

D6WE (Diet 6 with enzyme); D7NE (Diet 7 with no enzyme); and D8WE (Diet 8 with enzyme). Each of these diets was fed *ad libitum* to the experimental broiler finishers. The trial lasted twenty eight days. The feed intake, weight gain, cost per gain (N/Kg) and carcass characteristics were the parameters evaluated. There were significant differences ($P < 0.05$) in feed intake, weight gain and

carcass characteristics of broiler finishers fed the experimental diets. The result revealed that inclusion of enzyme in the spent tea leaf – based diets enhanced the performance of the finishing broilers.

Key Words: Evaluation, Spent tea leaf, Growth response, Finishing broilers

SCAD I (Avian Diseases)

M57 Efficacy of natustat and Bio-Mos for the control of Necrotic Enteritis and related *Salmonella* shedding in broiler chickens. G. Mathis^{*1}, C. Hofacre², and S. Heintzelman³, ¹*Southern Poultry Research, Inc., Athens, GA*, ²*University of Georgia, Athens*, ³*Alltech, Inc, Lexington, KY*.

The objective of the study was to determine if a Natustat starter/grower, BioMos finisher program would reduce Necrotic Enteritis and salmonella shedding. The treatments were nonmedicated, no Clostridium perfringens (CP) challenge (NM No CP), nonmedicated, CP challenge (NMCP), Natustat 2 lbs/ t (starter and grower) and BioMos 1 lb/t (finisher) CP challenge (NAT/BIO). A complete randomized block design was used with 6 replications of each treatment. Sixty male broiler chickens were placed into each pen. Prior to placement all birds were vaccinated with the coccidial vaccine, Coccivac-B. Half of the birds from each pen were tagged and dosed with *Salmonella* heidelberg. On Days 20 and 21, NMCP and NAT/BIO treatment birds were dosed with CP. On Day 22, ten birds per pen were Necrotic Enteritis lesion scored. The birds fed Natustat had significantly lower NE lesion score and NE mortality compared to NMCP birds. NMCP treatment birds had significantly poorer performance on Days 22 and 42 compared to the other treatments. NAT/BIO birds' performance, both feed conversions and weight gains, were not significantly different from the birds that were not dosed with CP (NM No CP). *Salmonella* drag swab samples on Day 14 showed that *Salmonella* was detectable in all pens, confirming the validity of the disease model. *Salmonella* drag swab samples on Day 42 showed significantly lower number of positive samples in the NAT/BIO compared to the NM No CP and NMCP pens. This study demonstrated the benefits of feeding Natustat in the starter and grower feeds and BioMos in the finisher feeds of broiler chickens exposed to Clostridium perfringens and *Salmonella*.

Key Words: Necrotic Enteritis, Bio-Mos, Natustat, *Salmonella*, Coccidia

M58 Discerning genetic differences in *Salmonella* Enteritidis isolates by RAPD, a powerful molecular tool for understanding *Salmonella* epidemiology in poultry integrators. D. Mathis^{*}, M. D. Lee, R. Berghaus, and J. J. Maurer, *University of Georgia, Athens*.

Salmonella continues to cause significant cases of foodborne illnesses in the United States. With poultry recognized as an important vehicle in past outbreaks, pressure has been placed on the poultry industry to reduce poultry and egg contamination with *Salmonella*. To be able to effectively reduce or eliminate *Salmonella* from poultry operations will require identifying its source(s), and while serotyping has been helpful, it has not been sufficient in identifying *Salmonella* to strain level. Pulsed-field gel electrophoresis (PFGE) has been a useful tool in typing most *S. enterica* serovars. However, *S. Enteritidis* (SE) is refractory to typing by PFGE, due to its clonal nature. We have been able to identify genetic differences in SE isolates using random polymorphic DNA amplification (RAPD) PCR. While we were able to discern some differences in SE isolates by RAPD, no single typing, PCR primer was sufficient to type SE by this method. However, when we collate the different RAPD DNA patterns for each typing primer into a single phylogenetic tree, we could identify sufficient genetic differences to discriminate SE isolates. From our analyses, we were able to identify geographic differences in the distribution of SE types, as well as discern source(s) of SE within a poultry integrator. This molecular approach to typing SE will prove a powerful epidemiological tool in determining the source of SE in poultry and layer operations.

Key Words: *Salmonella*, SE, Typing, PCR, Epidemiology

M59 Effect of Protexin[®] on cecal *Salmonella typhimurium* colonization in young broiler chicks. Y. O. Fasina^{*}, J. W. J. Bowers, and S. R. Mckee, *Auburn University, Auburn, AL*.

Salmonella enterica serovar *typhimurium* continues to be one of the most frequently isolated strains in human salmonellosis worldwide, and is commonly found in the intestine of broilers. The use of Probiotics for reducing intestinal *Salmonella* colonization has been recommended. Probiotics are live microbial feed supplements that beneficially affect the host animal by improving its intestinal microbial balance by competitively excluding pathogens. Protexin[®] is a commercially available probiotic designed for use in chickens. An experiment was conducted to evaluate the efficacy of Protexin[®] in reducing cecal *Salmonella Typhimurium* (ST) colonization in broiler chicks. Day-old ST-free chicks (126) were obtained from a commercial hatchery and randomly allocated to 3 treatments; treatment 1 (control, CN) consisted of chicks not challenged with ST; treatment 2 (CST) consisted of chicks that were challenged with ST; and treatment 3 (CPST) consisted of chicks given Protexin[®] (1.2×10^8 / bird from 1 to 7 days of age, and 3.0×10^7 / bird from 8 to 14 days of age) and challenged with ST. On day 3 of experiment, chicks in CST and CPST were orally gavaged 1 mL of nalidixic acid-resistant ST inoculum containing 10^6 CFU/mL. Throughout experiment (day 1 to 14), chicks in all treatments were fed an unmedicated corn-soybean meal diet. On days 7 and 14, growth performance of chicks (weight gain, feed intake, and feed conversion (FC)) was evaluated and the ceca of chicks were also cultured to enumerate ST levels. Results showed no significant difference ($P > 0.05$) in growth performance of chicks in all treatments. Microbiological enumeration of ST showed that chicks in the CN treatment remained ST-free throughout this study. Also, ST levels were similar for chicks in both CST and CPST treatments on days 7 and 14. Although ST level in the CPST treatment was numerically reduced from 4.0 log CFU on day 7 to 3.66 log CFU on day 14, the effectiveness of Protexin[®] in reducing intestinal ST levels in broiler chicks was not significantly apparent.

Key Words: Protexin[®], *Salmonella*, Broiler chicks

M60 Effect of Pectin-Protexin[®] synbiotic therapy on the concentration of *Salmonella typhimurium* in the ceca of broiler chicks. Y. O. Fasina^{*}, J. W. J. Bowers, and S. R. Mckee, *Auburn University, Auburn, AL*.

Synbiotic therapy comprising of a probiotic and a prebiotic has been proposed for use to reduce intestinal *Salmonella* colonization in poultry. Probiotics are live microbial feed supplements that competitively exclude pathogenic bacteria from the intestine. Prebiotics are non-digestible but fermentable polysaccharides that function as substrates to promote the growth of specific probiotic bacteria. Protexin[®] is a commercially available probiotic designed for use in chickens, while pectins are soluble indigestible polysaccharides that are fermented by intestinal microflora. It was hypothesized that sugar beet pectin would serve as prebiotic for the beneficial bacteria in Protexin[®] and subsequently reduce cecal *Salmonella* levels in chicks. An experiment was conducted to determine the effect of pectin-Protexin[®] synbiotic therapy on cecal concentration of *Salmonella Typhimurium* (ST) in broiler chicks. Day-old ST-free chicks (320) were obtained from a commercial hatchery and randomly allocated to 4 treatments; treatment 1 (control, CN) consisted of chicks not challenged with ST; treatment 2 (CST) consisted of chicks that were challenged with ST; treatment 3 (CPST) consisted of chicks given Protexin[®] in feed (0.15g / kg feed) and challenged with ST; and treatment 4 (CPSTE) consisted of chicks given Protexin[®] (0.15g / kg feed) and sugar beet pectin (5g / kg feed) in feed, and then challenged with ST. All chicks were fed unmedicated corn-soybean meal diet. On day 4 of experiment, chicks in CST, CPST and CPSTE were orally gavaged 1 mL of nalidixic acid-resistant

ST inoculum containing 10^6 CFU/mL, and the ceca of chicks were cultured on days 3 and 10 post-challenge (PC) to enumerate ST levels. Chicks in the CN remained ST-free throughout experiment. At both 3 and 10 days PC, there were no differences ($P > 0.05$) in cecal ST concentration of chicks in CST, CPST and CPSTE. The combination of pectin-Protexin[®] used in this study did not have any beneficial effect on cecal ST levels.

Key Words: Synbiotic, Pectin, Protexin[®], *Salmonella*, Broiler chicks

M61 Effect of a direct fed microbial (Primalac[®]) on energy metabolism and systemic immunity in broilers. R. Qiu*, J. Croom, R. Ali, M. Quiles, L. Daniel, and M. Koci, *North Carolina State University, Raleigh.*

Probiotics (direct fed microbials, DFM) have been used extensively in agriculture to enhance animal performance, however; their mechanism of action is still unclear. Previous studies in our laboratory have investigated the effect DFM has on poultry physiology. This study examined the effects of DFM on energy metabolism and immune response in chickens. Day-old male broilers (n=216) were divided into two diet groups. One group (Con) was fed a control starter diet (CSD). The second (DFM) was fed a CSD plus Primalac[®] (0.3% w/w). Within each diet treatment birds were divided into two subgroups which were either vaccinated (+) with sheep red blood cells (SRBCs) or mock vaccinated (-) with phosphate buffered saline (PBS) at d7, d14 and d21. Feed consumption, tissues and peripheral blood leukocytes (PBL) O₂ consumption, and PBL and macrophage ATP concentration were assayed to monitor energy metabolism. DFM- birds had the highest feed efficiency (1.33 g feed/g gain); however, the feed efficiency of DFM+ was the least (1.41 g feed/g gain). Interestingly, the ATP content of PBL and macrophages isolated from DFM- birds were significantly decreased ($p < 0.01$) as compared with Con- and DFM+. Additionally, the O₂ consumed by PBL, thymus and spleen from DFM- birds were lower than other groups. In spite of the reduced energy utilization by non-challenged DFM birds, the Ab response to SRBCs was similar between the two diet groups. These data suggest DFM supplementation decreased basal energy consumption by immune cells. Further investigations are needed to better understanding the mechanism(s) by which DFM alter immune energy consumption.

Key Words: Direct fed microbial, Immunity, ATP, Energy metabolism, Antibody

M62 Femoral head epiphysiolysis in broiler chickens. V. Durairaj^{*1,2}, N. C. Rath², K. S. Rasaputra^{1,2}, L. Kannan^{1,2}, C. C. Coon¹, W. E. Huff², G. R. Huff², and F. D. Clark¹, ¹University of Arkansas, Fayetteville, ²Agricultural Research Service/USDA, Fayetteville, AR.

Femoral head necrosis (FHN) and 'epiphysiolysis' are femoral growth plate-disarticulation disorders that cause lameness in broiler chickens. These conditions can lead to bacterial infections and/or osteomyelitis. The etiologies of these poultry leg problems are unknown. Based on the results of a comparative study of serum chemistry which showed elevated cholesterol, triglycerides, and low density lipoproteins (LDL) levels in birds with femoral head lesions, we hypothesized that epiphysiolysis may be associated with problems of fat metabolism. Thus, we fed groups of 30 chickens isonitrogenous diets containing 4- (control), 6- and 8% chicken fat from day 1 through 37 to find whether high fat diets would increase the incidences of femoral head disarticulation. There was no significant incidence of femoral head disarticulation or any changes in the growth parameters in chickens fed with 6 and 8% fat diets. However, when such control fed birds were administered prednisolone (~2mg/kg) by subcutaneous injections on two alternate days during the last week of the experiment, they showed a significant increase in the incidence of femoral head disarticulation. These chickens also had statistically significant increase in the levels of serum cholesterol, triglycerides, and LDL. However, the birds treated similarly with cholesterol showed neither femoral head disarticulation nor any change in the serum fat metabolite concentrations. These results suggest that femoral head disarticulation disorders may be associated with stress physiology.

Key Words: Femoral head necrosis, Epiphysiolysis, Fat, Serum chemistry, Chicken

M63 Efficacy of a live *E. coli* vaccine given at day-of-age, with or without previous administration of antibiotics. K. C. Cookson^{*1} and K. S. Macklin², ¹Fort Dodge Animal Health, Overland Park, KS, ²Auburn University, Auburn, AL.

Poulvac[®] *E. coli* is a modified live vaccine that is applied by coarse spray. *In vitro* assays have already established that Poulvac[®] *E. coli* is sensitive to both gentamicin (GM) and Naxcel[®] (Nax). Because day-of-age spray is an effective way to deliver respiratory vaccines and most broiler chicks receive an injection of GM or Nax in the hatchery, our objective was to measure any effect this common practice might have on the (*in vivo*) efficacy of Poulvac[®] *E. coli*. **Study Design:** 216 SPF leghorns were wing-banded and divided into 6 treatments (36 per). Groups 1 and 2 received a half dose of GM or Nax *in ovo*, while groups 3 and 4 received a half dose, respectively, subcutaneously (subQ). Groups 1-5 were also sprayed at hatch with a full dose of Poulvac[®] *E. coli*, then 2 birds from each group (10 per cage) were placed into batteries 1 and 2. Group 6 birds remained unvaccinated and were placed into cages in a third battery. At 42 days of age all birds were challenged intratracheally (IT) with 1.18×10^{10} pathogenic O78 *E. coli*. **Results:** Statistical analysis (see Table) indicates that all vaccine treatments had significant reductions in the incidence and severity of airsacculitis-by far the most common lesion. In addition, there was no difference in *E. coli* protection between vaccine groups, regardless of prior antibiotic prophylaxis. **Discussion:** The efficacy of Poulvac[®] *E. coli* given at day-of-age by coarse spray was not compromised by prior gentamicin or Naxcel[®] injection, either *in ovo* or subQ. This suggests that the levels of these antibiotics were not sufficient to interfere with the interaction between this vaccine and the day-of-age chick's immune system.

Table 1. Results of virulent O78 *E. coli* challenge (7 dpi)

Group	Antibiotic treatment	Spray Vaccine treatment	Airsac Mean ¹ lesion score	Airsac Lesion ² scores >1
1	<i>in ovo</i> gentamicin	Poulvac [®] <i>E. coli</i>	1.77b	69%b
2	<i>in ovo</i> Naxcel [®]	Poulvac [®] <i>E. coli</i>	1.86b	67%b
3	subQ gentamicin	Poulvac [®] <i>E. coli</i>	1.71b	62%b
4	subQ Naxcel [®]	Poulvac [®] <i>E. coli</i>	1.59b	59%b
5	None	Poulvac [®] <i>E. coli</i>	1.56b	58%b
6	None	Poulvac [®] <i>E. coli</i>	2.46a	92%a

Groups having a different letter are significantly different ($P < 0.01^1$ or $P < 0.05^2$).

M64 Development of a multilocus sequence typing scheme to examine clonal relationships among avian isolates of *Clostridium septicum*. A. P. Neumann* and T. G. Rehberger, *Agtech Products, Inc, Waukesha, WI.*

Clostridium septicum is a spore-forming anaerobe capable of causing histotoxic infections in animals. Examples in poultry production include avian malignant edema and gangrenous dermatitis. Birds experiencing *C. septicum* infection exhibit signs of severe toxemia characterized by depression, inappetence and ataxia. The clinical course of infection is brief, beginning in a seemingly spontaneous manner. Most often birds are found dead before any prior symptoms are observed. The result of infection is extensive myonecrosis with massive fluid accumulation in the subcutaneous tissues. Although *C. septicum* is not believed to be a member of the normal intestinal microbiota it has been cultured from the feces of healthy animals. It is also notable that, unlike most gangrenous infections caused by *Clostridium perfringens*, disease involving *C. septicum* often occurs with no visible disruption in the epithelium. This suggests that the intestine provides the main portal of entry to the body for the organism. In order to gain a better understanding of the diversity and population structure of avian isolates of *C. septicum*, eight housekeeping genes were partially sequenced and compared for this study. A diverse collection of 108 field isolates plus the *C. septicum* type strain ATCC 12464 were examined. The loci included for analysis were *gyrA*, *groEL*, *dnaK*, *recA*, *tpi*, *gmk*, *ddl*, and *glpK*. Most of these genes were chosen because of their inclusion in similar studies performed on isolates of *C. perfringens* and *C. difficile*. Less genetic diversity within these loci was observed than

has been reported for other clostridia of clinical importance. Two major clonal lineages were identified from the analysis. One of these lineages was endemic to the East Coast and Southern United States. Interestingly, the *C. septicum* type strain was very closely related to the majority of avian isolates examined. To our

knowledge this work provides the first description of the population structure of this poorly understood but significant pathogen.

Key Words: *Clostridium septicum*, Gangrenous dermatitis, Malignant edema, MLST

Nutrition III

M65 Observations on changes in nutrient concentration of broiler feed as affected by pellet quality. J. Wills* and Z. Aslam, *Grand Mills for Flour & Feed Co, Abu Dhabi, Abu Dhabi, UAE.*

It is well known that the feeding of pelleted feed improves broiler performance but scant data has shown the differences in the nutrient levels due to the per cent pellets and fines in the feeder pan. Two commercial broiler farms were selected to determine the per cent pellets and fines at the feed hopper, the fourth feeder pan from the feed hopper, mid point feeder pan and fourth feeder pan from the control feeder pan from the feed line next to the input auger from the bulk feed bin from 10 broiler houses on each farm. The criteria for pellets was all feed that was retained on a US # 6 sieve (3.360 mm), crumbles was all the feed retained on a US # 6 sieve (0.841 mm) where as fines were all feed that passed thru a US # 20 sieve (0.841mm). All of the feed was removed from each selected feeder pan then the feeder pans were recharged with fresh feed by running the feeder line. All feed was then removed from each of the pans to determine the per cent pellets, crumbles, and fines. Per cent crude protein, calcium and phosphorus were determined on the pellets, crumbles, and fines fractions.

The average per cent pellets for the three locations in the feed line was 56.0 percent with the per cent fines averaging 12.3 percent for Farm 1 where as the average per cent pellets was 91.6 and per cent fines was 2.6 per cent for Farm 2. The per cent pellets in the fourth feeder pan from the feed hopper was significantly higher for both farms compared to the per cent pellets in the fourth feeder pan from the control feeder pan. Per cent crude protein was significantly higher in the pellets, 19 and 22 per cent from either farm compared to the per cent protein in the fines, 15 and 20 per cent for Farm 1 and Farm 2, respectively. Per cent calcium was significantly higher, 1.26 and 1.37 per cent in the fines fraction for Farm 1 and Farm 2, respectively. This data points out the differences in nutrient density in the three feed fractions of the broiler feed fed as affected by the feed form texture.

Key Words: Pellets, Crumbles, Fines, Broiler, Feed

M66 The effects of sunflower and enzyme on performance of broiler chickens. A. Sheikhlar*, *University Putra Malaysia, Malaysia.*

Seven hundred twenty strait run day-old broilers were randomly allocated to 4 treatments, each of which had 9 pens of 20 chicks. This study was conducted to investigate the effects of an enzyme on growth performance and litter quality parameters. Four iso-caloric and iso-nitrogenous diets were fed ad libitum from day 1 to 56. The soybean meal in starter, grower and finisher diets, were replaced with 15, 15, and 5% sunflower meal, respectively. Experimental groups were: 1- corn-soy, 2- diet 1 plus enzyme, 3- corn-soy-sunflower meal without the enzyme, and 4- diet 3 supplemented with enzyme. On day 52, thirty six randomly selected birds from each dietary treatment were slaughtered and dissected to measure carcass yield, fat pad and weight of selected meat portions. Litter moisture was measured at the end of weeks 3, 6 and 8. Litter pH was measured at the end of weeks 5 and 8. The inclusion of sunflower meal in place of soy reduced feed intake (FI) and body weight gain (BWG) of birds and increased feed conversion ratio (FCR) compared with birds fed on soy-H diet. The addition of enzyme to sunflower meal included diets improved FI, BWG and FCR; however, only improvement in BWG and body weight (BW) compared with sunflower included diets with no enzyme was statistically significant ($P < 0.05$). Although enzyme inclusion lowered moisture content of litter, this effect was not statistically significant ($P > 0.05$), dietary enzyme supplementation significantly decreased litter pH at wk 7 as well ($P < 0.05$). Enzyme inclusion in soy based diets statistically improved BW, BWG and FCR ($P < 0.05$) and reduced litter pH. Despite the improvement in litter moisture, there was no statistically

significant effect of dietary enzyme inclusion on litter moisture at the end of the experiment ($P > 0.05$).

Key Words: Broiler, Sunflower, Enzyme, Soy-bean diet, Litter

M67 Effect of selenium supplementation of breeder hen diets on tissue selenium concentrations in progeny. L. M. Macalintal*, A. H. Cantor, J. L. Pierce, A. J. Pescatore, T. Ao, M. J. Ford, H. D. Gillespie, and W. D. F. King, *Alltech/University of Kentucky Nutrition Research Alliance, Lexington, KY.*

An experiment was conducted to examine the effect of selenium (Se) supplementation of broiler breeder hens on the Se status of their progeny. Breeder hens and roosters were fed a low-Se semi-purified basal diet alone or with 0.3 ppm supplemental Se provided by sodium selenite or Se yeast (Sel-Plex[®], Alltech Inc., Nicholasville, KY). Egg Se concentration was significantly higher for the Se yeast treatment than for the selenite treatment (0.25 vs. 0.19 ppm). Egg Se levels for these treatments were significantly higher than that for the basal treatment (0.04 ppm). Sixteen replicate groups of five straight-run chicks produced from each of the breeder treatment groups were housed in cages and fed a low-Se corn-soybean meal diet for 21 days. Samples of blood and liver, pooled from two or three birds from each of four pens per breeder treatment, were collected during the trial for Se analysis. On Day 1, plasma Se for the basal treatment (0.02 ppm) was significantly lower ($P < 0.05$) than the value for both Se-supplemented treatments (0.10 ppm). At Day 13, whole blood Se in chicks from both Se-supplemented treatments was similar (~0.05 ppm) and significantly higher than that for the basal treatment (0.04 ppm). The Se level in liver sampled on Day 1 was significantly higher for chicks from hens supplemented with Se yeast (0.52 ppm, fresh basis) compared with those from the selenite-supplemented hens (0.33 ppm). Liver Se in chicks from the basal treatment was only 0.12 ppm. By Day 22, liver Se levels in chicks from both Se-supplemented groups decreased to ~0.10 ppm but were still higher than that for the basal treatment (0.08 ppm). The results show that the Se status of progeny chicks is improved at hatching by supplementing breeder hens with Se yeast (vs. selenite). However, the benefit is not long lasting when chicks are fed a low Se diet.

Key Words: Selenium yeast, Selenite, Liver, Breeder diet, Chicken

M68 Effect of choline and folacin on performance and egg phospholipid composition in laying hens. P. Krishnan* and S.E. Scheideler, *University of Nebraska, Lincoln.*

Choline is an essential nutrient for all animals and a required dietary supplement for poultry. The study was designed to determine the effect of added choline and folacin on egg production, egg quality parameters and the phospholipid composition of egg yolk in laying hens. A corn-soy based diet was formulated with three levels of supplemental choline (0, 500 and 1000 ppm) and three levels of supplemental folacin (0, 2 and 4 ppm) in a 3 x 3 factorial arrangement. The nine experimental treatments were arranged in a randomized complete block design with four replicate cages and four birds per cage for a total of thirty six cages. Folacin at 2 ppm increased egg production significantly ($P < 0.05$) at all levels of choline inclusion. Egg wt was significantly ($P < 0.05$) higher at highest level of choline and lowest level of folacin supplementation. There were significant choline by folacin interaction effects ($P < 0.05$) on feed intake, albumen wt, yolk wt and haugh unit. At lower levels of choline supplementation (0 and 500) 4 ppm folacin inclusion increased feed intake, egg albumen and haugh unit while at the highest level of choline inclusion (1000 ppm) high folacin (2 and 4 ppm)