. G. Wu*, Z. Liu, M. Bryant, D. Roland, *Auburn University*.

Because of changing genetics of hens, it is necessary to know which strain has the best performance and to determine nutrient requirements that allow for maximum profits. Little or no research has been done with these current strains during Phase IV (67-76 wks). In this experiment, five commercial layer strains (Current-Bovans, Older-Bovans, Oldest-Bovans, Experimental-Bovans, and Dekalb) were used to compare performance and nutrient requirements when fed three protein levels (16.00, 14.85, and 13.99%). There were eight replicates of 15 hens for each treatment and the trial lasted 12 weeks. The results showed that there were no interactions (P > 0.05) between protein and strain on feed intake, egg production, egg mass, egg weight, feed conversion, egg specific gravity (ESG), and body weight of hens. Protein had significant effects on feed intake, egg mass, egg weight, (ESG), and body weight. There were significant strain effects on feed intake, egg production, egg mass, egg weight, feed conversion and ESG. Current-Bovans had the best overall performance among the five layer strains. However, Dekalb had significant higher egg weight compared to Bovans. The best performance of Current-Bovans and Dekalb was obtained with hens fed the 16.00% protein diet. The nutritional requirements for maximum profits were dependent upon egg and feed price.

Key Words: Strain, Nutrient Requirements, Bovans, Dekalb

S183 Amylase, protease and xylanase in broiler chickens vaccinated and challenge with mixed *Eimeria* spp.: Ileal amino acid and protein digestibility. E. O. Oviedo-Rondón^{1,2}, S. Clemente-Hernández^{3,1,4}, J. Parker¹, J. Remus³, E. Pierson³, ¹Stephen F. Austin State University, ²Facultad de Medicina Veterinaria y Zootecnia, Universidad del Tolima, Colombia, ³Danisco Animal Nutrition, ⁴Universidad Autónoma de Chihuahua.

Exogenous enzymes improve amino acid (AA) digestibility in healthy chickens. This trial evaluated the utilization of a combination of amylase, protease, and xylanase designed for corn-soybean meal diets (Avizyme® 1502 Feed Enzyme System) on the ileal digestibility (ID) of AA and crude protein (CP) in broilers vaccinated and challenge with mixed *Eimeria* spp. The trial was conducted in Petersime brooding units with 504 d-old male Cobb-500 chickens distributed in 72 cages. Twelve treatments as a result of a 3 x 3 factorial, plus 3

negative controls (No additives-No challenge) within each CP level were distributed. CP levels (19, 21, 23%) and anticoccidial control program (Cocci-Vaccine, Antibiotic + Ionophore, and Vaccine+Enzyme) were evaluated as main effects. All chickens, except those in the negative and positive control (A+I) treatments were vaccinated at 1 d of age with Advent®. All chickens, but those in negative control treatments were gavaged at 17 d with of *E. acervulina*, *E. maxima*, and *E. tenella*. Diets contained 0.8% Celite and 0.3% CrO₂ as markers. Eight days post-challenge, ileal digesta contents were collected, frozen, and lyophilized. Diets and digesta samples were analyzed for acid insoluble ash, CP, and AA contents. Nutrient ID was calculated. Significant effects of the interaction between dietary CP content and anticoccidial program were only observed for serine and tyrosine ID. Coccidia challenge reduced the ID of CP and AA by 7%. Cocci-vaccinated chickens had better ID than none vaccinated birds fed with diets containing A+I, without being statistically different. Enzyme addition did not improve significantly the ID of CP or AA. These results indicate that the beneficial effects of this complex enzyme combination over BWG (5.6 and 17.0 %) and FCR (4.9 and 8.6%) 7 days after mixed cocci-challenge, in diets containing 18.5 and 20.1% of CP, respectively, might be due to changes in carbohydrate substrates available to microflora communities in the ceca. This has beneficial effects against *E. tenella*, and finally in live performance.

Key Words: Enzyme, Amino acid digestibility, Crude protein, Coccidiosis, Broilers

S184 Differential allometric growth of broiler chickens influenced by dietary lysine levels. S. Clemente-Hernández^{*1,2}, E. O. Oviedo-Rondón^{1,3}, ¹Stephen F. Austin State University, Texas, ²Universidad Autónoma de Chihuahua, México, ³Facultad de Medicina Veterinaria y Zootecnia, Universidad del Tolima, Colombia.

The adequate and complete description of growth is a major bottleneck in the development and application of mathematical models to estimate nutrient requirements. Allometry, the study of the growth of one component of the body in relation to the whole, was used to describe effects of lysine in chicken growth and development. Amino acids can affect body composition and differential tissue development. Lysine has been linked to structural muscle development, especially *Pectoralis* muscles. This experiment was conducted to measure and model the effects of three dietary levels of lysine over the dynamic development of broilers. Cobb-500 chickens were placed under simulated commercial conditions, and fed one of three diets formulated to be iso-nutritive but to have either optimum levels of digestible lysine (1.19, 1.08, 0.98, and 0.85%) for maximum breast development, or 10% above or under this level in each one of the four dietary periods. Chickens were slaughtered and parts dissected at 1, 5, 12, 19, 32, 45 and 56 days of age. Whole body weight, feathers, blood, head and neck, feet and shanks, breast muscle, legs, wings, intestines, liver, gizzard and proventriculus, and rack were weighed in each chicken. A minimum of nine chickens per treatment were evaluated in each period. Parameters of growth curves were estimated by the non-linear procedure of JMP IN® 5.1. Allometric growth ratios were calculated by plotting the logarithms of parts (Y) and whole body weights (X) (linear procedure). Significant differences were observed for parts growth. Significant effects of diets over whole body and parts growth were observed. Internal organs grew at slightly lower rate than the whole body, and breast muscle, legs and wings growth faster than the whole body. Dietary lysine levels can affect differential body parts development. It is important to describe those dietary effects to develop accurate growth models.

Key Words: Modelling, Allometry, Growth and development, Chickens, Lysine

S185 Adhesion of probiotics to intestinal cells *in vitro*. A. Klimitsch¹, R. Plail², G. Schatzmayr^{*1}, E. Binder², ¹Biomim GmbH, ²Erber AG, ³Institute for Agrobiotechnology.

Adhesion to intestinal cells seems to be a crucial point in the mode of action of administered probiotics, thus providing an improved colonic flora and pathogen exclusion. Therefore the main objective of this study was to examine the adhesive ability of previously isolated bacterial strains from chicken in regard to their adhesion ability to intestinal cell lines *in vitro*. Adhesion properties were then used as additional selection criteria for probiotic strains for the de-

velopment of a competitive exclusion product for poultry.

Bacterial strains were isolated from the digestive tract of several 14 to 42 day old chicken. After identification finally 15 probiotic isolates were investigated in adhesion tests using two different cell lines (Caco-2 (ACC 169) and HT-29 (ACC 299), both obtained from Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH). Adhesion assays were performed at late postconfluence according to a method described by Bibiloni *et al.* with some modifications. Monolayers were incubated with bacterial suspension, non adherent bacteria were then removed by washing. Attached bacteria were determined after lyses of monolayers by plating applicable dilutions on appropriate agar plates.

Results clearly show the ability of the isolated strains to attach to intestinal cells *in vitro*. The amount of attached cells varies between 1.0x10⁵ and 1.0x10⁶ cells per cm² monolayer surface. We found good correlation for adhesion results between the two cell lines for most of the isolates. Additionally it could be demonstrated that some strains adhere to a higher extent to monolayers and results indicate that the extent of adhesion does not necessarily depend on the genus of the tested strain.

Due to the findings of our *in vitro* investigations the property of adhesion was used as additional selection criteria for bacterial isolates in the course of the development of a probiotic poultry product.

Key Words: Probiotics, Adhesion, Competitive exclusion

S186 Assessing antibiotics in a broiler withdrawal program. F. Yan^{*}, C. A. Keen, K. Y. Zhang, P. W. Waldroup, University of Arkansas.

Antibiotics are typically changed at intervals during the growing period of broilers with one type fed in starter and grower periods with another fed in the finisher period. The present study was conducted to compare the response of broilers to two different antibiotics used during the finisher period. Thirty male and 30 females of a commercial broiler strain were placed in each of 48 pens (50 ft² per pen). The pens contained new softwood shavings over concrete floors, with a topdressing of old litter. Diets were formulated to current industry standards for starter (0-14 d), grower (14-32 d) and finisher (32 to 47 d) periods. From day-old to 32 d the birds were fed a common diet supplemented with bacitracin methylene disalicylate at 50 g/ton and salinomycin at 55 g/ton. The test diets were fed from 32 to 47 d of age. One group received no antibiotic supplementation. The second diet was fortified with lincomycin (LM) at 2 g/ton, the third received LM at 4 g/ton, and the fourth diet received virginiamycin (VM) at 10 g/ton. Each treatment was assigned to twelve pens of birds. Birds and feed were weighed at 1, 14, 32, and 47 d. At day 47, two entire pens per treatment were processed for dressing percentage and parts yield. From 32 to 47 d, the weight gain and feed conversion of birds fed diets with 4 g/ton LM or 10 g/ton of VM was significantly better than that of birds fed the negative control. The addition of 4 g/ton of LM resulted in 0.047 kg increase in body weight gain and a reduction of 0.062 in feed conversion, while the addition of 10 g/ton of VM resulted in 0.049 kg increase in body weight and a reduction of 0.06 in feed conversion. No significant differences in mortality during the trial period were observed. No differences in processing parameters were noted. Feeding LM at 4 g/ton resulted in an additional 24.83 pounds of meat per ton of feed while feeding VM at 10 g/ton resulted in an additional 24.5 pounds of meat per ton of feed compared to the negative control. From these figures, one may determine the cost: return benefits based on current prices of antibiotics and value of broiler meat.

Key Words: Antibiotics, Broilers, Lincomycin, Virginiamycin

S187 S3 combined strategies counteract mycotoxin successfully. V. Starkl^{*}, Biomim Austria.

The most common approach to counteract mycotoxins is via adsorption of minerals. Unfortunately, mycotoxins are completely different in their chemical structure and therefore it is impossible to equally deactivate all mycotoxins by using only a single strategy. Adsorption works perfect for aflatoxin but less- or non-adsorbable mycotoxins have to be deactivated using a different approach. One investigated solution to this problem is the detoxification via biotransformation: Specific enzymes change the toxic group of a mycotoxin to a non-toxic metabolite under intestinal conditions. Two live organisms, *BBSH 797* and *Trichosporon mycotoxinivorans* are known to proliferate under intestinal con-

ditions and produce specific enzymes. Currently, zearalenone, ochratoxin A and all trichothecenes (DON & T-2 toxin) can be detoxified by *BBSH 797* and *Trichosporon mycotoxinivorans*. All mycotoxins are known to influence detrimentally toward the liver and can cause immunosuppression in animals. The addition of plant and algae extracts to the animals diet overcomes these negative influences. Silymarin, an extract of the milk thistle, is used as hepatoprotector and algae extracts are used to support the immune system of the mycotoxin-infected animals. Mycofix® Plus, a product based on the three above mentioned strategies proved to be a solution to help counteract the diverse mycotoxin problems in poultry.

Key Words: Mycotoxin, Biotransformation, Adsorption, Silymarin, Algae

S188 Crude protein level effects on gene expression in broiler chickens.

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Crude protein (CP) levels have been shown to affect live performance and *pectoralis major* development in multiphase dietary regimes. Specific genes including insulin-like growth factor I (IGF-I) and myostatin have been associated with muscle development. Low CP diets (LCPd) can support average performance when supplemented with synthetic amino acids (AA). This project focused on evaluating the expression of genes, previously associated with muscle development, in broilers fed diets formulated with varying CP levels, but including all essential AA at constant or under minimum recommended levels for ileal digestible ideal protein, by supplementation of synthetic Lysine, Methionine, Threonine, Tyrosine, Arginine, Isoleucine, Valine, and Glycine. Cobb-500 chickens were placed under simulated commercial conditions, and fed diets that had either standard commercial CP level (StCP) or reductions of up to 3 percentage points in each dietary phase. Combinations of StCP or LCPd were offered in each one of the 4 dietary phases, for a final factorial set of 16 feeding treatments. Tissue samples were collected at 36, 47, and 56 days of age for further analysis. Breast muscle samples, at 36 days of age, from the fixed-StCP and fixed-LCPd treatment groups were analyzed for the mRNA expression of IGF-1 and myostatin. This analysis indicated a significant decrease of myostatin gene expression in the fixed-LCPd treatment group in relation to the fixed-StCP group, which may, in part, explain the variation in performance associated with dietary CP levels.

Key Words: Gene expression, Breast muscle, Broilers, Dietary crude protein

S189 Crude protein levels on the dynamic development of breast muscle in broilers growing up to 56 days of age.

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Crude protein (CP) levels in different dietary phases affect breast muscle development to varying extents during the growth process of broilers. Low CP diets (LCPd) can support average performance when supplemented with synthetic amino acids (AA), but carcass composition can be affected. This research project evaluated the breast muscle development by RT-ultrasound images and serial slaughtering of broilers fed diets formulated to vary as to CP level. All essential AA were kept constant or under minimum recommended levels for digestible ideal protein, by supplementation of synthetic Lys, Met, Thr, Try, Arg, Ile, Val, and Gly. The significance of each phase over breast muscle development was evaluated. Cobb-500 chickens were placed under simulated commercial conditions and fed diets that have either standard commercial CP level (StCP) or reductions up to 3 percentage points in each dietary phase. Combinations of StCP or LCPd diets were offered in each one of the 4 dietary phases, starter (0-15d), grower (15-35d), finisher(35-42d) and withdraw (42-49d) for a final factorial set of 16 feeding treatments. Data of carcass part yields was collected by serial slaughter at different ages, and by repetitive measurements of the areas of breast muscle images captured with the RT-Ultrasound ALOKA-500™ from the same chickens throughout the grow-out pe-

riod. Diets were analyzed for CP and total AA. Data was analyzed by Mixed Model Proc for repetitive measurements and NLIN Proc of SAS. Gompertz growth curve parameters (initial growth rate=L, and rate of exponential decay=K) were estimated for whole body weight and breast meat yield of each one of the 18 chickens per treatment. ANOVA of Gompertz parameters indicate significant effects of dietary treatments over breast muscle development. The treatment fed StCP in starter and finisher, and LCPd in grower and withdraw had the lowest L and K. Contrarily, the treatment fed LCPd in starter, grower and withdraw and StCP in finisher period had the highest L and K values.

Key Words: Breast Muscle, Development, Broilers, Crude Protein, Synthetic Amino Acids

S190 Efficacy of low phytic acid corn and soybean meal in reducing manure phosphorus excretion by young broiler chicks.

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A 21 day study was conducted to determine the extent to which manure P could be reduced by feeding a combination of low phytate corn and low phytate soybean meal. One hundred day old male broiler chicks were randomly allotted to a 2 x 2 factorial arrangement of treatments from day 1 to 21. Treatments included: (1) normal corn (NC) and normal soybean meal (NSBM); (2) NC and low phytate soybean meal (MSBM); (3) low phytate corn (LPC) and NSBM; and (4) LPC and MSBM. The LPC contained 0.20% nonphytate P (NPP) and 0.32% total P (TP), whereas NC contained 0.05% NPP and 0.33% TP. The NSBM contained 0.12% NPP and 0.72% TP, whereas MSBM contained 0.45% NPP and 0.65% TP. Chicks fed diets containing MSBM consumed more feed (P <.05) compared with chicks fed diets containing NSBM. However, there were no differences in body weight gain (BWG; P >.05) between chicks fed diets containing MSBM and NSBM. As a result, chicks fed diets containing NSBM were more efficient (P <.05) in converting feed to BWG. Chicks fed diets containing NC gained more weight (P <.05) compared with chicks fed diets containing LPC. However, there were no differences in feed intake (P >.05) between chicks fed diets containing LPC and NC. As a result, chicks fed diets containing NC were more efficient (P <.05) in converting feed to BWG compared with chicks fed diets containing LPC. Percent toe ash and tibia ash were not affected (P >.05) by dietary treatments and averaged 12.8% and 44.5%, respectively across all treatments. Replacement of NC with LPC resulted in a 16% reduction in manure P, whereas replacing NSBM with MSBM resulted in a 29% reduction in manure P. When both LPC and MSBM were substituted for the normal grains there was a 48% reduction in manure P. Results indicate that the amount of P excreted in poultry waste could be substantially reduced by replacing normal corn and normal soybean meal with low phytate corn and low phytate soybean meal.

Key Words: Low phytate, Corn, Soybean meal, Broiler

S191 Is valine limiting in broiler grower diets based on corn and soybean meal?

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Broiler diets formulated to contain crystalline L-Thr when priced below the shadow value, in addition to synthetic Met and crystalline Lys, allow for more efficient amino acid utilization. However, minimums for the less limiting amino acids become more critical. Valine has not been researched to the extent of Ile, but initial dose response data indicated that the 21 to 42 d old broiler needs 0.65% digestible Val. Because this level is lower than that recommended (NRC, 1994), we conducted an experiment to determine Val responses in growing male broilers. Ross x Ross 508 chicks (360) were randomized across 30 floor pens and fed common diets to d 22. Five dietary treatments (6 replications/treatment) were implemented from 22 to 42 d: 1) Control with 0.74% digestible Val; 2) Val reduced to 0.65% digestible; 3) as 2 plus L-Val to equal treatment 1; 4) as 2 plus a non-essential amino acid mixture to equal the N content that L-Val contributed in treatment 3; and 5) as 3 with L-Arg and L-Trp to equal treatment 1. Growth performance was measured for the 22 to 42 d period, and processing characteristics and litter ammonia were measured at d 42. Feed conversion (P = 0.66) and BW gain (P = 0.11) did not differ among

treatments. However, broilers fed treatment 4 had reduced ($P < 0.05$) feed intake vs treatments 1, 2, and 5. Differences ($P < 0.05$) in carcass yields did not occur. However, carcass and tender weight in broilers receiving treatment 4 were lower than treatments 1 and 5, and 1, 3, and 5, respectively. No differences ($P < 0.05$) in litter ammonia were found among treatments. These results indicate that Val needs may be below 0.74% digestible for the growing male broiler. In addition, these results point to the ability to marginally reduce less limiting amino acids without compromising bird performance.

Key Words: Valine, Amino acid, Broiler

S192 Broiler responses to a feed enzyme in diets differing in amino acids and energy. M. L. West^{*1}, A. Corzo¹, W. A. Dozier, III², M. E. Blair³, M. T. Kidd¹, ¹Mississippi State University, ²USDA, ³Adisseo USA, Inc.

Diets with typical and reduced amino acid and energy levels, with and without a feed enzyme (Rovabio™), were fed to 1,472 Ross x Hubbard broilers (23 male and female chicks/pen randomly allotted to 32 pens) from 1 to 42 d of age. The floor pens contained built-up litter, nipple drinkers, and a tube feeder in a tunnel ventilated house. The combination of two diets with and without the feed enzyme resulted in a 2 x 2 factorial design (8 replications/treatment) implemented in feeds from 1 to 14, 15 to 31, and 32 to 42 d of age. Pen BW gain, feed conversion, and mortality were obtained in all periods. Uniformity was measured by pen at 42 d of age. At 42 d of age, five male and female broilers per pen were randomly selected for processing and subsequent deboned breast meat. The reduced diet resulted in poorer ($P < 0.05$) BW gain at d 31, but not at d 14 or 42. Corrected feed conversion for the weight of mortality was poorer ($P < 0.05$) in birds fed reduced diets in all periods. Enzyme treatment did not affect BW gain or corrected feed conversion and differences in uniformity did not occur (coefficient of variation averaged 12% for BW). However, an interaction ($P = 0.06$) occurred for 14 d mortality indicating that the reduced diet increased mortality without dietary enzyme, but mortality was eliminated in the reduced diet with feed enzyme. Although the reduced diet resulted in more ($P < 0.05$) abdominal fat, other differences ($P < 0.05$) in carcass parameters were not observed. Future research will be concerned with further reducing diet density and enzyme responses as the enzyme treatment in the reduced diet resulted in similar responses to the control diet. In conclusion, reducing dietary amino acids and energy resulted in higher corrected feed conversion and abdominal fat, and the deleterious effect of the reduced diet on early mortality was overcome with the feed enzyme.

Key Words: Feed enzyme, Amino acid, Energy, Broiler

S193 Dietary amino acid density, sex, and strain cross effects on growth and yields of broilers. A. Corzo^{*1}, M. T. Kidd¹, D. J. Burnham², E. R. Miller³, R. Gonzalez-Esquerre⁴, S. L. Branton⁵, ¹Mississippi State University, ²Ajinomoto Heartland, LLC., ³Aviagen North America, ⁴Novus International, Inc., ⁵USDA.

Two experiments similar in design, management and strain crosses, evaluated the effect of nutritional programs mimicking regimes currently used by much of the U.S. poultry industry (MD), and an isocaloric program with higher amino acid levels (HD), across broilers varying in gender and strain cross (one high-yield strain and two multi-purpose strains). Data from both experiments were pooled because no interactions between trials occurred. Feeding HD diets to broilers increased BW and decreased feed conversion throughout all phases of the study when compared to broilers fed MD diets ($P < 0.01$). Males had higher BW and lower feed conversion than females ($P < 0.01$). Mortality was unaffected by diet type, strain or sex. Broilers corresponding to the high-yield strain had lower BW and higher feed conversions when compared to the two multi-purpose strains ($P < 0.01$). Broilers fed HD diets resulted in lower abdominal fat percentage and higher breast meat yield at 42 and 56 d of age ($P < 0.01$). No effect of dietary regimen was observed for yield of carcass, wings, drums or saddle. Carcasses from female broilers typically had a higher percentage of fat and wings, and lower drum and saddle yields ($P < 0.01$). The high-yield strain had higher breast meat yield and dressing percentage, and lower percentage of fat and saddle ($P < 0.01$), when compared to the multi-purpose strains. Improvements in economically important parameters observed from feeding a high amino acid plane were noted. Considerations for increasing amino acid nutrient minimums should be made on a cost-benefit basis.

Key Words: Amino acid density, Breast meat yield, Broiler, Lysine, Protein

S194 Presence of dark spots in yolk from 60 weeks old broiler breeders. A. Hernandez¹, J.A. Quintana^{*1}, S. Carrillo¹, P.H. Ramirez², ¹Facultad de Medicina Veterinaria y Zootecnia, ²Instituto Nacional de Nutrición Salvador Zubiran.

The presence of dark spots in yolk must be related to physical and chemical factors that depend on the content of humidity, fat, protein, ashes, calcium, phosphorus and iron. The present study was made with the purpose of evaluating the physical characteristics of the egg and the presence of total lipid content in egg yolk of 60 weeks old broiler breeders presented dark spots in yolk. Weight of the yolk and albumen and dried shell, height of albumen, as well as the total lipid quantification in yolk of 60 eggs were evaluated individually by using two different techniques of lipid quantification; the method of Folch and determination of Etereo Extract. After the evaluation of physical characteristics, the eggs were divided in two lots; eggs without spots and with dark spots. The results were evaluated by means of descriptive statistical tests. Differences were obtained in the percentage of egg albumen, being observed a greater amount in eggs without spots; nevertheless, there were no differences in the percentage of yolk, weight of shell and height of albumen. 70% of eggs used in this experiment showed dark spots in yolk. In agreement to the amount of total lipids in egg yolk with spots and without spots, no differences were observed in both techniques of quantification. The lipid content in yolks with presence of dark spots by means of the technique of Folch was 27.5%; and in yolks without spots it was 27.42%, meantime using the technique of Etereo Extract, the lipid content in yolk with spots was 41.76% and without spots it was 42.38%. All these values are similar in yolks with spots and without spots, but they are inferior to the reported ones in the literature, that mentions 32% of total lipids by means of the technique of Folch and 61% by the technique of Etereo Extract. In accordance to the results of present study, it can be stated that no relation exists between the lipid content of the yolk and the presence of spots.

Key Words: Egg, Yolk, Lipid, Dark spot, Egg physical characteristics

S195 Cecal microbial ecology in chickens fed low crude protein diets supplemented with synthetic amino acids. S. Clemente-Hernández^{*1,3}, M.E. Hume², E. O. Oviedo-Rondón^{3,4}, ¹Universidad Autónoma de Chihuahua, México, ²USDA, ARS, Southern Plains Agricultural Research Center, Food and Feed Safety Research Unit, ³Stephen F. Austin State University, ⁴Facultad de Medicina Veterinaria y Zootecnia, Universidad del Tolima, Colombia.

Intestinal microbial communities (MC) influence animal performance and ammonia volatilization. Diet composition causes significant effects over MC and modulation of harmful microbes. Low crude protein diets (LCPd) supplemented with synthetic amino acids (AA) may gain importance due to environmental concerns and cost effective supplemental AA sources. This study evaluated the effects of feeding LCPd or commercial standard crude protein diets (StCpD) on cecal MC of broilers at 41 and 48 d of age. LCPd were formulated to be 3 percentage points lower than StCpD in each phase, but supplemented with synthetic Lys, Met, Thr, Try, Arg, Ile, Val, and Gly to keep all essential AA levels constant, or under minimum recommended levels for digestible ideal protein profiles, for each feeding period. Cobb-500 chickens were placed under simulated commercial conditions and fed with one of these two diets (StCpD or LCPd) in starter (0-15d), grower (15-35d), finisher (35-42d) and withdrawal (42-49d) phases, for a final factorial combination of 16 feeding treatments. Diets were analyzed for CP and total AA and a correlation of 98% was observed between formulated and analyzed values. Cecal samples were collected, frozen in liquid nitrogen and kept at -70°C. DNA was isolated and denaturing gradient gel electrophoresis (DGGE) was used to examine PCR-amplified fragments of a 16S ribosomal DNA variable region from cecal bacteria. There was only 74.6% similarity coefficient (SC) for the two clusters of genomic DNA from the two age periods evaluated. This indicates changes by diet and/or age in only 7 d. Samples for the 41 d and the 48 d formed two minor clusters with 88.4 and 86.8% SC between band patterns, respectively. Chickens fed LCPd in grower ration did not differ in cecal MC when fed StCpD or LCPd in finisher. However, SC greater than 92% were observed for treatments fed the same types of diets in grower, finisher and withdraw phases independently of the diet fed in the starter period. Dietary CP level and/or synthetic AA supplementation affect cecal MC.

Key Words: Broilers, Cecal microbial ecology, DGGE, Low crude protein, Synthetic amino acids

S196 The use of degermed-dehulled corn and low-phytate soybean meal to reduce phosphorus excretion from poult raised to 18 days of age. J. Godwin*, J. Grimes, A. Gernat, M. Wineland, V. Christensen, S. Russell, North Carolina State University.

An experiment was conducted to determine if feeding mechanically degermed-dehulled corn (DDC) and genetically selected low-phytate (LP) soybean meal (SBM) to turkey poults would support growth performance similar to diets containing normal corn and SBM, as well as reduce phosphorus (P) excretion from poults raised to 18 days of age. Nicholas male turkey poults (168) were housed in Petersime batteries with 24 pens (7 birds per pen) at day of hatch with 4 pens per treatment. Six starter rations were fed to poults in mash form. Treatments consisted of normal corn and SBM + calcium (Ca) and P at industry standards, NRC, and 85% of recommended NRC values (ConInd, ConNRC, Con85), and DDC and LP SBM + Ca and P at industry standards, NRC and 85% of recommended NRC values (DDCInd, DDCNRC, DDC85). Feed and water were provided ad libitum for 18d. The following parameters were measured; growth performance, AMEn, and apparent nitrogen retention (ANR). Feed consumption and feed to gain, by pen, and individual BW were determined at 6, 12 and 18d. The following parameters were also measured at 18d: percent toe and tibia ash, tibia breaking strength and P levels in tibia and fecal samples. Neither mean BW, feed conversion, cumulative feed conversion, toe ash, tibia ash, nor AME were significantly affected by treatment. Tibia breaking strength was significantly higher when poults were fed industry standards and NRC levels of Ca and P versus 85% of NRC. ANR was significantly higher when poults were fed control ingredients. Fecal P was significantly affected by ingredient source and Ca and P level. Fecal P was significantly lower when poults were fed DDC and LP SBM. Fecal P was decreased further when levels of Ca and P decreased from industry standards to 85% of NRC regardless of ingredient source. Using DDC and LP SBM resulted in poult performance equal to using control corn and SBM and also resulted in reduced fecal P.

Key Words: Phosphorus, Degermed-dehulled corn, Low-phytate soybean meal, Turkey poults

S197 Lycopene and lutein incorporation into egg yolks. J. B. Olson*, E. A. Koutsos, California Polytechnic State University.

Lycopene is a carotenoid with potential anti-cancer functions. Specifically, epidemiological data suggests that lycopene consumption is associated with reduced prostate cancer risk. Additionally, it has been demonstrated for other carotenoids (lutein) that bioavailability is greater in egg yolks than in supplements or plant-based sources. Therefore, second cycle laying hens (Hyline W36) were examined for their ability to absorb dietary lycopene and incorporate lycopene into egg yolks. A completely randomized design was used in which 3 levels of dietary lycopene (0, 1.0 and 5.7 mg/bird*day) or lycopene + lutein (5.7 mg lycopene + 0.8 mg lutein/bird*day) were incorporated into the birds normal diet. Birds were housed in commercial cages with ad libitum access to water (n=3 cages/diet; 5 birds/cage), and were fed 120 g diet/bird*day. Using the Roche color fan, egg yolks had no detectable change in pigmentation after 18 d of feeding lycopene. There was no evidence of lycopene incorporation into egg yolks or plasma, however the diet containing lutein resulted in a significant increase in yolk lutein (P<0.05) but not plasma lutein (P=0.36). Future trials will examine increased dietary lycopene levels and routes of administration.

Key Words: Lycopene, Lutein, Laying hen, Egg yolk

S198 Withdrawn.

S199 Withdrawn.

S200 Withdrawn.

S201 Use of yeast culture residue as a pre-harvest treatment in the control of *Campylobacter* in broiler chicks. P. Anderson*¹, V. Stanley¹, B. Grace¹, O. Taylor¹, M. Hume², A. Sefton³, ¹Prairie View A&M University, ²USDA-ARS, ³Alltech.

An experiment was conducted to examine the use of a yeast culture residue (YCR) as a pre-harvest treatment to control *Campylobacter* colonization in broiler chicks. Two hundred unvaccinated and unsexed Cornish Rock day-old broiler chicks were separated into four treatment groups: control uninfected and untreated; *Campylobacter* infected and untreated; YCR treated and uninfected; and *Campylobacter* infected and treated with YCR at 2 kg/ton of feed. The infected chicks were challenged with a cocktail mixture (10⁸ cfu) of ten strains of *Campylobacter* spp. (5 *C. jejuni* and 5 *C. coli* strains). Infected chicks were challenged by crop gavage at 1-day-old. Yeast culture residue was incorporated into the feed and the chicks were fed from one day of age. In the *Campylobacter*-free chicks, YCR did not significantly change the cecal concentration of the volatile fatty acids and lactic acids. However, birds infected with the organism had decreased concentrations (P<0.05) of cecal propionic acid (25.28 vs 13.97 μ mole/gram of cecal contents), but elevated butyric (34.01 μ mole/gram) and lactic acid levels (0.85 vs 0.62 μ mole/gram of cecal contents) with the feeding of YCR (P<0.05), compared to the control (17.07 and 0.62 μ mole/gram of cecal contents), respectively. A significant reduction (P<0.05) in the total population of the organism (6.14 vs 4.22 cfu/gram of cecal contents) was observed in the infected birds with the inclusion of YCR. In conclusion, the dietary inclusion of yeast culture residue at 2 kg/ton could be a useful pre-harvest treatment in the reduction of *Campylobacter* colonization in broiler chicks.

Key Words: *Campylobacter*, Yeast culture residue, Broilers

S202 Comparison of effects of induced molting through feed withdrawal or feeding of wheat middlings on humoral immunity of laying hens in a commercial egg-laying farm. T. Murase*¹, T. Sato¹, S. Miyahara¹, K. Otsuki¹, P. Holt², ¹Laboratory of Veterinary Microbiology Tottori University, ²USDA/ARS Southeast Poultry Research Laboratory

While induced molting provides the benefit of extending the effective egg-laying life of the flock, an altered immune response has previously been observed in birds subjected to experimentally induced molting through feed withdrawal (FW). Recently, it was demonstrated that feeding layers wheat middlings (WM), as an alternative method to FW, could successfully molt birds. In the present study, antibodies in sera of commercial layers subjected to molting through feeding of WM were compared with those molted through FW. All the flocks were given Newcastle disease (ND) vaccine through drinking water 3 to 4 times at 3- to 5-month intervals. Production of antibodies in sera was calculated by titrating HI titers against ND virus strain La Sota. Flocks 1 to 4 were molted through 11- or 12-day FW and flocks 5 and 6 were molted through 25-day feeding of WM. In flocks 3, 4, and 5, birds were vaccinated when the birds restarted egg lay after molt while flocks 1, 2 and 6 did not receive this postmolt vaccination. Sera were obtained at the following times: before the molting treatment; when the birds went totally out of egg production after the treatment; when the birds restarted laying after they returned to feed, and when the egg production reached a plateau. Among the flocks receiving ND vaccine only prior to molt, a mean titer in sera obtained from flock 6 given the WM were unchanged through the period, whereas titers in sera from flock 2 treated by FW decreased after the birds restarted egg lay. Among the flocks receiving ND vaccine before and after molt, a mean of the last titers in sera from flock 5 given the WM increased, whereas those in sera from flock 3 and 4 treated with FW were unchanged. These results suggest that molting via feeding WM exerts minimal negative effects on antibody production against ND vaccine compared with FW.

Key Words: Induced molt, Newcastle Disease vaccine, Feed withdrawal, Wheat middlings, Humoral immunity

S203 Effect of a commercially-available drinking water acidifier on *Salmonella enteritidis* growth and water consumption in broilers. A. Wolfenden^{*1}, R. Jarquin¹, G. Nava¹, C. Solis², S. Higgins¹, L. Bielke¹, G. Tellez¹, B. Hargis¹, ¹University of Arkansas, ²Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional.

A specific combination of organic acids and flavorings was previously shown to kill *Salmonella enteritidis* (SE) using a simulated *in vitro* broiler crop assay and within the crop of broilers *in vivo*. Moreover, this formulation did not reduce water consumption during feed withdrawal in market-age broilers. Presently, we evaluated the original acid mix (OAM) as compared to the commercially-available resulting product (Perform-Max Optimizer II; PMO). Using a previously published simulated *in vitro* chicken crop assay, with 7 replicates per treatment, we compared OAM and PMO at normal and high label-recommended concentrations to tubes containing saline alone. Tubes containing acids and sterile chick starter were individually vortexed for 2 sec. and incubated for 2.5h at 40C. At 2.5h, SE cfu/mL was determined for each tube. The OAM and each concentration of PMO significantly ($p < 0.05$) reduced recoverable SE in this assay. The low label-recommended concentration of POM reduced recoverable SE by 0.71 Log₁₀ cfu while the high concentration, recommended for feed withdrawal, reduced recoverable SE by 1.39 Log₁₀ cfu as compared to controls. In two separate experiments, using market-age broilers (n=30/pen, 4 replicates per treatment), water consumption was determined over 4h on feed or during a 7h simulated pre-slaughter feed withdrawal. Administration of PMO at either label-recommended dosage rate did not negatively affect ($p > 0.05$) water consumption as compared to controls regardless of the presence or absence of feed. These data suggest that this product may be useful as a substitute for lactic acid administration during pre-slaughter feed withdrawal for reduction of crop-borne salmonellae. A potential advantage of this approach may be increased water consumption and reduced carcass shrinkage associated with lactic acid administration.

Key Words: Salmonella, Organic acids, Feed withdrawal

S204 Feed additives, and *Eimeria spp.* vaccination and/or infection over microbial uricase activity to reduce ammonia volatilization from broiler manure. J. Parker¹, E. O. Oviedo-Rondón^{*1,2}, S. Clemente-Hernández^{1,3}, B. Clack¹, ¹Stephen F. Austin State University, Texas, ²Facultad de Medicina Veterinaria y Zootecnia, Universidad del Tolima, Colombia, ³Universidad Autónoma de Chihuahua, México.

Inhibition of microbial uricase in poultry manure helps to decrease ammonia (NH₃) volatilization. This project measured microbial uricase activity (MUA) in ileal contents to identify potential effects of feed additives (FA) and/or vaccination-infection with *Eimeria spp.* to reduce NH₃ volatilization. Samples from two experiments were analyzed with Amplex[®] Red/Uric Acid/Uricase kit. These trials were conducted in Petersime brooding units with 504 Cobb chickens distributed in 72 cages. In the first trial, 11 treatments were evaluated. The non cocci-vaccinated treatments corresponded to two control treatments, Uninfected-Unmedicated (UU) and Unmedicated-Infected, and treatments with the following FA combinations: BMD[®]+Coban[®], Stafac[®]+Sacox[®], Yucca schidigera extract (BioSupreme[®]), BMD[®]+BioSupreme[®], and Stafac[®]+BioSupreme[®]. Cocci-vaccinated groups received Advent[®] at 1 d of age and were fed diets that contained: no-FA, BioSupreme[®], BMD[®]+BioSupreme[®], Stafac[®]+BioSupreme[®]. In the second trial, 12 treatments using a 3 x 3 factorial, plus 3 UU within each dietary crude protein (CP) level were distributed. CP levels (19, 21, 23%) and anticoccidial control programs (BMD[®]+Coban[®], Advent[®], and Advent[®]+Avizyme-1502[®]) were the main effects. All chickens but those in UU were challenged at 21 or 19 d of age. Ileal contents were collected 7 d post-challenge. In trial 1, a significant effect of treatments was observed in the MUA. Yucca extract in non vaccinated birds had the lowest MUA. In contrast, the combination of Yucca with BMD and virginiamycin had the highest MUA. Cocci-vaccination did not influence MUA. In trial 2, CP level had a significant effect on MUA independently of the type of cocci-control program. The combination BMD[®]+Coban[®] caused the lowest MUA. Control treatments and the combination of Avizyme-1502[®]+Advent[®] showed a decrease in MUA as the CP level increased. The Yucca schidigera and BMD+Monensin combination were the FA that caused the lowest MUA, which suggests that they may help to reduce NH₃ volatilization.

Key Words: Microbial uricase activity, Ammonia volatilization, Feed additives, Coccidia, Broiler chickens

S205 Presence of inoculated *Campylobacter* and *Salmonella* in unabsorbed yolks of male broilers at six weeks of age. N. Cox¹, L. Richardson^{*1}, R. Buhr¹, J. Northcutt¹, B. Fairchild², J. Mauldin², ¹United States Department Agriculture, Agricultural Research Services, ²University of Georgia, Department of Poultry Science.

Day old male broiler breeder chicks were obtained from a commercial hatchery and raised as broilers. At 5 weeks of age, the broilers were orally inoculated with a 106 cocktail (three characterized strains) of either *Campylobacter jejuni* or *Salmonella* spp. One week after inoculation, the birds were killed and defeathered. The abdominal cavity was examined and any unabsorbed yolk material (and remaining yolk stalk) and cecae were aseptically removed for microbiological analyses. For each pooled sample (two birds per pool), a total plate count (TPC), an Enterobacteriaceae count (ENT) and a test for the presence of *Campylobacter* and *Salmonella* was performed. For the *Salmonella* inoculated birds, 2/12 cecae and 0/12 unabsorbed yolk samples were positive for *Salmonella*. The average yolk TPC was log 3.4cfu/g and the average ENT was log 1.9cfu/g. For the *Campylobacter* inoculated birds, 12/12 cecae and 9/12 unabsorbed yolk samples were positive for *Campylobacter*. The average yolk TPC was log 3.5cfu/g and the average ENT was log 3.1cfu/g. The inoculated *Campylobacter* colonized the cecae in every instance and were present 75% of the unabsorbed yolks. Alternatively, the inoculated *Salmonella* were not found in any of the unabsorbed yolks and only rarely in the cecae. In our previous studies, *Campylobacter* was found to be naturally present in the mature and immature ovarian follicles and in other internal organs of the broiler breeder hens, while *Salmonella* were not found. This study provides further evidence that *Campylobacter* and *Salmonella* differ in their abilities to colonize a chickens body.

Key Words: Unabsorbed Yolk, Campylobacter, Salmonella, Broilers, Cecae

S206 Effects of MG vaccinations on B and T-Cell populations in layer chickens. S. Collier^{*1}, G. Pharr², S. Branton¹, J. Evans¹, ¹USDA ARS South Central Poultry Research Laboratory, ²Miss. State Univ., College of Veterinary Medicine.

Mycoplasma gallisepticum (MG) results in economic losses in chickens via morbidity and mortality. The resulting chronic respiratory infection reduces egg production and contributes to condemnation of meat at poultry processing plants. Attempts to control MG infections have primarily involved prophylaxis using live vaccines of attenuated strains. However, the exact mechanisms by which the available MG vaccines confer protection in layer chickens is currently unknown. In the present study, flow cytometry was used to examine the humoral and cellular immune responses of chickens inoculated with 6/85 at 60 wk of age, then challenged with F strain at 62 wk of age. There were significant changes in the percentage of Bu-1⁺ and CD4⁺ peripheral blood lymphocytes isolated from vaccinated birds at 66 wk of age in comparison to control birds. The results of this study suggest that humoral and cellular immunity may play a role in the protective immune response induced by MG vaccines.

Key Words: Mycoplasma gallisepticum, Vaccinations, Layers, Chickens, Lymphocytes

S207 A comparison of fitting growth models with a genetic algorithm and nonlinear regression. W. Roush^{*}, S. Branton, USDA, ARS, South Central Poultry Research Laboratory.

A Genetic Algorithm (GA), an optimization procedure based on the theory of evolution, was compared with nonlinear regression for the ability of the two algorithms to fit the coefficients of poultry growth models. It was hypothesized that the nonlinear approach of using GA to define the parameters of growth equations would better fit the growth equations than the use of non-linear regression. Two sets of growth data from the literature, consisting of male broiler BWs grown over periods of 168 and 170 d, respectively, were used in the study. The growth data were fit to two forms of the logistic model, the Gompertz, the Gompertz-Laird, and the Saturated Kinetic Models using both the SAS NLIN procedure and a GA. There were no statistical differences for the comparison

of the residuals (the difference between observed and predicted BWs) of growth models fit either by a GA or nonlinear regression. The plotted residuals for the nonlinear regression and GA determined growth values confirmed observations of others that the residuals have oscillations resembling sine waves that are not represented by the growth models. It was found that GA could successfully determine the coefficients of growth equations. A disadvantage of slowness in converging to the solution was found for the GA. The advantage of GA over traditional nonlinear regression is that only ranges need be specified for the parameters of the growth equations; whereas, estimates of the coefficients need to be determined and in some programs the derivatives of the growth equations need to be identified. Depending on the goal of the research, solving multivariable complex functions with an algorithm that considers several solutions at the same time in an evolutionary mode can be considered an advantage especially where there is a chance for the solution to converge on a local optimum when a global optimum is desired. It was concluded that the fitting of the growth equations was not so much a problem with the fitting methodology as it is with the form of the equation.

Key Words: Broiler, Growth equations, Genetic algorithms, Regression analysis, Mathematical models

S208 Effects of two diverse air velocities at high temperatures with a high dew point on broiler performance. W. Dozier, III^{*1}, B. Lott², S. Branton¹, ¹USDA, ARS, South Central Poultry Research Laboratory, ²Mississippi State University.

Tunnel ventilation is a common practice in broiler production to remove excess heat. Previous research from this laboratory has shown that applying air velocity of 180 m/min improved growth responses of broilers from 42 to 49 d of age. Information is sparse on the ventilation needs of broilers reared under cyclic high temperatures. This study examined the responses of broilers to increasing air velocity from 120 to 180 m/min exposed to cyclic temperatures of 25-35-25° C and a dewpoint of 23° C from 21 to 49 d of age. Three trials were conducted. In each trial, seven-hundred and forty-two male broilers were randomly assigned to either six floor pens (53 birds/pen; 0.07 m²/bird) or two air velocity tunnels at 21 d of age. Each tunnel contained four pens (53 birds/pen; 0.07 m²/bird). Three treatments were employed: 1) control (still air), 2) air velocity of 120 m/min, and 3) air velocity of 180 m/min. Each of three trials over time represented a block. The experimental unit was the average value of the four pens in a wind tunnel and six floor pens, respectively, since air velocity treatments were fixed effects. Subjecting broilers to an air velocity of 180 m/min increased (P=0.05) BW and BW gain compared with broilers exposed to an air velocity of 120 m/min from 29 to 35, 36 to 42, 43 to 49, and 21 to 49 d of age. Broilers reared with an air velocity of 180 m/min consumed more (P=0.02) feed from 36 to 42 and 21 to 49 d of age, had improved (P=0.01) feed conversion from 21 to 49 d of age, and reduced (P=0.03) the incidence of mortality from 36 to 42 d of age compared with birds subjected to air velocity of 120 m/min. Subjecting birds to air velocity increased (P=0.02) BW, BW gain, and feed consumption during each weekly interval from 21 to 49 d of age over the control group. These data indicate that applying air velocity of 180 m/min is advantageous with high cyclic temperatures for broilers having an approximate BW of 2.0 to 3.0 kg.

Key Words: Air velocity, Broiler, Temperature, Ventilation

S209 Evaluation of the behavior patterns of laying hens on alfalfa-molt diets. C. Dunkley¹, W. Kim¹, R. Johnson², C. Woodward¹, K. Dunkley¹, T. Friend², L. Kubena^{*3}, D. Nisbet³, S. Ricke¹, ¹Dept. of Poultry Science, Texas A & M University, ²Dept. of Animal Science Texas A & M University, ³USDA-ARS.

The behavioral patterns of hens on a 90% alfalfa: 10% layer ration (A90) molt-diet was compared with feed withdrawal (FW) hens, using full-fed (FF) hens as a control. This was done in order to assess how much the A90 hen behavior was affected by the molting process. White Leghorn laying hen approximately 54 weeks old were put into three rooms for the induced molt study. Each room had one treatment; A90, FW or FF. The hens were individually housed in 2-tier battery wire cages with nipple waterers and they were given layer ration and water ad libitum. There were 39 hens per treatment and six hens from each

treatment were observed for behavior patterns on each day of the nine-day molt. The behavior patterns observed were; non-nutritive pecking, walking, drinking, feeder, still, resting, sitting, preening, pecking neighbor, and head movement. On Day 1 of the induced molt, A90 hens were given their diet and the feed was removed from the FW hens. On Day one of the molt, A90 and FF hens were observed to be drinking more than the FW hens (P<0.05). Throughout the nine molting period, the A90 and FF hens spent less time doing non-nutritive pecking than the FW hens. There were no significant differences between the A90 and FW hen in the preening activity on Days 5, 6, 7, 8 and 9 of the molt, with the amount of time spent preening increasing for the A90 hens on Day 8 to 20.27%. This could be an indication of the onset of feather push out which began on Days 8 - 9. As the period progressed the FW hens spent less time going to the area where the feeder was located while the A90 hens spent statistically the same amount of time at the feeder as the FF hens. Throughout the nine day molt period, A90 birds were observed walking an average 6.69% of the time, while the FW hens were walking 18.64% and FF 12.69% of the time. The behavior of the A90 hens over the nine-day molt period indicated that they were less affected by the molting process than the FW hens even though they were undergoing the molting process at a comparable rate as the FW hens as indicated by the time spent preening and the cessation of laying.

Key Words: Behavior, Molting, Alfalfa, Layers

S210 A self-propelled, constant speed, spray vaccinator for commercial layer chickens. S. Branton^{*1}, W. Roush¹, J. Evans¹, S. Collier¹, G. Pharr², ¹USDA, ARS, South Central Poultry Research Unit, ²College of Veterinary Medicine, Mississippi State University.

Vaccination of commercial layer chickens is labor intensive and often results in poor rates of seroconversion which, in turn, generally correlates with decreased flock uniformity and performance. Major problems with vaccinators currently in use by the layer sector of the poultry industry include the non-uniform speed of the applicator system and pressure fluctuations at the spray nozzles which together contribute to sporadic dispersion of the vaccine as the vaccinator is carried or pushed past the cages. The CPJ Vaccinator is battery-powered, self-propelled, maintains a constant speed, and operates with constant nozzle pressure. In field use, the CPJ Vaccinator has resulted in a labor savings (from 5 men to 1 man) and time savings (from 45 minutes to 7.5 minutes) to vaccinate a house of 75,000 pullets with live Mycoplasma gallisepticum (MG) vaccine. Six-week post-vaccination seroconversion rates for MG were also improved - 90.63% as compared to 70.57%.

Key Words: Vaccinator, Layers, Self-propelled, Seroconversion

S211 S16S rDNA community analysis of the intestinal microbiota of turkey poults in response to different treatments. K. Bos^{*}, T. Wiard-Baltzley, T. Parrott, T. Rehberger, Agtech Products, Inc.

The gastrointestinal (GI) tract of a turkey poult harbors a dense and metabolically active microbial community. Antibiotics and other antimicrobials are used as an intervention tool to control GI disease during the production process. However, the effects of these treatments on the GI microbial community are poorly understood. Traditional plating methods have previously been used to characterize microbial populations in the GI tract. Unfortunately, these techniques are limited in their ability to detect only cultivable microorganisms. The objective of this study was to use denaturing gradient gel electrophoresis (DGGE) to: (1) assess the succession events of the microbial community in the GI tract of turkey poults, (2) determine the effects of antibiotic use on GI microflora, and (3) determine the effects of litter treatment on GI microflora. Four treatments were examined in this study: control (no treatment), MicroTreat "P" (poultry litter treatment), Baytril (antibiotic), and MicroTreat "P" with Baytril. The GI tracts of three representative birds from each of 16 sites (4 sites per treatment) were dissected on days 1, 5, and 14, sampling the duodenum, jejunum, and ileum. Genomic DNA was extracted, amplified using PCR, and then visualized by DGGE. Results from DGGE analysis confirmed an increase in DNA bands (ribotypes) with an increase in bird age. DGGE results also indicated a shift in the GI microflora from higher G/C content on day 1 to a microflora with additional lower G/C content bacteria on days 5 and 14. MANOVA results indicated that replicates within each treatment group pos-

sess similar microbial communities, while microbial communities differ significantly between treatments ($p < 0.001$). MANOVA results also indicate bacteria which are prominent in each treatment group. DNA sequencing has identified these bacteria to include *Helicobacter cholecystus*, an uncultivable *Clostridium* sp., and uncultured bacterium from chicken cecum. Overall, DGGE has been an effective tool to monitor the microbial diversity and succession in response to treatments.

Key Words: 16S rDNA, Turkey poult, DGGE, Sequencing

S212 Winter gaseous flux from litter for commercial broilers at placement, middle and end of flock. D. Miles*, P. Owens, D. Rowe, *USDA-ARS Waste Management & Forage Research Unit.*

In 2003, the National Research Council recommended a process-based, mass balance approach to estimate emissions. Empirical methods, such as the one described below, will form the basis of the desired models. The objective of this study was to characterize the variability of litter gas flux through a winter flock in a solid sidewall commercial broiler house. On d 2, 22, and 45, ammonia, nitrous oxide, and carbon dioxide concentrations were measured using a photoacoustic multigas analyzer and flux boxes. The 146 m by 12.8 m house was sampled on a grid at 5 m across the house and 12 m down the house (36 sampling points). Instantaneous flux measurements were estimated from the differences in time zero and one-minute concentrations using the ideal gas law. Litter temperature, air temperature and relative humidity were concurrently measured on the grid; litter was sampled at each site to determine litter pH and moisture. Ammonia flux on d 2 averaged 439 and 361 mg/(m² hr) for the brood and vacant ends of the house. The greater flux in the brood area corresponds to higher litter and air temperature and low litter moisture. Flux for nitrous oxide and carbon dioxide were also greater in the brood area at d 2. At d 22, all gas fluxes were diminished along the center of the house and were elevated at the sidewalls, mimicking ventilation profiles. Ammonia flux on d 45 for the entire house averaged 694 mg/(m² hr); carbon dioxide flux for the house averaged 19386 mg/(m² hr) for this date. The lowest air temperatures (18.9-22.8 °C), moderate litter temperatures (24.4-31.1 °C), and the highest litter moistures (25-39%) accompanied these fluxes. Litter ammonia flux increased only marginally from placement to mid-growout but more rapidly from mid-flock to sell-age. Litter moisture was the only parameter to approximate this same trend. Bird age, or collinear factors such as size, amount of deposition, and management, is a significant factor for the increase in litter gas flux during the winter and should be considered in comprehensive models for emission estimates.

Key Words: Ammonia, Broiler, Carbon dioxide, Emissions, Litter

S213 Short-term exposure of elevated carbon dioxide concentrations on broiler growth responses. H. Olanrewaju*, W. Dozier, III¹, S. Branton¹, D. Miles², B. Lott³, B. Fairchild⁴, A. Pescatore⁵, ¹USDA, ARS, *Poultry Research Unit*, ²USDA, ARS, *Forage and Waste Management Unit*, ³Department of Poultry Science, *Mississippi State University*, ⁴Department of Poultry Science, *University of Georgia*, ⁵Department of Animal Sciences, *University of Kentucky*.

Air quality is essential to getting chicks off to a good start. Improvements in poultry house design and construction have reduced heat loss. To conserve fuel usage, growers ventilate less during winter growouts. As a result, carbon dioxide (CO₂) concentration often exceeds 3,000 ppm during brooding with modern housing. Three trials were conducted to evaluate growth responses of broiler chicks subjected to progressive concentrations of CO₂ gas. In each trial, 480 d old male Ross x Cobb chicks were randomly distributed to eight environmentally-controlled chambers (60 chicks/chamber; 0.08/m²). Four treatments were employed. The CO₂ was metered into the chambers to maintain concentrations of 3,000, 6,000, and 9,000 ppm from 1 to 14 d and no addition of CO₂ served as the control. After 14 d, CO₂ addition was ceased and experimentation continued throughout a 42 d production period. Each treatment was represented by six replicate chambers (two chambers/trial) with three trials being replicated over time. Progressive additions of CO₂ reduced ($P < 0.04$) growth rate, but feed conversion and the incidence of mortality were unaffected from 1 to 14 d of age. Final BW gain and feed conversion were similar among the treatments, but cumulative mortality increased ($P = 0.025$) linearly. From 29 to 42 d, the incidence of mortality increased ($P = 0.049$) with gradient

increments of CO₂. Increasing CO₂ from 3,000 to 9,000 ppm led to a 228% increase (5.3 vs 12.1%) in mortality from 29 to 42 d with it being largely due to an occurrence of ascities. These results indicate that elevated CO₂ concentrations from 1 to 14 d did not alter cumulative growth performance, but increased the incidence of late-mortality.

Key Words: Aerial gas, Broiler, Carbon dioxide, Ventilation

S214 Characterization of the cross-reactivity of anti-Salmonella typhimurium antibodies to various strains of Salmonella typhimurium, and Salmonella enteritidis. P. Herrera¹, S. Ricke¹, L. Fang², R. Marquardt², L. Kubena³, D. Nisbet³, A. Byrd³, ¹Department of Poultry Science, *Texas A&M University*, ²Department of Animal Science, *University of Manitoba*, ³USDA-ARS.

Antibodies are useful in the rapid detection and quantification of specific antigens. However, the derivation of antibodies from mammalian sources have been time consuming and costly. Egg yolk antibodies (EYA) are proving to be a more rapid and less expensive. Eggs from inoculated hens contain relatively high concentrations of immunoglobulins which can be easily purified. However, EYA are polyclonal antibodies containing antibodies to several antigens. Thus it is necessary to test for cross-reactivity to other related antigens when working with EYA. The purpose of this study is to characterize the cross-reactivity of *Salmonella typhimurium* (ST) antibodies to various strains of ST and *Salmonella enteritidis* (SE). Leghorn hens were inoculated with purified flagella, lipopolysaccharide (LPS), and outer membrane protein (OMP) antigens from ST strain ATCC 13311. The eggs were collected and the EYA were purified by ammonium sulfate precipitation and dialyzation. The cross-reactivity of was determined by an indirect ELISA. Serovars of ST tested included: Anatum, Arizona, Javiana, Muenchen, Newport, Rubislaw, and Texas. Also tested were American Type Culture Collection (ATCC) strains 13311 and 14028, as well as poultry isolates designated BJ2710, NA/NO, and UK-1. The strains of SE tested were ATCC strains 13076, 40214, and BAA-708. The bacteria were diluted to an O.D. value of 0.4 at 600 nm. Aliquots (100 μ l) bound onto microtiter plates. The ELISA was performed using EYA diluted to 1:50,000. In the ELISA performed with the flagella antibody, ST strain ATCC 14028 reacted the strongest. Cross-reactivity ranged from 18.7 % for SE strain ATCC 13076 to 91.5 % for ST strain ATCC 13311. Similar results were with the LPS antibody; ATCC 14028 exhibited the highest response with cross-reactivities ranging from 29.4 % for SE strain ATCC 13076 to 70.5 % for ST strain ATCC 13311. In the ELISA performed with the OMP antibody no significant differences were observed; the antibody reacted strongly with all the strains tested.

Key Words: Salmonella, Antibodies, Cross-reactivity, ELISA

S215 Comparison of two models for induction of controlled stress in broilers. W. S. Virden*¹, C. D. Zumwalt¹, J. P. Thaxton¹, A. Corzo¹, W. A. Dozier, III², M. T. Kidd¹, ¹Mississippi State University, ²USDA.

Prolonged stress in broilers results in the release of the stress hormone corticosterone (CS). Elevated levels of CS in the blood cause a severe decrease in meat production as a result of CS-induced gluconeogenesis. Research has demonstrated that controlled stress can be induced in broilers through continuous administration of either CS or adrenocorticotrophic hormone (ACTH).

An experiment was conducted to compare two methods of eliciting a controlled stress response in broilers. Two hundred-forty Ross X Ross 508 male broilers were randomly placed into 20 pens (12 birds/pen). All broilers received common starter diets from d 1 to 20. From d 21 to 35, stress treatments were administered. Treatments consisted of 1) control (no ACTH); 2) 4 IU of ACTH/kg BW injected i.m. for 7 d; 3) 8 IU of ACTH/kg BW injected i.m. for 7 d; or 4) 15 mg CS/kg of diet suspended in soybean oil for 14 d. On d 35, chicks receiving treatment 4 had lower BW ($P < 0.01$) than all other treatments. Chicks given either ACTH injection treatment had lower ($P < 0.05$) BW than that of control. Broilers receiving treatment 4 also displayed higher ($P < 0.01$) feed conversion ratio over chicks receiving all other treatments, whereas chicks receiving ACTH injections did not differ from control. Heterophil to lymphocyte ratio was higher ($P < 0.01$) in broilers receiving treatment 4 than in all other treatments. Chicks receiving treatment 3 had higher ($P < 0.01$) heterophil to lymphocyte ratio than

chicks receiving treatment 2 or control. Cumulative feed intake and percentage mortality did not differ among treatments. Based on this research, feeding CS appears to be a more efficient method for eliciting a controlled stress response in broilers than ACTH injection.

Key Words: Stress, Corticosterone, Adrenocorticotrophic hormone, Broiler

S216 Influence of grain particle size and insoluble fiber content on *Salmonella* colonization and shedding in turkeys fed a corn-soybean meal diet. F. Santos*, A. Santos, Jr., P. Ferket, B. Sheldon, *North Carolina State University*.

Previous studies have shown that changes in feed formulation practices can impact the anatomy and physiology of the intestinal tract of poultry. Besides physical changes in the diet, variations in the composition can also alter the avian intestinal microflora. This study was conducted to determine the impact of feeding partially ground corn or insoluble fiber to 0-28 day old turkeys on intestinal development and its ability to modulate *Salmonella* cecal colonization and fecal shedding. Nicholas toms reared in cage batteries were assigned to 1 of 3 treatment (trt) diets: ground corn-soybean meal diet (C-SBM) (Control, TRT1), coarse ground C-SBM (TRT2), and 4% wood shavings + C-SBM (TRT3). A 3-strain cocktail of nalidixic acid-resistant *Salmonella enterica* serotypes Hadar, Javaina, Banana was orally-gavaged into each chick at placement. Cecal and fecal *Salmonella* populations (pop.) were estimated on days 7, 14, 21, 28, and 1, 14, 28, respectively. Growth performance and intestinal weights and lengths were also measured. The diets had no impact on *Salmonella* cecal or fecal pop. Cecal pop. at 7d averaged 5.9, 6.3 and 6.5 log CFU/g for TRT1-3, respectively. At 28d, *Salmonella* cecal pop. decreased by 3-logs across all treatments. The diets also did not impact body weight or gain. TRT2 and 3 had lower feed consumption (FC) at 7d (60, 62 vs 70 g, P<.05), but at 14d TRT2 had the highest FC (192 vs 174, 169 g, TRT1 and 3, respectively, P<.05). Compared to TRT1 and 2, TRT3 improved the 1-28d feed to gain ratio (1.33 vs 1.40, 1.47 g, respectively, P<.05). TRT2 and 3 produced significantly heavier gizzards throughout the study. Also, TRT2 had the heaviest gizzard weights at 28d (30 vs 28, 22 g/kg, TRT3 and 1, respectively, P<.05). Moreover, TRT2 also produced heavier small intestinal tracts, especially the jejunum. The use of coarse ground corn and wood shavings had no detectable influence on *Salmonella* colonization and fecal shedding and little effect on growth performance. However, the treatments did significantly impact gizzard development.

Key Words: *Salmonella*, Turkey, Gizzard, Whole grain, Wood

S217 Extra provision of oxygen (O₂) during incubation of leghorn breeder eggs and its effect in the embryo growth on 2,240 m altitude over sea level. A. Hernandez¹, J. A. Quintana^{*1}, A. Sanchez², ¹*Facultad de Medicina Veterinaria y Zootecnia*, ²*Cryoinfra SA de CV*.

The embryo depends on oxygen coming from the air, which contains 21%, that is the optimal concentration for their development. The partial increase of oxygen as well as a high temperature of incubation accelerates the rank of growth of the organs in the embryo. When the eggs are incubated in regions of high altitude, this can lower their hatchability due to the reduced oxygen concentration in the air. The objective of this study was to evaluate the effect of different oxygen concentrations in the development of embryo organs in a 2,240 m above sea level in Mexico City. Were used 5 setters type Brinsea that maintains the conditions necessary of temperature, humidity, turning and ventilation for the incubation, 30 eggs of Leghorn hens were placed by setter, and treated with three different oxygen concentrations, two setters with 23%, two with 25% and one with 21% with a rank + - 0.5%. When chicks were born, they were weighted and sized individually. Later autopsy was made, the heart, yolk sac, liver and intestine were weighted individually. A greater size of the chick, increased weight of liver and intestine were observed in the treatments of 23 and 25% of oxygen (p<0.05). With the treatment of 23% of oxygen, the greatest weight was obtained, whereas with the treatment of 25% of oxygen the intestine weighted more and the yolk sac was smaller (p<0.05). Descriptive significant differences were not obtained for the weight of the heart. In accordance with the results in the present study it was observed that the oxygen addition during the incubation period improves the development of some organs.

Key Words: Incubation, Embryonic development, Oxygen, Leghorn hens, High altitude

S218 Evaluation of Hisex brown hens performance, using nipple or cup drinkers. E. Estrada, G. Salazar, JA. Quintana*, *Facultad de Medicina Veterinaria y Zootecnia*

Water is one of the most important issues for animals; it is the main component in cells, and aids in the transport of nutrients and wastes in

an animal's body. Water can be a disease transmission source when contaminated. Nipple drinkers are the most common drinkers in modern poultry houses, and have some advantages compared to open drinkers. When poultry house temperatures rise, water consumption rises, too. Oppositely, when temperature in poultry houses with nipple drinkers rises, water consumption could decrease. In order to compare some performance issues on Hisex brown hens in two flocks in their first production cycle, cup drinkers were placed in three commercial laying hen houses, whereas nipple drinkers were placed in another three houses. Water consumption, egg weight and mortality was higher in cup drinkers (p<0.05). Broken egg was greater for nipple in the first flock, but lesser in the second flock, and we have no explanation for this finding. Number of eggs per housed hen, egg kilograms per housed hen, feed conversion, flock productivity index and percentage of dirty eggs has no significant differences. In conclusion, apparent water consumption and egg weight was higher with cup drinkers. Mortality was greater with cup drinkers which could possibly be due a contamination on open drinker systems.

Key Words: Water, Nipple Drinkers, Cup Drinkers, Hisex Brown, Hen

S219 Health and performance analysis of commercial turkey flocks treated with a commercial *Lactobacillus* -based probiotic. A. Torres-Rodriguez^{*1}, J. Barton², G. Tellez¹, B. M. Hargis¹, ¹*Poultry Science Dept.*, ²*Turkey Division*.

There have been isolated reports claiming improvements on body weight gain when probiotics are used, particularly under controlled experimental conditions, with limited field study information. To evaluate a commercially available probiotic product (FM-B11; IVS/Wynco), we evaluated the effect of treatment or non-treatment of a large number of commercial turkey flocks with regard to performance and selected health criteria. The probiotic was administered in drinking water at final concentration of 10E6 cfu per mL on three consecutive days and at three times of life of the flock: placement, after move to the grower house (around week 6 of life), and three to two weeks prior to live haul for processing. All flocks in the study were evaluated at processing plant for weight and condemnations from April to June, 2004. Data from 118 (58 Control, 60 Probiotic) flocks were compared by analysis of variance for average body weight, average daily gain (ADG), and feed conversion ratio (FCR), taking age as covariable. Flocks treated with the probiotic were heavier (6.91 ± 0.034 vs 6.72 ± 0.035; kg ± StdErr) and had higher body weight gain (74.5 ± 0.38 vs 72.9 ± 0.39; g/day ± StdErr) than untreated flocks (p<0.05). FCR was numerically improved (1.3 or 0.2 points, depending upon breed), although no statistical significance was observed (p>0.05) between treated and untreated flocks. The commercial producer reported that the additional 187 gm (0.412 lb) body weight at processing in probiotic-treated flocks accounted for \$0.078 per head as compared to controls when all costs were evaluated.

Key Words: Probiotics, Turkey, Performance, Health

S220 Effect of a probiotic and dietary lactose on poult performance. J. L. Vicente^{*1}, A. Torres-Rodriguez¹, X. Hernandez^{2,1}, S. E. Higgins¹, A. Wolfenden¹, G. Tellez¹, B. M. Hargis¹, ¹*Department of Poultry Science*, ²*DPA: Aves, FMVZ, UNAM*.

Recently, we have demonstrated that a commercially-available probiotic (FM-B11; IVS/Wynco) in combination with 0.1% dietary lactose increased body weight in turkeys by up to 15% under commercial field conditions. To evaluate the effect of these treatments under very clean isolation conditions, two treatments were evaluated in this study: LPC [dietary lactose (0.1%) and probiotic culture (~10⁶cfu/g) on feed and probiotic culture (10⁶cfu/ml) in the drinking water] and untreated controls. On the day-of-hatch, poults were moved from a commercial hatchery to a BSL2 isolation room which had been disinfected and

provided with fresh softwood shavings. Poults were fed a non-medicated turkey starter diet and water ad-libitum. Lactose and the probiotic culture on the feed was provided during the entire experiment in the LPC group and probiotic culture in the drinking water during the first three days. Due to the high variability in body weight, 100 poults were weighed and poults with body weight between the mean \pm 1STD were included in the experiment. Three hundred and twenty selected poults were randomly divided in 2 treatments with 4 replicate pens each (n=40/pen). Poults were tagged and initial body weight was recorded at placement and on days 7 and 14 of the experiment. Feed consumption and feed conversion were evaluated only during the second week. Body weights of LPC treated poults were significantly ($p<0.05$) increased at 7d (control: 163.3 ± 1.97 g vs. LPC: 175.5 ± 1.62 g) and at 14 d (control: 344.4 ± 3.60 g vs. LPC: 382.3 ± 3.58 g). Total feed consumption (days 7-14) was not significantly ($p>0.05$) different between treatments (control: 364.85 ± 15.45 g vs. LPC: 355.33 ± 10.12 g). However, feed conversion was significantly ($p<0.05$) improved in the LPC group (control: 2.022 ± 0.087 g vs. LPC: 1.772 ± 0.065 g). These data suggest that dietary lactose with an appropriate probiotic may enhance performance of poults even under very clean environmental conditions.

Key Words: Probiotic culture, Lactose, Turkey Poultry

S221 Effect upon egg-loss and hatchability of an artificial cuticle applied to eggs from Leghorn breeder hens. M. Juarez-Estrada^{*1}, O. Prado-Rebolledo², J. Quintana-Lopez¹, ¹*Department of Animal Production: Poultry, FMVZ-UNAM, ²FMVZ Colima University.*

Some Leghorn breeder hatching egg producers in [\[www.ntsearch.com/search.php?q=Mexico&v=56\]\(http://www.ntsearch.com/search.php?q=Mexico&v=56\) Mexico wash and ship eggs that are laid on the scratch area in an attempt to maximize saleable chick number. But washing eggs is not good practice to get at first quality chickens. An option is to apply an artificial cuticle by spray. A total of 1,464 eggs were collected from a 13 wk old post-molted commercial Leghorn breeder flock of Babcock B-300 \(n=500\). The AC was made from egg albumin lyophilized plus aqueous mixture of organic based disinfectant, it was evaluated upon egg-loss weight \(ELW\) and hatchability \(HA\) of Leghorn molted hen eggs in 2 X 2 factorial arrangement with two sources of eggs, Nest and Floor and two disinfectant treatments, with AC or without AC, with 183 eggs each group, and one replicate by group. The four groups were a\) Nest eggs with AC, b\) Nest eggs without AC, c\) Floor eggs with AC and d\) Floor eggs without AC. All eggs were weighed prior to and after storage, and at transfer from the setters to the hatchers. Each of the four treatment groups was placed into separate setters and hatchers to prevent cross-contamination. After 21 d of incubation all chicks were counted. The data were analyzed using the GLM procedure on SAS, and significance measured at \$P<0.05\$. Fresh egg weight was not different between the treatments. At 21 days there was not interaction between any factor. ELW of fertile eggs was significantly \(\$P<0.05\$ \) lower in the groups with artificial cuticle \(AC \$18.46\pm 3.72^b\$ %; without AC \$19.64\pm 2.64^a\$ %\). HA did not show factor interactions, but Nest factor was improved by AC \(Nest \$70.24\pm 14.05^a\$; Floor \$60.71\pm 4.61^b\$ \) and by itself \(With AC \$70.68\pm 10.21^a\$ %; without AC \$60.27\pm 8.45^b\$ %\). The AC helped to diminish ELW, and apparently did not produce any damage to the embryo. Using AC is good option to diminish WLE from high porosity eggs or when the incubation place is located at higher altitude over sea.](http://</p>
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Key Words: Molted hens, Egg-loss weight, Egg natural barrier, Breeder birds, Incubation