

pelleted feeds. The goal of the meta analysis was to combine data from 4 studies and evaluate the enzyme product across all studies. Data were tested for homogeneity and pooled to enable a statistical meta-analysis, where $P=0.05$ was considered significant. Data from the starter period indicated an improvement of 2.8% and 2.6% in growth and feed efficiency, respectively ($P<0.01$). Growth and feed efficiency were improved by 4.9% and 3.8%, respectively during the grower period ($P<0.01$). From 0-42d, Hemicell[®] improved growth and feed efficiency by 4.2% and 3.6%, respectively ($P<0.001$). Also, a significant improve-

ment of 7.5% ($P<0.001$) was observed for the European Production Efficiency Factor, 1-42 d (gain, g of survivors/(FCR*10))*(100 - % mortality). Mortality (mean 4.7%) was considered normal with no significant differences between control and treated birds. The meta-analysis supports the conclusion that Hemicell[®] Feed Enzyme is effective in broilers at the recommended dose of ~79,000 U/kg feed.

Key Words: broilers, B-mannanase, meta analysis, body weight, Feed conversion

POSTERS

Monday, January 23

Room: 308-309

S-P150 Initial proteomics analysis of differentially expressed proteins from ts-11 and F strain detected by Western blotting. S.D. Collier*¹, G.T. Pharr², S.L. Branton¹, J.D. Evans¹, and S.A. Leigh¹, ¹USDA, Agricultural Research Service, South Central Poultry Research Laboratory, Mississippi State, Mississippi, ²Mississippi State University, Mississippi State.

Mycoplasma gallisepticum (MG) is the causative agent of chronic respiratory disease in layer chickens. The MG vaccine strains that are approved and commercially available for use in layer chickens include F, ts-11 and 6/85. The MG vaccine strains ts-11 and 6/85 are safer than the F strain vaccine and they have little or no potential of spreading from bird to bird. However, ts-11 and 6/85 appear to be less efficacious than F strain. Results from studies suggest that the use of MG vaccine strain F in replacement flocks over a period of time results in the displacement of the original field strain. Kleven and colleagues (1998) showed that in pen trial studies the F strain displaced the virulent R strain, but ts-11 and 6/85 did not. Also reports of MG breaks in layer flocks previously vaccinated with ts-11 or 6/85 have resulted in revaccination of these flocks by F. The continued use of F strain in displacement and revaccination regimens necessitates the development of more rapid and sensitive field tests that will differentiate between wild-type and vaccine strains of MG. In the present study, ts-11 and F strain whole cell extracts were analyzed by Western blotting and proteomic methodologies. Differentially expressed bands were excised, in-gel digested with trypsin, and analyzed by mass spectrometry. The proteins were characterized as internal proteins and were predicted to be mostly involved in such cellular processes as carbohydrate transport and metabolism, energy production and conversion, posttranslational modification, protein turnover, chaperones and transcription and translation. The results of this study suggest that proteomics may aid in the characterization of proteins that could contribute to the development and improvement of serologic and DNA based MG diagnostic tests.

Key Words: western blotting, proteomics, MG, ts-11, F strain

S-P151 Effect of an ultrabiotic on Salmonella typhimurium colonization and blood composition in turkeys experimentally challenged. A. Koncicki¹, B. Mazur-Gonkowska¹, A. Krasnodebska-Depta¹, and M. Contreras*², ¹University of Warmia and Mazury, Olsztyn, Poland, ²Citrex Inc., Miami, Florida.

The effect on intestinal colonization and blood composition in turkeys experimentally challenged with ST and treated with a commercial

ultrabiotic (Citrex) in the drinking water was evaluated. Thirty healthy 6 week-old BUT turkeys were divided into 3 treatments and kept in isolated areas. The first group was non-treated and non-challenged (negative control), the second group was challenged by intubation into the crop with a bacterial suspension containing 6×10^9 CFU/ml; and the third group was also challenged with ST and treated with Citrex (100 ppm) daily in the drinking water 24 hours before challenge and 7 days post challenge (PC). Seven days PC, five turkeys from the second and third groups were randomly separated from the rest and treated with Citrex for 14 days. At 1, 7 and 21 days PC, cloacal swabs for ST isolation were cultured. Seven days PC, swabs from internal organs were cultured for ST isolation and blood samples were tested for blood composition determination. Twenty one days PC, no ST was isolated from the group challenged and treated with Citrex, nor the negative control group. Seven days PC, the hematocrit, hemoglobin and white blood cells values detected in the negative control group and the group treated with Citrex were significantly higher than the values obtained in the group challenged with ST. Under the conditions of this experiment, the administration of Citrex in the drinking water avoided a permanent intestinal colonization with ST and eliminated the infection after challenge. The hematological results showed the effectiveness of Citrex in protecting against the deleterious effects caused by ST.

Key Words: Citrex, *S. typhimurium*, ultrabiotic, turkey, intestinal colonization

S-P152 Comparison of in vitro inhibition of growth of Salmonella Typhimurium and Escherichia coli on broiler feed media by two sources of Bacillus subtilis. A. Murry*¹ and A. Hinton², ¹University of Georgia, Athens, ²Agricultural Research Service, USDA, Athens, Georgia.

In this study, a *Bacillus subtilis* isolate obtained from the fecal contents of adult male broilers was compared with a *B. subtilis* isolate (#10774) obtained from the American Type Culture Collection (ATCC) to evaluate their ability to in vitro inhibit the growth of *Salmonella* Typhimurium and *Escherichia coli*. The *B. subtilis* fecal isolates were recovered from broiler fecal droppings and identified using the MIDI Sherlock Microbial Identification System. For the inhibition assay, agar media composed of 7.5 % of a broiler starter or grower diet and 1.2 % agar were inoculated with 18-24 h cultures of *S. Typhimurium* or *E. coli*. Sterile filter paper disks were dipped in cultures of the *B. subtilis* isolates that were grown in Tryptic Soy Broth (TSB) for 24 hours at 30°C. The disks dipped in TSB without the *B. subtilis* isolates were used as con-

trols. The disks were then placed in the center of plates with the feed agar that were inoculated with *S. Typhimurium* or *E. coli* and incubated for 24 hours at 37°C. After incubation, zones of inhibition of *S. Typhimurium* and *E. coli* growth around the filter paper disks were measured. Results indicated that zones of inhibition produced by both *B. subtilis* isolates were larger for *S. Typhimurium* ($P < 0.03$) and *E. coli* ($P < 0.001$) than zones for the controls in both the starter and grower feed agar media. In addition, the fecal *B. subtilis* isolate produced zones of inhibition of *S. Typhimurium* and *E. coli* that were larger ($P < 0.001$) than zones produced by the ATCC isolate. These findings indicate that although *B. subtilis* isolates from different environments can inhibit the growth of *S. Typhimurium* and *E. coli* *in vitro*, isolates recovered from the fecal contents of broiler chickens may produce significantly greater inhibition of the growth of enteric bacteria associated with poultry.

Key Words: *Salmonella*, *Escherichia coli*, *Bacillus subtilis*, *in vitro*, inhibition

S-P153 Effects of betaine on immune response, IGF-1 and hepatocyte proliferation in laying hens. J.H. Park¹, S.Y. Park¹, C.W. Kang², and K.S. Ryu*¹, ¹Department of Animal Resources & Biotechnology, ²School of Veterinary Medicine, Chonbuk National University, Chonju, Republic of Korea.

An experiment was conducted to determine the effects of betaine on immune response, IGF-1 concentrations and hepatocyte proliferation in laying hens. A total of 72 ISA-brown laying hens were divided into four groups of 18 hens each and fed corn-soybean meal based diets with 0, 300, 600 and 1,200ppm betaine addition for four weeks. The effects of betaine on splenocyte proliferations with mitogens, concanavalin A (Con A) and pokeweed mitogen (PWM), were assayed after incubation using 3H-thymidine uptake. Proliferations of splenocyte were significantly increased by activation of mitogen, Con A or PWM. Mitogen effects of Con A were increased by Con A plus betaine injection (0.1mM), whereas PWM effects did not affect in PWM plus betaine injection (0.1mM) *in vitro*. Splenocyte proliferation by laying hens fed betaine weakly increased in the presence of PWM, but slightly suppressed in the presence of Con A *in vivo*. Con A-induced splenocyte proliferation were increased in dietary 600ppm betaine, but inhibited in 1,200ppm betaine supplementation diet. Spleen weights and sheep red blood cell (SRBC) titers of hens fed betaine tended to increase compared to those of control, but were not significantly different. Increasing dietary betaine concentration was increased to IGF-1 concentrations of blood and liver in dose dependent manner.

Betaine supplementation stimulated H3-thymidine incorporation and suppressed p42/44 MARK activation in hepatocytes. These results suggested that betaine may be involved in cell proliferations, p42/44 MARK and IGF-1 concentration of blood and liver in laying hens.

Key Words: betaine, immunity, IGF-1, Splenocyte, SRBC

S-P154 Effects of ACTH-infusion on blood physiological variables and acid-base balance in broiler chickens. H. Olanrewaju*¹, S. Wongpichet², J. Thaxton², W. Dozier¹, and S. Branton¹, ¹USDA/ARS Poultry Research Unit, Mississippi State, Mississippi, ²Mississippi State University, Mississippi State.

Research has shown that adrenocorticotropic hormone (ACTH) infusion at 8 IU/kg BW/d for 7 d was the minimum effective dose that

caused physiological stress in broilers. However, the understanding of acid-base status during ACTH infusion in broilers is lacking. The present study was conducted to study effects of stress, caused by continuous infusion of ACTH, on acid-base balance in broiler chickens. Osmotic pumps delivered 8 IU ACTH/kg BW/d for 7 d or saline at 1ML/h for 7 d. Arterial blood samples were taken on d 0 (baseline values) and on d 4, 8, and 14 after onset of infusions. The ACTH treatment caused increased blood concentrations of hematocrit (cHct), hemoglobin (ctHb), HCO_3^- , mean corpuscular hemoglobin concentration (McHc) and corticosterone (CS), along with decreased blood concentrations of pO_2 , cNa^+ , and Cl^- during post-implantation period ($P < 0.05$). Blood pH and concentrations of K^+ were not significantly ($P < 0.05$) changed by ACTH treatment. Results indicate that stress induced by infusion of ACTH does not prevent homeostatic regulation of acid-base balance, as indicated by constant blood pH. However, due to the increased need for O_2 to support gluconeogenic energy production, the bird responded by increased erythropoiesis. This adaptive response provided greater numbers of erythrocytes and the total amount of circulating hemoglobin to deliver need O_2 for metabolism.

Key Words: acid-base balance, stress, ACTH, broiler

S-P155 Life cycle changes in bone mineralization of broilers. P. Talaty* and P.Y. Hester, Purdue University, West Lafayette, Indiana.

Leg problems due to valgus/varus deformities, tibial dyschondroplasia (TD), field rickets, and femoral head necrosis are costly to the broiler industry. A national survey of broiler companies indicate that broiler flocks experience 1.1% mortality due to leg problems and that an additional 2.1% of the birds are condemned or downgraded during processing as a result of leg abnormalities. The current study was carried out to determine life cycle changes in bone mineralization of the tibia and humerus of male and female commercial meat-type chickens. Ross male and female broilers were placed in separate littered floor pens at day of age with 48 birds/pen at a density of 774 sq cm/ bird. Birds were raised using standard management procedures. Broilers used for live scans were selected at random from each of the two floor pens. The humerus and tibia of 6 females and 6 males were scanned at weekly intervals from 1 to 7 wk of age using dual energy X-ray absorptiometry (DEXA). Using the mixed model procedure of SAS, bone mineral density (BMD) was analyzed using an analysis of covariance with BW as a covariant. The whole plot was the sex of the bird, whereas the type of bone (tibia and humerus) was a subplot using the individual bird as the experimental unit. A split plot with repeated measures was used to compare ages (2, 3, 4, 5, 6, and 7 wk). Bone mineralization at 1 wk of age was low and undetectable by DEXA in many broilers; therefore, the data collected at 1 wk of age were not included in the statistical analysis. Results indicated that the BMD of the humerus and tibia increased from 2 to 4 wk of age and peaked at 4 wk of age. The BMD values remained at approximately peak values for the remainder of the study (to 7 wk of age) with one exception. The BMD of the humerus of male broilers decreased at 6 and 7 wk of age as compared to peak values at 4 and 5 wk of age resulting in a bone x sex x age interaction ($P < 0.04$). When considering the short life cycle of growing broilers, these results suggest that the BMD of the tibia and humerus reaches its peak at 4 wk of age.

Key Words: broiler, bone mineral density, tibia, humerus, dual energy X-ray absorptiometry

S-P156 Eggshell conductance effects on turkey embryo cardiac function. V. Christensen*¹, L. Bagley², J. Prestwich², D. Ort¹, and M. Wineland¹, ¹North Carolina State University, Raleigh, ²Moroni Turkey Hatchery, Moroni, Utah.

Eggs produced by flocks at high altitude have reduced eggshell conductance (G) compared to those at sea level. Immature tissues result because of the shorter incubation periods noted at high altitude. Two tissues sensitive to this immaturity are the intestine and the heart. Intestinal diseases and heart failure are two major causes of poult mortality. It was hypothesized that hypoxia or accelerated development may cause reduced growth or maturation in cardiac tissue in the neonatal poult. To test the hypothesis, eggs were produced by flocks of turkeys located at high altitude (3,000 m). The initial study measured heart rates of embryos in eggs of known weight and G. Correlation analysis indicated a slight but significant positive correlation between G and heart rate. A second study was conducted to verify the first in which G was reduced artificially by coating the shell with paraffin either 1 or 2 cm from the pointed end. Reducing G reduced heart rates in a graded response that confirmed the prior results. In the third study, G and incubator temperature were tested for their effects on cardiac physiology. Increased incubator temperature increased heart rates and affected cardiac physiology with no subsequent effect on embryo or hatchling survival. In the fourth study, G and incubator oxygen concentration were tested for their effects on cardiac physiology. Both low G and low oxygen reduced heart rates and affected cardiac physiology. Low oxygen reduced embryo survival, but low G had no effect on embryo or hatchling survival. It is concluded that reduced G in turkey eggs at high altitude is a physiological mechanism to ensure adequate cardiac function and embryo survival. Incubators at high altitude may need to be operated to ensure longer incubation periods to optimize poult quality.

Key Words: high altitude, cardiac function, eggshell conductance, embryo survival

S-P157 S-Plenic lymphocytes interferon pattern during a secondary response in *Eimeria tenella* infected broiler chickens. M.A. Juarez-Estrada* and T.L. Fehervari, *Department of Animal Production: Poultry; FMVZ-UNAM., México, D.F. México.*

Interferon (IFN) secretion pattern from splenic lymphocytes T (SLT) stimulated with Concanavalin-A, during *Eimeria* secondary response was investigated. At first study, 32 twenty days old broiler chickens (Hubbard x Hubbard) were challenged with 1×10^4 sporulated oocysts of *Eimeria tenella* (SOET). They were again challenged 14 days later (5×10^4 SOET). At the second trial, 32 twenty days old broiler chicks were trimming immunized during 10 days with 1×10^3 of SOET. Ten days after the last trimming dose, they were challenged (5×10^4 SOET). Spleen pools from challenged group (CG) and non-challenged group (NCG) were prepared separately. SLT nylon wool columns were isolated into four spleens pools at 1, 3, 7 and 9 days. The IFN was detected in tissue culture by inhibition of the cytopathic effect of NDV and IBDV, as positive control was used 1st Inf Ref prep Inter Chick 67/18 (80 UI/mL). On the 1st day p.s.i of the first trial, at NDV assay CG showed up IFN level of $13.3 \pm 4.13 \text{ Log}_2$, it was different ($P < 0.05$) to NCG ($5.3 \pm 3.06 \text{ Log}_2$). At 3rd day CG reached an IFN peak ($14.7 \pm 13.5 \text{ Log}_2$), it was different ($P < 0.05$) to NCG. On the 7th day the IFN from CG diminished ($4.33 \pm 4.13 \text{ Log}_2$), it was no different to NCG. At 9th day the CG IFN level increased ($12.67 \pm 5.32 \text{ Log}_2$), it was different ($P < 0.05$) to NCG. The IBDV assay had the same pattern than NDV assay, however, it showed lower up IFN levels. At the second experiment higher IFN

levels were detected, however, both viral models showed up the same pattern than first trial. IFN secretion pattern detected with both immunization models, showed up a specific role for a SLT subset. When antigen was inoculated to the birds at the second time, anamnestic STL responses occurred quickly, and likely its becoming to this subset into active SLT that it was secreting this upregulating IFN. Trimming immunization model had better IFN enhanced than secondary immunization model, even though the challenge dose was the same.

Key Words: cytokine, T lymphocytes, *Eimeria tenella*, trimming model, broiler chicks

S-P158 Use of FTA[®] filter paper for the molecular detection of Newcastle disease virus. F. Perozo*¹, P. Villegas¹, C. Estevez², I. Alvarado¹, and L. Purvis¹, ¹University of Georgia, Athens, ²Southeast Poultry Research Laboratory (USDA), Athens, Georgia.

The feasibility of using FTA[®] cards to collect allantoic fluid (AF) and chicken tissue samples for molecular detection of Newcastle disease virus (NDV) was evaluated. Trizol[®] RNA extraction and one step reverse transcriptase polymerase chain reaction (RT-PCR) were used to amplify the F protein gene from the cards. FTA[®] cards allowed the identification of NDV from AF with a viral titer of at least $10^{5.8} \text{ ELD}_{50} / \text{ml}$. The virus inactivated on the FTA[®] cards remained stable for 15 days. NDV was also detected from FTA[®] imprints of trachea, lung, cecal tonsil and cloacal feces of experimentally infected birds. The results showed that the FTA[®] card was at least as sensitive as the test run with the homologous frozen tissue and to virus isolation. Direct nucleotide sequence of the amplified gene allowed prediction of NDV virulence. The FTA[®] cards provide a hazard free sample and a reliable source of RNA for molecular characterization, avoiding the risks of transportation and processing live NDV.

S-P159 Detection of avian reovirus by RT-PCR in specimens collected on FTA filter paper. H. Moscoso*, G. Brown, and C. Hofacre, *University of Georgia, Athens.*

Reovirus infections in chickens and turkeys occur worldwide and are associated with conditions like arthritis, tenosynovitis, respiratory disease and stunting syndrome. Several tests have been developed for the identification of reovirus infections such as virus isolation in cell culture, ELISA, and western blot but they are time consuming and less specific and sensitive than the reverse transcriptase polymerase chain reaction (RT-PCR). We have previously shown that avian pathogens are rendered non-infectious upon contact with FTA cards and that their nucleic acids remain stable over time as demonstrated by molecular tests. Here we utilized a RT-PCR using primers that flank a 532 bp DNA sequence containing the S1 gene of avian reovirus to detect the virus in specimens collected on FTA cards. Reovirus vaccine and reference strains were collected on FTA as 5-10 ul aliquots. Field samples were collected as tendon impressions on FTA or synovial fluid swabbed on FTA. RNA was extracted from FTA punches by commercial kits for RT-PCR. The reovirus RT-PCR did not cross-amplify infectious bronchitis virus, newcastle disease virus, adenovirus, mycoplasma gallisepticum or mycoplasma synoviae collected on FTA. Sensitivity of the test was between 1 ng and 5 ng of RNA template. The virus was detected from specimens stored on FTA cards at room temperature for at least 3 months or at -20C for more than a year. The inactivation of reovirus in samples stored on FTA cards allow their transport to and

from the USA, in compliance with federal regulations, in order to perform molecular analysis in centralized laboratories.

Key Words: reovirus, FTA, inactivation, RT-PCR, RNA

S-P160 The effect of added automotiva waste oil on Δ -aminolevulinic acid dehydratase (ALAD) activity in laying hens.

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Previous studies have shown that activity of red blood cell Δ -aminolevulinic acid dehydratase (EC 4.2.1.24, ALAD) is a sensitive indicator of lead exposure in humans and animals. An experiment was conducted to study the effects of dietary added waste automotive oil (WAO), clean–unused automotive oil (UAO) and lead (Pb) on inhibition of ALAD enzyme in laying hens. Two hundred sixteen, 60 week old, laying hens (Hisex Brown) were allocated in nine treatments with three replication (8 hen per replicate). Hens were fed diets with four levels of WAO (0.5, 1, 2 and 4%), two levels of UAO (2 and 4%), two levels of added Pb (5 and 50 ppm, used as positive control treatments), or untreated control. Experiment was divided in three phases: first intoxication phase (used unleaded automotive oil), second intoxication phase (used leaded automotive oil), and withdrawal phase (without added automotive oil or Pb). In the end of second intoxication phase red blood cell ALAD activity was significantly inhibited ($P < 0.0001$) in all treatments: with added WAO (0.5% WAO for 30% of ALAD activity in start, 1% WAO for 54%, 2% WAO for 66%, and 4% WAO for 57%, respectively), with added UAO (1% UAO for 28% of ALAD activity in start, and 4% UAO for 35%, respectively), and with added Pb (5 ppm for 20% of ALAD activity in start, and 50 ppm Pb for 73%, respectively). Two weeks after withdrawal of contaminated feed, activity of ALAD was significantly increased ($P < 0.0001$) and brought the enzyme activity to 93% (treatment with 0.5% WAO), 92% (1% WAO), 103% (2% WAO), and 95% (4% WAO), 92% (1% UAO), 103% (4% UAO), 106% (5 ppm Pb), and 64% (50 ppm Pb) of activity of enzyme in the start. Activity of ALAD shows highly negative correlation with the levels of added WAO, UAO and Pb (-0.848, -0.762 and -0.989, respectively). It was confirmed that primary determined hypothesis that waste automotive oil has significant effect on activity of ALAD enzyme and that the hens can be used as a reliable biological monitoring model for studying toxicity of waste automotive oil.

Key Words: toxicology, hens, ALAD, automotive oil, Lead

S-P161 Lead accumulation in laying hens fed automotive waste oil.

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An estimated 1,800 tons of automotive waste oil (WAO) enters in Kosova by spillage and disposal on land. The lead (Pb) content in WAO has been reported to be as high as 40,000 ppm (average 8,400 ppm). An experiment was conducted to study the effects of dietary added waste automotive oil (WAO), clean–unused automotive oil (UAO) and lead (Pb) on lead accumulation in tissues of laying hens. Sixty week old laying hens (Hisex Brown) were allocated in nine treatments with three

replication (8 hen per replicate). Hens were fed diets with four levels of WAO (0.5, 1, 2 and 4%), two levels of UAO (2 and 4%), two levels of added Pb (5 and 50 ppm, used as positive control treatments), or untreated control. Experiment was divided in three phases (two weeks each): first intoxication phase (unleaded automotive oil), second intoxication phase (leaded automotive oil), and withdrawal phase (without added automotive oil or Pb). In the end of second phase of intoxication and in the end of withdrawal phase, three hens per replication were randomly selected, blood sampled and then sacrificed. Pb was determined in whole blood samples. Lead concentration was determined in liver, kidneys, brain and tibia. In the end of second intoxication phase Pb level in blood, liver, kidneys, brain and tibia was significantly increased in all treatments (< 0.0001). Pb accumulation shows high correlation in treatments with added WAO (blood 0.99, liver 0.92, kidneys 0.99, brain 0.98, and tibia 0.99), with added UAO (blood 0.95, liver 0.97, kidneys 0.95, brain 0.95, and tibia 0.73), with added Pb (blood 0.94, liver 0.90, kidneys 0.99, brain 0.99, and tibia 0.99). The order of total accumulation of Pb (ug/g) in tissues in the end of second intoxication phase was tibia>liver>kidney>brain. Order in relative increase of Pb in this phase in relation of control treatment was brain>liver>kidneys>tibia (based on percentage of increase). Two weeks after withdrawal of contaminated feed order of tissue Pb decrease was brain>liver>kidney>tibia. In conclusion, exposure to automotive waste oil in the diet resulted in significant accumulation of lead in blood, liver, kidneys, brain, and tibia.

Key Words: toxicology, hens, Pb, automotive waste oil

S-P162 AgGard: A nexus for poultry health, agricultural security and national security.

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AgGard is a new national security program being developed by the Federal Bureau of Investigation.

The AgGard program is modeled after a previously existing and very successful program called the InfraGard network. The network is expected to be operational in the 2005-2006 timeframe.

Through a secure web portal, members of the agricultural community and academia will be able to share information with each other, and with governmental scientists, state and local law enforcement, and the FBI. Members can pose questions, discuss current and developing issues or even alert the FBI to suspicious and unusual activities or events in or around commercial agriculture.

Poultry and animal health continue to emerge as ever increasingly important national security issues. Much of this new concern has been generated by the increasing public awareness of avian influenza as a significant potential threat to public health. Other concerns have also emerged as intelligence agencies have identified potential agroterrorism threats from domestic and international terrorist groups.

As AgGard is further developed, it can serve as a significant new tool for national security as related to agricultural security and counter-agroterrorism. Collectively through the cooperative efforts of professional poultry health groups, industry and academic membership, commercial agriculture, including the poultry industry will be better protected. The end result of strengthening agriculture will be the continuation of a robust and healthy economy, which in turn is a significant component of overall national security and the well being of the citizenry.

Key Words: AgGard, agroterrorism, national security, counter-agroterrorism, agricultural security

S-P163 Phenotypic characterization of *aeae+* *Escherichia coli* associated with yolk sac infection. B. Supak¹, R. Merino², and C. Rosario^{*2}, ¹Texas A&M University, College Station, ²Facultad de Medicina Veterinaria y Zootecnia UNAM, Mexico DF Mexico.

In this study, we explored the characteristics of particular strains of *E. coli* carrying the *aeae* gene in search of some traits described for APEC group that would amplify their ability as disease-causing agents within a poultry flock. Thirty eight *E. coli* strains previously characterized as *aeae+* were analyzed. In essence, we characterized each strain through antigenicity (somatic O and flagellar H). Serotyping was performed in the laboratory of Public Health of the Medicine School of UNAM. The study shows a great diversity of serotypes; however, the most predominant were O2:NM (n= 10) and O84:H8 (n= 6). Additionally 50% of the strains were non motile (NM). Colicin Production essay was performed using indicator strains 726 and its isogenic mutant. This test showed that 15.7% of the isolates were non-producers, 21.05% produced Col V plus other colicins, 36.84% colicins different from Col V and 26.31 only produced Col V. Strains were streak in Blood Agar in order to determine the hemolytic capacity. Sixty three percent of the strains were negative for hemolysis test. Congo red binding has been mentioned as a trait of pathogenic *E. coli* however, only 15.8% (n= 6) were positive. Antimicrobial susceptibility test (antibiogram & Vitek[®]), showed that the highest resistance was against Tiamulin (33 strains), Trimetoprim-sulfa (24 strains), Enrofloxacin (24 strains), and sodic sulfaclopiridacine (23 strains). Considering the ability to survive in the presence of some antibiotics, these strains could represent a serious concern for Public Health. Additionally, the absence of some characteristics traditionally described for APEC could suggests that these strains belong to a particular group of strains associated to poultry disease in Mexico

Key Words: *Escherichia coli*, colicin production, serotyping, antimicrobial resistant

S-P164 Isolation and pathogenesis of *Salmonella enteritidis* biovar Issatschenko and *Salmonella enteritidis* Pt 13a in broiler chicken. G. Ruiz-Flores*, F. Constantino-Casas, C. Cedillo-Pelaez, J.A. Quintana-Lopez, and O. Urquiza-Bravo, UNAM.

Due to that is few information about *Salmonella* spp pathogenesis in chicks, the objective of the present work was to determine *Salmonella enteritidis* biovar Issatschenko phage type 6a (SI) and *Salmonella enteritidis* phage type 13a (SE PT 13a) pathogenesis in 4 days old broiler chicken. Twenty-eight birds per treatment were inoculated with a dose of 1x10⁹ (SI) and 1x10⁸ (SE) respectively. Fourteen different times post inoculation samples were carried out (6, 18, 30, 42, 54, 78, 102, 126, 150, 174, 198, 222, 246 and 270 hours post inoculation (h, pi)), in order to obtain *Salmonella* spp. isolation from liver, spleen, heart, lung, crop, duodenum, jejunum, ileum and caecum for bacteriology, histopathological and ultrastructural examination. During the first week some depressed birds were observed and after the first week SE and SI indurated yolk sac was seen. The percentage of infected organs was different between treatments. Positive SI isolations were obtained at 42, 150, 174 and 222 hours pi, from crop, jejunum, ileum and caecum samples. Ileum was the organ from which more frequently the bacterium was isolated, also SE PT13a was isolated at 18, 30, 42, 54, 78, 102, 126, 150, 174, 198, 246 and 270 h, pi from all organs previously described and the same as SI, ileum was the main site of isolation. No mortality was obtained in either treatments. Histopathology revealed inflammation, coagulative necrosis, congestion and hemorrhages in gastrointestinal tract

(TGI) and visceral organs since 6 h pi in both treatments with different lesions grades (from mild to severe). Severe changes in enterocytes cytoplasm and also intracellular bacterium were observed ultrastructurally in chicks infected with SE PT 13a and SI. Results of this research showed pathogenesis SE PT 13a as well as SI pathogenesis in broiler chickens. It was also possible to isolate SI from internal organs of broiler chickens experimentally inoculated, demonstrating that SI is able to infect chickens and not only Muridae family.

Key Words: *Salmonella enteritidis*, *Salmonella issatschenko*, *Salmonella issatschenko* pathogenesis, *Salmonella* pathogenesis, *Salmonella* in broiler chickens

S-P165 Avian influenza in commercial broiler chickens, diagnosis by immunocapture and virus isolation. B. Supak^{*1}, C. Rosario², and R. Merino², ¹Texas A & M University, College Station, ²Facultad de Medicina Veterinaria y Zootecnia, UNAM, Mexico DF, Mexico.

Some outbreaks of low pathogenicity avian influenza (AI) were reported in Mexico during 2005. The tools for AI diagnosis include virus isolation, RT-PCR and immunocapture. The aim of this study was to use an immunocapture strip (Flu Detect[™], Synbiotics Co.) to detect AIV in both, experimentally challenged and field infected broiler chickens. Twenty 3-w-o broiler chickens were inoculated with 50 MI of low pathogenicity AIV H5N2 (10^{6.2} ID₅₀/ml) via nostrils, 10 unchallenged chickens were placed as negative control. Swab samples were taken at 1, 3, 5, 7 and 10 days post-challenge. All samples were placed in 1 ml PBS and frozen until tested. On testing day, all samples were thawed and 5 samples pools were made. All pooled samples were tested by immunocapture, following the manufacturer's directions, and virus isolation in 9 day old chicken embryos according to standard procedures. Negative control samples were always negative in both tests. Virus isolation was positive in samples from first to tenth day post challenge. The immunocapture strip showed positive results only in samples from 3 and 5 days post inoculation. On the other hand, some 46-days-old broiler chickens from central Mexico showing respiratory distress were received at the laboratory of avian pathology from the National Autonomous University of Mexico. Clinical history included respiratory symptoms starting at day 35 and a slight mortality increase at 42 days old. These data and necropsy findings suggested an infection with Infectious Bronchitis Virus. Swab samples, as well as trachea and lung samples, were taken, for AIV immunocapture and virus isolation. Swab samples were tested with the AIV immunocapture strips, and the results were positive. Virus isolation was attempted for both, AIV and infectious bronchitis virus. Results indicated a mixed infection, since isolations were positive for both IBV and AIV (H5N2, low pathogenicity). According to these results, the immunocapture strip could be used as a helpful tool to detect and differentiate AIV infections from other respiratory diseases in the field.

Key Words: avian influenza, broiler chicken, immunocapture, virus isolation, field infection

S-P166 Effects of salt concentration on *Mycoplasma gallisepticum* vaccine FVAX-MG survival in solution. S.A. Leigh*, J.E. Evans, S.L. Branton, and S.D. Collier, USDA-ARS South Central Poultry Research Unit, Mississippi State, Mississippi.

Infection of layer chickens with *Mycoplasma gallisepticum* (MG) results in decreased egg production compared to uninfected hens. Live

MG vaccines are available; however the methods used to administer these vaccines by the end user vary, resulting in the potential for marked differences in vaccine efficacy. One variable is the use of water to resuspend the vaccine prior to administration. Many users resuspend the vaccine in distilled water. However, because mycoplasmas lack a cell wall, resuspension in distilled water can result in an increasingly fragile mycoplasma cell, which can lead to osmotic lysis, particularly during vaccine administration. The addition of sodium chloride, in the form of a powdered phosphate-buffered saline (PBS) concentrate was studied for its ability to improve FVAX-MG survival following resuspension. FVAX-MG was resuspended and incubated in distilled water, or distilled water containing 0.1X, 1X, or 10X PBS concentrate (all between pH 7.3 and 7.5). Samples were removed at 15, 30, and 60 min., and numbers of viable mycoplasmas were determined. The results show increasing FVAX-MG mycoplasma survival in solutions containing the PBS concentrate compared to the distilled water control, as measured by color-change units (CCU) per milliliter. The amount of PBS concentrate added seems to be less important, although the 1X (physiological) concentration appears to yield the least variation in results. This suggests that isotonic strength may improve vaccine survival during application, resulting in increased vaccine efficacy.

Key Words: *Mycoplasma gallisepticum*, FVAX-MG, ionic strength

S-P167 *Salmonella* spp determination during one processing in broiler chickens in Guanajuato state, Mexico. V. Hernández-Mancera, G. Salazar-Matali, R. Saldivar-Hernandez, and O. Urquiza-Bravo*, UNAM.

During many years it has been recognized that different species carcasses can transmit diseases to humans and the bacterial deposited in the carcasses during processing, is not a factor that determines the hygiene and health of the processing plant from where these come. In broiler chickens, it has demonstrated that from the air of the processing plants could isolate *Salmonella* due to the movement of the wings when the birds are initially slaughtered, representing a contamination source. The objective of the present work was to determine the presence of *Salmonella enterica* during one broiler chicken processing in Guanajuato state, Mexico. Six cloacal swabs were taken from alive birds just before being hung, three water samples from the scalding tank before the beginning of the processing, two water samples from the shower used to wash the eviscerated carcasses, two water samples from the defeathering machine, four from the scalding tank, two samples of water draining from the transport carts, one sample of water from eviscerated table. Fifteen samples from carcasses washed with peptonated water before being eviscerated, eight samples were taken after being processed, fourteen after the evisceration and also we took samples the hands of workers (2 samples) and one from the gloves of one worker. Coliform total count was made and microbiological count from all waters. The cloacal swabs, the glove sample, and the washed hands samples were cultured in tetrastate broth. 0.1% of peptonated water was used for the carcasses washed. There was not isolation of *Salmonella enterica* in this work, nevertheless, we identified other bacterial groups like *Escherichia coli*, *Citrobacter freundii*, *Proteus vulgaris*, *Proteus mirabilis*, *Klebsiella* and *Eduardsiella* in the beginning of the processing and these bacteria were not found at the end of the processing. The election of the correct conditions during the processing and having a good hygiene models, these bacteria can be removed of the carcasses, avoiding therefore the risk to the public health.

Key Words: broiler processing, *Salmonella enterica*, *Salmonella enterica* in broiler, *Salmonella enterica* during processing

S-P168 Intervention with a one-time dose of FINELACT poultry blend (*Lactobacillus reuterii* and *salivarius*) in drinking water of broiler chickens 17 to 30 days of age or caged laying hens during field cases of necrotic enteritis due to *Clostridium perfringens* in Japan. T. Imabayashi¹, M. Kato², and D.M. Hooge*³, ¹Calpis Company, Ltd, Tokyo, Japan, ²Calpis USA, Inc., Schaumburg, Illinois, ³Hooge Consulting Service, Inc., Eagle Mountain, Utah.

An investigation was conducted in Japan during the summer of 2003 using 12 commercial broiler chicken flocks (range about 4,800 to 11,500, average 8,107, total 97,280 birds identified as having necrotic enteritis due to *Clostridium perfringens*. Intervention was carried out using the commercial direct-fed microbial product FINELACT Poultry (Calpis Company, Ltd, Tokyo, Japan) in the drinking water beginning when the disease was confirmed at varying ages from 17 to 30 d (average 25.9 d). The direct-fed microbial product contains two strains of intestinal colonizing *Lactobacilli* (*reuterii* and *salivarius*). Initiation of FINELACT water supplementation, d "0", coincided with the peak or near peak level of mortality (7 to 37, average 17.25 dead birds/flock/day). The number of dead broilers on preceding d averaged 5.25 for d -1, 5.58 for d -2, 3.00 for d -3, and 2.82 for d -4. The number of dead birds on d following initiation of FINELACT water supplementation averaged 11.50 for d +1, 7.08 for d +2, 4.64 for d +3, and 3.00 for d +4. Based on the rapid return of daily mortality level to normal in these broiler flocks, it was concluded that FINELACT supplementation via the drinking water was beneficial during necrotic enteritis outbreaks. In two commercial caged laying hen flocks experiencing necrotic enteritis, numbers of dead hens daily decreased with FINELACT water supplementation. In the first flock, dead bird numbers averaged 20.33/d for 3 d before and 8.33/d for 3 d after d "0" (154 d old). In the second flock, dead birds averaged 41.00/d for 3 d before and 22.67/d for 3 d after d "0" (149 d old). FINELACT in water was beneficial for reducing mortality of broilers or caged layers experiencing necrotic enteritis.

Key Words: broiler, Finelact, lactobacillus, laying hen, necrotic enteritis

S-P169 Recovery of *Clostridium perfringens* from poultry dump coops after different disinfectant regimens. B. McCrea*^{1,2}, K. Macklin¹, and J. Blake¹, ¹Auburn University, Auburn, Alabama, ²University of California, Davis.

Poultry transportation dump coops are difficult and time consuming to clean. If not adequately performed the coops become a potential source for spreading contamination between farms. Research on dump coop cleaning and transmission with regard to *Salmonella* spp. and *Campylobacter jejuni* has determined that dump coops were the source of bacterial contamination of birds transported from *Salmonella* and *C. jejuni* negative farms. *Clostridium perfringens* has a cosmopolitan distribution and is a part of the natural gut flora of both poultry and humans. It is the causative agent of necrotic enteritis and gangrenous dermatitis in poultry and foodborne gastroenteritis in humans. Our study examined *C. perfringens* recovery on poultry dump coops after different cleaning and disinfection regimens as well as after an extended drying period.

A poultry dump coop with 18 compartments was utilized in this experiment. Nine randomly selected compartments were selected for each treatment and there were two trials. In each compartment contained 10 male and 10 female, 43 day old broilers and dump coops were transported for one hour to simulate transport conditions. Compartments were tested immediately after birds were removed. These counts established the baseline data for crate contamination (A). The three cleaning

and disinfection treatments consisted of power washing (B), power washing and sodium hypochlorite (5% v/v) spray (C), and power washing and quaternary ammonium (0.4% v/v) spray (D). Treatments C and D were subjected to 48 hours of drying to create treatments E & F, respectively.

The recovery of *C. perfringens* from dirty dump coops averaged 4.43 log₁₀ cfu/ml for the two trials. Regardless of the trial, allowing crates to dry for 48 hours produced a significant log reduction in *C. perfringens*. Treatment F, the quaternary ammonium spray followed by 48 hours of drying, performed the best. Excluding the drying treatments, treatment C produced the greatest log reduction in *C. perfringens* recovery (1.84 log₁₀ cfu/ml).

Key Words: *Clostridium perfringens*, dump coop, disinfection, transportation, crate

S-P170 Microbiological efficacy of spray washing broiler carcasses using Fresh F™ on E.coli, total coliforms and Salmonella.

K. Ingram*, J. Northcutt, J. Cason, and A. Hinton, Jr., *USDA-ARS, Athens, Georgia.*

A study was conducted to determine the effect of using FreshFx™, a combined citric, hydrochloric and phosphoric acid solution, in a spray cabinet on the numbers of E.coli, coliforms and Salmonella recovered from broiler carcasses. During each of three experimental trials, broiler carcasses were obtained from a commercial processing facility. Untreated control carcasses were removed from the processing line before entering a two-stage cabinet washer. Treated carcasses were removed after being sprayed for 8 sec with FreshFx™ or tap water in the cabinet washer. After treatment carcasses were aseptically removed from the processing line, placed in clean bags and transported in insulated coolers to a pilot plant scale facility for analysis. The bacterial flora of the carcasses was sampled using a 400 ml whole carcass rinse procedure. Rinsates were analyzed for the presence of Salmonella and level of E.coli and total coliforms. After an 8 sec spray treatment, there was a 56% incidence of Salmonella in rinsates from water treated carcasses versus a 47% incidence of Salmonella in rinsates from FreshFx™ treated carcasses. This represented no significant difference between the treatments. However, levels of E.coli and coliforms recovered from carcasses sprayed with FreshFx™ was 0.6 log₁₀ cfu/ml lower than those counts recovered from water treated samples. Control carcasses and water treated carcasses did not differ significantly (P<.05) in either E.coli or coliform counts (3.1 vs. 3.0, 2.8 vs. 2.7 log₁₀ cfu/ml respectively). The present study demonstrates that FreshFx™ could be a viable option for reduction of E.coli and coliform counts on broiler carcasses; however, its impact on Salmonella incidence after an 8 sec spray application seems to be minimal.

Key Words: *Salmonella*, coliforms, spray washing, antimicrobial, broiler carcasses

S-P171 Detection of *Campylobacter* from broiler carcass rinse samples using the Tecra Visual Immunoassay (VIA). J.M. Cox¹, L.J. Richardson*², P. Fedorka-Cray³, J.S. Bailey³, and N.A. Cox², ¹The University of New South Wales, Sydney, NSW, Australia, ²USDA-ARS-MSRU, Russell Research Center, Athens, Georgia, ³USDA-ARS-BEAR, Russell Research Center, Athens, Georgia.

Poultry meat is considered to be a major vector of transmission of *Campylobacter*, either directly, through consumption of poorly pre-

pared product, or indirectly, through introduction of the bacterium into the food production environment. Efficient detection of *Campylobacter* is intrinsic to the management of the pathogen during poultry production. The Tecra VIA protocol, enrichment in a proprietary Tecra *Campylobacter* enrichment broth followed by an ELISA, was compared to a conventional cultural method, with enrichment in Bolton medium (containing lysed horse blood), followed by plating to Campy Cefex agar. Of the 240 broiler carcass rinses tested, from eight commercial processing plants, the ELISA yielded 201 *Campylobacter*-positive results while conventional enrichment and plating detected the bacterium in only 168 samples. Plating to Campy Cefex agar of the Tecra enrichment broths yielding positive ELISA results revealed three false-positives. The 44 false-negative results (30 more than the ELISA method) from the conventional method were attributed to suppression of *Campylobacter* in the enrichment broth, due primarily to overgrowth by the background microflora, as seen by comparison of plates from both enrichment media. Of the negative ELISA results, 14 were shown to be false negative by comparison to the conventional method and of those, 10 came from one plant. All these false negatives came from rinses of carcasses collected toward the end of the production process, suggesting that severely injured *Campylobacter* may not recover in the Tecra enrichment broth, though very low numbers were detected from similar samples from other plants. Delayed addition (6h) of the antibiotic supplement to the Tecra enrichment broth yielded more positive samples, reinforcing the potential for loss of severely injured cells when the broth is used with antibiotics throughout enrichment. In conclusion, the Tecra enrichment-ELISA method proved to be superior overall to the conventional cultural method for the detection of *Campylobacter* in chicken carcass rinses.

Key Words: *Campylobacter*, immunoassay, Tecra VIA, carcass rinses, broiler

S-P172 Impact of alternative broiler genotype and production system on sensory attributes. A. Fanatico*, P. Pillai, J. Emmert, J. Meullenet, and C. Owens, *University of Arkansas, Fayetteville.*

Consumer interest in natural and organic poultry is growing. An experiment was conducted to assess the impact of alternative genotypes and production systems on sensory attributes. A slow-growing and a commercial fast-growing genotype (females) were raised for 91 and 63 days, respectively. The placement dates were staggered in order to achieve a similar final body weight. Each genotype was assigned to four floor pens of 20 birds each and raised indoors in a conventional facility; each genotype was also assigned to four floor pens in a small portable facility with outdoor access. The treatments were Slow-Out, Slow-In, Fast-Out, and Fast-In. The birds were fed diets formulated to be low in energy and protein for a slower rate of production as in the French Label Rouge program. Birds were commercially processed and deboned at 4 h postmortem. A descriptive analysis of breast and thigh meat was conducted by a trained panel on all treatments. A consumer analysis was also conducted on Slow-Out and Fast-In products, representing specialty and conventional production. The descriptive analysis indicated that the breast meat from the outdoor birds was more cohesive than the meat from the indoor birds in the first bite stage (P < 0.05). In terms of flavor, there were no significant differences for most basic tastes and aromatics; however, both the breast and thigh meat of the Fast birds tasted more salty than the Slow birds (P < 0.05) although no salt was added to product. The Slow birds had more dark meat fat flavor than the Fast birds (P < 0.05). Results from the sensory analysis by the con-

sumer panel showed no significant differences in overall liking, appearance, texture, and flavor of the breast meat or thigh meat. The Just-About-Right distributions of consumer responses did not vary between the Slow-Out and Fast-In treatments for most attributes; however, more panelists found the breast meat of the Slow-Out treatment too dry ($P < 0.05$). Although a trained panel detected some differences in texture and flavor between conventional and alternative poultry products, the consumer panel did not indicate differences in liking.

Key Words: broilers, organic, sensory, free-range

S-P173 Use of acidified sodium chlorite for sanitation of poultry carcasses. T. Doan* and N. Khanna, *Bio-Cide International Inc., Norman, Oklahoma.*

In the field of poultry processing, the use of acidified sodium chlorite (ASC) is prevalent for sanitation of poultry carcasses. ASC is effective in controlling a broad spectrum of microorganisms, such as *Salmonella*, *Listeria*, *coliforms*, *Campylobacter*, and *Enterobacteriaceae*. Since the ultimate break down product of ASC application is NaCl, the organoleptic qualities of the meat are largely unaffected and the sanitizer leaves no toxic residues. In comparison to common oxidants, such as ozone, ASC is resistant to the heavy organic load commonly encountered in poultry processing facilities. The intervention can be applied in the form of a dip or a spray with the later application mode being more suited to the emerging trend of blast chilling. An ASC spray can be conveniently applied to carcasses going through blast chillers to provide immediate antimicrobial effect as well as a barrier shield for further contamination from the environment. Keeper® Professional, a proprietary ASC developed by Bio-Cide International Inc, (Norman, OK), is FDA-approved for this application. In-vitro studies show that Keeper® Professional effectively provides a 6-log kill on common pathogens of concern.

Regulatory requirements mandate generation of ASC on-site. In-plant application of ASC is influenced by chemical makeup, spraying pressure and cabinet design. This study was performed to investigate the efficacy of Keeper® Professional for the control of total aerobic bacteria and *E.coli O157:H7* on poultry products. Chicken carcasses were inoculated with *E.coli O157:H7* 20 minutes prior to treatment. The carcasses were sprayed in a specially designed cabinet with 0.1% of ASC product for 30 seconds. The inoculated untreated carcasses were used as control. Fifteen minutes after spraying, the carcasses were rinsed. The rinsate was analyzed for aerobic bacteria and *E.coli O157:H7*. In comparison to the control, a 2.0-log reduction in CFU/ml of aerobic bacteria was observed on ASC treated carcasses; *E.coli O157:H7* was reduced by 1.5 logs CFU/ml. The study demonstrated that ASC was an effective antimicrobial agent for use on poultry carcasses.

Key Words: Acidified sodium chlorite, ASC, Sanitation, Poultry, *E.coli O157:H7*

S-P174 Magnetic bead based high throughput viral RNA isolation provides high quality viral RNA for molecular diagnostics. M. Bounpheng*¹, R. Baker², D. Mulrooney², R. Willis¹, W. Xu¹, Q. Hoang¹, A. Burrell¹, and X. Fang¹, ¹Ambion, Austin, Texas, ²Oregon State University, Corvallis.

Quantitative reverse transcriptase PCR (qRT-PCR) has become a powerful tool for molecular diagnosis and surveillance of animal diseases. In

the case of an outbreak, numerous samples must be processed within a short time thus requiring the use of automation for high throughput RNA extraction and qRT-PCR. Our magnetic beads based RNA purification technology, MagMAX, provides a highly efficient and effective method for viral RNA isolation from low titer samples of various biological sources such as blood, serum, plasma, and cloacal/oral/nasal swabs. More importantly this method enables low and high throughput viral RNA purification in a 96 well format manually or by automation. To demonstrate the efficacy of MagMAX for diverse sample processing, Whatman FTA cards containing West Nile Virus (WNV) and plasma, buffy coat, and C/E cells containing Avian Leukosis Virus (ALV) were used for viral RNA isolation using MagMAX. WNV RNA from infected birds was efficiently isolated from brain tissues and respective oral swabs stored on FTA cards. Brain tissues and their respective FTA stored oral swabs from 160 birds were tested; 12 WNV positive birds were identified correctly. The results show highly sensitive (Ct values of 16-23) detection of WNV; many FTA samples yielded better sensitivity (lower Ct) than brain samples. Four different ALV positive samples were serially diluted 10 fold (12 billion to 12 copies) into negative plasma, buffy coat, and C/E cells. ALV RNA was isolated and used for qRT-PCR for ALV detection. The highest ALV detection sensitivity was obtained using ALV inoculated plasma samples; the detection limit was less than 60 copies. These results demonstrate successful viral RNA isolation from diverse sample matrix using MagMAX, enabling superior molecular diagnostics of animal diseases.

Key Words: quantitative RT-PCR, viral RNA isolation, FTA cards, WNV, ALV

S-P175 Mannan oligosaccharide supplementation of wheat-based diets for broilers. J.B. Blake*¹, J.B. Hess¹, K.S. Macklin¹, S.F. Bilgili¹, A.E. Sefton², and A. Kocher³, ¹Auburn University, Auburn University, Alabama, ²Alltech, Inc., Nicholasville, Kentucky, ³Alltech Biotechnology Centre, Dunboyne, Ireland.

Broilers placed at 0.84 ft²/bird were subjected to three treatments (10 pens/trt) which included a control (CON), 50 ppm Bacitracin Methylol Disalicylate (BMD) or mannan oligosaccharide (MOS) (Bio-Mos, Alltech, Nicholasville, KY) in a three feed program. MOS levels were 2.0 kg/tonne starter; 1.5kg/tonne grower; and 0.5 kg/tonne withdrawal. Diets were corn-wheat-soybean meal based to include 30% wheat and 600 units/ton xylanase (Allzyme PT, Alltech, Nicholasville, KY). Each bird was allocated 0.8 kg starter, 1.6 kg grower and withdrawal to termination. The two consecutive experiments discussed here were reared on litter from two previous flocks. Broilers and feed were weighed at 14 and 28 d and at the end of each experiment.

In Experiment 1, the only differences in BW that were apparent occurred at 14 d where BMD showed the heaviest BW (382.1 g) with MOS intermediate (377.5 g) and CON lowest (352.8 g). Feed consumption differences were noted during the 0-28 d period where CON was lowest (1.904 kg), BMD intermediate (1.929 kg) and MOS highest (1.989). This trend was also reflected in feed efficiency from 0-28 d where the best to worst was BMD (1.528), CON (1.593), and MOS (1.663), respectively. Mortality (5.5%) was unaffected by treatment. In Experiment 2 there were no significant ($P > 0.10$) differences in bodyweight (BW) among the treatments; however, BW for the Bio-Mos (MOS) treatment was numerically higher (401.2 vs. 384.4 g and 1.236 vs. 1.227 kg) than the control at 14 and 28 d, respectively. At 14 d, feed consumed (FC) was highest for MOS (483.1 g/bird) and lowest for control (CON) (462.2 g/bird). Differences in BW, FC, and FE were

not apparent by day 37 and there were no distinct pattern among the treatments. Mortality was lowest in the MOS treatment (2.6%), intermediate in the BMD treatment (4.2%) and highest in the CON treatment (6.2%). The lack of significant differences in these trials would indicate a low challenge level that did not allow either MOS or BMD to show benefit as compared to CON.

Key Words: mannan oligosaccharides, broilers, wheat

S-P176 Salmonella control by the use of acidifiers in poultry production. C. Lueckstaedt¹ and R. Beltran^{*2}, ¹*Biomim Germany GmbH*, ²*Biomim USA Inc.*

Different strategies have been suggested to control *Salmonella* in feed. The use of acidifiers in feed has been found to be an effective solution to counteract the growth of *Salmonella*.

Organic acids will traverse the membrane in the non-dissociated form. Since the proportion of dissociated acid increases as pH increases, once inside the cell, they will be exposed to the near neutral intracellular pH of the bacteria and dissociate, releasing anions (A⁻) and protons (H⁺) into the cytoplasm. The internal pH will decrease and because pH sensitive bacteria do not tolerate a big difference between the internal and the external pH, a specific mechanism (H⁺-ATPase pump) will act to bring the pH inside the bacteria to a normal level. This phenomenon consumes energy and eventually can stop the growth of the bacteria or even kill them.

Typically, blends of organic acids representing different stages of dissociation and non-dissociation (like formic and propionic acid) are more effective against *Salmonella* than single acids alone. This synergistic effect has been for example demonstrated, when it was observed that the combination of propionic and formic acids gave better results when compared to the single acids.

Within two separate experiments the growth of *Salmonella* was tested. In a first experiment the growth of *Salmonella typhimurium* in intestinal juice (in-vitro) under treated (acidifier) and non-treated conditions was determined and it could be concluded that the used acidifier reduced the gram-negative bacteria *Salmonella typhimurium* under the conditions of the small intestine, while a second experiment determined the inhibition capacity of the used acidifier against *Salmonella enteritidis*. The acidifier was able to stop the growth of *Salmonella* within the recommended dosage rate (3 - 5 kg / t) at a level of 10⁷ to 10⁸ *Salmonella* per ml in the inoculated medium.

It can therefore be stated that the use of a well chosen acidifier can successfully counteract the growth of *Salmonella* and other gram-negative bacteria and will lead therefore to increased performance in poultry production.

S-P177 Effect of dietary phytase on AME, growth performance and endogenous losses in young chicks. V. Pirgozliev^{*1}, T. Acamovic¹, and M.R. Bedford², ¹*Scottish Agricultural College, West Mains Road, Edinburgh*, ²*Syngenta Animal Nutrition Inc., Marlborough, Wiltshire, England*.

The effects of dietary phytase concentration on apparent metabolisable energy (AME), growth performance and endogenous losses, measured as sialic acid in young broiler chickens (from 7 to 17d age) were investigated. Forty-eight male Ross broilers were used and four soya-maize based diets (positive control (PC), negative control (NC), NC + 500, +

12500 FTU (phytase units/kg feed)). The enzyme used was derived from an evolved *E. coli* phytase (QuantumTM). There were six replicates of each diet in a randomised block design. Dry matter (DM) metabolisability for the diet with 12500 FTU was higher (P<0.05) and the AME tended (P>0.05) to be higher compared to the others. Birds offered the diet containing 12500 FTU also performed significantly better (P<0.05) than the NC group and tended (P>0.05) to have better growth performance compared to PC fed birds. Chickens fed PC and NC +12500 FTU diets tended (P>0.05) to have lower sialic acid excreted (mg/kg liveweight). Dietary AME explained about 31 % of the variation in the growth (P=0.003). There was a negative correlation (P<0.05) between excreted sialic acid (mg/kg liveweight) and dietary AME, DM digestibility and performance. Increased activity of dietary phytase increased (P<0.05) feed and AME intake, growth and DM metabolisability and tended to reduce sialic acid excretion. The result of this study support the hypothesis from previous research that dietary phytase improves gut health, reduce endogenous losses from the gastrointestinal tract and, as a result, improves nutrient utilisation and the performance.

Key Words: phytase, broilers, performance, AME, endogenous losses

S-P178 Evaluation of high levels of sodium in broiler prestarter diets. J. Yang^{*}, F. Yan, and P.W. Waldroup, *University of Arkansas, Fayetteville*.

It has been suggested that high levels of sodium fed during the first 7 days of the chick's life will enhance growth rate and improve subsequent performance. The objective of this study was to evaluate different levels of sodium fed during the first 7 days, using both sodium chloride and sodium bicarbonate to also control levels of chloride fed. A diet was formulated to meet nutrient needs of the chick from 0-14 d of age, with nutrient levels typical of those used in the US broiler industry. The base diet contained 0.20% Na provided by NaCl. Additional diets contained 0.45% sodium from either NaCl or sodium bicarbonate. These diets were blended to provide sodium levels of 0.20, 0.25, 0.30, 0.35, 0.40, and 0.45% from both sodium sources. Diets were fed in mash form. Each of these treatments was assigned to 12 pens of 5 male broiler chicks (Cobb 500) in battery brooders and fed for the first 7 days post hatch. At this time, six of the replicate pens were placed on the diet with 0.20 Na for the remainder of the study through 35 days of age. The other six pens were fed the original levels and sources of sodium for the remainder of the study at 35 d of age. Body weight and feed consumption were measured at 7, 14, and 35 d of age.

Feeding sodium levels of 0.40 and 0.45%, especially when the source was NaCl, resulted in an increase in BW at 7 d of age as compared to those fed the diet with 0.20% Na. There was some carryover effect of this BW increase at 14 d of age but by 35 d of age there were no significant differences in BW among those fed different sodium levels from 0 to 7 d or those maintained on the high sodium levels to 35 d. Similar effects were observed for feed conversion; higher levels of sodium resulted in improvements at 7 d with some lingering effect at 14 d but by 35 d of age no significant differences were observed among dietary treatments. It can be concluded that feeding higher than normal sodium levels in diets fed 0 to 7 d may result in increases in BW and feed conversion but this effect does not persist to 35 d.

Key Words: prestarter, broilers, sodium

S-P179 Growth performance of pearl grey guinea fowl pullets fed diets varying in dietary metabolizable energy and crude protein concentrations. S.N. Nahashon*, N. Adefope, and A. Ameniyenu, *Tennessee State University, Nashville.*

The objective of this study was to evaluate dietary metabolizable energy (ME) and crude protein (CP) concentrations for optimum growth performance of pearl grey guinea fowl pullets. In a 3 x 3 factorial arrangement, 540 day-old pearl gray guinea keets were randomly assigned to experimental diets with 2,900, 3,000 and 3,100 kcal of ME/kg of diet; each contained 20, 22 and 24% CP, respectively, from 0-8 wk of age (WOA). At 9-16 WOA, experimental diets had 3,000, 3,100 and 3,200 kcal of ME/kg of diet, and each contained 17, 19 and 21% CP, respectively. Each dietary treatment was replicated 4 times, and feed and water were provided ad libitum. Body weight (BW) and feed consumption (FC) were measured weekly. Mortality was recorded as it occurred. Overall, FC was higher in birds on 2,900 and 3,000 kcal of ME/kg of feed, and 24 and 21% CP diets than other dietary treatments at 0-8 and 9-16 WOA, respectively. Higher BW gains ($P < 0.05$) and lower feed conversion ratios (FCR) were observed in birds fed 3,000 and 3,100 Kcal of ME/kg of diet and 24% CP than other dietary treatments at 0-5 and 6-8 WOA, respectively. At 9-16 WOA, mean BW gains were higher and FCR were lower ($P < 0.05$) in pullets fed 3,100 and 3,200 kcal of ME/kg of diet and, 17 and 19% CP diets than those on other dietary treatments. Thus, diets comprising 3,000 and 3,100 Kcal of ME/kg of diet were utilized more efficiently by the pearl grey guinea fowl pullets at 0-4 and 5-16 WOA, respectively. Also, these birds utilized more efficiently diets containing 24 and 17% CP at 0-8 and 9-16 WOA, respectively.

Key Words: pearl grey guinea fowl pullets, metabolizable energy, crude protein

S-P180 Effect of dietary energy and molting methods on post-molt performance of Bovans White and Dekalb White hens. G. Wu*, P. Gunawardena, M. Bryant, and D. Roland, *Auburn University, Auburn, Alabama.*

A 4 x 2 x 2 factorial experiment of four dietary energy levels, two molting methods (feed withdrawal and no salt diet), and two strains (Bovans White and Dekalb White) was conducted to determine the effect of dietary energy and molting method on post-molt performance of two strains of commercial Leghorns. Feed was withdrawn from half of the hens (66 wk of age) for 9 days. Bovans and Dekalb hens lost 32.8% and 32.9% body weight, respectively. A molt feed was fed from day 10 to 28. The other half of hens was fed a no salt diet for 28 days. Bovans and Dekalb hens lost 16.4% and 17.8% body weight at the end of molt, respectively. After molt, Bovans White hens (n = 768) and Dekalb White hens (n = 768) at 70 wk of age were randomly divided into 16 treatments (8 replicates of 12 birds per treatment). Bovans hens had significantly higher egg production and lower egg weight and egg specific gravity than Dekalb hens. With increasing dietary energy hens adjusted feed intake to achieve a constant energy intake so that the similar quantities of dietary energy (5.8-5.9 kcal) were used to produce 1 g of egg. Dietary energy had no effect on feed intake, egg production, egg weight, egg mass, feed conversion, egg specific gravity, body weight, or mortality. Because feed ingredient prices and egg price vary, there can be no fixed ideal dietary energy level for optimal profits. There were no significant differences in feed intake, egg weight, egg mass, feed conversion, body weight, and mortality between hens molted by feed withdrawal and hens molted by no salt diet. Egg production of hens molted by feed

withdrawal was significantly higher than that of hens molted by no salt diet in wk 6, 7, 9, 10, and 11. Hens molted by feed withdrawal had significantly higher egg specific gravity than hens molted by no salt diet during wk 8. There were no significant differences in overall average egg production and egg specific gravity due to molting method. Other than slightly reduced egg production and egg specific gravity, feeding no salt diet to induce a molt could be used as an alternative for conventional feed withdrawal method.

Key Words: strain, dietary energy, molting methods

S-P181 Effect of dietary energy and protein level on performance of Hy-line W-36 hens during Phase II. G. Wu*, P. Gunawardena, M. Bryant, and D. Roland, *Auburn University, Auburn, Alabama.*

A 4 x 3 factorial experiment with four added fat levels (0.00, 1.67, 3.35, and 5.04%) and three protein levels (17.4, 16.7, and 16.1%) was conducted to determine the effect of dietary energy on performance and profits of Hy-line W-36 hens at different protein levels. The basal diets of the 17.4, 16.7, and 16.1% protein contained 2758, 2776, 2791 kcal ME/kg. Hy-line W-36 hens (n = 1080) in Phase II (40 weeks of age) were randomly divided into 12 treatments (6 replicates of 15 birds per treatment) and fed the experimental diets for 12 wks. There were no significant interactions between protein and dietary energy in feed intake, egg production, egg weight, egg mass, feed conversion, egg specific gravity, mortality, or body weight. Protein had no significant effect on feed intake, egg production, egg weight, egg mass, feed conversion, egg specific gravity, mortality, or body weight. Increasing dietary energy by the addition of poultry oil had significant effects on feed intake and feed conversion. As dietary energy increased, feed intake and feed conversion linearly decreased. Increasing dietary energy by the addition of poultry oil had no significant effect on egg production, egg weight, egg mass, egg specific gravity, body weight, or mortality. Hens linearly decreased feed intake as dietary energy level increased so that similar quantities of dietary energy (5.2-5.4 kcal/kg) were consumed to produce 1 g egg. In conclusion, increasing dietary energy by the addition of poultry oil had a positive influence on feed conversion of laying hens at three protein levels in Phase II. The dietary energy level for optimal profits varies with changing egg price and feed ingredient prices.

Key Words: protein, dietary energy, feed conversion

S-P182 Evaluation of the efficacy of a commercial purified phyllosilicate to reduce the toxicity of T-2 toxin in broiler chicks. A. Casarin¹, M. Forat¹, E. Soto², and D. Zaviezo*³, ¹*Instituto Internacional Investigacion Animal, Queretaro, Mexico*, ²*Avimex, Mexico City, Mexico*, ³*Special Nutrients, Miami, Florida.*

The use of 2.5 kg/mt of a commercial HSCAS (Myco-Ad) have been previously demonstrated to effectively prevent the toxic effect of 1.25 ppm T-2 toxin (T-2) in broilers. An experiment was conducted to study the efficacy of a very low inclusion commercial purified phyllosilicate (Myco-Ad A-Z) in preventing the deleterious effects of T-2 in broiler chicks. Thirty two 5-day-old Ross male broiler chicks individually caged were randomly distributed into four dietary treatments with 8 replications each. Birds were fed a basal sorghum-soybean meal mash diet containing or exceeding NRC recommended nutrients levels. The feed was experimentally contaminated with synthetic T-2 from Sigma Chemi-

cal Company, USA. Treatments were: (1) control diet; (2) control + 1.0 kg/mt Myco-Ad A-Z; (3) control + 1.25 ppm T-2; and (4) control + 1.25 ppm T-2 + 1.0 kg/mt Myco-Ad A-Z. Results at 38 days of age indicated that broilers fed 1.25 ppm T-2 contaminated diet presented significant lower body weight, poorer feed conversion, and severe macroscopic oral lesions than chicks fed the control diet. The addition of Myco-Ad A-Z to the contaminated diet resulted in statistically significant heavier (1772 v 1563 g) and more efficient (1.97 v 2.19) broilers, with statistically reduced gross oral lesions and substantial reduction in microscopic organs lesions (tongue, gizzard, thymus, and bursa) than those fed 1.25 ppm T-2. The addition of 1.0 kg/mt of Myco-Ad A-Z to chick diets did not show any statistical difference in performance and bone mineralization compared to the control diet, demonstrating its lack of interference with nutrients absorption. These results indicated that Myco-Ad A-Z at 1.0 kg/mt was effective in preventing the toxic effects of T-2 in broilers chicks.

Key Words: Myco-Ad A-Z, T-2 toxin

S-P183 Effect of commercial methionine sources added alone or combined with organic acids on survival of *Salmonella typhimorium* in feed. M. Locatelli¹, M. Rademacher², and D. Watson³, ¹Degussa Corporation, Kennesaw, Georgia, ²Degussa AG, Wolfgang, Germany, ³Abbott Analytical Institute, New Ferry, United Kingdom.

The use of organic acids in feed can prevent microbial contamination. The objective was to study the effect of DL-methionine (DLM) or liquid methionine hydroxy analog (MHA-FA) supplemented either alone or combined with organic acids on the reduction of *Salmonella typhimorium* in feed. A four kilogram sample of feed was artificially contaminated with *Salmonella typhimorium* by spraying it carefully across the feed surface. Twenty aliquots of the meal were treated with the following additives (2 duplicates per treatment): T1, no additives; T2, 0.6% acid A; T3, 0.6% acid B; T4, 0.15% DLM; T5, 0.23% liquid MHA-FA; T6, 0.17% liquid MHA-FA; T7, 0.6% acid A + 0.15% DLM; T8, 0.6% acid A + 0.23% liquid MHA-FA; T9, 0.6% acid B + 0.15% DLM; and T10, 0.6% acid B + 0.23% liquid MHA-FA. Acid A: Bolifor[®] AS 2500S, and acid B: Bolifor[®] FA 1000L. Each additive was mixed evenly with the feed. Treated samples were stored at room temperature for up to 48 hs. Recovery of surviving organisms was carried out at 0, 4, 24 and 48 hs after compounds addition using standard analytical procedures according to BS 5673. After incubation at 37°C for 24 hs *Salmonella* colonies were counted. Neither DLM nor liquid MHA-FA added alone substantially reduced the survival rate of *Salmonella* (91.4, 90.0, 84.3 and 86.2 % for T1, T4, T5 and T6). The combination with acidifiers A and B (T7, T8, T9 and T10) showed survival rates of 19.0, 17.5, 10.0 and 9.9%, respectively, and did not further improve the effect of the exclusive addition of acids (18.8 and 12% for T2 and T3). The results showed that methionine sources individually added at typical levels used in poultry diets have no relevant effect on controlling *Salmonella*. Even combined with organic acids, methionine sources were unable to reduce *Salmonella* in feed below the level reached by the organic acids added alone.

Key Words: *Salmonella*, methionine, acids, feed, survival

S-P184 Can liquid methionine hydroxy analog replace organic acids to control *Salmonella typhimorium* in feed? M. Locatelli¹, M. Rademacher², and D. Watson³, ¹Degussa Corporation, Kennesaw, Georgia, ²Degussa AG, Wolfgang, Germany, ³Abbott Analytical Institute, New Ferry, United Kingdom.

The use of organic acids in feed can prevent microbial contamination. The objective was to evaluate the effect of a partial replacement of an organic acid addition by methionine hydroxy analog (MHA-FA) to feed on the survival of *Salmonella typhimorium*. A four kilogram sample of feed was artificially contaminated with *Salmonella* by spraying it carefully across the feed surface. Ten aliquots of the meal were treated with the following additives (2 duplicates per treatment): T1, no additives; T2, 0.40% Bolifor[®] FA 1000L; T3, 0.3% Bolifor[®] FA 1000L + 0.1% liquid MHA-FA; T4, 0.25% Bolifor[®] FA 1000L + 0.15% liquid MHA-FA and T5, 0.20% Bolifor[®] FA 1000L + 0.20% liquid MHA-FA. Each additive was mixed evenly with the feed. Treated samples were stored at room temperature for up to 48 hs. Recovery of surviving organisms was carried out at 0, 4, 24 and 48 hs after compounds addition using standard analytical procedures according to BS 5673. After incubation at 37°C for 24 hs *Salmonella* colonies were counted. The survival rate of *Salmonella* at T1 was 86.95%. Addition of 0.40% Bolifor[®] FA 1000L to control diet dramatically reduced survival rate (18.15%). Reducing the organic acid addition from 0.3% in T3 to 0.2% in T5 allowed an increase of *Salmonella* survival compared with T2. The partial replacement of Bolifor[®] FA 1000L by liquid MHA-FA in T3, T4 and T5 did not help to prevent the increase in survival of *Salmonella* (23.80, 36.05 and 51.45%, respectively). Based on these results it was concluded that under the given circumstances liquid MHA-FA is not suitable to replace an organic acid to control *Salmonella typhimorium* growth in feed.

Key Words: *Salmonella*, methionine analog, acids, feed, survival

S-P185 Influence of hens' age and egg storage time on growth and bone abnormalities in broiler chicks. M.Y. Shim^{*}, G.M. Pesti, R.I. Bakalli, and H.M. Edwards, University of Georgia, Athens.

An experiment was conducted with chicks hatched from eggs laid by Ross × Ross 308 hens to investigate the influence of hens' age (29 vs. 46 wk) and egg storage time (0 vs. 10 d) on growth and bone abnormalities in chicks. The diets were based on corn, soy bean meal and soybean oil. The tibial dyschondroplasia (TD)-inducing diet contained 0.60 % Ca and 0.50 % available P and the Phosphorous (P) rickets-inducing diet contained 1.00 % Ca and 0.25 % available P. Four chicks from each hen age and egg storage time combination (16 chicks total) were placed in each of 5 pens per diet (15 pens total). Hens' age had significant effects (P<0.05) on 0 – 16 d chick growth (359 ± 14 vs. 400 ± 12 for 29 and 46 wk old hens, respectively). The chicks from the older hens showed lower TD score (P=0.0021) and incidence (P=0.0020), but hens' age did not affect P rickets score and incidence. The longer egg storage time resulted in lower P rickets score (P=0.0398) and incidence (P=0.0726). The TD inducing diet caused a much higher incidence of TD in chicks from young (66%) vs. older (38%) hens (interaction P = 0.0215). The P rickets-inducing diet caused a much lower incidence of P rickets in chicks from the eggs stored for 10 days (21%) vs. those from fresh eggs (39%) (interaction P = 0.0096). Bone ash was affected by diet, hens' age and egg storage time (3-way interaction P = 0.0089). The incidence of bone abnormalities in broilers is influenced by the hens' age, egg storage time and diet.

Key Words: broiler, TD, P rickets, hens' age, egg storage time

S-P186 Influence of hen age on response of turkey poults challenged with cold stress and *Escherichia coli* to Alphamune™, a dietary yeast extract antibiotic alternative. G. Huff*¹, W. Huff¹, N. Rath¹, M. Farnell³, F. Solis de los Santos², and A. Donoghue¹, ¹USDA/ARS/PPPSRU, Fayetteville, Arkansas, ²University of Arkansas, Fayetteville, ³Texas A&M University, College Station.

Two battery trials were conducted using a yeast extract feed supplement, Alphamune™, to protect turkey poults from production losses due to cold stress and *E. coli* infection. Trial 1 used commercially hatched day-old male Hybrid Converter poults from 33-wk-old hens in their 2nd wk of lay and Trial 2 used male poults of the same line from 40 wk-old hens in their 8th wk of lay. In both trials poults were fed a standard unmedicated turkey starter diet or the same diet with either 1 lb/ton or 2 lb/ton Alphamune™. Challenged birds were exposed to intermittent cold stress (12-16°C) during wk 1-3 and inoculation of eye and nares by course spray of a 10⁸ cfu culture of *E. coli* at 1 wk of age. Controls were neither stressed nor inoculated. Birds were bled and necropsied at 3 wk of age. In both trials, challenged birds had significantly decreased BW and feed conversion efficiency (FC) as compared to non-challenged controls. In Trial 1, BW was increased during the 1st wk pre-challenge by both levels of supplementation, with 1lb/ton resulting in significantly higher BW than 2 lb/ton. Both BW and FC of challenged poults were protected by both levels of supplementation. Total leukocyte numbers (WBC) were decreased by challenge of control-fed birds only, and there was no effect of challenge on the heterophil/lymphocyte (H/L) ratio. In Trial 2, neither level of Alphamune™ improved BW or FC and 1 lb/ton decreased BW of challenged birds relative to those challenged and not supplemented. In Trial 2, the WBC was decreased and the H/L ratio was increased in challenged control-fed birds. Alphamune™ resulted in increased basal H/L ratios of unchallenged birds, but there was no further increase due to challenge of the supplemented birds. These results suggest that poults from young breeder hens may have a differential response to stress compared to those from older hens, and that Alphamune™ may protect poults from young breeder flocks from the production losses due to cold stress and *E. coli* infection.

Key Words: turkeys, hen age, Alphamune™, cold stress, *Escherichia coli*

S-P187 Efficacy of a new multi-strain probiotic product in promoting broiler performance and modulating the composition and activities of cecal microflora. K. Mountzouris*, H. Beneas, P. Tsirtsikos, E. Kalamara, and K. Fegeros, *Agricultural University of Athens, Athens, Greece.*

The forthcoming ban of antibiotics in animal nutrition in the EU by January 2006, highlights the need for effective alternative products that will help sustain productive and high performance animal husbandry. In this work the efficacy of a new multi-strain probiotic product (Biomin®PoultryStar) in broiler nutrition was evaluated. The product comprised two *Lactobacillus* strains, one *Bifidobacterium* strain, one *Enterococcus* and one *Pediococcus* strain (Biomin GmbH). Four hundred, one day old, male Cobb broilers were allocated in 4 experimental treatments for 6 weeks. The experimental treatments were: C (corn-soybean basal diet), PFW (basal diet contained 1g/kg probiotic + probiotic administered in water for the first 4 weeks), PF (basal diet contained 1g/kg probiotic) and A (basal diet contained 2.5 mg avilamycin/kg). Each treatment had five replicates of 20 broilers. Overall, the probiotic product administered in feed and water (PFW)

displayed a growth promoting effect that did not differ from the antibiotic avilamycin treatment (A). In addition, overall FCR in treatment A (1.73) was significantly better (P=0.05) than treatment C (1.81), whereas treatments PFW (1.77) and PF (1.79) were intermediate between A and C and did not differ from A.

The probiotic product modulated the composition of the cecal microflora as evidenced by the significant (P=0.05) increases in the concentrations of bacteria belonging to *Bifidobacterium spp.*, *Lactobacillus spp.* and Gram positive cocci, seen in treatments PFW and PF compared to C and A. In terms of cecal microflora metabolic activity, the higher numerical VFA concentrations and significantly higher specific activities of A-galactosidase and B-galactosidase seen in treatments PFW and PF compared to C and A, it could be postulated that the examined probiotic product resulted in a metabolic stimulation of the cecal microflora.

Key Words: probiotics, cecal microflora, microbial enzymes, broiler chicken

S-P188 Availa®Zn and Availa®Mn improve broiler performance and intestinal elasticity. S. Davis¹, T. Cheng*², and T. Ward², ¹Colorado Quality Research, Wellington, Colorado, ²Zinpro Corporation, Eden Prairie, Minneapolis.

A total of 882 Ross x Cobb 500 chicks were randomly placed into 49 pens. The treatments consisted of (1) Sulfate Control [100 ppm Zn from ZnSO₄ and 110 ppm Mn from MnSO₄]; (2) ISO 40 Availa-Zn [Availa-Zn zinc amino acid complex replaced 40 ppm Zn from ZnSO₄]; (3) ISO 80 Availa-Zn [Availa-Zn replaced 80 ppm Zn from ZnSO₄]; (4) + 40 Availa-Zn [Availa-Zn provided 40 ppm Zn on top of Control]; (5) ISO 40 Availa-Mn [Availa-Mn manganese amino acid complex replaced 40 ppm Mn from MnSO₄]; (6) ISO 80 Availa-Mn [Availa-Mn replaced 80 ppm Mn from MnSO₄], and (7) + 40 Availa-Mn [Availa-Mn provided 40 ppm Mn on top of Control]. Among the zinc treatments, broilers from the ISO 40 Availa-Zn treatment had numerically heavier 56-day body weight (3.90 vs. 3.78 kg) and higher percentage breast meat (26.3 vs. 25.7%; P = 0.015) when compared to the Control. Percentage breast meat for the + 40 Availa-Zn treatment was numerically higher than the Control (26.1 vs. 25.7%). Among the manganese treatments, the ISO 40 Availa-Mn treatment had numerically heavier 56-day weights than those reported for the Control (3.93 vs. 3.78 kg). The ISO 80 Availa-Mn and + 40 Availa-Mn treatments yielded numerically higher percentage breast meat when compared to the Control (26.1, 26.0 and 25.7%, respectively). The + 40 Availa-Zn treatment showed significantly higher intestinal elasticity when compared to the Control (5.93 vs. 4.67 cm; P = 0.044).

Key Words: zinc, manganese, complexes, broiler, performance

S-P189 Effect of phytase supplementation on mineral digestibility in young broilers. M. Hruby*¹, J.C. Remus¹, E.E.M. Pierson¹, F. Santos², and N.K. Sakomura², ¹Danisco Animal Nutrition, Saint Louis, Missouri, ²Universidade Estadual Paulista, Jaboticabal, San Paulo, Brazil.

A study was conducted to evaluate the effect of variable phytase levels (500, 750, and 1000 FTU/kg of Phyzyme® XP 5000G, Danisco Animal Nutrition) in corn-based diets reduced progressively in nutrients (P, Ca,

ME, crude protein (CP), amino acids (AA) on Ca, P, Cu, K, Mg, Na and Zn digestibility and bone mineralization. Performance results from this study were presented previously. A total of 1680 male broiler chicks (Cobb) were assigned to seven treatments with six replicates of 40 chicks each: Positive control (PC), 3 negative control diets with progressive reduction of nutrients (NC1, NC2 and NC3) and 3 levels of phytase for each NC treatment. Digestibility of macro minerals and trace elements was determined by ileal digesta collection. At 35 days, 15 birds per replicate were killed and the contents of the terminal ileum were collected. Additionally, at day 42, the right tibia from 4 broilers per replicate was analyzed for breaking resistance, bone ash and Ca, P, Cu, K, Mg, Mn, Na and Zn concentration. As expected, nutrient reductions (including Ca and P) contributed significantly to lower ($P<0.05$) ash % and breaking resistance while phytase addition improved those parameters. Ca, P, Zn and K levels in bone were significantly affected by dietary nutrient reductions but not Mg, Na and Cu. Phytase addition significantly improved P, Ca, Zn and Mg bone levels. Ileal digestibility of Ca, P, Na, Mg, K and Zn was significantly improved with phytase addition. The results suggest that phytase can improve digestibility of both macro and trace minerals. While Ca and P digestibility is typically accounted for in the phytase nutrient matrix currently, the trace element contribution is not but could merit inclusion in the future.

Key Words: phytase, calcium, phosphorus, trace minerals

S-P190 Effect of apparent metabolizable energy regimes on growth and carcass traits of broilers varying in strain cross and gender. A. Corzo*¹, M.T. Kidd¹, W.A. Dozier, III², E.R. Miller³, and B.I. Fancher⁴, ¹Mississippi State University, Mississippi State, Mississippi, ²USDA-ARS, Mississippi State, Mississippi, ³Mountaire Farms, Selbyville, Delaware, ⁴Aviagen North America, Albertville, Alabama.

Energy represents a large constraint in feed formulation considering oscillating fat prices. Further, low energy diets may not necessarily be a feasible solution when desiring optimum growth and carcass traits from some broiler strain crosses. A study was designed to evaluate the cumulative responses of three dietary regimes varying in apparent metabolizable energy (ME) value. Starter (2932, 3043 or 3153 kcal/kg ME), grower (3031, 3142 or 3252 kcal/kg ME), finisher (3086, 3197 or 3307 kcal/kg ME) and withdrawal (3108, 3219 or 3329 kcal/kg ME) feeding phases were each fed for two weeks, and in pellet form with the exception of the starter phase (crumbles). Two strains (Ross x Ross 308 vs. 708) along with gender were added to model (3 ME regimes x 2 strains x sex = 12 trt with 10 replicate pens) for a total of 2,160 1-d-old chicks placed in 120 floor pens. Live performance was quantified at the end of each feeding phase and processing was done on 4 randomly selected birds from each pen at d 35, 42 and 56.

Males were heavier and had improved feed conversion and caloric efficiency than females throughout the study ($P<0.001$). The 308 cross exhibited faster growth rate and feed consumption while the 708 cross had improved caloric efficiency and final feed conversion values ($P<0.001$). Higher carcass and breast meat yields were observed in the 708 broiler, but higher drumstick yield was seen in the 308 cross ($P<0.001$).

As broilers received increasing levels of ME throughout the study, feed conversion improved but caloric efficiency was negatively affected ($P<0.001$). Feed consumption was reduced as dietary ME increased ($P<0.001$), but only birds fed the lowest ME diet resulted in lower body weights throughout the study ($P<0.05$). Carcass and total breast meat yields were reduced in birds fed the highest ME regime, concurrently

with an increase in abdominal fat percentage ($P<0.01$), at 35, 42 and 56 d of age. In conclusion, higher ME regimes may successfully reduce feed conversion, but increased dietary amino acids may be warranted to overcome possible reductions in associated feed consumption.

Key Words: metabolizable energy, caloric efficiency, broiler

S-P191 Feed intake (FI) explains differences in dose responses between 2-hydroxy-4-(methylthio)-butanoic acid (HMTBA) and DL-methionine (DLM). C.D. Knight*, J.J. Dibner, R. Gonzalez-Esquerria, and M. Vazquez-Anon, *Novus International, Inc.*

Previous reports have indicated that under some situations, broilers fed MET deficient diets exhibit lower feed intake (FI) and body weight gain (BWG) when supplemented with HMTBA than DLM. Conversely, supplementation of 1% MET to corn soybean meal (CS) diets results in lower FI and BWG of broilers fed DLM than HMTBA. Two experiments were designed to determine if BWG differences were due to differences in FI or the efficiency with which the MET source was used by the animal. In trial 1, broiler males (8/pen, 8 pens/treatment) were fed a semi-purified isolated soy protein diet (Met + Cys = 0.46%) with either HMTBA or DLM supplemented at 2 levels (0.08% and 0.10%). These chicks were allowed to consume feed ad libitum (AL) while a third DLM treatment was pair-fed (PF) to that of HMTBA-AL. Diets supplemented with 0.10% exhibited greater FI than 0.08% (407 vs. 450g) and BWG (202 vs. 236g), regardless of MET source ($P<0.01$), indicating the diet was responsive to MET. Feed intake and BWG were lower ($P<0.01$) for HMTBA-AL than DLM-AL birds (410 vs. 460g and 242 vs. 205g, respectively; $P<0.01$), however, DLM-PF and HMTBA-AL birds had the same BWG at each MET level. In trial 2, broilers (10 males/pen, 8 pens/treatment) were fed CS diets from 14-28 days containing 0.70% total M+C supplemented with 1% HMTBA or DLM. The FI (1.423 vs. 1.510kg) and BWG (0.903 vs. 0.963 kg) for DLM-AL were both lower than for HMTBA-AL ($P<0.01$), but BWG for HMTBA-PF and DLM-AL did not differ (0.897 vs. 0.903kg). Thus, differences in BWG between HMTBA and DLM below and above the peak response are the result of the FI. Consequently, HMTBA and DLM exhibit differences in relative dose responses that cannot simply be explained as one being a dilution of the other. The implications of these findings are that relative efficacy of Met sources cannot be described by a single value, but depend upon the levels that are being compared, making it imperative that they be compared at intended levels of use.

Key Words: HMTBA, methionine, broilers, feed intake

S-P192 S-The effect of selenium source on glutathione peroxidase activities in brain and liver of chick embryos and chicks. T. Ao*, R. Power, J.L. Pierce, A.J. Pescatore, A.H. Cantor, and M.J. Ford, *Alltech-University of Kentucky, Lexington.*

Two experiments were conducted to investigate the effect of selenium source (Sel-Plex[®], a selenium yeast product, or selenite) on Se-dependent glutathione peroxidase (GSH-Px) activities in brain and liver of newly hatched and 21-day-old chicks. Two hundred eighty-eight Hy-Line W-36 laying hens in Experiment 1 and 288 Hy-Line brown shell laying hens in Experiment 2 were randomly assigned to one of three dietary treatments. Treatments consisted of feeding a low-Se corn-soy basal diet with 0 or 0.3 ppm added Se from sodium selenite or Sel-Plex[®]. In each experiment, fertile eggs were collected after 28 weeks of feeding

the experimental diets. After 21d incubation, 10 newly hatched chicks per treatment were sacrificed to take liver and brain samples. Another 36 chicks per treatment were grown in cages (six chicks per cage) in an environmentally controlled room. Chicks from all three hen treatments were fed the same low-Se torula yeast diet for 21day. Then four chicks per cage (24 chicks per treatment) were randomly sacrificed for brain and liver samples. All samples were immediately put into liquid nitrogen and stored at -80°C until assay of GSH-Px activity. The data from both experiments showed that Se supplementation significantly ($P < 0.01$) increased the GSH-Px activity in both liver and brain sampled from newly hatched chicks. No significant difference was found between two Se sources. Sel-Plex[®] supplementation of the hen diet significantly ($P < 0.01$) increased brain GSH-Px activity of the 21-d old chicks, compared with no supplementation or supplementing sodium selenite. Liver GSH-Px activity was also significantly ($P < 0.05$) increased by supplementing the hen diet with Sel-Plex[®]. The results indicate that the chick tissue GSH-Px activity can be enhanced by Se supplementation of the hen diet and that the enhanced enzyme activity in growing chicks fed a low-Se diet is more prolonged by adding organic Se to the hen diet, compared with selenite.

Key Words: chick, tissue, glutathione peroxidase, selenium yeast, selenite

S-P193 Effects of normal and low phytate diets on zinc and phosphorus utilization by young turkey poults. J. Scott, D. Ledoux*, J. Broomhead, C. Walk, and T. Veum, *University of Missouri, Columbia.*

An experiment was conducted to determine if turkey poults fed a low phytate diet would more efficiently utilize dietary zinc compared with poults fed a normal diet. One hundred and twenty day-old female turkey poults were assigned to a 2 x 3 factorial arrangement of treatments (4 pens of 5 poults/treatment) and fed diets from hatch to day 21. Factors were diet type (normal diet or low phytate diet) and supplemental zinc (0, 20 or 40 mg/kg of Zn from zinc sulfate). The normal diet contained normal barley and normal soybean meal, and the low phytate diet contained low phytate barley and low phytate soybean meal. Feed intake, body weight gain, and feed conversion were not affected ($P > 0.05$) by dietary treatments and averaged 648 g, 471 g, and 1.38 g:g, respectively. Percent toe ash was not affected ($P > 0.05$) by diet type but was affected ($P < 0.05$) by Zn level, and a significant diet type by Zn level interaction ($P < 0.05$) was also observed. Phosphorus retention was not affected ($P > 0.05$) by Zn level but a significant diet type by Zn level interaction ($P < 0.05$) was observed. Retention of P was higher ($P < 0.05$) in poults fed the low phytate diet compared to those fed the normal diet (64% vs 54%). A significant diet type by Zn level interaction ($P < 0.05$) was observed for toe Zn. Toe Zn was higher ($P < 0.05$) in poults fed the low phytate diet compared with poults fed the normal diet (86 vs 67 mg/kg), and increased ($P < 0.05$) with increasing levels of dietary Zn (65, 77, and 87 mg/kg, respectively). Results indicate that poults fed the low phytate diet utilized more dietary Zn than poults fed the normal diet. Poults fed the low phytate diet also retained more P than poults fed the normal diet.

Key Words: low phytate diet, zinc utilization, turkeys

S-P194 The influence of energy (fat) on performance of eight commercial leghorn strains including interior egg quality. M. Bryant*, G. Wu, and D. Roland, *Auburn University, Auburn, Alabama.*

This trial was conducted to study the influence of energy (fat) on the performance of eight commercial layer strains and as a comparison of strains. Eight strains of 21 week old commercial layers were placed in an environmentally controlled cage house and housed 3 per cage. There were 270 hens per strain for a total of 2,160 hens. Each strain was fed one of three diets yielding a 3 x 8 factorial arrangement with 90 hens per treatment. Corn-soy diets were formulated with no added fat, 3.4 % fat or 6.8 % fat for the 3 energy levels. Because previous trials have shown a decrease in feed consumption (FC) with increasing energy, Lysine, Methionine + Cystine, Na, Ca, available P, mineral and vitamin premix levels were adjusted to make differences observed due only to strain or energy level. Study duration was 16 weeks. There was a linear increase in egg weights (EW) from 57.8 g for hens fed the diet with no added fat to 59.1 g from hens fed the highest level of fat. There was a linear decrease in specific gravity (SG) and FC as energy increased. Hens fed the diet with no added fat ate an average of 110 g per day and FC dropped to 102 g for hens fed the highest level of fat. There was no energy effect on egg production (EP). Haugh units, egg solids and percent egg components were determined at 8 and 16 weeks. There was a linear increase and a quadratic effect of energy on the haugh units of eggs laid in the eighth week and on the average of the eighth and sixteenth week haugh units as well as a linear increase in whole egg solids of eggs laid at eight weeks. There were strain differences in every parameter measured. There were no interactions between strain and fat level except for hen weights. The weight of the hens at the end of the trial significantly increased as fat level increased in only three of the strains. The optimal energy level for performance and profits depends on ingredient prices and may not necessarily be the same for the table egg and breaker egg industries.

Key Words: energy, fat, Leghorn

S-P195 Phase-feeding during the grower and finisher phases: impact on growth, uniformity, and production cost. V. Brewer*, P. Pillai, T. OConnor-Dennie, and J. Emmert, *University of Arkansas, Fayetteville.*

Phase-feeding (PF) has been effective at maintaining broiler growth and yield while reducing cost of production (\$/kg gain or breast), but the impact on uniformity has not been assessed, and Ca and P have not been incorporated. An experiment was conducted to determine the effects of decreasing dietary amino acid (AA) and Ca and P levels every other day using the PF approach. Treatments consisted of 1) diets formulated to meet NRC recommendations, 2) diets with phased levels of AA, Ca, and P, 3) diets with phased levels of AA, and Ca and P reduced by 0.2%, 4) as diet 2 with AA reduced by 10%, 5) as diet 3 with AA reduced by 10%. For PF diets were prepared that contained Lys, SAA and Thr levels matching the predicted requirements for birds at 27 d (high nutrient density) and 61 d (low nutrient density). Pelleted high and low nutrient density diets were blended to produce rations containing AA levels that matched the predicted PF requirements over two-day intervals. Birds were fed the NRC grower and finisher diets from 27 to 43 and 43 to 61 d, respectively or a series of PF diets that were switched every other day. Treatments were replicated in 8 pens, with each pen containing 20 birds. Weight gain, feed intake and feed efficiency were calculated, and birds were processed on d 60 or 61 (four replicate per day) to allow calculation of carcass and parts yields. No differences ($P > 0.05$) in

weight gain, feed efficiency, or breast yield were noted when comparing PF diets to the NRC diet, with the exception of diet 5 which lowered these parameters. Carcass yield of broilers fed the NRC diet and diets 2 and 4 were similar ($P > 0.05$), but reduction of Ca and P levels in diets 3 and 5 resulted in reduced ($P < 0.05$) values. Production costs (\$/kg gain or breast) were lower ($P < 0.05$) for PF diets 2, 3, and 4 than for the NRC diet. Treatment SD and CV values were very similar, indicating that PF did not impact uniformity. Substantial savings with PF appear to be possible, and incorporation of Ca and P levels into the PF approach seems feasible.

Key Words: broilers, phase feeding, amino acids, calcium, phosphorus

S-P196 Betafin™ and Avizyme® 1500 improve performance and egg quality parameters in laying hens kept under heat stress and fed diets reduced in energy, methionine and choline chloride.

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A study was conducted to evaluate the effect of amylase, xylanase and protease feed enzyme mixture (Avizyme® 1500) and natural betaine (Betafin™, both from Danisco Animal Nutrition) supplementation on egg production (EP), egg quality, feed intake (FI) and feed conversion ratio (FCR) of laying hens fed corn/soy diets reduced in ME (-100 kcal/kg feed), methionine (300 mg/kg feed) and without any added choline chloride and kept under heat stress conditions (average temperature of 36°C). Three hundred and sixty 22-week old brown Hy-line laying hens were kept up to 42 weeks of age. They were assigned into six treatments, 20 cages per treatment and 3 birds per cage. The birds were reared under similar environment and management. There were no significant differences among treatments in body weights. The enzyme addition significantly ($P < 0.05$) increased egg mass, total egg number, egg weight and EP compared to both negative and positive control treatments (NC and PC). Similar trend was observed in betaine-supplemented treatments either alone or in a combination with the enzyme. Both supplements alone or in the combination reduced the percentage of broken eggs compared to PC and NC. The enzyme, betaine and their combination compared to PC and NC, significantly improved FCR. The percentages of yolk and shell and shell thickness were significantly increased when birds were fed diets supplemented with the enzyme, betaine and their combination compared to PC and NC. The results suggest that both the feed enzyme mixture and betaine can contribute to a significant improvement in performance of layers fed diets with variable nutrient densities and kept under heat stress conditions.

Key Words: layer, betaine, feed enzymes, heat stress

S-P197 Glycogen status and growth of poults in ovo fed carbohydrate and hydrolyzed soy relative to positive and negative controls.

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In ovo feeding (IOF) improves turkey poult quality and viability, but formulations must be optimized relative to appropriate control treatments. The objective of this study was to compare different controls

and IOF formulations. At 23 days of incubation (E), 840 Hybrid turkey eggs were sorted into 5 groups of similar weight distribution and assigned to treatments: 1) non-injected control (NC); 2) shell hole punch control (HC); 3) 1.5 ml IOF saline control solution (.4% NaCl, 136 mOsm) (SC); 4) 1.5 ml carbohydrate IOF solution (.4% NaCl+.2% HMB+20% dextrine+1.5% maltose+3% sucrose, 496 mOsm) (CH); and 5) 1.5 ml carbohydrate-protein solution (.4% NaCl+.2% HMB+5% hydrolyzed soy protein+10% dextrine, 496 mOsm) (CHP). Hatchability rate (HR) and body weights (BW) were recorded at hatch and then the poults were randomly distributed by treatment and sex among 12 replicate pens. Glycogen concentration [GLY] of liver (L), breast muscle (BM), and pipping muscle (PM) were determined at 25E (8 eggs/treatment) and hatch (10 poults/treatment). BW was determined at 7 and 14 d. IOF treatments increased HR in comparison to controls (93% and 93% for CHO and CPT vs 90%, 91%, and 91% for NC, HC, and SC). CH and CHP had higher BW by 2% over controls (NC, HC, and SC) at hatch ($p < .05$). BW of toms was greater than hens, but there was no difference among treatments after 7d. There were no treatment effects on [GLY] in PM or L at 25E. At hatch, PM [GLY] was greatest for CH, intermediate for CHP, and lowest for NC and SC (16.8, vs 8.6, vs 2.8 and 4.1 mg/g, respectively, $p < .05$). BM [GLY] was greatest for NC, followed by CHP than CH and SC (2.2, 1.3, .7, and .4 mg/g, respectively). L [GLY] was higher for CH than CHP, NC, and SC (11.9 vs 4.8, 6.6, and 5.7 mg/g, respectively, $p < .05$). IOF solutions CH or CHP increased HR and BW at hatch, which may be due to greater [GLY] status. Because there were no differences among controls (NC, HC, and SC), any of these may serve as controls in IOF studies.

Key Words: turkeys, in ovo feeding, hatchability, body weight, glycogen status

S-P198 Influence of previous lysine level on the apparent ileal amino acid digestibility of corn soybean meal diets for broiler chickens.

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Accurate estimates of amino acid (AA) digestibility coefficients are important to formulate precise diets based on ideal protein profiles. Age, heat stress, feed ingredients, NaCl levels, Arg:Lys ratio, and Met source could affect estimates of apparent ileal digestibility (ID) of Lys. Low Lys levels in starter diets carry out a detrimental effect until 49 d of age independently of Lys levels used in other phases. This trial was carried out to determine the effects of Lys levels on ID of AA at 11 and 28 d of age. A bioassay was accomplished with 324 broilers raised in 27 floor pens. Three levels of Lys in the starter (1-17d) and three levels in the grower (18-35 d) period were fed, for a total of 9 feeding programs. Corn-soybean meal basal diets were formulated to obtain optimum (O) recommended AA levels for breast muscle development in both phases, and supplemented with DL-Met and Thr to follow an ideal protein profile. Low (L) and high (H) levels of Lys were achieved through modifications of L-Lys HCl inclusion at the expense of sand. Dietary electrolyte balance was kept at 254 and 242 mEq/kg for all starter and grower diets, respectively. Arg:Lys ratios were 1.25, 1.07 and 0.93 for L, O, and H diets, respectively in both phases. Each diet contained 1% of Celite. At 11 and 28 d of age, 3 birds per pen were euthanized and ileal digesta contents were collected, frozen and lyophilized. Diets and digesta samples were analyzed for acid insoluble ash, CP and AA contents. Nutrient apparent ID was calculated. At 11 d, chickens fed L-Lys starter

diets had lower Lys ID ($P < 0.05$), BWG and higher FCR ($P < 0.001$) than the ones fed H-Lys diets. The ID of all other AA was not affected ($P > 0.10$) by Lys level. At 28 d, BW and FI, and the ID of all essential AA were affected ($P < 0.05$) by the Lys level in the starter phase and L-Lys level in the grower period. ID of AA increased with age in chickens fed H and O diets, but not in broilers fed L-Lys starter diets. These results suggest that the level of Lys in the previous dietary phase could affect the ID of all essential AA in the following periods.

Key Words: lysine, amino acid digestibility, broilers

S-P199 The effect of dietary phosphorus level and Ca:P ratio on growth performance and bone response variables in broilers.

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Two experiments were conducted to evaluate growth performance and bone response variables in 0 to 14 d-old Ross x Ross broilers. Each treatment was replicated with a minimum of 5 pens of 6 chicks per pen. Initial and final BW were 38 and 400 g and 41 and 358 g in Experiments 1 and 2. Diets were formulated to contain 1.26% Lys and 3,200 kcal/kg ME. Each experiment contained a positive control (PC) corn soybean diet (2.22 Ca:non phytate P [nPP] ratio at 0.45% nPP). In Experiment 1 in addition to the PC diet, 2 levels of nPP (0.25 and 0.35%) were fed at Ca:nPP ratios of 1.6, 1.9, 2.2, and 2.5. In Experiment 2 in addition to the PC diet, 2 levels of nPP (0.25 and 0.35%) were fed at Ca:nPP ratios of 1.6, 1.9, 2.2, 2.5, 2.8, and 3.1. In Experiment 1, increasing nPP from 0.25 to 0.35% increased ($P < 0.02$) daily gain, feed intake, gain:feed, and bone breaking strength. Gain:feed was increased linearly ($P < 0.04$) as Ca:nPP increased. Bone ash percentage was not affected by diet ($P > 0.10$). In Experiment 2, nPP level did not affect growth performance ($P > 0.10$). There was a quadratic effect ($P < 0.06$) of Ca:nPP on daily gain with gain being optimum at a Ca:nPP of 2.2 in broilers fed 0.25% nPP or at a Ca:nPP of 1.9 in broilers fed 0.35% nPP. Bone breaking strength and bone ash percentage were increased ($P < 0.001$) by increasing nPP from 0.25 to 0.35%. Bone breaking strength was increased quadratically ($P < 0.001$) by Ca:nPP with an optimum at a Ca:nPP of 2.2 regardless of nPP level. Bone ash percentage was increased quadratically ($P < 0.02$) by Ca:nPP with an optimum at a Ca:nPP of 2.5 at 0.25% nPP and at an optimum of 2.8 at 0.35% nPP. A Ca:nPP ratio of 1.9 to 2.2 is optimum, and 0.35% nPP does not maximize bone response variables in broilers regardless of the Ca level of the diet.

Key Words: broilers, calcium, phosphorus, ratio, bone

S-P200 The effect of chromium as chromium propionate on growth and carcass traits of broilers. A. Jackson*¹, L. Southern¹, J. Shelton¹, S. Johnston¹, F. Valdez², and V. Sewalt², ¹*Louisiana State University Agricultural Center, Baton Rouge*, ²*Kemin Industries, Des Moines, Iowa.*

Two similar experiments were conducted to evaluate the effect of dietary chromium propionate (CrProp) on growth performance and carcass traits of 0 to 42 d-old and 0 to 49 d-old commercial Ross X Ross broilers. Both experiments consisted of 4 treatments that were replicated with 7 pens (4 male and 3 female) with either 50 male or 55 female broilers per pen. Average initial and final BW for Experiment 1 were 37

g and 2,136 g, and 37 and 2,147 g for Experiment 2. In both experiments 0, 200, 400, or 800 ppb of Cr as CrProp were evaluated. In Experiment 1, 400 ppb Cr decreased (quadratic, $P < 0.10$) daily gain and gain:feed in the grower phase, but mortality was reduced (cubic, $P < 0.10$) in broilers fed 200 or 800 ppb Cr. In the finisher phase, gain:feed was increased (quadratic, $P < 0.10$) in broilers fed all dietary levels of Cr, and mortality was reduced (quadratic, $P < 0.10$) in broilers fed 200 and 400 ppb Cr. Chromium supplementation did not affect the overall growth data, and it did not affect carcass yield and breast weight, drip loss, cook loss, or shear force. In Experiment 2, Cr did not affect growth performance. The results of these experiments indicate that Cr as CrProp improved gain:feed in the later phases of growth and reduced mortality in one experiment but not in another experiment.

Key Words: broiler, chromium, propionate, carcass, growth

S-P201 WITHDRAWN

S-P202 Comparison of Gompertz and neural network models of broiler growth. W. Roush*, W. Dozier, and S. Branton, *USDA/ARS Poultry Research Unit, Mississippi State, Mississippi.*

Neural networks offer an alternative to regression analysis for biological growth modeling. There is very little research that has been conducted to model animal growth using artificial neural networks. Twenty-five male chicks (Ross x Ross 308) were raised in an environmental chamber. BW were determined on a daily basis. Feed and water were provided for ad libitum consumption. The birds were fed a starter diet (23% CP 3,200 kcal ME/kg) from 0 to 21 d, and a grower diet (20% CP and 3,200 kcal ME/kg) from 22 to 70 d. Dead and female birds were not included in the study. Average BW of 18 birds were used as the data points for the growth curve to be modeled. Training data consisted of every other d weights starting with the first d. Validation data consisted of BW at all other age periods. Comparison was made between the modeling by the Gompertz nonlinear regression equation and neural network modeling. Neural network models were developed with the Neuroshell Predictor. Accuracy of the models were determined by Mean Square Error (MSE), Mean Absolute Deviation (MAD), Mean Absolute Percentage Error (MAPE), and Bias. The Gompertz equation was fit for the data. Forecasting error measurements were based on the difference between the model and the observed values. For the training data, the lowest MSE, MAD, MAPE and bias were noted for the neural developed neural network. For the validation data, the lowest MSE, MAD were noted with the genetic algorithm developed neural network. Lowest bias was for the neural developed network. As measured by bias, the Gompertz equation underestimated the values while the neural and genetic developed neural networks produced little or no overestimation of the observed BW responses. Past studies have attempted to interpret the biological significance of the estimates of the parameters of an equation. However, it may be more practical to ignore the relevance of parameter estimates and focus on the ability to predict responses.

Key Words: growth equation, Gompertz, neural network

S-P203 Bacterial levels found in litter associated with broilers fed mannan oligosaccharides. K.S. Macklin*, J.P. Blake, B.A. McCrea, R.A. Norton, J.B. Hess, and S.F. Bilgili, *Auburn University, Auburn, Alabama.*

Litter bacterial levels were measured in birds whose corn-wheat based diet was supplemented with either: Bacitracin Methyline Disalicylate (BMD), mannan oligosaccharide (MO) (Bio-mos, Alltech, Nicholasville, KY), or no supplement (CON). Each diet was replicated in 10 pens containing 50 birds/pen. Birds in these trials were raised on litter that had two subsequent flocks to 6 weeks of age under standard management conditions. Litter samples were collected the day before chick placement and immediately after bird removal from. Samples were collected from three locations within each pen and mixed in a sterile bag. They were then serially diluted and plated on the following media: plate count agar (PCA) for determining total aerobic bacteria, reduced tryptic soy agar with 5% sheep red blood cells (RBA) to determine anaerobic bacterial numbers, and MacConkey agar (MA) for total enteric bacterial numbers. Media was then incubated at 37C under appropriate conditions for 24 hours then enumerated. Counts (cfu/g) were transformed using log10 and analyzed using GLM with P<0.10.

There was no difference in the initial bacterial numbers for both trials. The first trial showed no statistically significant differences (P>0.10) for the bacterial counts between the three diets at the end of the trial. However, bacterial recovery from BMD fed pens were ~0.4 log10 lower than CON and MO on PCA and RBA plates. MO had the greatest reduction in MA counts decreasing the enteric numbers by ~0.6 log10. For the end of growout sampling for the second trial, MO produced lower bacterial counts than either BMD or CON on all three media types. Taking these trials, as well as previous work done with these diets into consideration, the use of MO and BMD as a feed supplement reduces total aerobic, anaerobic, and enteric litter bacterial counts.

Key Words: mannan oligosaccharides, litter, bacteria

S-P204 Effects of inorganic and organic selenium on the performance and egg composition of laying hens fed cottonseed meal. V. Stanley*¹, D. Wiley¹, O. Taylor¹, V. Vaughan¹, S. Woldesenbet¹, and A. Sefton², ¹*Prairie View A&M University, Prairie View, Texas*, ²*Alltech, Guelph, Canada.*

A trial was conducted to examine the effects of inorganic and organic selenium (Se), (Sel-Plex) on egg production, egg composition, feed consumption, and egg cholesterol of eighty 66-wk-old laying hens, which were approximately 65 percent in production and fed cottonseed meal (CSM). Hens were placed 2 birds per cage and assigned to four treatment groups. Treatment groups were Group 1, Control (without Se or CSM); Group 2, 15% CSM without Se; Group 3, 15% CSM with inorganic Se; and Group 4, 15% CSM with organic Se. Duration of the study was four weeks. The addition of 15% CSM to the diet had no significant effect on egg production and egg weight. Eggs collected from the hens supplemented with organic Se were the heaviest (62.5g) compared to eggs from hens fed inorganic Se (60.6 g) and control (60.2 g). A significant difference (P<0.05) was found for yolk weight among treatment groups, with mean values ranging from 15.9 ± 0.3 to 17.4 ± 0.2 g. The largest (P< 0.05) yolk was collected from the organic Se-fed hens compared to the control (17.4 g and 15.9 g, respectively). Albumen weight differed significantly (P<0.05) among treatments with mean values ranging from 32.2 ± 0.5 to 35.4 ± 0.5 g. Percentage albumen varied from 61.5% (organic Se) to 59.5 and 58.1% (inorganic Se and control,

respectively) and 57.8% for the CSM. No significant (P<0.05) effect of treatments on feed consumption was observed. Specific gravity significantly (P<0.05) improved in eggs from hens fed organic Se compared to the other groups. Reduction in cholesterol concentration per egg observed in eggs collected from the organic Se-fed hens was not consistent. Results indicate that hens fed organic Se can affect egg size and composition.

Key Words: layers, selenium, egg composition, cholesterol, production

S-P205 Ethanol immersion method for the collection of separate external and internal microbiological spleen samples of baby broiler chicks. L.J. Richardson*¹, N.A. Cox¹, R.J. Buhr¹, J.S. Bailey², and M.A. Harrison³, ¹*USDA-ARS-PMSRU, Russell Research Center, Athens, Georgia*, ²*USDA-ARS-BEAR, Russell Research Center, Athens, Georgia*, ³*University of Georgia, Athens.*

Campylobacter species have been recovered from the lymphoid tissues of avian species. However, whether the bacteria are located internally in these tissues has not been determined. The objectives of the present study were to 1) develop a method to sample the inside and outside of the spleen and 2) determine if *Campylobacter* can be recovered from the internal tissue of the spleen. Five experiments were conducted and for each experiment, day-of-age broiler chicks were obtained and inoculated by different routes with *Campylobacter jejuni*. Two days post-inoculation, necropsy was performed and the spleen and ceca were aseptically removed from each bird and individually placed into sterile sampling bags, packed on ice and transported back to the laboratory for evaluation. For external (ES) spleen sampling, 3 ml of Bolton enrichment broth was added to each spleen sample and shaken for 30s. The spleen was then aseptically removed from the bag. For internal spleen sampling, the spleen was submerged into a 70% ethanol solution for 10s, then removed and submerged into a saline solution to detect sterilization ability of the immersion technique. The spleen was then placed into a sterile sampling bag, macerated and 3 ml of Bolton enrichment broth was added and the sample was stomached for 30s. Standard laboratory procedures were then performed on the above samples (ES, IS, ethanol and saline solution) and ceca for the recovery of *Campylobacter* species. Overall, *Campylobacter* was recovered from 75% (82/109) of the ES samples, 71% (77/109) of the IS samples and from 100% (109/109) of the ceca samples. Furthermore, ethanol and saline samples were negative for *Campylobacter* suggesting that the ethanol immersion method is a good sterilization method of the external surface of the spleen. With *Campylobacter* residing on the external surface and in the internal tissue of the spleen, the organisms could be systemic inside the bird. Further research will determine the mechanisms required for this bacterium to colonize these different tissue types.

Key Words: broilers, *Campylobacter*, ethanol immersion, spleen, ceca

S-P206 Presence of naturally occurring *Campylobacter jejuni* and *Salmonella* spp. in the internal organs of 6 and 8 week old commercial broilers. N.A. Cox*¹, L.J. Richardson¹, R.J. Buhr¹, J.S. Bailey², and P.F. Cray², ¹*USDA-ARS-PMSRU, Russell Research Center, Athens, Georgia*, ²*USDA-ARS-BEAR, Russell Research Center, Athens, Georgia.*

Previous studies have demonstrated that when *Campylobacter* or *Salmonella* were either orally or intracloacally inoculated into day old

broiler chicks, within one hour these bacteria moved rapidly to the lymphoid organs. These bacteria were still present one week after inoculation. The objectives of the present study were to determine if *Campylobacter* and *Salmonella* are naturally present in some of these internal organs of commercial broilers and if present, what species or serovars would be found. Six and eight week old broilers were obtained from a commercial poultry operation and brought to the laboratory for analysis. Necropsy was limited to the removal of the spleen, liver/gallbladder (L/GB) and ceca using aseptic techniques. To reduce the possibility of cross contamination between samples, the spleen and L/GB were aseptically removed prior to the ceca. Samples were individually bagged and standard laboratory procedures for *Campylobacter* and *Salmonella* were carried out for all samples. Thirty 6 week old broilers were analyzed and *Campylobacter* were found in 10/30 L/GB, 8/30 spleen and 14/30 ceca. *Salmonella* were found in 1/30 L/GB, 2/30 spleen, and 2/30 ceca. Forty 8 week old broilers were analyzed and *Campylobacter* were found in 2/40 L/GB, 3/40 spleen and 10/40 ceca. *Salmonella* were found in 21/40 L/GB, 15/40 spleen, and 25/40 ceca. The internal organs of the younger birds were more heavily contaminated with *Campylobacter* while *Salmonella* was the predominant organism isolated in the older birds. There is no doubt that these bacteria are naturally present in these organs. Overall, *Campylobacter* was found in 12/70 L/GB and 11/70 spleen, while *Salmonella* were isolated from 22/70 L/GB and 17/70 spleen. All *Campylobacter* isolates were found to be *C. jejuni*. The predominant *Salmonella* serotype was *S. Typhimurium*, however 7 other serotypes were found. The significance of these reservoirs in the internal organs of commercial broilers is yet to be determined but may have an impact on the microbiology of the intestinal tract and hence the final food product.

Key Words: *Campylobacter*, *Salmonella*, lymphoid organs, broilers, Ceca

S-P207 Effect of oviposition time on percent eggs laid, egg weight, and egg specific gravity. K. Choate*, G.M. Pesti, R.I. Bakalli, and J.P. Driver, *University of Georgia, Athens.*

An experiment was conducted to determine the influence of time of oviposition on percent eggs laid, egg weight, and egg specific gravity. The relationship between egg weight and egg specific gravity was observed. 320 hens, 36 weeks of age, were used over a period of three days. The hens were on a 15 hour lighting program, 0400 to 1700 hours. Eggs were collected hourly starting at 0500 and ending at 1700 hours. Specific gravity was estimated by floatation in various salt solutions. Over the three day period, a total of 881 eggs were laid. Egg production peaked during the 0900-1000 hours collection. Egg weight declined steadily from the 0600-0700 hours collection (59.2g/egg) to the 1300-1400 hours collection (54.3g/egg). Specific gravity was highest at the 0500-0600 hours collection period (1.089). It declined to 1000-1100 hours (1.082) and increased to the 1500-1600 hour collection period (1.087). Specific gravity displayed significant quadratic effect. There was no relationship found between egg weight and egg specific gravity. It is concluded that sub-sampling eggs to determine egg weight or specific gravity should include representative sampling over the entire day.

Effect of oviposition time on % eggs laid, egg weight, and egg specific gravity

Time	n	Production (%)	Egg Weight (g)	Egg Specific Gravity
0500-0600	10	1.14	57.0	1.089
0600-0700	52	5.9	59.2	1.084
0700-0800	70	7.9	57.8	1.084
0800-0900	138	15.7	56.7	1.083
0900-1000	200	22.7	56.4	1.082
1000-1100	150	17.0	57.2	1.082
1100-1200	121	13.7	55.1	1.082
1200-1300	64	7.3	54.9	1.083
1300-1400	32	3.6	54.3	1.083
1400-1500	16	1.8	55.9	1.087
1500-1600	16	1.8	54.5	1.087

Key Words: Laying hens, Hy-Line W-36, oOviposition time, egg weight, egg specific gravity

S-P208 Comparison of four sampling methods for the detection of *Salmonella* in broiler litter. R.J. Buhr*, L.J. Richardson, J.A. Cason, and N.A. Cox, *USDA-ARS Russell Research Center, Athens, Georgia.*

Day of hatch male broiler breeder chicks obtained from a commercial hatchery were brooded and reared in two sets of adjacent floor pens with clean wood shavings. Twenty-five chicks were challenged orally with a 10^5 suspension of naladixic acid resistant *Salmonella*, and wing banded, and an additional 25 nonchallenged chicks were placed into each challenge pen. Fifty nonchallenged chicks were placed into each nonchallenge pen located adjacent to the challenged pens. Personnel movement between pens was minimal but not restricted. At 6 wk of age, 12 challenged and 12 nonchallenged birds from the challenged pens and 12 birds from the nonchallenged pens were euthanized by electrocution and the ceca collected for determination of *Salmonella* status. Broilers remained in the challenge pens throughout the litter-sampling period, but were removed from the adjacent pens at 6 wk of age. At 7, 8, 10, and 11 wk of age the litter was sampled using four methods (duplicate samples per pen per sample time): feces, litter, drag swab, and sock (10 cm section of tube bandage worn over disposable plastic boots). At 6 wk of age, ceca samples were *Salmonella*-positive from 4/12 challenged broilers and from 5/12 nonchallenged broilers raised commingled in the challenged pen, and from 6/24 nonchallenged broilers raised in the nonchallenged adjacent pens. At the four samplings times (from 7 to 11 wk) for the challenged pens, *Salmonella*-positive samples were detected in 5/16 fecal samples, 10/16 litter samples, 9/16 drag swabs samples, and 11/16 sock samples. Samples from the nonchallenged pens were *Salmonella*-positive in 2/16 litter samples, 6/16 drag swab samples, and 12/16 sock samples. Drag swabs, litter, and sock samples had relatively higher rates of *Salmonella* detection than feces samples in pens containing broilers. In pens where broilers had been removed, sock samples had higher recovery rates of *Salmonella* than litter or drag swab samples.

Key Words: *Salmonella* detection, litter sampling, broilers, drag swabs, ceca

S-P209 The impact of sodium bisulfate (PLT[®]) on hen manure, ammonia emissions and flies. P. Patterson¹, T. Cravener¹, C. Myers², G. Martin³, and Adrizal*¹, ¹*Penn State University, University Park*, ²*Berks Co. Coop. Ext., Leesport, Pennsylvania*, ³*Lancaster Co. Coop. Ext., Lancaster, Pennsylvania*.

A commercial high-rise hen house was used to evaluate the impact of amending manure with sodium bisulfate (PLT[®]) at two levels for potential merit with regard to manure management, nutrients, ammonia emissions and flies compared to control manure. For 45d in April-June, 2005 three central rows of manure in a 5-row house were either not amended (Control) or amended with two levels of PLT[®] at 0.97kg/m (1X) or 1.95kg/m (2X) while mixing with a Compost Cat (Farmer Automatic, Inc.). Composting with the Cat was practiced in all rows 3d/wk and amendments were made 8X during the 45d experimental period. Manure density, depth, and row width were determined at 6 locations in each treatment row at the beginning of the study (t=0) and on days 4, 17, 31 and 45, corresponding to t=1, 2, 3, and 4. Manure nutrients, adult flies, pupae, larva and ammonia emissions per 0.215m² were also measured using Drager Pac III detectors in flux chambers at T=1, 2, 3, and 4. Manure depth and row width increased during the experimental period; however, there were no consistent treatment effects on manure density or architecture. Adult flies (P=0.0724) and pupae counts in the hen house were reduced in the 1X and 2X rows compared to the control at the end of the study. Pupae counts per 150g manure were significantly reduced in the 2X row at t=2, 3 and 4 while larva counts were elevated in the 1X row at t=2. Manure nutrients were significantly influenced by both PLT[®] levels resulting in greater concentrations of manure N, NH₃-N, sulfur, and sodium and less P₂O₅ compared to control manure. Ammonia emission rate (ppm/sec) was significantly reduced by the 1X level at t=3 (0.7751) compared to the control (0.9883) and the 2X level at t=1 and 4 compared to the control 0.2178 vs. 0.6140, and 0.6435 vs. 1.1863, respectively. In conclusion, commercial application of sodium bisulfate to hen manure reduced ammonia losses, increased manure N and reduced fly activity as evaluated.

Key Words: manure amendments, nutrients, ammonia, nitrogen, flies

S-P210 Supply of 23.5% oxygen during broiler breeder egg incubation at 1,500 M above sea level and its impact on newborn chicks and during finishing at 42 days. J. Quintana*, A. Hernandez, J. Ordaz, and G. Ponce, *Universidad Nacional Autonoma de Mexico, Mexico, DF, Mexico*.

Oxygen supply during incubation increases hatchability, reduces mortality and promotes embryo growth. The objective of this study was to evaluate the effect of oxygen on hatchability and some of the quality characteristics of the newborn chick, as well as weight, conversion and mortality up to 42 days of male broiler chicks. Two incubators were used, in the first one, 23.5% oxygen was added and the other one was maintained under normal oxygen conditions. Ross line broiler breeder 11,340 hen eggs were set per incubator. Hatchability was recorded. At birth, a sample of 50 chicks per treatment was taken, and they were weighed individually and quality characteristics were evaluated for each one. The parameters that were taken into consideration were tarsus color, activity, closed umbilicus and appearance of the eye, assigning grades of maximum 2 and minimum of 0. Variance analysis was performed on chick quality and productive parameters of the broilers, and

the average was evaluated by Tukey. Hatchability was 89.07 % in the incubator with oxygen and 82.89 % in the incubator without oxygen. Chicks were heavier at 42.91g with the addition, while without oxygen, 40.67g, respectively. Results for quality characteristics were: tarsus 72, activity 98, umbilicus 76 and open round eyes 98 with oxygen added, while without oxygen added, the grades were for tarsus 64, activity 90, umbilicus 72 and eyes 86. There was a statistical difference (p<0.05) in all the evaluated parameters. Male chicks were reared in 5 sections for each treatment in a natural environment house at 200 moms/l. Results at 42 days of age for the chicks in the incubator with oxygen, body weight was 2.390 kg, conversion index 1.785 and 4.0% mortality; while chicks without oxygen were 2.200 kg body weight, 2.016 conversion index and 3.58% mortality. There was significant statistical difference (p<0.05) for body weight and conversion index. Oxygen injection in the incubators and hatcheries improved hatchability, weight gain and conversion index at 42 days of age.

Key Words: oxygen, incubation, chicks, broiler

S-P211 Supply of 25.5% oxygen during broiler breeder egg incubation and its impact on newborn chicks and at 45 days during finishing at 2,240 M above sea level. A. Hernandez*, J. Quintana, and J. Nuñez, *Universidad Nacional Autonoma de Mexico, Mexico, DF, Mexico*.

The objective of the present study was to evaluate the effect of the oxygen addition in two stages of the incubation on the weight and height of chicks at hatch, productive parameters during finishing and yield. Eggs of Ross hens were placed by setters, that used oxygen concentration was of 25.5%. Two setters added oxygen from the first day until 11 days of incubation (treatment A), two were added from 12 days until 21 days of the incubation (treatment B) and the remainder were left with the natural conditions (treatment C) in a 2,240 m above sea level in Mexico City. When chicks were hatched, they were weighed and measured to the end of the tip middle finger, then housed under similar conditions to finish them to 45 days of age. The chickens were weighed weekly, feed consumption measured, nutritional conversion and mortality. The yield was done taking into account the yield without skin, shanks, neck and viscera. Variance analysis was performed on chick quality and productive parameters of the broilers, and the average was evaluated by Tukey. At hatch, the weight and the height averages were of 42.7g, 44.7g and 43.8g and the measurements were 17.1, 17.0 and 17.0 mm for the treatments A, B and C respectively. The weight average in the first week was 143.5g (a), 134.3g (b) and 125.2 g (c) and at 45 days was 2.303 kg, 2.249 kg and 2.294 kg for the treatment A, B and C respectively. The feed conversions were 1.93, 1.99 and 2.21 for the treatments A, B and C respectively. Accumulated mortality was 6.6%(a) treatment A, 10%(a) treatment B and 30%(b) treatment C. The yield was 62.57%, 62.83% and 61.59%. for the treatments A, B and C respectively. In accordance with the results in the present study, it was observed that the oxygen addition during first half of incubation improved the body weight for the first week of age, while mortality and feed conversion were less with oxygen addition during all the incubation time.

Key Words: incubation, oxygen, broiler, mortality, conversion

S-P212 Effect of two commercial competitive exclusion probiotics on *Salmonella enterica* serovar *enteritidis* infection of Leghorn chicks. M.A. Juarez-Estrada*, L. Gonzalez-Soto, and R. Merino-Guzman, *Department of Animal Production: Poultry; FMVZ-UNAM., Mexico, D.F. Mexico.*

A trial was developed in order to evaluate one defined competitive exclusion probiotic (DCEP) and one non-defined competitive exclusion probiotic (NDCEP) on *Salmonella enterica* serovar *enteritidis* phagotype 13^a (SE PT13^a) infection. One-day-old Leghorn chicks were reared in electrical batteries. Four groups and 6 replicates of 20 birds each one (n=240) were used in two challenge times. Experimental groups were: A) Negative control, B) DCEP (Broilact[®]) 1 mg at first day, C) NDCEP (Aviguard[®]) 12.5 mg at first day, D) Positive Control. Groups B, C and D were SE PT13^a (1X10⁸) UFC/bird challenged at 11 and 19 days. On 12 and 20 days, 60 birds from every challenged groups were euthanized. SE PT13^a was recovered from liver-spleen (LS), and cecal tonsils (CT) from each chick. At 20 days, group B showed up 21.7% of SE PT13^a from LS, lower (P<0.05) than group D (51.7%). Group C (36.7%) was not different to B or D treatments. There were no differences in recovery rates from CT at either, 12 or 20 days. Group A was always negative to *Salmonella* isolation. Although, there was not difference in LS protection level between DCEP or NDCEP groups, DCEP showed up a more solid protection. Intestinal native microbiota from DCEP took almost three weeks in settling down into the chickens gut, thus, its protection effects were delayed, since they were observed until 20 day of age. In order to get an effective protection level from DCEP against early *Salmonella* infection, it should be tested the effect of a booster DCEP treatment in chicks from one to twenty days old.

Key Words: probiotics, *Salmonella* control, Leghorn chicks, layer farm, fertile eggs

S-P213 Effect of a booster treatment with a defined competitive exclusion product on *Salmonella enterica* serovar *enteritidis* infection in Leghorn chicks. M.A. Juarez-Estrada* and J.A. Molina-Hernandez, *Department of Animal Production: Poultry; FMVZ-UNAM., México, D.F. México.*

In order to evaluate a defined competitive exclusion product (DCEP) with only one *per os* treatment at one-day-old or a drinking water booster treatment, was carried out one experiment. At first was divided into three groups with 28 birds each and three replicates by group. Group A) At first day DCEP (1 mg/bird Broilact[®]) was given *per os*, 28 birds were challenged with *Salmonella enterica* serovar *enteritidis* phagotype 13^A (SE PT13^A) (1 x 10⁸ CFU/bird) each time at 7, 13 and 23 days of age; B) At first day chicks received DCEP, it was boosted by drinking water (1 mg/bird Broilact[®]) at 6, 12 and 22 days of age, 24 hours after every booster treatment 28 birds were challenged with SE PT13^A; C) At first day of age birds received PBS, they were challenged *per os* with SE PT13^A at the same time like groups A and B. All birds were euthanized 24 hours after every challenge. SE PT13^A was recovered from liver, spleen (LS) and cecal tonsils (CT). At 14 days of age SE PT13^A; isolates from group B (LS 4.5% and CT 22.7%) were lower (P<0.05) than group C (LS 34.6% and CT 96.1%); and group A (LS 17.2% and CT 62.0%) respectively. With only 28 birds by treatment, group A was not different to B or C treatments. At 8 and 24 days there were not differences between groups. The booster treatment was better than only one DCEP dose, however, booster treatment with DCEP delayed to diminish SE PT13^A; infection from LS and CT, until the last of the second week. Prophylactic treatment with defined competitive exclusion products would be a good biological skill toward *Salmonella* infection in Layer farms.

Key Words: probiotics, booster treatment, *Salmonella* control, breeder hens, Leghorn chicks

**Tuesday, January 24
Keynote Speaker
SCAD Keynote Address
Room: B313.**

Resurgence of runting stunting syndrome in broiler chickens.
G. Zavala*, *University of Georgia, Athens.*

Runting and stunting syndrome is a condition involving significant body weight depression and low flock uniformity detectable at an early age, but the detrimental effects are observable throughout the entire broiler growout. As a syndrome, the clinical presentation of this condition may vary substantially from flock to flock, but runting and stunting syndrome (RSS) is invariably associated with poor economic performance derived at least from slow growth, low uniformity, increased mortality or culling of unthrifty chickens and increased feed conversion. RSS was first described in the 1970s and since then most research has attempted to resolve potential pathogens. Broiler flocks of all breeds or breed crosses may be affected, albeit certain crosses are more frequently and/

or more severely affected. Progeny from younger breeder flocks tends to be affected by RSS easier than progeny from hens over 45 weeks of age.

Some of the agents found in RSS-affected flocks include reovirus, enterovirus-like particles, adenovirus, astrovirus, rotavirus and other small round enteric viruses. Bacterial species have also been examined for their potential ability to induce RSS, but none have been regarded as important candidates. Direct inoculations in chickens with any of these agents alone or in combination have not reproduced entirely all the detrimental effects observed with RSS in the field. However, two models have consistently reproduced severe stunting. First, gavage inoculations of intestinal homogenates from affected birds into susceptible chickens usually induce body weight depression equivalent to more