on 5 wk BW, where dietary inclusion of Az improved the BW of birds fed the PC diet (p<0.05). Throughout the growth trial, the NC diets resulted in increased BW than PC, especially when supplemented with enzymes (p<0.05). In comparison to PC, NC and NC250 increased 5 wk BW, which was further increased by NC1500 (1.561 vs 1.642 and 1.662 vs 1.700, p<.001). NC1500 also had significantly improved 0-5 wk FCR than the other treatments (1.635 vs 1.662, 1.685, and 1.693, p<.01), but not for 0-14 wk FCR. In comparison to PC, 14 wk BMY was increased by the NC diets, which was increased further by NC250 and NC1500, respectively (23.83 vs 24.58 and 24.79 vs 25.102% of BW, p<.05). No treatment effects were observed on mortality rate. Dietary supplementation of Xyl and Phy improved growth performance of turkey hens during the brooder phase and through to market age, and will improve breast meat yield, especially when at highest dietary level of Phy supplementation.

**Key Words:** turkey hens, growth performance, xylanase, phytase level, Azomite (R)

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### Metabolism & Nutrition III

**M99** The effect of Original XPC on egg production, component yield and composition in laying hens

Rachel Blount mgs1, Juan Suarez2, Hilary Pavlidis2, John Carey1

An experiment was designed to evaluate the effects of the functional metabolites of Diamond V Original XPC™ on egg production, quality, component yield, and composition in commercial laying hens. Birds in this experiment were fed a standard layer diet control (CON) or a diet containing Original XPC at either 0.625 kg/MT (FM-L) or 1.25 kg/MT (FM-H). Overall, no significant treatment effect (P > 0.95) was observed for egg production during the entirety of the study (20-53 weeks of age). Hens from the FM-H group had significantly higher feed consumption compared to the CON group, feed consumption of the FM-L group was not significantly different from the other treatments. Hens from the FM-L and FM-H groups had significantly improved feed conversion (P < 0.0009) compared to the CON group. FM-L hens had lower hen-day egg mass (P < 0.0013) compared to those of CON or FM-H. Compared to CON and FM-H, FM-L hens had significantly (P < 0.0183) greater percentage of jumbo-sized eggs. Egg characteristics were evaluated weekly 30-53 weeks of age. Yolk weight from FM-H hens was significantly (P < 0.0001) heavier at 16.3g compared to CON and FM-L hens at 16.0g and 16.1g, respectively. Percent yolk yield from FM-H hens was also significantly (P < 0.0001) increased to 26.3% compared to 25.9% and 26.1% for the CON and FM-L hens, respectively. Compared to CON, eggs from FM-H hens exhibited a significant (P < 0.0001) increase in yolk solids of 0.10% and a decrease in yolk nitrogren of 0.09% with FM-L hens being intermediate in yolk yield. Each treatment was significantly different (P < 0.0004) from the others for percent albumen yield (64.4%, 64.0% and 63.8% for CON, FM-L and FM-H, respectively). Albumen nitrogen in the FM-H group was 14.08%, which was significantly (P < 0.0004) greater than the CON and FM-L groups at 14.01% and 14.02%, respectively. Egg weight, albumen weight, shell weight, shell yield and albumen solids were not significantly impacted by the treatments. This research demonstrates that feeding Original XPC had a positive impact on egg production parameters as well as egg component yield and composition.

**Key Words:** Original XPC, egg components, egg yield, egg solids, egg production

**M100** Effect of lignosulfonate on pellet durability under marginal pelleting conditions

Jeffrey Pope1,2, Adam Fahrenholz1, Thomas Winowski1 mgs1 North Carolina State University; 2Diamond V

Three trials were conducted to investigate the effect of a lignosulfonate (LS) pellet binder on pellet durability under marginal pelleting conditions. Factors understood to affect pellet durability include, but are not limited to, conditioning temperature, mixer-added fat (MAF) inclusion, grain grind size, and crude protein (CP) level. The aforementioned factors are inevitably implemented to spare heat sensitive ingredients, supply adequate nutritional energy and protein, and stimulate gizzard function. The first trial investigated the interaction between conditioning temperature and LS. Diets were pelleted over a range of temperatures from 70 to 82 °C with or without LS supplementation at 0.5% on top of the basal formulation. It was determined that LS improved pellet durability more at cooler condition-

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**M101** The effect of refined functional carbohydrates (RFCs) from enzymatically hydrolyzed yeast on the transmission of Salmonella spp. between broilers and proliferation in broiler housing

Grayson Walker1 mgs1, Sangita Jalakar1, John Blake1 North Carolina State University; 2Arm and Hammer Animal Nutrition

Enzymatic hydrolysis of yeast produces RFCs that have activities against gram negative bacteria. Specifically, Aviator SCP (Arm and Hammer Animal Nutrition, Princeton, NJ) possesses sugars that interfere with Salmonella attachment to the intestinal lumen. Hatching eggs were collected from four treatment groups of broiler breeder females that had been fed RFCs or control diets, with RFCs included at 0+0, 0+50, 50+0, or 50+50 g/MT during growing (0-21 wk) and laying (+22-48 wk), respectively. 576 male and female broiler progeny chicks were assigned to sex separate, new-litter pens by parent treatment and fed a 0 or 50 g/MT RFC diets in a 4 x 2 factorial design within sex. Treatments were randomly assigned to 6 replicate pens of 12 broilers per interaction for both sexes. BW and feed intake were determined at 14, 28, and 42 d. Litter was sampled by pen using sterile socks at 35 d and tested for Salmonella spp. using enzyme linked fluorescence assay methods. Salmonella spp. was isolated in 7 of 48 control-fed broiler pens but was not isolated in RFCs-fed pens. Thereafter, the 48 males and 48 females selected based on litter Salmonella presence and RFCs treatment had their cecas aseptically excised and tested for Salmonella spp. presence and RFCs treatment. Salmonella spp. using enzyme linked fluorescence assay methods. Salmonella spp. was isolated in 7 of 48 control-fed broiler pens but was not isolated in RFCs-fed pens. Therefore, the 48 males and 48 females selected based on litter Salmonella presence and RFCs treatment had their cecas aseptically excised and tested for Salmonella spp. presence. The 48 of control-fed broilers from litter-positive pens, 16 were confirmed positive for cecal Salmonella spp. No broilers from litter-negative pens fed RFCs were positive (P<0.05). Female broilers that had been fed RFCs exhibited greater BW at 28 d (P<0.05) and 42 d (P<0.10). Female broilers that were progeny of 50+50 and 0+0 parent treatment groups exhibited improved overall feed conversion (P<0.05). These data demonstrated that RFCs had a beneficial effect on the presence of Salmonella in the litter and ceca of broilers when fed continuously while not having detrimental live performance impacts.

**Key Words:** Salmonella, refined functional carbohydrates, broiler
M102 Coarse corn improves feed efficiency in both coccidiosis-vaccinated and salinomycin-fed broilers Coltin Caraway, John Brake
North Carolina State University
This study evaluated two coccidiosis control methods (CM) beginning at placement: Vaccine (VAC) and Salinomycin (SAL) versus a non-treated control (CON). Beginning at 11 d, two corn particle size (PS) treatments were applied: coarse corn (CC) or fine corn across the three CM treatments to complete a 3 x 2 factorial arrangement. CC had been shown to improve live performance in broilers fed salinomycin. However, many coccidiosis stats could come under scrutiny in antibiotic-free production, thus it was important to understand how CC affected coccidiosis-vaccinated broilers. Treatments were randomly assigned to 36 pens resulting in 6 replicate pens per treatment combination with 16 birds per pen at placement. Data was analyzed using JMP 12.2 with means separated by Student’s T-test. At 10, 20, 28, 35, and 48 d of age, feed intake (FI) and body weight (BW) were measured and used to calculate AdjFCR. At 10 d, no differences due to CM were observed in live performance. At 20 d, CON (952 g, 1.32 g/g) and SAL (946 g, 1.31 g/g) were heavier and demonstrated improved (P<0.01) AdjFCR compared to VAC (921 g, 1.36 g/g). At 35 d, SAL (2575 g) exhibited increased (P=0.01) BW when compared to both VAC (2527 g) and CON (2504 g). From 21-35 d, all three CM treatments exhibited significantly (P<0.01) different AdjFCR with SAL (1.56 g/g) < VAC (1.62 g/g) < CON (1.66 g/g). However, from 35-48 d, no differences were observed as a result of CM. No differences were observed as a result of PS from 10-20 d or 21-35 d, nor were any interactions observed. However, from 35-48 d, the CC (1.90 g/g) improved AdjFCR compared to fine corn (1.95 g/g; P=0.01). At 48 d, no differences were observed in cumulative FI or BW as a result of CM or PS but cumulative AdjFCR was affected by PS [CC (1.64 g/g) < FI (1.65 g/g); P<0.05] and by CM [SAL (1.65 g/g) < VAC (1.66 g/g) & CON (1.66 g/g); P<0.01]. The results of this study demonstrated that CC benefited coccidiosis-vaccinated broilers similarly to broilers fed a coccidiostat.

Key Words: particle size, broilers, vaccine, antibiotic free, coccidiostat

M103 Computed tomographic precision rate-of-passage assay without a fasting period in broilers: more precise foundation for targeting the releasing time of encapsulated products
Jundi Liu, Scott Secrest, Justin Fowler, Department of Poultry Science, University of Georgia; Department of Veterinary Biosciences and Diagnostic Imaging, University of Georgia
The objective of this study was to develop a precision-fed rate-of-passage assay through computed tomography methods in broilers. Twenty-two Cobb-Cobb male broilers were obtained on the day of hatch and fed a standard corn-soybean meal starter diet until d 21. All birds were then orally gavaged 3 g of feed mixed with 2 ml of iodinated contrast. Two birds were selected for collection of the gastrointestinal tract (gizzard, duodenum, jejunum, ileum, ceca, and colon) at 0:15, 0:30, 0:45, 1:00, 1:30, 2:00, 2:30, 3:00, 4:00, 5:00, 6:00 h post-gavage. A computed tomographic exam of the intestinal tract was acquired to determine the location and percentage of each intestinal segment which contained the admixed contrast and feed. Results indicated that feed entered the gizzard extremely fast after the gavage (less than 0:15 h). The marked feed left the gizzard between the 0:15 and 0:30 h time points, and was shown in both the duodenum and jejunum after 0:30 h. After 1:30 to 2:00 h, feed reached the ileum and was found in ceca after 4:00 h. The enteric cavity was virtually cleared of the iodinated contrast between the 4:00 to 6:00 h time points, except for a few stagnated spots in the gizzard and ceca. The results indicate that the rate-of-passage can be easily determined in young broilers by using iodinated contrast as a marker without fasting the birds. It is recommended that the birds be gavaged with 3 g feed mixed with 2 ml iohexol using a tube-feeder when conducting such assay. The digestive time for feed passing through the anterior digestive tract (from mouth to ileum) is less than 2:30 h and arriving at the ceca at 3:00 to 4:00 h. Most of the feed is digested 4:00 to 5:00 h after feeding. This assay would provide further accurate digestive time results of the bird in a non-fasted state, and support research conducted with encapsulated products that are evaluating releasing times using the in vitro technology.

Key Words: precision feeding, iodinated contrast, rate-of-passage, broiler

M104 Effects of lysophospholipid product (Lipidol UltraTM) on growth performance and carcass characteristics in broilers
Chongxiao Chen, Byoungyoun Jung, Woo Kyun Kim, University of Georgia; EasyBio Inc.
A study was conducted to evaluate the effects of supplementing different levels of lysophospholipid product (Lipidol UltraTM) to normal or reduced energy diets on growth performance and carcass characteristics in broilers. A total of 960 1-day-old Cobb 500 male birds were randomly placed to 8 treatments with 6 replicates each with 20 birds. The experiment employed a 2 x 4 factorial arrangement. Factors were energy level (normal or 100 kcal/keg ME reduced) and Lipidol UltraTM level (0, 0.025%, 0.05% or 0.075%) of diets. Three diet phases were fed throughout the trial: starter (d 0-7), grower (d 8-21), and finisher (d 22-42). Body weight (BW), feed intake (FI), and feed conversion ratio (FCR) were calculated at the conclusion of each phase. At d 42, four birds per replicate were selected to measure the carcass characteristics. The birds fed with normal energy diets (NE) group had higher BW and BWG in all phases; higher FI in grower and overall trial period; and better FCR in the starter and finisher periods compared with the birds fed reduced energy diets (RE) group (P<0.05). Lipidol UltraTM main effects were observed with a lower FI at 0.05% dosage during the finisher period and throughout the study (P<0.05) and then resulted in an improved trend of cumulative FCR compared with the others (P<0.1). The interactions showed adding 0.075% Lipidol UltraTM to NE improved BW, BWG and FI in finisher and the overall period compared with the one without Lipidol UltraTM (P<0.05). In RE, improved growth performance was with 0.025% dosage (P<0.05). For the meat characteristics, NE had higher live body, hot carcass, cold carcass, major, minor, wing, and leg weight (P<0.05) but a lower minor percentage (P<0.1). The main effect of 0.075% dosage increased dressing percentage compared with the rest (P<0.05). The interactions were detected with adding 0.05% and 0.075% Lipidol UltraTM in NE diets increased major percentage compared with the one without Lipidol UltraTM (P<0.05). In conclusion, adding 0.025% Lipidol UltraTM to low energy diets, and 0.075% to normal diets had a positive effect on growth performance and the latter could improve meat characteristics as well. Moreover, supplementation of 0.05% Lipidol UltraTM would help birds balance the BWG and FI to reach a better FCR.

Key Words: lysophospholipid, growth performance, carcass characteristics

M105 Evaluation of Direct Fed Microorganism and enzyme blend co-administration on the gastrointestinal microbiota of broilers fed US commercial type diets, with or without antibiotic growth promoters.
Tyler Askelson, Scott Flores, Sadie Dunn-Horrocks, Yueying Dersjant-Li, Kirsty Gibbs, Ajay Awati, Jason Lee, Tri Duong, Texas A&M University; Danisco Animal Nutrition, DuPont Industrial Biosciences
Direct-Fed Microorganisms (DFM) and exogenous enzymes have been demonstrated to improve growth performance in poultry and are potentially important alternatives to antibiotic growth promoters (AGP). We investigated the administration of a feed additive composed of a DFM culture containing spores of three Bacillus amyloliquefaciens strains and an enzyme blend containing endo-xylanase, α-amylase, and serine-protease (XAP) in diets with or without antibiotics at sub-therapeutic levels in broiler chickens over a 42 day growth period. Treatment groups were arranged as a 3 (AGP) x 2 (feed additive) factorial experiment and were fed experimental rations formulated to contain combinations of an AGP (control, bacitracin methylene disalicylate, or virginiamycin) with or without the feed additive. Evaluation of growth performance determined feed conversion of broiler chickens administered the feed additive was comparable to
A 42 day experiment was completed to evaluate the effects of pen hygiene to levels similar to antibiotic administration. Correlation analysis revealed significant associations between bacterial counts and feed efficiency. Moderate positive associations were observed between total LAB counts on Day 21 with Day 42 (r = 0.405, P = 0.002) and cumulative (r = 0.278, P = 0.042) FCR. Our results suggest co-administration of DFM and exogenous enzymes may potentially be an important component of antibiotic free poultry production programs and that LAB and C. perfringens may be important targets in the development of alternatives to AGPs in poultry production.

Key Words: DFM, Enzymes, AGP, gastrointestinal microbiota, broiler

M106 Effects of lactic acid bacteria and organic acids on the concentration of an antibiotic resistant strain of Salmonella Heidelberg, in vitro Dana Dittoe*, GS, Chris McDaniel, Aaron Kiess Mississippi State University

Lactic acid producing bacteria and organic acids are being investigated in poultry diets as alternatives to antibiotic feed additives to control pathogen prevalence in the gastrointestinal tract. In this study, the objective was to determine the effect of these two feed additive products on the growth of an antibiotic resistant strain of Salmonella Heidelberg (S). The two products consisted of a probiotic supplement, containing L. acidophilus, L. rhamnosus, B. thermophilum, and E. faecium (P) and an organic acid product, consisting of encapsulated butyric acid (B). Thus, the treatments consisted of the 2 products (P, B) and the combination of S and products (S+P, S+B). A 12 h stock of S was diluted 10-fold to provide 10^6, 10^5, and 10^4 cfu/ml. 1 g of product was weighed and reconstituted in 9 ml of broth. For combinations, 1 ml of S stock culture (10^6, 10^5, and 10^4) was added to broth containing 1 g of product. After treatments were made, 100 μl was serially diluted at 0, 2, 4, 6, and 8 h of incubation and spread plated onto Tryptic Soy Agar (TSA) containing nalidixic acid and incubated under aerobic conditions at 37°C for 24 h. Log transformed counts were analyzed using a randomized complete block design with split plot over incubation time. Means were separated using Fishers protected LSD test. Over the first 35 d, the birds on CL resulted in higher body weight gain (BWG) than those on DL without dietary treatment (P ≤ 0.05). From 1 to 42 d, the birds on CL had greater BWG than those on the AC, while DL treated birds were intermediate, but not significantly different than either (P > 0.05). The FA treated birds showed increased BWG in comparison to DL birds over the first 35 d (P ≤ 0.05), but this significance was lost for the 1 to 42 d period. The BWG of FA birds was significantly reduced in comparison to CL treated birds for the first 14 d period, but was not significantly different from CL birds after 14 d until the conclusion of the experiment at 42 day of age. Unexpectedly, AC birds resulted in BWG that was less than DL birds (P ≤ 0.05). The FA birds resulted in the lowest FCRm from 1 to 28. From 1 to 35 d FCRm was reduced in FA birds compared to DL birds (P ≤ 0.05), however as with BWG this significance was lost from 1 to 42 d. Lesion scoring was unable to confirm necrotic enteritis, but oocyst shedding tended to be reduced with CL and/or FA and AC, and taken with the performance does suggest a mild microbial challenge. Overall, throughout the majority of the experiment, exposure to DL reduced performance in comparison to CL birds, but treatment with VANNIX™ C restored performance to that of birds raised on CL.

Key Words: tannic acid, Bacillus coagulans, performance, lesion score, oocyst

M108 Evaluation of Safmannan on full term broiler performance with coccidiosis vaccinated broilers on used litter Morouj Al-Ajeeli*, GS1, Thomas Gaydos2, Raghad Abdaljaleel1, Hector Leyva-Jimenez1, Jimmie Corley1, Christopher Bailey1 Texas A&M University; 2Phileo Lesaffre Animal Care

The poultry industry’s move toward antibiotic free poultry production has increased the demand for antibiotic alternatives. This study was conducted to evaluate the effect of a proprietary yeast cell wall (YCW) product on performance of broilers reared on used litter. A total of 1200 Commercial broilers chicks were randomly distributed among 60 floor pens (20 birds/pen) with 12 pens per treatment. A basal diet with coccidiosis vaccinated broilers on used litter and supplemented with a commercially available phytase enzyme was formulated and divided into five treatments; basal control diet (T1), T1+salmomycin (T2), T1+bacitracin MD (T3), T1+YCW 250 ppm (T4), T1+YCW 500 ppm (T5). Birds in all treatments except T2 received Coccivac®-B52 (Merck Animal Health) on the day of hatch. Treatments were distributed in a randomized block design. Body weight (BW) and feed consumption were recorded on day 14, 28, 42, and 49 of the study. On day 14, birds fed salinomycin had significantly higher BW and weight gain than the control, and birds fed YCW (T4&T5) or bacitracin were statistically similar to the salinomycin treatment. On day 28, birds fed salinomycin had significantly higher BW (1465 g) than control birds (1404 g), and birds fed YCW in T4 (1438 g) and T5 (1420 g) treatments were statistically similar performance to the salinomycin (T2). The phase and cumulative feed gain ratios were significantly better at day 28 than the control treatment for birds fed salinomycin, bacitracin MD, and YCW 250. By day 42, there were no significant differences with respect to body weight and cumulative feed conversions were not significantly different from the control for any treatment. By day 49, the bacitracin treatment had the lowest performance index which was significantly lower than the control treatment. In summary, both YCW treatment levels are effective in reducing the negative impact associated with the cycling of coccidiosis.

Key Words: broilers, coccidia, yeast cell wall, salinomycin, bacitracin

M107 Effects of VANNIX™ C on the performance of broilers raised on dirty litter. James Lewis*, GS1, Rachel Tonda2, Jon Rubach2, Mitch Poss2, Michael Persia1 Texas A&M University; 2Phileo Lesaffre Animal Industries, Inc.

A 42 day experiment was completed to evaluate the effects of pen hygiene and feed additive (VANNIX™ C, a proprietary blend of tannic acid extract and Bacillus coagulans) on the performance of broilers. In total, 1,104 heritage broiler chicks were randomly assigned to four treatments including clean litter (CL), dirty litter from birds grown to 28 days that had received a coccidial vaccine (DL), the dirty litter with feed additive (VANNIX™ C added at 0.5 lb/ton; FA) and dirty litter with an anticoccidial Zoamix® (zoalene added at 11.35 g/ton; AC). Treatments were administered to 12 replicates of 23 broilers in a randomized block design. Body weights and feed consumption were measured weekly. At 14 d, litter was sampled for oocyst shedding and 3 birds/pen were euthanized for intestinal lesion scoring. All data were analyzed using ANOVA and if significant differences were noted (P ≤ 0.05), means were separated using Fishers LSD test. Over the first 35 d, the birds on CL resulted in higher body weight gain (BWG) than those on DL without dietary treatment (P ≤ 0.05). From 1 to 42 d, the birds on CL had greater BWG than those on the AC, while DL treated birds were intermediate, but not significantly different than either (P > 0.05). The FA treated birds showed increased BWG in comparison to DL birds over the first 35 d (P ≤ 0.05), but this significance was lost for the 1 to 42 d period. The BWG of FA birds was significantly reduced in comparison to CL treated birds for the first 14 d period, but was not significantly different from CL birds after 14 d until the conclusion of the experiment at 42 day of age. Unexpectedly, AC birds resulted in BWG that was less than DL birds (P ≤ 0.05). The FA birds resulted in the lowest FCRm from 1 to 28. From 1 to 35 d FCRm was reduced in FA birds compared to DL birds (P ≤ 0.05), however as with BWG this significance was lost from 1 to 42 d. Lesion scoring was unable to confirm necrotic enteritis, but oocyst shedding tended to be reduced with CL and/or FA and AC, and taken with the performance does suggest a mild microbial challenge. Overall, throughout the majority of the experiment, exposure to DL reduced performance in comparison to CL birds, but treatment with VANNIX™ C restored performance to that of birds raised on CL.

Key Words: tannic acid, Bacillus coagulans, performance, lesion score, oocyst
M109 In vitro evaluation of seven commercially available Bacillus spp based probiotic supplements and one Saccharomyces cerevisiae based prebiotic supplement and their effects on an antibiotic resistant strain of Salmonella Heidelberg Claudia Castaneda, Omar Gutierrez, Christopher McDaniel, Aaron Kiess, Mississippi State University; Huvepharma

Because of the concerns about bacterial resistance to antibiotics, alternatives such as probiotics and prebiotics have been developed to reduce pathogens in poultry. Therefore, the objective of this study was to evaluate 7 Bacillus spp probiotic products and 1 Saccharomyces cerevisiae prebiotic product for their ability to reduce different concentrations of an antibiotic resistant strain of Salmonella Heidelberg (S) in vitro. Treatments included: an antibiotic resistant strain of S (control) at 10^6, 10^5, 10^4, and 10^3 cfu/ml; 7 probiotic products (P1-P7); and 1 prebiotic product (P8). Products were combined with each level of S to create (S+P1 - S+P8). For S, a 12 h stock was diluted 10-fold to create the desired concentrations. For products, 1 g was diluted in 9 mL of nutrient broth and incubated for 24 h to obtain 10^6 cfu of probiotic or prebiotic/ml. Afterward, 100 µl of each treatment was serially diluted at 0, 2, 4, 6, and 8 h of incubation, spread plated on their appropriate agar, and incubated at 37°C for 24 h (probiotics) and 48 h (prebiotic) under aerobic conditions. Counts were log transformed and analyzed using a factorial arrangement of treatments (4 levels of S x 8 products) within a split plot design over incubation time. A time by treatment interaction (P<0.0001) revealed that when products were added to 10^6 cfu S/ml there were no significant reductions of S over time. However, when products were added to 10^5 cfu S/ml only P8 reduced S immediately but S recovered at later time periods. When products were added to 10^6 cfu S/ml, at 0 h S was completely reduced by P3, P6, and P7; by 2 h, P3 and P6 maintained this reduction; and by 4 h all products except P5 and P7 reduced S by 1 log. When products were added to 10^4 cfu S/ml, at 0 h all products except P4 reduced S completely; by 2 h P6 and P8 reduced S completely while P4, P5 and P7 reduced S by 1 log; and by 4 h S recovered for all products except P6 which did not allow S to recover until 6 h. In conclusion, although all products contain Bacillus they can have different serovars, which could affect how certain products worked against S in this study.

Key Words: Antibiotic alternative, Salmonella, Probiotic, Prebiotic, Poultry

M111 Effects of replacing antibiotics and anticoccidials with probiotics in broiler diets on growth performance Kacey O’Donnell, Xi Wang, Kelley Wamsly, Aaron Kiess, E. Peebles, Wei Zhai, Mississippi State University

The study was conducted to determine an optimal time to withdraw antimicrobials (antibiotics and anticoccidials) and replace them with probiotics in broiler diets without adverse effects on growth performance. A total of 1,536 male Ross × Ross 708 broilers were divided into 12 treatments with 8 replications each. Birds were fed in 6 phases: 0-14, 14-21, 21-28, 28-35, 35-46, and 46-56 days with 1 of 3 feeds including basal, antimicrobial, and probiotic diets during each feeding phase, so that antimicrobials were withdrawn at different phases. In place of antimicrobials, half of the diets were supplemented with probiotics. On day 14, all the birds were challenged by oral gavage of 10 × dose of commercial coccidial vaccine including live Eimeria (E.) acervulina, E. maxima, E. maxima MFP, E. meleagrimitis, and E. tenella. One-way ANOVA was used to analyze the data using Proc GLM of SAS 9.4. Dietary treatments did not affect BW on day 14 before the coccidial challenge (P = 0.680). Within a week of Eimeria challenge, the removal of antimicrobials from the diets decreased body weight (BW) on day 21 (P = 0.0001). Two weeks after Eimeria challenge, the removal of dietary antimicrobials on day 21 decreased BW on days 28, 35, and 47 (P = 0.0005, < 0.0001, and 0.0002, respectively). However, supplementation of probiotics to the basal diet brought the BW back close to that of antimicrobial groups (P = 0.400, 0.071, and 0.456, respectively). This continued until day 55 when birds that started receiving probiotics on day 21 exhibited similar BW as compared to the antimicrobial groups (P = 0.403 and 0.499). Birds that had antimicrobials taken out on day 28 showed a significantly lower BW on days 35, 47 and 55 (P = 0.0023, 0.0400, and 0.0030, respectively). Birds supplemented with probiotics starting on day 28 exhibited similar BW as those fed antimicrobials on days 35, 47, and 55 (P = 0.083, 0.216, and 0.676, respectively). Withdrawal of antimicrobials or supplementation of probiotics on day 35 did not affect BW on day 47 (P = 0.796 and 0.912) or 55 (P = 0.712 and 0.331). Supplementation of probiotics in the last feeding phase (days 47 to 55) did not affect BW on day 55 (P = 0.312). In conclusion, the results suggest that supplementing probiotics may alleviate the adverse effects of coccidiosis on growth performance of broilers fed diets with antimicrobial taken out on day 21 or 28.

Key Words: broiler, coccidiosis, antibiotic, antimicrobial, coccidial, probiotic

M112 Effects of probiotics on performance of broilers fed corn or sorghum-based diets Albana Sarsour, Edwin Oviedo, Rondón, Hernan Cordova, Beatriz Saldaña, Luis Bernal-Arango, Mariana Mesquita, Ricardo Fasanoro, Rose Whelan, Kiran Doranalli, North Carolina State University; Universidad Politécnica de Madrid; Politécnico Colombiano Jaime Isaza Cadavid; Universidad Federal de Goiás; Universidad Estadual Paulista; Evonik Nutrition & Care GmbH

Probiotics could be used as alternatives to antibiotic growth promoters. An experiment was conducted to evaluate the effects of feeding a Bacillus subtilis probiotic compared to BMD-50 in broiler diets based on either corn
or sorghum. Six treatments were evaluated resulting from a 2 x 3 factorial arrangement of treatments with two basal diets based on either corn or sorghum and including one of three additives (No additive, 50g/MT BMD-50, or 5x105 cfu/MT B. subtilis DSM 32315) as main factors. A total of 2,016 Ross 708 day-old male chicks were placed in 72 pens (28 chicks/pen) on used litter. Chicks were fed starter, grower and finisher diets between 1-14, 15-35, and 36-40 d of age, respectively. Group BW and feed intake were recorded. FCR and BW gain were calculated at the end of each phase. At 42 d, 2 broilers/pen were selected to obtain the weights of carcass and cut up parts. Data was analyzed as a randomized complete block design with grain type and additive as main effects and 12 replicates/treatment. At 7, 14, and 21 d of age, a two-way interaction effect (P < 0.05) was observed for BW and BW gain. Chicks fed the non-additive and BMD corn-based diets were heavier than broilers fed sorghum-based basal and B. subtilis DSM 32315 diets up to 14 d of age. BW was affected by grain (P < 0.001) and additive (P < 0.01) at 40 d of age. Chicks fed BMD were heavier than the control and B. subtilis DSM 32315 had intermediate results. At 21 d of age, a two-way interaction effect (P < 0.01) was observed for feed intake. Chicks fed the control or BMD corn-based diets consumed more feed than the control or BMD sorghum-based diets. Additives affected (P < 0.05) FCR at 7, 14, and 21 d of age. At 14 and 21 d both feed additives improved FCR, but this effect was not significant (P > 0.05) at 40 d of age. Flock uniformity was worse (P < 0.05) in the sorghum basal diet, but broilers fed diets with additives had coefficient of variation % similar to that observed in corn diets. No interaction or main effects (P > 0.05) of grain source or feed additives were observed for mortality, carcass yield or cut up part yield. In conclusion, this probiotic could be used as an alternative for BMD in corn and sorghum-based diets.

Key Words: probiotics, broilers, performance, growth promotants

M113 Effects of sodium butyrate, essential oils, and medium chain fatty acids to control Clostridium perfringens induced Necrotic Enteritis
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Limited use of antibiotics for growth promotion may increase the incidence of necrotic enteritis (NE) in broilers. Thus, gut health feed additives have an increasing importance in the prevention and control of NE. The objective of this study was to determine the effectiveness of sodium butyrate protected with sodium salts of palm fatty acids (NATESSE; SB+EO), and sodium butyrate protected with sodium salts of medium chain fatty acids (DICOSAN; SB+MCFA) to reduce the negative effects of a toxigenic Clostridium perfringens in broiler chickens. One-day-old broiler chickens were assigned to 6 treatments with 8 replicates of 58 birds each. The treatments were: 1 - Negative control – NC (basal diet and no challenge), 2 - NC + challenge, 3 - Bacitracin Methylene Disalicylate (BMD, with 0.05% of inclusion)+challenge, 4 - SB+challenge, 5 – SB+EO+challenge, 6 - SB+MCFA+challenge. The three additives were included at 0.1%. On d 1, all birds were vaccinated against coccidiosis by coarse spray. On d 13, the birds from treatments 2 to 6 were inoculated with 25,000 oocysts of Eimeria maxima by oral gavage. On d 18 and 19, the same birds were administered a fresh broth culture of Clostridium perfringens via drinking water. Performance data was obtained at 13, 21, 34 and 41 d of age. Scoring for NE was performed at 21 d, and excreta oocysts were counted at 21 and 28 d. At 21 d, the unsupplemented challenged birds gained 5% less than the unchallenged control, whereas challenged birds supplemented with BMD, SB or SB+MCFA did not. The supplementation of SB+EO improved the FCR (P<0.05) from 1 to 41 d of age when compared to the challenged and unsupplemented group (1.507 vs. 1.620). Oocyst shedding at 21 d increased due to the challenge (P>0.05); however, no additive was able to prevent the lesions caused by NE (P>0.001). The use of SB+EO was effective in ameliorating the performance of NE challenged birds by 41 d of age, and was the only treatment with lesion score similar to the negative control; no feed additives were able to reduce the severity of infection as measured by lesion score and oocyst shedding.

Key Words: Gut health, Coccidiosis, Feed additives

M114 Effects of Mannan Oligosaccharide on lean tissue, fat tissue, and bone mineral composition in broiler ducks
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The effects of a mannan-oligosaccharide (MOS) feed additive on lean tissue, fat tissue, and bone mineral composition were evaluated in 25 day old Pekin ducks using dual-energy x-ray absorptiometry (DEXA). The experiment consisted of five treatments; Control, 250 g/ton of MOS (T1), 500 g/ton of MOS (T2), 1 kg/ton of MOS (T3), and 2 kg/ton of MOS (T4). Birds were housed in battery units with nine replicates per treatment. One bird from each unit was randomly selected for DEXA analysis (45 birds total). Light and temperature were controlled and maintained equal for all replicates. There were no challenges or therapies applied to the ducks during the experiment. Feed conversion data were also gathered. At 25d, the 45 birds were humanely euthanized via carbon dioxide asphyxiation. Immediately after, they were transported to the Applied Exercise Science Laboratory at Texas A&M University. The DEXA scanner was used to scan the ducks from the ventral side. The results of the feed conversion data show that there was no significant difference between the Control and treatments. All data concerning lean and fat tissue in pounds, fat tissue percentage, as well as bone mineral density and bone mineral content were analyzed and recorded from the birds. In terms of lean tissue, the experiment showed that there were no significant differences in lean tissue deposition in pounds between the control and any of the treatment groups. The results of the experiment concerning fat tissue deposition in pounds showed that T1 had significantly more fat tissue than T2. The results of the experiment in terms of percentage of fat showed that T1 had a significantly greater percentage of fat deposition. The effects of the experiment on bone mineral density showed that there were no significant differences in bone mineral density among the treatments. The bone mineral composition of T3 was significantly greater than that of the Control, and was numerically the highest of all the treatments. Due to the fact that bone mineral composition is a measurement of the amount of hydroxyapatite salt in bone these results indicate that there may be a correlation between the changing of gut morphology due to the MOS. Therefore MOS may increase nutrient absorption.

Key Words: mannan-oligosaccharide, DEXA, Pekin ducks, hydroxyapatite

M115 Proving the concept that commercial in ovo delivery of a probiotic and prebiotics can positively impact broiler performance
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It is expected that the world populace will exceed 9 billion by the year 2050 and the question being asked is how poultry will contribute to feeding the populace, especially without antibiotics. Probiotics and prebiotics appear to be acceptable alternatives to antibiotic supplementation, however, the method by which prebiotics and probiotics are administered may have