P127 Effect of pectinase, cellulase and hemicellulase on performance and digestibility of diets in broilers Fatemeh Alemi1, Ali Mahdavi2, Sirous Eshidvandi3, Seyed Abdullah Hosseini4, Ali Mostafa Tehrani4, Vahid Ghasemloo5 1Ph.D of Poultry Nutrition, Tehran, Iran, 2Semnan University Veterinary Faculty, Tehran, Iran, 3Shooshtar University, Shooshtar, Khuzestan, Iran, 4Animal Science Research Institute, Karaj, Alborz, Iran

This trial was conducted to investigate the effects of pectinase, cellulase and hemicellulase supplementation on performance and nutrient digestibility in broiler chickens fed on corn-soybean meal based diets. The experimental diets consisted of 1.corn-soybean meal based control diet 2. Control diet supplemented with pectinase. 3. Control diet supplemented with cellulase. 4. Control diet supplemented with pectinase + cellulase. 5. Control diet supplemented with pectinase + cellulase + hemicellulase. All chicks were reared under conventional commercial broiler starter diet until 15 d of age. The diets were fed to 150 broiler chicks between 15 and 35 d of age. Chicks were given experimental diets containing 0.33, 2 and 2 U/g of diet cellulase, hemicellulase and pectinase respectively. There were not any significant differences between the experimental groups in body weight gain and feed conversion ratio but the treatment that consist of 3 enzymes showed greater body weight gain and better feed conversion ratio than the other treatments. This treatment improved FCR in first, second, third week and total period of experiment 6.56, 13.08, 10.10 and 9.04 % to control group respectively. The effect of an exogenous enzyme containing pectinase+cellulase+hem cellulase on digestibility of a corn-soy-based diet was the highest. This experimental group increased organic matter and energy digestibility respectively 6.54 and 7.18 % than control group. Also supplementation of three enzymes together eventuated the highest digestibility of protein (P<0.05). It can be concluded that combination of these enzymes is effective in improving digestibility. It is concluded that supplementation with these enzyme preparations, which can improve uniformity and decrease mortality in broiler chickens fed on maize-based diets. This improvement is achieved through enzyme effects on digestion and potential of utilization.

Key Words: Antinutritional factors, Chicken, Extruded full fat soy bean, Soy bean meal, Pancreas


Two experiments investigated the pelleting stability of a thermo-stable commercial bacterial protease (RONOZYME® ProAct) derived from No cardiopsis prasina and produced by Bacillus licheniformis. Experiment 1 was conducted at the Kansas State University Department of Grain Science and Industry feed production facilities. In a 2 x 3 factorial, two conditioning times (30 and 60 seconds) and three pelleting temperatures of 70, 80 and 90°C were tested. Temperatures were confirmed with a digital thermometer near the exit of the conditioner. Conditioning moisture was set to be maximized at 17%. ProAct was added at 200 ppm to a corn-soybean meal based broiler grower feed. For each batch, 5 samples of mash and 3 samples of pellets were collected, and survivability was determined by the analytical quantification of protease in mash versus pellets. At 70, 80 and 90°C, the survivability was 97%, 95% and 97%, respectively. Minimal difference in stability was found across conditioning times. For 30 and 60 seconds across all three temperatures, survivability was determined to be 94 and 98%, respectively.

In Experiment 2, the thermal stability of ProAct was determined in a group 8 commercial poultry feed mills across a large geographical area with a mean pelleting temperature of 88°C and conditioning time of 42 seconds. In these mills, ProAct exhibited a survivability of 95 +/-3%.

Controlled and commercial testing confirms the superior stability during feed pelleting of RONOZYME® ProAct.

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Key Words: RONOZYME, ProAct, protease, thermal, stability

Poult. Sci. 91(Suppl. 1)
P130 Effect of different phytases on the concentration of inositol phosphate isomers and P net absorption in different segments of the digestive tract in broilers

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In vitro studies have shown that phytases of different origin initiate myo-inositol hexakisphosphate (InsP6) degradation and release of P at different positions on the inositol ring, leading to different myo-inositol pentakisphosphate (InsP5) isomers. The objective of the present study was to investigate the influence of an Aspergillus 3-phytase (Finase®P) and two E.coli derived 6-phytases (QTR and QPT2) on InsP6-degradation, concentrations of InsP6-isomers and P net absorption in different sections of the digestive tract in broilers. Six hundred 16-day-old unsexed broilers were allocated to 40 floor pens (n=10 pens per treatment). The low-P corn and soybean meal-based diets were fed without or with supplementation of one of the phytases at a level of 500 FTU/kg. At 25 days of age the animals were asphyxiated by CO2 exposure. Digesta from different digestive tract sections was pooled per segment on a pen basis. All samples, after being frozen and freeze-dried, were analysed for P, inositol phosphates and the marker TiO2. InsP6 isomers were detected by High Performance Ion Chromatography, excluding enantiomer differentiation. In the crop, all phytases significantly improved InsP6-degradation from 9% in the control up to 64% (Finase®P), 31% (QTR) and 44% (QPT2), with the 3-phytase treatment being significantly higher than the other phytase treatments. In the duodenum/jejunum this difference disappeared and the average InsP6-degradation was 64%. InsP6 degradation at the terminal ileum tended to be higher with the 6-phytases (QTR, 79%; QPT2, 82%) compared to the 3-phytase (74%) or the control (74%). Accordingly, P net absorption until the terminal ileum tended to be higher with the 6-phytases (QTR: 60%; QPT2: 64%) compared to the 3-phytase (56%) or the control (57%). In all segments of the digestive tract the dominating InsP6 isomer was Ins(1,2,3,4,5)P5 for the 3-phytase, while it was Ins(1,2,3,4,5,6)P6 for the 6-phytases. This confirms results from in vitro studies that had shown appearance of different InsP6 hydrolysis products. In broilers this results in InsP6 degradation efficiency differing between phytases up to the end of the ileum.

Key Words: Broiler, InsP6 degradation, Isomers, Phytase, Phosphorus

P131 Effect of dietary β-mannanase and palm kernel meal (PKM) on laying performance and egg quality of older laying hen

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This study was conducted to evaluate how dietary β-mannanase supplementation affect older laying hen. A total of 240 Lohmann laying hens at 73 wk of age with average 77.5% egg production were randomly allocated to 4 treatments with 4 replicates. Two levels of PKM (0 vs 5% PKM) and two dietary β-mannanase (CTCzyme6, CTCBio Inc., Korea) levels (0 vs 480IU/kg of diet) were 2 × 2 factorially arranged to set 4 treatments for 4 weeks feeding trial. All diets were formulated to be isocaloric (2,720kcal/kg) and isonitrogenous (16.2%). Egg production, feed intake (FI) and feed conversion ratio (FCR) were measured weekly. Apparent nutrient utilizations (%) were measured at the end of feeding trial using total collection method. In addition, egg qualities, serum IgG and yolk IgY were measured. Egg production was not affected by either PKM inclusion or β-mannanase supplementation into diets. However, feed intake was decreased (P<0.05) by dietary β-mannanase supplementation regardless of PKM inclusion into the diets. FCR was tend to be improved by β-mannanase supplementation.

Key Words: turkey, phytase, performance, phosphorus, calcium

P132 Efficiency of a thermotolerant phytase on turkey performance

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The efficacy of a thermotolerant 6-phytase QPT2 was evaluated in 1200 female B.U.T. 9 turkeys fed 4 dietary treatments (12 replicates, each with 25 turkeys). Corn and soybean meal diets with recommended (PC) or reduced (NC) mineral level were tested. Diets contained 0.67% non-phytate P (nP), 1.3% Ca and 0.17% Na (PC) or 0.43% nP, 1.0% Ca and 0.14% Na (NC) (from 0 to 28 d; 0.56% non-phytate P (nP), 1.15% Ca and 0.17% Na (PC) or 0.35% nP, 0.86% Ca and 0.14% Na (NC) from 29 to 56 d and 0.45% non-phytate P (nP), 0.98% Ca and 0.17% Na (PC) or 0.26% nP, 0.71% Ca and 0.14% Na (NC) from 57 to 86 d. Phytase was added at 500 or 1000 FTU/kg to NC diets. Performance was measured at days 28, 56 and 86. The experiment was set up as randomized complete block design and data were subjected to ANOVA.

Over the entire period, the weight gain of the NC birds did not differ from the PC ones (80.7 vs. 82.6 g/d; P>0.05), whereas phytase addition improved gain compared with the NC, with no differences between inclusion rates (84.7 g/d; P<0.05). Feed intake of 169.3 g/d for NC birds increased to 175.2 g/d for birds fed the PC and 178.6 or 176.4 g/d for those that received 500 and 1000 FTU/kg phytase respectively (P<0.05). No effect of diet or phytase on feed conversion ratio was noted (2.08 to 2.12, P=0.05).

In the separate feeding periods similar effects were seen but they were more distinct between days 29 and 56. In this period the weight gain of the NC was significantly lower compared with the PC turkeys (97.1 and 100.6 g/d respectively; P<0.05). Phytase significantly improved weight gain compared with the NC with birds achieving 102.1g/d (500 FTU/kg) and 104.3 g/d (1000 FTU/kg), the latter being significantly superior to the PC (P<0.05). FCR in this period was improved in turkeys offered 1000 FTU/kg (1.64 g/PC) when compared to the other treatments (1.68-1.70 g/PC).

In this experiment QPT2 phytase increased availability of minerals associated with phytate, allowing reduced dietary P, Ca and Na levels without penalizing performance.

Key Words: turkey, phytase, performance, phosphorus, calcium

P133 Evaluation of high dose phytase and NSPase inclusion in diets varying in energy level on broiler performance and carcass yield

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An experiment was conducted to investigate the effect of increased levels of phytase (OptiPhos®) inclusion and a cocktail NSPase (Ensira®) on growth performance and processing yield in diets varying in energy level. The experimental design included a total of seven dietary treatments with two energy levels: a positive control (PC) and negative control (NC) with a reduction of 130 kcal/kg ME throughout the experiment compared to the PC. Additional treatments included phytase supplemented at 4X the recom-
mended dose in the PC and NC, NSPase inclusion in the PC and NC, and the combination of high phytase and NSPase in the NC diet. Each treatment included seventeen replicate pens with 14 broilers placed per treatment group (1666 total chicks placed). Dietary program consisted of a starter (day 1-14), grower (day 15-29), and finisher (day 30-42). Broilers were weighed and feed consumption determined on days 14, 29, and 42. Following an 8 hr feed withdrawal, two male and two female broilers per replicate pen were processed to determine WOG and fat pad weight. Body weight was reduced (P<0.05) in the NC diet as compared to the PC diet on day 14 and 29. Inclusion of high dose phytase in the PC diet increased body weight through day 29 while inclusion in the NC increased body weight throughout the experiment. Inclusion of NSPase in the NC diet increased (P<0.05) body weight through day 29 of age. Mortality corrected feed conversion ratio (FCR) was increased (P<0.05) throughout the experiment in the NC as compared to the PC diet. Inclusion of high levels of phytase reduced (P<0.05) FCR in the starter diet and cumulatively through 42 days of age in both the PC and NC diets. Inclusion of NSPase reduced (P<0.05) FCR when included in both the PC and NC diets at the conclusion of the experiment. Inclusion of the high dose phytase in the NC diet increased (P<0.05) WOG weight and yield. The combination of high levels of phytase with a cocktail NSPase did not lead to improvements in performance as opposed to individual inclusion. These data indicate that high levels of phytase and a cocktail NSPase can improve growth performance in high and low energy diets when added separately, however no additive effects were observed when used in combination.

Key Words: enzyme, energy, broiler, performance, phytase

P134 Effect of a protease on a phytase when fed to broiler chickens
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A trial was conducted to determine whether a phytase can maintain its activity in the presence of a protease in the diet of broiler chicks. Ross 308 x Ross 708 male broiler chicks were fed one of six corn-soybean meal mash diets from day of hatch to 21 d in a randomized complete block with 6 replications per dietary treatment and 8 birds per replication. The positive control (PC) diet contained 0.45% available P (AP) with no additional enzymes. The negative control (NC) diet contained 0.30% AP with no additional enzymes. The remaining 4 diets were arranged in a 2x2 factorial utilizing phytase A or B at 0.01% and with or without a protease at 0.05% added to the NC. At the conclusion of the experiment, two birds from each replicate were sacrificed to determine tibia ash as a percentage of fat-free bone. Body weight gain, feed consumption, and feed conversion were not affected by dietary treatment (P>0.05) over the 21-d experiment. Tibia bone ash was significantly reduced (P<0.001) for birds fed the NC diet (36.0%) in comparison with all other dietary treatments. Tibia ash was similar among the remaining dietary treatments with a mean of 39.8%. There was no significant interaction between phytase and protease. The significant increase of tibia bone ash in chicks fed the diets containing phytase A or B plus the protease when compared to the NC indicated that phytase activity is not compromised by the inclusion of protease in the diet.

Key Words: protease, phytase, bone ash, enzyme, broiler

P135 Effects of xylanase and dietary energy on first cycle laying hen production
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A 24 wk experiment was conducted using 432 first cycle Hy-line 36 laying hens to determine the performance response to various dietary energy concentrations with and without enzyme supplementation (Hostazym X®). The experiment was a 2x3 factorial arrangement, with xylanase addition and 3 dietary energy concentrations (Control; 2,850 kcal/kg, Control -77 kcal/kg; 2,772 kcal/kg, Control -104 kcal/kg; 2,696 kcal/kg). The experimental unit (EU) was 3 consecutive cages of 3 birds per cage (68 in2/bird), resulting in 8 EU of 9 birds per treatment. Pullets were secured from a commercial facility and were allowed to transition to the experimental facilities for 2 wk before experimental diets were provided. Egg production and mortality data were collected daily, feed intake was measured weekly and hen body weight and egg mass was determined monthly. ANOVA was conducted using a 2x3 factorial arrangement with Students T test used to separate means if significance was detected. Birds fed diets supplemented with xylanase had increased hen housed egg production over the duration of the experiment (P<0.05). Feed intake increased with the reduction of dietary energy (P<0.05). Egg mass was increased due to xylanase addition in week 12, but a significant interaction occurred in wk 16 and 20, as supplementing hen diets with xylanase resulted in increased egg mass in all diets but the lowest energy diet (P<0.05). Feed efficiency was generally improved with xylanase supplementation to the diets from wk 8 to 16 (P<0.10). Hen body weight was not affected by xylanase or energy concentration. Overall, supplementing the diets with xylanase increased egg production and improved egg mass and feed efficiency over specific periods. The xylanase response was consistent over the various dietary energy concentrations, but was not able to always increase egg mass in the diet with the lowest energy concentration (-104 kcal/kg), this was possibly due to decreased feed intake at this dietary energy concentration.

Key Words: laying hen, production, enzyme, dietary energy

P136 Effect of Pelleting Temperature on the Recovery and Efficacy of a Xylanase in a Corn-Soybean-DDGS-Based Diet
Byoungyun Jung1, Amy Batal2 1The University of Georgia, Athens, GA, 2Huvepharma Inc., Peachtree, GA

The supplementation of exogenous enzymes improves the energy utilization of the diet and broiler performance by increased digestibility of nutrients in the diet, reduced mucosal viscosity and degradation of cereal cell walls. In today’s commercial poultry feed mills, most of the feed is heated and then compressed to form pellets. Overheating can reduce protein digestion and activation of exogenous enzymes. Therefore, the stability of supplemented enzymes in the diet after pelleting may be a major concern of feed manufacturers. An experiment was conducted to evaluate the effect of pelleting temperature on the recovery of a xylanase as well as the efficacy of a xylanase in the diet by monitoring broiler performance. In a 2 (a positive or negative control diet) × 2 addition (or no addition of xylanase) × 3 (different pelleting temperatures; 173, 183, 193 F) factorial design, 432 one-d-old male Cobb-500 broilers were randomly assigned to the 12 dietary treatments. The negative control (NC) diet was formulated to be reduced in energy by 80 kcal/kg compared with the positive control (PC) diet. Six replicate pens containing 6 chicks were fed each experimental diet from 0 to 21 d of age. The xylanase activity in the diets reduced as the pelleting temperature increased. No effects on BW gain, feed intake, and feed efficiency (G: F) were observed by the reduced energy diet, xylanase addition, and pelleting temperatures from 0 to 7 d of age. From 8 to 14 d of age the birds fed diets pelleted at 183 F were heavier than the birds fed diets pelleted at 193 F regardless of the different energy levels and the xylanase addition from 8 to 14 d of age. The birds fed the NC diet had higher feed intake than the birds fed the PC diet regardless of the xylanase addition and different pelleting temperatures from 8 to 14 d of age. The addition of a xylanase to the broiler diet tends to positively affect BW gain and feed intake regardless of the different energy level and different pelleting temperatures from 8 to 14 d of age. In conclusion, pelleting temperature in the pelleted broiler diet should be carefully considered due to negative effects on BW gain and efficacy of

Poult. Sci. 91(Suppl. 1)
enzyme activity in the diets. This data suggests that although xylanase recovery is low in the diets with high pellets temperature there may still be some xylanase activity.

Key Words: Broilers, xylanase, pelleting temperature, performance

P137 Energy evaluation of cottonseed meal with or without exoge- nous enzymes for broilers Alciene Maria Andrade Tavares-Samay1,2, Andrew Henrique da Silva Cavalcanti Andrew Henrique da Silva Cavalcanti Coelho1, Wilson Moreira Dutra Júnior1, Carlos Bóia-Viagem Rabello1, Cláudia Costa Lopes1, Elaine Cristina Lopes1, Camilla Roana Costa de Oliveira1, Emanuela Nathaly Ribeiro Barbosa1, Costa Fernando Guilherme Perazzo1,2, Universidade Federal Rural de Pernambuco, Recife, Pernambuco, Brazil, 2Universidade Federal da Paraíba, Areia, Paraíba, Brazil

In order to determine the chemical composition and energetic values for cottonseed meal (CM) with or without addition of enzymes (phytase+protease) for broilers from eight to 21 days of age, we conducted a test metabolism method collection of excreta using 192 male broiler chickens, Cobb 500. We used a completely randomized 2x2 factorial design (levels of CM: 0 and 25% vs addition of enzymes, with and without enzyme) with six replicates and eight birds per plot. The collection period was four days. We used 1% ferric oxide as a marker. The treatments were: reference diet, with corn and soybean meal, with and without enzymes (T1 and T2, respectively) and feed-tests with 25% of CM with and without enzymes (T3 and T4, respectively) with 40g/100kg which were added ferrous sulfate. The phytase and protease were used in amounts 15 and 20g/100kg, respectively, following manufacturer’s recommendations. The variables were submitted to ANOVA and means were compared by the test T. The chemical composition of CM was 94.58% for dry matter, 24.28% for crude protein, 7.51% for ash and 4.614 kcal/kg gross energy. The apparent metabolizable energy (AME), corrected for the apparent nitrogen (AMEn), metabolizability coefficient of dry matter (MCDM) and gross energy (MCGE) was analyzed and the CM in the dry matter were: 3344 and 3165 kcal/kg, 68.80 and 69.90% for T1, 3325 and 3150 kcal/kg, 67.74 and 69.19% for T2, 3228 and 3009 kcal/kg, 62.15 and 64.30% for T3; 3124 and 2944 kcal/kg, 60.24 and 63.48% for T4 and 2878 and 2491 kcal/kg, 47.15 and 64.90% for the CM without enzymes and 2523 and 2335 kcal/kg, 45.68 and 60.21% for the CM with enzymes, respectively. The addition of enzymes did not provide significant differences in relation to metabolizable energy, and MCDM MCGE in both the experimental diets and the CM, demonstrating that the enzymes used did not increase the availability of energy of feed ingredients. The presence of enzymes did not affect the AME, AMEn, MCDM and MCGE of CM in diets for broiler in initial phase.

Key Words: metabolizable energy, phytase, protease, digestibility, metabolizable energy

P138 Broiler responses to corn-soybean diets having phytase and protease in single or combined supplemen- tations Sergio Vieira1, Andre Favero1, Roselina Angel2, Henrique Cemin1, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, 2University of Maryland, College Park, MD

A study was conducted to evaluate phytase and protease supplementations in corn-soy meal broiler diets. A total of 270 Cobb 500 slow feathering male broilers were fed a positive control diet (PC) with 0.37% NPP or a negative control diet (NC) with 0.23% nPP. The NC diets were supplemented with 500, 1000 or 1500 FYT from Peniophora lyii and one NC diet was supplemented simultaneously with 1500 FYT of the same phytase in combination with 200 ppm of a protease from Nocardiopsis prasina (75,000 PROT units/g of enzyme). Birds were fed the experimental diets from 1 to 21 d of age in battery cages, with 8 replicates of 5 birds each. All diets had 22.0% CP (1.15% digestible Lys, 0.86% digestible TSAA, and 0.75% digestible Thr), 0.80% Ca, and 2.950 kcal ME/kg. Analyzed CP, Ca, total P, phytase and protease in the diets were similar to formulated in the diets. Body weight gain (BWG) was reduced for NC non supplemented with phytase or protease when compared with PC. Supplementation of NC with phytase or protease led to graded improvements (P<0.001), such that BWG were: PC=921g, NC=568g, NC+500FYT=821g, NC+1000FYT=893g, NC+1500FYT=939g, and NC+1500FYT+Protease=912g. Feed conversion ratio corrected for the weight of dead birds (FCR) was depressed when PC was compared to NC without enzyme supplementation. However, phytase supplementation led to recovering in performance to values similar to PC. FCR values for the PC, NC, NC+500 FYT, NC+1000FYT, NC+1500FYT and NC+1500FYT+Protease were respectively: 1.304, 1.389, 1.285, 1.292,1.276, and 1.223. Simultaneous supplementation of phytase and protease led to added benefits in FCR which were higher (P<0.001) when compared to the PC diet. It is concluded that the phytase and protease used in this study were able to produce added gains when combined at 1500 FYT and 200 ppm of protease which produced similar or better performance than the PC diet.

Key Words: broiler, phytase, protease, performance

P139 Meta-analysis of the effects of a Phytojenic Feed Additive on performance in broiler Leopold Jungbauer1, Kenneth Purser2, Karola Renate Wendler1, Delacon, Steyregg, Austria, Steyregg, Upper-austria, Austria, 2Nutriquest, Quincy, IL

Aim of this meta-analysis is to show the beneficial effects of the phytojenic feed additive Biostrong® 510 (PFA) on weight gain (DWG), feed intake (DFI) and feed conversion ratio (FCR) in 42 day old broilers. A total of 1,296 day-old chickens in 5 different trials at 3 different institutes were randomly allocated to two treatment groups (T1: Control, T2: PFA at 150 g/t) with each 6-12 repetitions and each repetition with 20-30 broilers. Starter feed was offered until 21 days of age, followed by finisher feed until the end of the trials on day 42. Diets consisted mainly of corn, soybean meal and wheat and were calculated to provide appropriate nutrient concentrations for chickens for fattening. Diets were free of antibiotic growth promoters. Water and feed were available ad libitum. Chickens were weighed at the start of each trial, at the end of the starter phase and at the end of the experiment. Feed intake and feed conversion ratio were recorded per pen for the two phases and overall. Data were used in a meta-analysis conducted as a complete randomized design using the MIXED procedure of SAS for Windows (SAS Institute, 2002). The model includes treatment as a fixed effect and trial as a random effect. Statistical significance is declared at P ≤ 0.05, and a near-significant trend at 0.05 < P ≤ 0.10. Results show that the addition of the PFA had no effect on performance during the starter phase till day 21. During the grower phase DWG was slightly increased by 2% (p=0.244) and FCR was significantly improved by 4.2% (p=0.003) through the addition of the PFA. During the whole growing period DWG was slightly increased by 1.5% (p=0.315) and DFI was numerically reduced by 1.7% (p=0.288), whereas FCR was significantly improved by 3.1% (p=0.008). These results show that the addition of Biostrong® 510 improves performance in broiler production, supposable through a positive effect on nutrient digestibility. Consequently an improved FCR and increased BW enhance profitability of broiler production.

Key Words: phytojenic, plant extract, broiler, feed conversion, performance
Effect of graded inclusion levels of a novel bacterial 6-phytase on apparent ileal digestibility of phosphorus in laying hens

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A 4-week experiment of was conducted to evaluate the efficacy of a bacterial 6-phytase (RONOZYMEn HiPhos) in a liquid form in laying hens fed a phosphorous deficient diet based on maize and soybean meal. The basal diet was formulated to contain 2.0 g available P and 34.5 g Ca per kg. The laying hens were fed with the basal diet without enzyme supplementation from 23 weeks to 25 weeks of age to induce a phosphorus deficiency. At 25 weeks of age, the hens received the basal diet either unsupplemented (negative control) or supplemented with the phytase at 500, 1000 and 2000 U/kg. As reference a diet supplemented with dicalcium phosphate to provide 1 g P per kg diet was fed and served as a positive control treatment. Ileal digestibilities of phosphorus and tibia characteristics were determined as response parameters.

The results of the experiment demonstrated that the apparent ileal digestibility of phosphorus was significantly improved by phytase supplementation in a dose dependent manner. Relative improvements in a range of 19.8% to 28.2% were demonstrated with graded inclusion levels of phytase. The response of the apparent ileal digestibility of phosphorus to the addition of the phytase was described by a non-linear regression $y = 45.9 + 12.6 (1-e^{-0.001x})$, $R^2 = 0.98$. Under the conditions of the present trial, tibia strength responded to phytase supplementation in a linear manner ($R^2 = 0.99$) with numerical improvement in a range of 12% to 38%.

Key Words: 6-phytase, ileal digestibility, phosphorus

Effect of a novel bacterial phytase on broiler performance, tibia ash and mineral digestibility

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An experiment (Exp) was done to test the responses of increasing concentration of a phytase (bacterial 6 phytase expressed in Aspergillus oryzae by the use of a gene mimicking Citrobacter braakii; HiPhos, DSM Nutritional Products). Cobb 500 slow feathering male broilers were fed one of 7 diet treatments (Trt) from 7 to 21 d of age. Birds were fed a commercial starter prior to the start of the Exp. Each Trt was duplicated 11 times (5 birds per battery cage). Corn soy diets were formulated to meet industry nutrient concentration (PC, 21.6% CP, 1% Ca and 0.45 nPP) and reduced to 0.35, 0.30 and 0.27% nPP and 0.88, 0.82, and 0.77% Ca, respectively for the Trt labeled negative control (NC) 500, 1000, and 2000. The NC diets were also formulated reducing ME and digestible AA as compared to the control based on matrix values for 500, 1000, and 2000 FTY/kg (NC500, NC1000, and NC2000, respectively). For example digestible Lys (dLys) was reduced by 0.007, 0.011, and 0.014 in the NC500, NC1000, and NC2000, respectively. The phytase was added at 500, 1000, and 2000 FTY/kg to the NC500 (NC500+), NC1000 (NC1000+), and NC2000 (NC2000+) diets resulting in 7 Trt. Diet nutrient and phytase content analyzed close to formulated. BW at 21 d was affected ($P < 0.001$) by Trt. Birds fed the PC diet had greater BW than those fed the NC1000 and NC2000 with those fed the NC500 being intermediate. Broilers fed the NC Trt with phytase performed as well as those fed the PC Trt. Similar results were seen for FCR. FCR was 1.319, 1.370, 1.391, 1.414, 1.353, 1.350, and 1.342 for the PC, NC500, NC1000, NC 2000, NC500+, NC1000+, and NC2000+ Trt, respectively. Ca digestibility was greater in the NC1000+ (52.0%) and NC2000+ (58.6%) Trt (41.5% average). P digestibility was decreased when the NC Trt were fed (43.9% average) vs the PC fed birds (53.4%). When the phytase was added, P digestibility improved as compared to all other Trt (56.0, 66.8, 73.3% for the NC500+, NC1000+, and NC2000+, respectively). Tibia ash was highest for the PC, NC500 and the phytase supplemented NC Trt as compared to the NC500 and NC1000 Trt. The phytase, added to the NC diets was efficacious in returning performance to PC levels even when the NC diets by matrix values beyond Ca and nPP.

Key Words: Broiler, Phytase, calcium and phosphorus digestibilities, performance, tibia ash

Evaluation of multiple energy enzyme inclusion in reduced energy diets on broiler growth performance and processing yield

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An experiment was conducted to investigate the inclusion of multiple commercial energy enzyme inclusion in low energy broilers diets on broiler growth performance and processing yield. The experimental design included six dietary treatments including a positive control (PC), negative control (NC) with a reduction of 130 kcal/kg ME throughout the experiment compared to the NC, and the NC supplemented with one of four commercially available enzymes (A, B, C, and D). Each treatment included eight replicate pens with 30 broilers placed per treatment group (1440 total chicks placed). Dietary program consisted of a starter (0.68 kg/bird), grower (1.45 kg/bird), finisher (1.45 kg/bird), and withdrawal (remainder of grow out). Broilers were weaned and feed consumption determined on days 14, 28, and 44. Following an 8 hr feed withdrawal, six male broilers per replicate pen were processed, air chilled, and deboned for white meat yield determination. Body weight was reduced (P<0.05) in the NC diet as compared to the PC diet on day 14 and 28. Inclusion of multiple enzymes increased (P<0.05) broiler body weight compared to the NC diet throughout the experiment. Cumulative mortality corrected feed conversion ratio (FCR) was decreased (P<0.05) with inclusion of enzyme D as compared to the NC. The NC diet yielded the lowest processing yields and all enzyme inclusion treatments increased multiple processing parameters to a level similar to the PC including WOG weight and breast weight. These data confirm the ability of commercially available energy enzymes to improve growth performance in low energy broiler diets providing producers a cost saving measure.

Key Words: enzyme, energy, broiler, performance, processing yield
copper, manganese, molybdenum, sulphur, chloride ion, cobalt, taurine, proline, hydroxyproline, aspartic acid, threonine, serine, glutamic acid, lanthionine, glycine, alanine, cysteine, valine, methionine, isoleucine, leucine, tyrosine, phenylalanine, lysine, hydrolysine, ornithine, histidine, arginine, tryptophan and energy. The results of the chemical determinations revealed that CBS, CPH, KOT and KPH have a fairly good chemical composition suitable for use as poultry feed ingredients. The fibre contents may however dictate the level of the co-products that can be incorporated in the rations of poultry.

**Key Words:** selected tree crops, co-products, nutritional values, feed resource, poultry

**P144 Nutritional value of full fat soy bean deactivated by different processes** Bernardo Iglesias1, Martin Ruiz de Galarrreta2, Jorge Azcona1, Viviana Charriere1 1INTA - EEA Pergamino, Seccion Aves, Pergamino, Buenos Aires, Argentina, 2UNNOBA Pergamino - ECANA, Pergamino, Buenos Aires, Argentina

Heat treatments as steam, hot dry air (roasted) and dry extrusion are commonly used to deactivate full fat soy beans. The improvements achieved in soy beans nutritional value could be explained by the reduction of trypsin inhibitors (TI) and the improvement in protein digestibility as a consequence of changes in the protein structures induced by heat. An experiment was conducted to evaluate the effect of the mentioned processes on dry matter, TI level, and energy and amino acids utilization using adult cocks. The dry matter contents were 88.7%, 93.7% and 92.8% for steam, roasted and extruded soybean; the TI level decreased to 2.4, 3.2 and 10.1TIU/mg (from 30.2TIU/mg in the raw material); the gross energy utilization was 69.3, 67.8 and 76.4% and lysine utilization was 91.9, 90.2 and 95.2% respectively. To validate these results a trial was performed using isonutritives diets based on the determined nutrient profiles. A corn - soybean meal (44% protein and 4.3TIU/mg) plus soy oil diet was used as control. A total of 420 1-d-old male Cobb broilers chicks were allocated to 4 treatments with 7 replicates of 15 birds each in a randomized complete block design. Data was subjected to ANOVA and Duncan’s multiple range test. The treatments were T1: Soybean meal + soy oil; T2: Soybean meal + steam full fat soybean; T3: Soybean meal + roasted full fat soybean; and T4: Soybean meal + extruded full fat soybean. The determined true metabolizable energies of diets were coincident with the calculated values. No differences in feed intake were observed (p > 0.05). However, the body weight (BW) until 21 days was lower when roasted or steam full fat soybean were used (p < 0.05). No differences in BW were observed at the end of the experiment (49 days) (T1: 3384g, T2: 3343g, T3: 3332g and T4:3395g) (p > 0.05). The feed conversion ratio (FCR) of T2 and T3 (steam and roasted) was higher than the control (T1), these differences were significant (p < 0.05) from day 28 until the end of the trial (T1: 1.806, T2: 1.879, T3: 1.865 and T4: 1.835). No differences in pancreas weight were observed (T1: 5.4g, T2: 4.8g, T3: 5.1g and T4: 5.3g) (p > 0.05) indicating that the reductions in TI were appropriate. The poorer FCR observed with steam or roasted soybeans could be due to a lower chick nutrient utilization compared with roosters. In conclusion, the three processes evaluated allow controlling TI, and dry extrusion achieves similar results than soybean meal + oil diet. More research is necessary to maximize the chick nutrient utilization controlling TI, and dry extrusion achieves similar results than soybean meal + roasted full fat soybean; and T4: Soybean meal + extruded full fat soybean. The TI level decreased to 2.4, 3.2 and 10.1TIU/mg (from 30.2TIU/mg in the raw material); the gross energy utilization was 69.3, 67.8 and 76.4% and lysine utilization was 91.9, 90.2 and 95.2% respectively.

**Key Words:** CP digestibility, SBM, intact, cecctomized, laying hens

**P146 Absorption and skin deposition of pigment in broilers fed various levels of yellow xanthophylls from Tagetes erecta** María de los Ángeles Tepox-Pérez1, Benjamin Fuente-Martínez1, Xóchitl Hernández-Velasco2, Manuel Quiroz-Pesina3, Ernesto Avila-González1 1Centro de Enseñanza, Investigación y Extensión en Producción Avícola (CEEFPAv), Mexico City, Mexico DF, Del. Coyoacán, México, 2Depar-temiento de Medicina y Zootecnia de Aves, Mexico City, México DF, Del. Coyoacán, Mexico FMYZ, UNAM, 3Independent Asesor, Mexico City, Mexico DF, Del. Coyoacán, Mexico

In order to analyze the effect of feeding different increasing levels of yellow xanthophylls (YX) of Tagetes erecta on skin pigmentation in broilers, one hundred and thirty Ross 308, three-week-old broiler chickens were randomly allotted to 6 treatments, consisting of different levels of yellow xanthophylls (65, 92, 119, 146, 173, and 200 ppm). The broilers were raised by sex in battery cages within an open-sided house from 3 to 7 weeks of age. Treatments contained 3 replications of 4 birds each one (2 males and 2 females). Females had 2.8 skin yellowness units more than the males at the end of the study (7 weeks of age). Level of saturation of yellow skin pigmentation at 6 weeks of age was higher (P<0.05) in chickens fed 146, 173, and 200 ppm of YA than those fed 65, 92, and 119 ppm of YA; however, at the end of the experiment the chickens that consumed 119 ppm had a similar yellow skin pigmentation than the chickens fed 146, 173, and 200 ppm of YA (P<0.05). It was observed that the highest yellow skin pigmentation was reach 23 days after the experiment began (44 days of age).

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**Key Words:** yellow skin pigmentation, broilers, yellow xanthophylls, Tagetes erecta

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**P145 Apparent digestibility of crude protein of soy bean meal estimated from ileal digesta of intact and total excreta collection of cecctomized laying hens** Eustace Iyayi1, Oghenemega Eyarefe, Oluwatobi Onarinde 1University of Ibadan, Ibadan, Oyo, Nigeria

This study compared the apparent digestibility of crude protein (CP) of soy bean meal (SBM) up to the terminal ileum in intact and cecctomized laying hens. The objective was to investigate the appropriateness of using excreta of cecctomized birds for estimating apparent CP digestibility in comparison with the use of ileal digesta. Five diets were formulated: A control diet which contained no SBM and 4 test diets in which SBM replaced 50, 100, 150 and 200 g/kg cassava starch. Titanium dioxide was added as an indigestible marker at 5g/kg diet. Twenty 18-week-old point-of-lay Bovans Nera hens were housed in individual cages and had unrestricted access to a layers mash and water up to week 26 at the end of which the birds were weighed and randomly assigned in groups of 4 to each of the 5 test diets. Each cage was an experimental unit. They were fed the test diets for 7 days. Feed intake (FI) and egg production were recorded. On d 7, the birds were weighed and euthanized by CO2 asphyxiation, the body cavity opened and digesta from the last two-third of the ileum harvested, frozen and freeze-dried for analysis. Another set of 20 16-week-old Bovans Nera point-of-lay hens were housed in individual cages and offered a layers mash and water ad libitum. When the birds were 23 weeks old, they were cecctomized and fed layers mash for further 3 weeks. At the end of week 26, a group of 4 cages were randomly assigned to each of the 5 diets similar to the ones offered to the intact birds. The birds also had unrestricted access to the diets and water for 7 days during which excreta samples were collected and pooled on cage basis, immediately frozen and freeze-dried for analysis.

FI was significantly (P<0.05) higher in the cecctomized than in the intact birds. There was no significant effect of level of SBM on CP digestibility in the intact or cecctomized birds. The CP digestibility of SBM was similar for intact (95%) and cecctomized birds (96%). Results of the present study showed that cecctomized laying hens are a good alternative to broilers for CP digestibility studies since digestibility can be determined using the birds’ excreta and the birds can be used in repeated studies.

**Key Words:** CP digestibility, SBM, intact, cecctomized, laying hens
P147 Evaluation of De-oiled DDGS Products in Laying Hens  Brett Kreifels1,2, *Graduate Student, Department of Animal Science, University of Nebraska, Lincoln, NE

The objective of this study was to evaluate the inclusion of de-oiled dried distillers grains plus solubles (DDGS) in the diets of laying hens. One-hundred sixty, 20-wk old Bovan White Leghorn Hens were housed 4 per pen in 40 pens with 10 replicates per treatment. Hens were randomly assigned to pens in a randomized complete block design consisting of treatments, (control, normal fat DDGS, medium fat DDGS, and low fat DDGS). An inclusion rate of 20% DDGS with varying percentages of fat: normal (11.20%), medium (7.30%), and low (5.62%) were included in a standard corn/SBM layer diet. A corn/SBM diet without added DDGS acted as the control. All hens were given ad libitum access to feed and water. Response variables included: egg production, egg weight and feed intake, all recorded weekly with hen body weight observations recorded on wk 0, 8 and 13 with the study lasting a total of thirteen weeks. There was no significant effects of treatment with respect to egg production, egg weight, feed intake and hen body weight (p>0.05). Varying the percentage of fat in 20% DDGS diets fed to laying hens does not affect egg production parameters.

Key Words: DDGS, fat, inclusion, normal, percentage

P148 Quality and egg production of red hens fed different levels of meat flour and supplemented with basil Ibiara Correia de Lima Almeida Paz, Fábio Luiz da Silva, Rodrigo Garofalo Garcia, Fabiana Ribeiro Caldara, Viviane Maria Oliveira dos Santos Ferreira, Leonardo de Oliveira Seno, Leonardo Willian de Freitas, João Damas Graciano Universidade Federal da Grande Dourados, Dourados, Mato Grosso do Sul, Brazil

We used 320 hens (Isa Brown) at 33 weeks of age. A completely randomized design with 8 treatments and 4 replicates of 10 birds: T1 - control diet; T2 - diet with 7.7% of meat flour, T3 - diet with 10.0% of meat flour, T4 - diet with 12.3% of meat flour, T5 - control diet + 1% basil T6 - diet with 7.7% of meat flour + 1% basil, T7 - diet with 10.0% of meat flour + 1% basil T8 - diet with 12.3% of meat flour + 1% basil. The diets were offered isonutritives and comfortable. Was calculated and mass production of eggs for the experimental period. Evaluations were made of skin color and the yolk and sensory evaluation of boiled eggs. There were differences (p<0.05) for egg production and egg mass, and the birds fed with 12.3% of meat flour, with or without the basil had better results. The quality of eggs also was influenced only by the addition of meat flour, which makes use of basil optional until the maximum level of meat flour tested.

Key Words: egg production, meat flour, basil, egg quality, boiled eggs

P149 The use of canola meal in broiler diets. 2. Formulated to optimum density with constant level of poultry oil C. D. Bradley1,2, *S.C. Goodgame, S.D. Goodgame2, F.J. Mussini2, C. Lu2, P.W Walldroup1 *University of Arkansas Poultry Science Department, Fayetteville, AR; 1Poultry Science Department University of Arkansas, Fayetteville, AR

In a previous study in which diets were maintained isocaloric by increasing the level of poultry oil, it was found that up to 40% solvent extracted canola meal (CM) obtained from a biodiesel producer could be fed to broilers without loss of performance. However the economics of feeding high levels of supplemental fats precludes the use of this feeding strategy in commercial production. The objective of the present study was to evaluate the use of CM when a fixed level of 2% poultry oil (PO) was fed, typical of current industry feeding levels. Within each age period five diets were formulated ranging from 0 (Control) to 40% CM in increments of 10%. These diets were formulated to digestible amino acid levels suggested by Rostagno et al. (2005) adjusted to a dietary energy level commensurate with 2% PO. Each of the diets was fed to six pens of 50 males (Cobb 500) for a 42 d feeding period. Five birds from each pen were processed for dressing percentage and parts yield. At 42 d, birds fed diets with 30 and 40% CM were significantly lighter than those fed the control diet with a significantly worse feed conversion. Feed intake was negatively affected by increasing CM levels. However, calorie conversion was not significantly different among treatments. Dressing percentage and breast meat yield was reduced linearly as the level of CM increased. These data suggest that when diets are formulated with a constant level of supplemental fat that the level of canola meal should probably not exceed 20% of the diet.

Key Words: Broilers, Canola, Protein source, optimum density

P150 Nutritional composition of low-oil corn distillers dried grains with solubles Ahmet Guney1,2, *Byoungyun Jung, Amy Batal, University of Georgia Poultry Science Department, Athens, GA

As ethanol production increases, additional corn distillers dried grains with solubles (DDGS) are available to the poultry industry. The government support for biodiesel production is encouraging ethanol producers to extract oil from the DDGS in order to produce biodiesel. The leftover over product is called low-oil DDGS (LO-DDGS), which should have relatively less oil content than traditional DDGS. Currently only limited research has been conducted to evaluate the nutritional composition of LO-DDGS. This study evaluated the nutritional composition of LO-DDGS. Ethanol plants throughout the U.S. were surveyed and the ones that were currently extracting oil were contacted and LO DDGS samples were collected. Ten different LO-DDGS samples were collected from these ethanol producers in U.S. Proximate composition analysis results show that LO-DDGS has a lower average crude fat compared to traditional DDGS (7.6% vs. 9%), and a range of 1.9. LO-DDGS has slightly higher average crude protein than traditional DDGS (27.6% vs. 27%), and a range of 7.2. Overall, 10 LO-DDGS samples did not show too much variation in fat content due to prior oil extraction to produce LO-DDGS. Protein content of 10 LO-DDGS samples showed relatively less variation compared to traditional DDGS (range; 7.2 vs. 10.4). LO-DDGS samples have lower average crude fiber content (7% vs. 8.5%), lower average P content (0.75% vs. 0.89%), slightly lower Na content (0.18% vs. 0.2%) and lower average GE (4,496 kcal vs. 5,530 kcal) compared to traditional DDGS. TME values and amino acid digestibility have been determined using conventional and cecctomized precision-fed rooster assays. Average particle size is 705 microns, and has a range of 581 microns. The average total amino acid levels in the LO DDGS were higher than that stated for traditional DDGS (Lysine; 0.95% vs. 0.80%) (Threonine; 1.10% vs. 0.92%). Most ethanol facilities will eventually consider extracting oil from DDGS. However, currently it’s not known for sure whether the oil is being extracted or not due to technical issues such as not having the required technology or enough capacity. This is usually the cause for high variation that can be seen in DDGS samples.

Key Words: low-oil corn distillers dried grains with solubles, proximate composition, particle size, oil extraction, ethanol

P151 Evaluating the effect of feeding up to 30% distillers dried grains with solubles (DDGS) and Allzyme SSF® on egg production and egg quality of white layers through 60 weeks production Anthony D. Quant1, Anthony J. Pescatore, James L. Pierce, Tuoying Ao, Austin H. Cantor, Micheal J. Ford, W. D. King Alltech/University of Kentucky Nutrition Research Alliance, Lexington, KY

The inclusion of distillers dried grains with solubles (DDGS) in poultry diets has become more prevalent as a cost-cutting strategy in response to the high demand of corn for fuel ethanol production. Previous work in our laboratory have indicated that inclusion of up to 30% DDGS

Poult. Sci. 91(Suppl. 1)
in diets fed to laying hens resulted in limited detrimental effects on egg quality through the first half of a production cycle (30 weeks). An experiment was conducted to evaluate the effect of feeding layer diets including up to 30% DDGS with or without an enzyme supplement (Allzyme SSF®; Alltech, Nicholasville, KY) throughout an entire production cycle (60 weeks). This experiment utilized 288 Hy-Line W-36 hens that were randomly allotted to 5 dietary treatments (12 hens per replicate). Dietary treatments included 1) a positive control (corn-soybean meal), 2) 15% DDGS, 3) 15% DDGS + 150 g/ton Allzyme SSF®, 4) 30% DDGS, and 5) 30% DDGS + 150 g/ton Allzyme SSF®. In comparison to the positive control diet, diets containing DDGS were calculated to contain reduced levels of ME (2877 vs. 2794 Kcal/kg), Ca (4.22 vs. 4.10%), and available P (0.29% vs. 0.17% for the 15% DDGS diet, and 0.23% for the 30% DDGS diet). Six eggs from each replicate were randomly selected every 4 weeks for determination of egg quality. Overall during the 60 week production cycle, diets containing 30% DDGS and Allzyme SSF® resulted in greater Haugh unit values than the other treatments (P<0.01). Yolk color was affected by DDGS inclusion, regardless of enzyme inclusion, as L* (lightness) values decreased, and a* (redness) and b* (yellowness) values increased as dietary DDGS inclusion increased (P<0.01 for all). Other egg quality parameters were unaffected by dietary treatment (shell breaking strength; whole egg, shell, yolk, and albumin weights). There was no effect of dietary treatment on hen body weight, feed conversion, and hen day production within 60 weeks of production. This study suggests that DDGS can be included up to 30% in layer diets without any detrimental effects on hen performance or egg quality.

**Key Words:** DDGS, egg quality, enzyme, layers


Due to increased interest in production of canola as a winter crop in the southern U.S. to provide oil for biodiesel production more canola meal (CM) may be available for use in poultry feeds. The CM has typically been fed at low levels and few studies have utilized CM in diets based on digestible amino acids. Due to the high fiber content diets with CM usually are lower in energy or need supplemental fat. In this study diets were formulated to meet digestible amino acids suggested by Rostagno et al. (2005) with no protein minimum. One diet (control) within each age period contained no CM while the other completely replaced soybean meal (49.7, 45.8, and 41.9% CM in start, grow, and finish respectively). Diets were blended to provide 0, 10, 20, 30, 40%, total CM or full replacement for a total of six diets, each of which was fed to four pens of 25 male chicks for a 42 d feeding period. Diets were maintained isocaloric with the 0 diet containing 1% poultry oil (PO) increasing as the level of CM increased requiring 7.0, 6.6, and 6.2% PO in start, grow, and finish diets respectively. As a result pellet quality decreased with increasing CM level. At both 35 and 42 d birds fed diets with up to 40% CM did not differ significantly in BW from those fed the 0% CM diets. However birds fed diets with complete replacement of soybean meal by CM had significantly lower BW than those fed the 0% CM diets. The feed conversion worsened with each increment of CM, due in part to the poor pellet quality of these diets. Breast yield tended to follow a linear reduction as CM increased. These data suggest that canola meal can be used as a partial replacement for soybean meal in broiler diets when formulated on a digestible amino acid basis; more work is needed to define proper usage levels in diets without excessive levels of supplemental fats.

**Key Words:** broilers, canola meal, digestible amino acids

**P153 Validation of dicalcium phosphate anhydrous (DCPA) as source of P and Ca for broilers** Jose CharalSC, Thomas Bidner, Lee Southern School of Animal Sciences, Louisiana State University Agricultural Center, Baton Rouge, LA

This study was conducted to validate the relative bioavailability (RBV) of P and Ca in DCPA compared with monocalcium phosphate (MCP). Ross 708 female and male broilers were allotted to 2 treatments with 8 replicates with 25 broilers per pen. The broilers were housed in an environmentally controlled building and fed in 3-phase feeding program from 0 to 10 d for phase 1, 11 to 24 d for phase 2, and 25 to 42 d for phase 3. Analyzed P and Ca were obtained for DCPA (22.7 and 29.1%) and MCP (20.7 and 17.6%). Diets were formulated on a non-phytate P (nPP) basis and using 100% RBV of P and Ca in DCPA found in previous research. The diets were formulated to contain 0.50% nPP and 1.05% Ca, 0.45% nPP and 0.90% Ca, and 0.42% nPP, and 0.85% Ca for phase 1, 2, and 3, respectively. Phase 1 ADG, ADFI, G:F, tibia ash, and bone breaking strength (BBS) were not affected by P source (P > 0.10). Female broilers fed DCPA had lower BBS than males (P < 0.10). In phase 2, broilers fed DCPA had greater ADG, G:F, and tibia ash content (P < 0.10) compared with broilers fed MCP. Females had lower ADG, and ADFI (P < 0.10) compared to male broilers. For phase 1 and 2 combined, broilers fed DCPA had greater ADG and G:F than broilers fed MCP (P < 0.10). In phase 3, P source had no effect on growth, BBS, and tibia ash (P > 0.10); but female broilers had lower ADG, ADFI, G:F, and BBS (P < 0.10). Female broilers fed MCP and males fed DCPA had greater ash content than males fed MCP and females fed DCPA (P < 0.10). In overall results, P source had no effect on growth, BBS, and tibia ash (P > 0.10), but female broilers had lower ADG than male broilers (P < 0.10) independent of P source. These results indicate that broilers fed DCPA had similar growth, feed intake, feed efficiency, BBS, and tibia ash as broilers fed MCP under commercial conditions and can be used to replace MCP in a 1:1 basis for P and Ca content.

**Key Words:** relative bioavailability, dicalcium phosphate anhydrous, bone breaking strength, ash

**P154 Use of Yeast in Broiler Diets** Lucio Araujo1, Lara Valadares1, Ricardo Barbalho2, Cristiane Araujo1, Berenice McClellan, H. Cecilia A. R. Araujo1, 2University of Sao Paulo - Nutrition and Animal Science Department, Pirassununga, SP, Brazil, 3ICC Brazil, Pirassununga, SP, Brazil

The aim of this experiment was to determine different nutritional plans through the use of different types of yeast in the diet of broilers in the period from 1 to 42 days. There were used autolyzed, hydrolyzed and whole yeast and its influence on performance parameters (weight gain, feed intake and feed conversion) and carcass characteristics (carcass yield, breast yield and legs yield). 1,080 chicks, males, one day old, Cobb, were allocated in a completely randomized design in a factorial arrangement 3 x 3: 3 forms of yeast supplementation for the period 1 to 14 days (without yeast, yeast autolyzed yeast and hydrolyzed) and three forms of the supplementation period of 15 to 42 days (without supplementation, autolyzed yeast and whole yeast) plus a positive control treatment, with the addition of an antibiotic growth promoter (APC), with 10 treatments, 9 replicates of 12 birds each. The diets used were formulated based on corn and soybean meal, and zinc bacitracin was used as APC in the inclusion of 0.5 kg / ton in all diets. In the period from 1 to 14 days, It was used the inclusion level of 10kg/ton autolyzed yeast and hydrolyzed. In the 15 to 42 days period it was used the inclusion of 5 kg/ton of autolyzed and whole yeast. Statistical analysis of data were performed using analysis of variance with the aid of the GLM procedure of SAS (2002) and in case of statistical significance, means were compared by Tukey test at 5% probability. In the period from 1 to 14 days hydrolyzed yeast showed better viability of using the diet. For the use of a continuous program, the
combined use of hydrolyzed yeast in the period from 1 to 14 days and
autolyzed yeast within 15 to 42 days, presents itself as best response by
the birds.

Key Words: Carcass characteristics, Growth promoter, Performance, Prebiotic

P155 Effect of a wheat-based diet supplemented with a formulation of benzoic acid and essential oils compounds on broiler performance
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This trial was conducted at the Avian Research Centre of the Scottish Agricultural College (UK) to investigate the ability of CRINA® Poultry Plus (CPP), a formulation of benzoic acid and essential oils compounds (including thymol, eugenol, pipeline), to improve broiler performance. 688 Ross 308 broilers from one breeder flock were distributed into two treatment groups with 8 pens per treatment (4 containing male and 4 containing female) in a randomized block design. The period of the trial was 40 days in order to achieve body weights representative of commercial field results and the stocking density was 33 kg/m2 to mimic challenging commercial conditions. Treatment one [T1] contained no growth promoter additives (negative control) and treatment two [T2] contained 300 mg/kg CPP. A 4-phase feeding schedule was applied and the same wheat based diet was used for both treatments and formulated: at 12.8 MJ/kg and 23 % crude protein for the starter period (1-11 days), 13.1 MJ/kg and 20.0 % crude protein for the grower phase (11-25 d), 13.5 MJ/Kg and 18 % crude protein for the finisher phase (25-35 d) and the withdrawal phase (35-40 d). Both feed and water were available ad libitum throughout the study. In all experimental periods, the body weight (BW) of broilers fed T2 was significantly higher than T1 with a final difference of 131 g in favor of the CPP group of which the average weight was 2,614 g at 40 d. An improvement in the feed conversion ratio (FCR) was also observed in all growth phases. FCR in T2 at 40 days was 1.56, which was significantly higher (+7 points) than the control (T1). In conclusion, CPP is a tool to consider for improving the profitability of modern broiler operations.

Key Words: essential oils, organic acid, broiler, performance

P156 Mycotoxin binders as feed additives in the European Union
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Since 2010, a new group of feed additives has been created in the European Union (EU): substances for the reduction of the contamination of feed by mycotoxins. These products are classified as technological additives and can only be added to feed that complies with the maximum levels of mycotoxins set in EU legislation. The European Food Safety Authority has developed guidance for the assessment of the safety and efficacy of these products. The additive needs to be fully identified and characterized in terms of composition, purity and stability. The target mycotoxin(s) against which the additive is effective should be stated, and evidence should be provided that use of the additive will not interfere with the analytical determination of mycotoxins in feed. The safety of the additive for the target species, consumers of food products derived from animals fed the additive, for people handling it and for the environment follow the general rules for technological feed additives. The main difference with respect to other technological additives is in the assessment of efficacy. Since these additives are only effective once ingested by the animal (no direct effect in feed), in vivo studies should be provided showing that the use of the additive reduces absorption, increases excretion or reduces the concentration of mycotoxins in plasma, tissues or food products. In general, mycotoxin/metabolites excretion in feces/urine, concentration in blood/plasma/serum, tissues or products (milk or eggs) or other relevant biomarkers should be taken as endpoints. The end-points should be selected according to the mycotoxin and target species, and taking into account their relevance (close correlation to exposure). The studies should be performed with the target species for which the additive is intended. A minimum of three studies showing significant effects on the relevant end-points should be provided to demonstrate efficacy for all animals (except fish). Specific studies are required for fish.

Key Words: mycotoxin binders, feed additives, safety, efficacy, European Union

P157 The effects of different levels of Aloe vera gel powder on antibody titer against Newcastle disease virus and performance in Broilers
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Prohibition of antibiotic growth promoter use in Europe in 2006 resulted in recent attempts for using additives with herbal origins. A well-known herb for this purpose is Aloe vera. The present study attempts to examine the effects of different levels of Aloe vera gel powder (AVGP) on antibody titer against Newcastle disease virus (NDV) and performance in 240 1d-old male chickens from Ross-308 distributed on a completely randomized design to 4 groups each with 4 replicates. The experimental groups included a control group (basal diet), and 3 groups with their basal diets mixed with 0.5, 0.75, and 1% Aloe vera gel powder (AVGP). The experiment period was 49 d. On d 20, two broilers were randomly selected from each replicate and their blood samples were taken from their right wing veins. Antibody titer against NDV was determined using hemagglutination inhibition. The results showed that increased AVGP can improve antibody titer against NDV. Groups receiving AVGP showed significant difference from each other; however no significant difference was observed between control and 0.5% AVGP groups. Results also indicated significant increase in feed intake of AVGP groups during starter (0-21 d), grower (22-35 d) and finisher (36-49 d) periods with the highest feed intake observed in 1% AVGP group. In addition, no significant difference was found between the groups treated with AVGP regarding feed intake. The largest body weight gains during starter and grower periods were those of 0.75% and 1% AVGP groups showing significant difference from control and 0.5% AVGP groups. Results also indicated significant increase in feed intake of AVGP groups during starter (0-21 d), grower (22-35 d) and finisher (36-49 d) periods with the highest feed intake observed in 1% AVGP group. In addition, no significant difference was found between the groups treated with AVGP regarding feed intake. The largest body weight gains during starter and grower periods were those of 0.75% and 1% AVGP groups showing significant difference from control and 0.5% AVGP groups. In finisher period, the largest body weight gain was observed in 1% AVGP group (P<0.05). The lowest feed conversion ratio during starter and grower periods was found in 1% AVGP group (P<0.05) while during finisher period no significant difference was observed between 0.75% and 1% AVGP, although a significant decrease was found compared to control and 0.5% AVGP groups. The findings suggest that among the three groups treated with AVGP, 0.75% and 1% AVGP groups had improved performance and increased antibody titer against NDV.

Key Words: Aloe vera, Newcastle, Performance, Broilers

P158 Effect of a formulation of benzoic acid and essential oil compounds on performance and intestinal micro-flora population of broilers
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The aim of this experiment was to evaluate the effects of a formulation of essential oil compounds (thymol, eugenol, pipeline) and benzoic acid (CRINA® Poultry Plus, CPP) on performance and intestinal micro-flora of broilers. One day old broiler chicks were randomly allocated to 3 different treatments, replicated with 6 pens of 32 males and 6
pens of 36 females, each. The same wheat-based diet in pelleted form was used for all treatments and formulated to contain 12.3 MJ/kg and 20.7% crude protein for the starter period (1-21 days) and 12.7 MJ/kg and 20.0% crude protein for the grower period (22-42 days). CPP was added to the feed at 0 mg/kg from 1 to 42 days for T1; 300 mg/kg from 1 to 42 days for T2; 450 mg/kg up to 22 days, 150 mg/kg up to 42 days for T3. Over the entire growth period, body weight was slightly higher with T2 and T3 compared to T1. The results at 42 days of age are presented in Table 1. Feed conversion was improved for T2 and T3 and significantly decreased (p <0.05) with the step down program T3 (-0.02 compared to T1). There was a reduction of the counts of potentially pathogenic bacteria (Clostridia, Coliforms, Streptococci) without any negative effect on Lactobacilli, in the ceca of broilers fed with T2 and T3. In conclusion, CPP improved feed conversion and tended to positively modulate the intestinal micro-flora population of highly productive broilers.

**Key Words:** Broilers, Essential oils, Benzoic Acid, Performance, Intestinal micro-flora

**P159 Effect of a formulation of benzoic acid with essential oil compounds on performance of broiler chicks**

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This study aimed at determining the effects of a mixture of essential oil compounds (thymol, eugenol, pipericine) with benzoic acid (CRINA® Poultry Plus; CPP) on the performance of broiler chickens. Three-hundred 1-day-old male chicks (Cobb 500) were allotted randomly to 3 dietary treatments, each replicated with 10 groups of 10 birds per pen. The pens were distributed along 2 drinking lines in a commercial broiler house, containing 8500 loose-housed birds of the same age. By that housing, the experimental chicks were exposed to the pressure of the loose-housed broilers with respect to health, hygiene, husbandry and stocking density. The experimental broilers were subjected to one of 3 treatments: T1 = basal diet not supplemented with CPP (control), T2 = basal diet with the addition of 150 mg/kg CPP or T3 = basal diet with the addition of 300 mg/kg CPP. A 4-phase feeding schedule was applied: Starter (days 0-10), grower (days 11-20), finisher (days 21-34) and withdrawal (days 35-42). All feeds were pelleted; both feed and water were available ad libitum throughout the 42 days of the study. Weight of chicks and feed consumption were determined on days 10, 28, 35 and 42. In all experimental periods the body weights (BW) of broilers supplemented with CPP (T2 and T3) were numerically superior to the control (T1), but the difference was only statistically significant in the starter period between T1 and T3. Feed intake was generally similar between the various treatments, but during the finishing period (days 35-42), T3 was significantly lower than T1 (P≤0.05). Over the entire trial, the feed conversion ratio (FCR) of T3 (1.62) was significantly lower than the FCR of T1 (1.69) (P≤0.05). The FCR of T2 (1.65) was intermediate. In conclusion, the supplementation of feeds with CPP tended to improve performance (BW, FCR) of broilers in a dose response fashion.

**Key Words:** Broilers, Essential oils, Benzoic Acid, Performance, FCR

**P160 Evaluation of the nutrient matrix values of a novel bacterial 6-phytase in broiler chickens**

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Having correct nutrient matrix values (NMV) allow poultry feed formulator to adjust dietary nutrient density (Ca, P, AA and ME) in phytase containing diets, thus reducing the cost of feed. A 21-d experiment was performed to evaluate the NMV of the novel bacterial 6-phytase in a heat-stable form (RONOZYME HiPhos GT) in broiler chickens. Four diets based on maize and soybean meal were formulated: diet I was adequate in all nutrients and contained 5.9 g total P, 4.8 g available P (avP) and 7.2 g Ca per kg, diets II to IV were formulated by using the phytase NMV established in previous efficacy trials and calculated for an inclusion at 500, 1000 and 2000 U/kg, respectively. Diets II to IV targeted 3.8, 3.3 and 2.9 g avP, respectively, and were fed with or without added phytase. Each treatment was replicated with 12 groups of birds, each containing 8 birds. Body weight and feed intake were measured on days 8, 15, and 22 and feed conversion ratio (FCR) was calculated. Excreta were collected from day 14 to day 17 through total collection method and P and Ca utilization were determined. Birds were euthanized on day 23 of age and the right tibiae were collected for tibia ash analysis. Reducing the Ca, avP, other nutrients and energy concentrations according to the NMV of the phytase in diets II to IV significantly decreased growth, P and Ca utilization and bone mineralization compared to diet I. Using the NMV for phytase at the tested doses resulted in similar growth performance and bone mineralization compared with broilers fed diet I. P utilization in phytase-supplemented treatments was significantly higher than in diet I when the NMV of phytase were used, irrespective of the inclusion level. The results confirmed that the proposed NMV can be used in formulating diets that incorporate the novel bacterial 6-phytase.

**Key Words:** 6-phytase, phosphorus, nutrient matrix, bone mineralization

**P161 Evaluation of a combination of essential oil compounds and organic acids on broiler and laying hen performance**

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This paper contained two trials conducted with the objective of evaluating the effects of a blend of essential oil compounds (thymol, eugenol, pipericine) and benzoic acid (CRINA® Poultry Plus, CPP) on broiler chicken and laying hen performance. In the broiler trial (d8-29 of age), 216 day-old Ross PM3 chicks were used in a 2x2 factorial arrangement with two iso-protein and iso-energetic diets (Corn-SBM or Corn-wheat-SBM) and two supplementation levels of CPP (0 and 300 mg/kg feed). Each treatment was replicated in nine pens of six birds each. Performance, apparent ileal protein digestibility (AID) and intestinal morphology were measured. The inclusion of CPP in both diets was tending to improve body weight gain compared to the respective control. BWG was improved by 1.8 and 3.1% in corn-SBM and corn-wheat-SBM diet respectively. CPP supplementation significantly improved egg weight, egg shell breaking force and eggshell thickness (P <0.05). These results showed that supplementing layer hen diet with CPP at the tested levels improved laying hen performance and egg shell quality. CPP supplementation from 150 to 600 ppm tended to increase the % of lay in a dose dependant way from 90.4% to 93.3% respectively compared to the control. In conclusion, CPP is an alternative solution to reduce egg breakage problems and to optimize profitability in egg production.

**Key Words:** essential oils, protein digestibility, intestinal morphology, broiler and laying hen performance, egg shell quality
P162 Evaluation of the toxicity of aflatoxins in broilers and the efficiency of two antimycotoxin agents to decrease their toxic effects
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The objective of this work was to evaluate the efficacy of two antimycotoxin agents, with an aluminosilicate base, to decrease the effects produced in broilers, after consumption of feed contaminated with 680 µg/kg (ppb) of aflatoxin B1 (AFB1). 270 day old broilers (commercial breed), were divided randomly in six groups of 15 birds each with 3 repetitions, and were fed ad libitum for 28 days. Diets were identified as: 1) Control diet, with no adsorbent and no AFB1 (AFs), 2) innocuity diet, containing Mexican adsorbent at 5kg/t, 3) diet with AFB1, 680 ppb (contaminated), 4) challenge diet, containing Mexican adsorbent at 5kg/t and AFB1, 680 ppb, 5) innocuity diet (South American adsorbent: 5kg/t) and 6) challenge diet with 5kg/t of South American adsorbent and 680 ppb of AFB1. The aflatoxins were prepared at the laboratory of NUTEK, with strain NRRL 2999 of Aspergillus flavus (Fierro et al., 1999, 1999b); feeds used were commercial and the absence of contamination with other mycotoxins was demonstrated: zearalenone, fumonisin B1, aflatoxin, and toxin T-2. Birds were weight at one day of age and individual weights were registered each week until the end of the experiment. Feed conversion was calculated weekly. An ocular inspection of the environmental conditions and health of the animals was performed everyday. Animals were bled and sacrificed at day 28 of the experiment; the liver and the spleen were removed and were weight individually. Samples were obtained for histopathology assays. Biochemical parameters and hepatic enzymes were measured on the obtained serum. We expected to confirm the effects of AFB1 with statistically significant differences on weight gain, feed conversion, liver relative weight, spleen and liver fat; also we expected numeric differences in the concentration of the enzymes gamma-glutamyl transferase (GGT), aspartate aminotransferase (AST) and alanine aminotransferase (ALT), between the control group and the intoxication group (contaminated with aflatoxins), but there were only numeric differences reported in all evaluated parameters. Thus it is concluded that AFB1 at the level studied here and in the laboratory conditions in which the experiment was performed did not affect the parameters considered. The adsorbents could not be evaluated for the same reason.

Key Words: Aflatoxins, Mycotoxins, Aluminosilicates, Binder

P163 Effect of organic preservatives on the stability of feed additives
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Two strategies are used in the feed industry to safeguard the hygienic quality of feed: heat treatments and/or the addition of organic preservatives. The latter may also affect animal performance by acidification of the feed, but decrease the stability of sensitive feed additives. This hypothesis was tested in feed treated with a blend of organic acids (50% propionic, 50% formic acid) or a disinfectant (formalin) dosed between 2 and 3 kg/T.

In the first trial, a poultry mash feed was supplemented with commercial forms (ROVIMIX®) of vitamins A, E, B2, Stay-C and Hy-D and a commercial form (CAROPHYLL®) of canthaxanthin and treated with the acids. After 2 weeks storage at room temperature, retained additive contents were superior to 95%, hence these vitamins and the carotenoids were unaffected by the treatment. Results were similar in feed treated with the disinfectant. Additionally, stabilities of a phytase enzyme (RONOZYM® HiPhos (GT)) and a protease (RONOZYM® ProAct (CT)) were also measured. Both enzymes product forms were practically unaffected by the acid treatment, since activity retentions reached over 90%. Activity retentions obtained in feed treated with the disinfectant were over 84%.

In a second trial the influence of acids and a disinfectant on the stability of two encapsulated and non-encapsulated additives in pelleted poultry feed was compared. With red pigmenting carotenoids, 100% of product concentration was retained after 2 weeks of storage with the encapsulated canthaxanthin (CAROPHYLL®), while a non-encapsulated capsanthin retained only 50%. Both preservative treatments did not additionally reduce pigment contents. With phytase sources, a non-encapsulated source retained 73% of target activity in the acid treated feed, and 20% with the disinfectant. The encapsulated phytase (RONOZYM® HiPhos (GT)) retained 92% with the acid treated feed and 86% with the other feed.

In summary, based on their technological and chemical stability, the behavior of feed additives varies considerably to the different hygienic treatments applied to feeds. Suitable product forms should be selected to retain desired effects.

Key Words: preservative, feed additive, stability, phytase, vitamin

P164 Evaluation of mycotoxin-deactivator product on the egg production, Vitamin A concentration and total cholesterol in laying hens
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Mycotoxins effect a wide variety of species in many different and detrimental ways. When mycotoxins are present research has previously shown that a mycotoxin-deactivator will decrease these negative effects which ultimately have an impact on performance. This feeding trial was conducted to evaluate the effect of deoxynivalenol (DON) and zearalenone (ZON) contaminated diets on egg production, egg weight and egg mass and determine the effects of mycotoxin-deactivator (Mycofix Select) supplementation. Concentration of vitamin A in the liver and total cholesterol in the serum of layers were also measured. A total of 288 Hy-Line Brown layers were divided into 24 groups and fed 6 different diets for 11 weeks. T1= control, T2= commercial diet + MSL 0.25%; T3= DON 5.0 ppm; T4= DON 5.0 ppm + MSL 0.25%; T5= DON 5.0 ppm + ZON 1.0 ppm; T6= DON 5.0 ppm + ZON 1.0 ppm + MSL 0.25%. A significant decrease of egg production and egg mass of birds fed mycotoxins for 8 weeks was verified when compared to the control diet and contaminated diets with mycotoxin-deactivator. Concentration of vitamin A in the serum was decreased in mycotoxins contaminated groups. The total serum cholesterol of the layers had a decreased tendency in mycotoxin-deactivator supplemented groups in comparison to non-supplemented groups. Results suggest that the negative effects of mycotoxins in poultry can be attenuated when a mycotoxin counteracting product is incorporated.

Key Words: laying hens, deoxynivalenol, zearalenone, mycotoxin-deactivator

P165 Crina Poultry Plus® as an alternative feed additive to antibiotic growth promoters in broiler diets
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The objective of this study was to evaluate the addition of Crina Poultry Plus®, a blend of plant extracts and benzoic acid, in diets based on corn and soybean meal for broilers and its action as an alternative to antibiotic growth promoters (AGP). For that reason, a 6-week floor pen study was conducted at Poultry Laboratory at Universidade Federal de Santa Maria – Brazil. It were used 1550 one-day old Cobb 500 male broiler chicks. Birds were randomly assigned in five treatments with ten replicate pens of 31 birds each. The diets were: without growth
promoters (WGP); with 0.1kg/ton of AGP(Avimycin); with 0.3kg/ton of CPP from 1-42 days (CPP), a diet with 0.1kg/ton AGP from 1-21 days and 0.3kg/ton of CPP from 22-42d (AGP/CPP) and a diet with 0.1kg/ton AGP and 0.3kg/ton of CPP from 1-42d (AGP & CPP). All the diets were mashed and had the same nutrient levels. The data were submitted to ANOVA and Tukey’s test. Significant differences were observed in body weight gain (BWG), daily weight gain (DWG), feed conversion rate (FCR) and productive efficiency index (PEI). The CPP diet increased (P=0.0001) BWG (2518.7g) in 1-42d period compared to birds fed on WGP diet (2383.9g) and AGP diet (2439.6g). The FCR (P=0.0001) and PEI (P=0.0030) are better in birds fed on CPP (1.83 and 321.6), AGP/PP (1.86 and 307.1), AGP & CPP (1.88 and 306.8) than birds fed on WGP (1.94 and 286.4) in 1-42d period. However It was not observed significant differences on these parameters compared to AGP (1.86 and 306.5). Birds fed on CPP, AGP/PP and AGP & CPP presented higher DWG (59.9, 58.6 and 58.5g, respectively) than birds fed on WGP (56.7g) and AGP (58.1g) diets. The results suggest that Crina Poultry Plus® can be used as an alternative product to antibiotic growth promoters.

**Key Words:** antibiotic growth promoters, broiler, organic acid, animal performance, plant extracts

### P166 Effects of mycotoxin-deactivation product supplementation into mycotoxins contaminated diets in broiler breeders

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Mycotoxins are toxic substances produced by molds that often grow on the primary sources of nutrition for poultry. The diverse range mycotoxins present in poultry feed have a detrimental effect on different parts of the bird, leaving a necessity for a mycotoxin-deactivator to counter-act these effects. Effects of dietary contamination with various levels of ochratoxin A (OTA) and zearalenone (ZON) and the potential preventive effect of mycotoxin-deactivation product (Mycofix® Plus) were investigated on 100 Ross broiler breeders. The birds were divided into 20 groups and fed 5 different diets for 8 weeks. Group 1: control (mycotoxin free); group 2: OTA (2 mg/kg) and ZON (5.0 mg/kg) without mycotoxin deactivator; group 3: OTA (2 mg/kg) and ZON (5.0 mg/kg) with addition of a mycotoxin deactivator 0.25 % of diet; group 4: ZON 10 mg/kg without mycotoxin deactivator; group 5: ZON 10 mg/kg with mycotoxin deactivator 0.25 % of the diet. Egg productivity was recorded daily, blood and tissues samples were collected after 8 weeks. The egg production, egg weight and egg mass in mycotoxin groups were significantly reduced if compared with the control group and alleviated by addition of the mycotoxin deactivator. The eggshell thickness of groups fed diets containing mycotoxins was significantly decreased compared to that of the control group, which was also alleviated by the mycotoxin deactivator. Combination of OTA and ZON was responsible for significant increase of liver weight while the presence of a mycotoxin deactivator in such contaminated diet could partially counteract this effect.

**Key Words:** broiler breeders, ochratoxin A, zearalenone, mycotoxin-deactivator

### P167 Efficacy of curcumin, supplied by turmeric (Curcuma longa) powder, in ameliorating the toxic effects of aflatoxin in young turkeys.

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An experiment was conducted to evaluate the efficacy of curcumin, supplied by turmeric (Curcuma longa) powder, in ameliorating the adverse effects of aflatoxin in female turkey poults. Two hundred day-old poults were purchased from a commercial hatchery and assigned to one of eight treatments from hatch to day 21. Each treatment consisted of five replicates with five poults per replicate. The dietary treatments included: 1) basal diet (BD) that contained no curcumin or AF, and was formulated to meet or exceed NRC requirements; 2) BD plus 296 mg/kg curcumin; 3) BD plus 200 µg/kg aflatoxin B₁ (AFB₁); 4) BD plus 200 µg/kg AFB₁ and 74 ppm curcumin; 5) BD plus 200 µg/kg AFB₁ and 148 ppm curcumin; 6) BD plus 200 µg/kg AFB₁ and 222 mg/kg curcumin; 7) BD plus 200 µg/kg AFB₁ and 296 mg/kg curcumin; and 8) BD supplemented with 20 µg/kg of total aflatoxins. Addition of 296 mg/kg curcumin to the BD did not affect (P > 0.05) feed intake (FI), body weight gain (BWG), relative liver weight, or serum concentrations of glucose, total protein, calcium or uric acid. Addition of 200 µg/kg AFB₁ to the BD caused reductions (P < 0.05) in FI and BWG, decreases (P < 0.05) in relative liver weight and serum concentrations of glucose, total protein and calcium, but an increase (P < 0.05) in serum uric acid concentration. The addition of 20 µg/kg total aflatoxins to the BD did not negatively affect (P > 0.05) growth performance, but did decrease (P < 0.05) relative liver weight and serum concentrations of glucose and calcium. Inclusion of up to 296 mg/kg curcumin to a diet containing 200 µg/kg AFB₁, was not effective in ameliorating (P > 0.05) the effects of AFB₁ on FI, BWG, and relative liver weight, but ≥ 222 mg/kg curcumin did prevent an increase in serum uric acid. These results are in contrast to a previous study in which 74 mg/kg curcumin ameliorated the negative effects of 1 mg/kg AFB₁ on growth performance and relative liver weight of broilers.

**Key Words:** aflatoxin, toxicity, poults, curcumin, turmeric powder

### P168 Supplementing coccidiosis vaccinated broilers with Hy-D® to overcome performance losses

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The goal of this experiment was to determine if early growth depression, caused by coccidiosis vaccination, can be reduced by supplementing Hy-D® (25-hydroxyvitamin D3, (25-OH D₃)) in the diet of broiler chickens. A total of 3,312 straight run broilers were evenly divided among forty-eight floor-pens with recycled pine litter. Birds were stocked at a density of 0.067m² per bird and reared to 42d. All birds received commercially formulated diets containing Hy-D for 0d, 14d, or 42d. One-half of the birds were vaccinated with Coccibac-C (CV), while the other half received salinomycin (SAL) in their diets. All diets contained bacitracin methylene disalicylate (BMD) in the starter and grower diets. Birds were randomly assigned to one of six treatment groups; TRT 1) Hy-D 0d/CV; TRT 2) Hy-D 0d/SAL; TRT 3) Hy-D 42d/CV; TRT 4) Hy-D 42d/SAL; TRT 5) Hy-D 14d/CV; TRT 6) Hy-D 14d/SAL. Each pen was collectively weighed at d18, d30, d37, and d42. Blood samples were collected at d1, d14, d24, d33, and d42, from 2 randomly selected broilers/pen to determine the serum 25-OH D₃ levels. A yield study was conducted on 192 birds (8 birds/ pen from TRT 2, 4, & 6). On d30, TRT 4 had a significantly higher average body weight than TRT 1, and a significantly lower feed conversion than TRT 5. By d37, TRT 3 &4 had a significantly higher average body weight than TRT 5. On d42, TRT 6 had a significantly higher average body weight than TRT 5, while TRT 2&4 had a significantly lower feed conversion than TRT 5. 25-OH D₃ serum levels were significantly higher in TRT 3&4 as compared to all other treatment groups on d24 and d42. TRT 4 had a significantly higher amount of breast meat yield than TRT 6 at the completion of the study. The results suggest that the inclusion of Hy-D® to the feed can help to overcome the decrease in early performance losses due to coccidiosis vaccination, as well as increase overall breast yields.

**Key Words:** 25-hydroxyvitamin D₃, performance, coccidiosis, yield, broiler
P169 Effects of supplemen¬ted diets with CALSPORIN®, Q-MOST™, BMD®/Stafac® or QMOS plus BMD®/Stafac® on live performance of broiler chicks. Troy Lohrmann1, Michael Sims2, Virginia Diversified Research Corp., Harrisonburg, VA

A 42-d pen trial was conducted with 1,800 straight-run Cobb 500 broiler chicks using 6 dietary treatments: 1) negative control (NC); 2) CALSPORIN® (CSP; 300,000 cfu/g feed); 3) 1x Q-MOST™; 4) 2x Q-MOST™; 5) BMD® 50 g/t 0-21 d, 25 g/t 21-35 d, and Stafac® 35-42 d; and 6) 2x Q-MOST™ plus BMD®/Stafac®. The Q-MOST™ is a proprietary Saccharomyces cerevisiae cell wall derived product. There were 10 replicate pens of 30 chicks each per treatment (60 pens total). Each pen measured 1.22 x 1.52 m which provided a stocking density of 0.062 m² (0.67 ft²) per bird based on pen dimensions. Chicks were placed on 7.6 cm of clean litter initially, and at 7 d of age 0.91 kg of recycled litter was added to each pen. Salinomycin 60 g/t was added to all starter and grower feeds (0-35 d). The 42-d BW were respectively 1.932d, 2.057c, 2.059c, 2.098d, 2.375d, and 2.439a kg (p<0.001; 1-way ANOVA, LSD). The 0-42 d mortality-adjusted FCR were respectively 1.67, 0.67, 3.00, 2.00, 1.67, and 2.33 (p=0.396 raw data; p=0.420 arcsine transformed data). Coralic conversions using mash feeds were respectively 6.776, 6.420, 6.317b, 6.267, 5.915, and 5.815 kcal ME/kg BW (p<0.001). Broilers fed diets supplemented with CALSPORIN® or Q-MOST™ alone had significantly improved BW, mortality-adjusted FCR, and FCR adjusted using a common BW of NC (7:1 BW:FCR) compared to broilers fed NC alone. The 0-42 d mortality-adjusted FCR adjusted to BW of NC and using 7:1 BW:FCR were respectively 2.138a, 1.995b, 1.963b, 1.978b, 1.987d, and 1.879c (p<0.001). Broilers fed diets supplemented with CALSPORIN® or QMOS™ plus BMD®/Stafac® had further significantly improved BW and FCR adjusted to BW of NC and using 7:1 BW:FCR compared to broilers fed diets with CALSPORIN® or QMOS™ alone.

Key Words: antibiotic, Bacillus subtilis C-3102, broiler, CALSPORIN®, QMOS


A study was conducted to evaluate the response to Lysine (Lys) and Methionine (Met) in diets on performance of broilers from 35-49 d. The NRC (1994) recommendations for total Lys and TSAA during this period are 0.85% and 0.60% respectively or approximately 0.75% and 0.53% digestible, assuming 88% digestibility. Diets were formulated using a composite Ideal Ratio of amino acids to lysine derived from ten literature reports. Corn and soybean meal were used to formulate diets to provide 0.60 to 1.1% digestible Lys (dLys) in increments of 0.10%, with no minimum placed on level of Met or TSAA. All amino acids other than Met and TSAA were calculated to meet or exceed the expected ratio to Lys. Experimental diets were prepared by addition of variable amounts of DL methionine (0.10, 0.20, or 0.40%) or inert filler to each of the six lysine basal diets resulting in a total of 24 treatments. The digestible TSAA (dTSAA) content ranged from 0.36% to 0.94% while the dTSAA/dLys ratio ranged from 49 to 127, compared to the composite value of 72. Compared to NRC (1994) for birds 6-8 wk, diets with less than 0.90% dLys failed to meet all essential amino acid needs. Male chicks (Cobb 500) were grown on nutritionally complete diets and at 35 d five chicks were assigned to each of 144 compartments in finisher batteries. Each of the diets was fed to the six replicate pens. Body weights by pen were obtained at 35 and 49 d of age with feed consumption determined during the test period. Three birds per pen were processed to determine dressing percentage and parts yield. There were significant effects of dietary Lys levels on BW and FCR with minimum dLys for BW and FCR of 1.01 ± 0.06 and 1.05 ± 0.02%, respectively. Met levels had a significant effect only on FCR with the zero addition level being significantly greater than the supplemental levels. No significant interactions were observed between Lys and Met for FI, BW, and FCR. There were differences in the estimated ratios of Met or TSAA to Lys required for optimizing FI, BW, and FCR for chicks fed different Lys levels. Results of this study suggest that the response to variation in Lys level is independent of Met level, and vice versa in broiler finisher diets, and that quantitative needs for all essential amino acids must be met.

Key Words: broilers, lysine, methionine, ideal protein, finisher diets
localcalciferol (Hy-D®)/kg feed; or C) like B), but CRINA® Poultry Plus was added at 0.03% (300 mg/kg). At 21 days, performance of B and C birds was better than that of the control birds. Feed conversion (FCR) of B and C birds was significantly better than that of the control birds: 1.429 (A) vs. 1.382 (B) and 1.366 (C). At 42 days, body weight of the B and C birds, although not significant, was numerically higher than that of the control birds: 2.87 kg (A), 2.92 kg (B) and 2.90 kg (C). Similarly, daily weight gain was numerically improved by the treatments (68.21 g vs. 69.47 g and 69.08 g) and FCR (1-42d) showed a similar trend: 1.796 vs. 1.776 and 1.747. Results of this trial suggest that the inclusion of OVN® and CRINA® Poultry Plus in the feed positively affects broiler production throughout the production period.

**Key Words:** optimum vitamin nutrition, essential oils, 25-hydroxycholecalciferol, broiler, performance

P173 Combined dietary effects of threonine and purified fiber on growth performance and intestinal health of young chicks Emma Wils-Plotz*SC, Ryan Dilger University of Illinois, Urbana, IL

Profiling the ‘healthy gut’ becomes critical as the variety and inclusion rate of specialized ingredients increase in poultry diets. The objective of this study was to determine whether inclusion of purified fiber sources affects dietary threonine (Thr) requirements and intestinal structure of young chicks. Semi-purified diets contained 7% added silica sand (control), cellulose, or high-methoxy pectin. In Study 1, six replicate pens of 6 chicks received dietary treatments through d 14 post-hatch, and growth performance and nutrient digestibility were determined. In Study 2, the impact of purified fiber on dietary Thr requirements was determined using a Thr-deficient basal (3.2 g/kg diet) and 7 graded levels of supplemental Thr (0 to 7.2 g/kg of diet). Six replicate pens of 5 chicks were tested from d 8-21 post-hatch, and ileal tissue was collected at study conclusion for histological evaluation. In study 1, purified cellulose and pectin reduced (P < 0.05) weight gain by 8 and 32%, respectively. Purified cellulose reduced N digestibility by 31%, but affected neither DM digestibility nor AMEn content. Pectin caused a 22-24% reduction in DM and N digestibility, as well as AMEn. No differences in feed intake due to fiber inclusion were observed. In Study 2, a 1-slope, broken-line (i.e., piece-wise) regression model was used to estimate supplemental Thr requirements based on growth performance. For the control, cellulose, and pectin diets, supplemental Thr requirements were estimated at 3.64, 2.60, and 2.38 g Thr/kg of diet, respectively, and 778, 737, and 576 mg of Thr intake over the feeding period, respectively, based on body weight gain. For histological measures, villus height and goblet cell count (per villus) were affected (P < 0.02) by dietary Thr concentration, and purified fiber affected crypt depth (P < 0.02), serrosal thickness (P < 0.05), and goblet cell count and density (P < 0.01). These findings suggest both dietary Thr concentration and fiber source affect growth performance and intestinal health indices in young chicks, which may directly impact poultry feeding strategies.

**Key Words:** cellulose, histology, pectin, requirement, threonine

P174 Relative bioavailability value of zinc proteinate (Bioplex Zn®) compared with zinc methionine for chicks Tuoying Ao*, James Pierce, Marquisha Paul, Kristen Brennan, Anthony Pescatore, Austria Cotton, Mike Ford, Karl Dawson Alltech-University of Kentucky Nutrition Research Alliance, Lexington, KY

The objective of this study was to evaluate the relative bioavailability value of Bioplex Zn® (Zn proteinate) compared with zinc methionine for broiler chicks. A total of 336 1-day old male broiler chicks was housed in an environmentally controlled room for 3wk. Dietary treatments were: corn-soybean meal basal diet without zinc supplementation or the basal diet with three supplemental levels of Zn (5, 10 and 20 mg/kg) either from Bioplex Zn® or from zinc methionine. Eight replicate cages of six chicks were randomly assigned to each of seven diets. Body weight and feed consumption were recorded weekly. At the end of the trial, two birds from each cage were randomly selected and euthanized with argon gas to collect tibia samples for the analysis of zinc. Small intestine samples were also collected, flash frozen in liquid nitrogen and stored in -80°C later for the analysis of gene expression of metallothionein by using real time PCR. No significant effect of zinc source or level on overall growth performance of chicks was found. The relative gene expression level of metallothionein in both duodenum and jejunum tissues was significantly increased when chicks were fed diets with the highest supplemental level of zinc from both zinc sources. The tibia zinc content was increased linearly (P <0.01) as dietary supplemental level of zinc was increased. Multiple linear regression of tibia zinc content on dietary supplemental level of zinc from Bioplex Zn® or zinc methionine resulted in a following equation: \[ Y = 351 + 14.8X_1 + 11.5X_2 \] (r² = 0.94, P<0.01), in which Y represents zinc content in tibia ash, X1 represents dietary supplemental level of zinc as Bioplex Zn® and X2 represents dietary supplemental level of zinc as zinc methionine. The slope ratio from this equation indicated that the relative bioavailability value of Bioplex Zn® was 129% compared with zinc methionine.

**Key Words:** broiler chick, zinc proteinate, zinc methionine, bioavailability, metallothionein

P175 Early life trace mineral nutrition affects growth performance and mineral deposition in broilers through 21 d Ryan Samuel*, Tuoying Ao, Marquisha Paul, Mike Ford, Kristen Brennan, Malinda Spry, Anthony Pescatore, Austin Cantor, James Pierce Alltech-University of Kentucky Nutrition Research Alliance, Lexington, KY

Animals respond to nutrient restriction in general by increasing absorption rates and utilization efficiency. Nutrient availability in early life may interact directly with genes and their regulatory elements to alter patterns of growth and gene expression. To evaluate the long-term effects of post-hatch trace mineral (Zn, Cu, and Mn) nutrition in early life on growth performance and tissue mineral content through 21 d, 480 d-old chicks were randomly assigned to one of six treatment groups. Diets consisted of rations with Zn, Cu, and Mn provided at 100% (normal), 20% (low, L) of NRC (1994) recommendations from inorganic or Bioplex (Alltech, Inc.) sources for a total of six dietary treatments. All diets were based on corn-soy diet and formulated to provide the trace minerals except the trace minerals of interest according to the NRC (1994) recommendations. Body weight and feed intake were measured on d 1, 5, 15, & 21 post-hatch. On d 5 and at the end of the trial, liver and tibiae were collected and analyzed for mineral content. Weight gain (g/bird) and body weight on d 15 and 21 were negatively impacted by switching from N to L diets. Weight gain (d 5-15, d 0-21) of chicks fed only the L Bioplex diet was greater (P<0.01) than chicks which received only the N Bioplex diet, indicating a negative impact of excess trace minerals. Similarly, weight gain tended (P<0.10) to be greater (d 0-21) from chicks fed only the inorganic L diet compared to N diet. Feed intake (d 15-21) was lower (P<0.03) for birds switched from inorganic N to L diet. Overall feed:gain tended (P<0.07) to be improved by feeding L diets and was not different between the mineral sources. On d 21, liver and tibia Mn concentrations were greater in chicks fed only N Bioplex diets than chicks fed L diets. Liver Zn concentration was greater (P<0.03) in chicks fed Bioplex diets (331 vs. 311 ppm) compared to chicks fed inorganic diets. Gene expression patterns were altered and growth rate and feed efficiency of broiler chicks was improved by providing the trace minerals Zn, Cu, and Mn at 20% of current recommendations as Bioplex minerals.

**Key Words:** broilers, Bioplex, mineral, growth
P176 Effects of calcium and phosphorus levels during the grower phase for Heritage broilers: live performance and mineral retention  
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One experiment was conducted to evaluate the effects of calcium (Ca) and non phytate phosphorus (nPP) levels during the grower phase (18 to 35 d) on performance, bone traits and leg abnormalities of Heritage broilers. Common starter and finisher corn-soybean diets were fed from 1 to 17 and 36 to 49 of age, respectively. A basal grower diet was mixed with amounts of limestone and dicalcium phosphate to obtain 16 diets that contained combinations of 4 levels of Ca (0.46, 0.62, 0.78, 0.94%) and 4 levels of nPP (0.23, 0.30, 0.37, 0.44%). 1,920 male and female chicks were distributed in 64 pens with 15 chicks of each sex per pen. BW gain, FI, and FCR were assessed at the end of each dietary phase. At 31 d and 44d of age Ca and P retention were evaluated. Individual BW were obtained at 49 d and flock uniformity was calculated. Data were analyzed as a completely randomized design by response surface methodology. Male BW gain was affected (P<0.05) by the interaction of Ca and nPP levels during the grower phase, and also during the whole grow out (0 to 49 d). Maximum BW gain during grower phase was obtained at 0.92% Ca and 0.53% nPP levels. In females, BW gain was affected quadratically (P≤0.01) by Ca during the grower phase, and linearly (P≤0.05) in the whole grow out. FCR was affected quadratically (P<0.01) by Ca and linearly (P≤0.01) by nPP levels during the grower phase. Optimum FCR (1.532) was observed at 0.76% Ca and 0.42% nPP levels. No significant effects of dietary treatments (18 to 35d) were observed on flock uniformity at 49 days. At 31d Ca retention was affected quadratically (P≤0.05) by Ca and nPP; however, nPP retention was only affected quadratically by nPP (P≤0.01). At 44d Ca and nPP retention were affected quadratically (P≤0.05) by Ca and nPP levels in the grower diets. Minimum P retention was obtained using 0.71% Ca with 0.39% nPP. It was concluded that Ca and nPP in grower diets influenced live performance and mineral retention, even during the subsequent day phase.

Key Words: Calcium, Phosphorus, Broilers, Live performance, Mineral retention

P177 Effect of dietary lysine intake on the reproductive performance of Cobb 500 broiler breeder hens Leonel Mejía¹, Keyla Lopez, Christopher McDaniel, Holly Parker, Alex Corzo 'Mississippi State University, Mississippi State, MS

A study was conducted to examine the reproductive parameters of Cobb 500 broiler breeder hens fed different daily consumption levels of dig Lys (mg/hen/d). A total of 240 Cobb 500 broiler breeder pullets and 40 cockerels, 20 wk of age, were obtained from a commercial blackout rearing house and placed in individual cages. A common breeder diet (16% CP, 3.0% Ca, 0.65% dig Lys) was fed from 20 to 23 wk of age. Experimental diets were fed from 24 to 42 wks of age. Treatment 1 diet was a typical corn-soybean meal diet formulated to have a dig Lys intake of 1,000 mg/hen/d (CS1,000). Treatments 2, 3, and 4 had the inclusion of DDGS with dig Lys intake levels of 1,000 (DDG1,000), 800 (DDG800), and 600 (DDG600) mg/hen/d, respectively. The study was a completely randomized design, and each treatment was replicated 6 times. Each replicate consisted of a group of 10 hens. Hens were artificially inseminated on weeks 25, 30, 35, and 41 with 50 µL of undiluted semen obtained from the Cobb 500 roosters. Hen-day egg production and egg weight were observed to be similar among all the treatments. Fertility parameters were unaffected by the dig Lys intake levels fed. Additionally, hatchability was not altered possibly because early dead, middle dead, late dead, contaminated or pipped eggs were similar for all treatments. Feeding dig Lys levels below 1,000 mg/hen/d did not impact broiler breeder reproductive performance, thus suggesting that Lys may be in diet surplus concentrations under current practical conditions.

Key Words: broiler breeder, lysine, fertility

P178 Effect of dietary metabolizable energy (ME) levels on growth performance of both male and female Korean native chicken  
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Two ME levels (3,150-3,200 vs 3,000-3,050 kcal/kg, also designated as high vs low ME diets) with the same protein regimen (19-18%) were implemented respectively for starting phase(d10-40)-finishing phase (d41-70) diets of meat-type Korean native chicken(KNC). A total of 400 male and 448 female KNC were employed into 32 floor pens with 8 male and 8 female replicate pens per each ME regimes. In each pen, either 25 male or 28 female birds were assigned to allow similar stocking density (~18.5 kg/m²) on their finishing stage. The feeding trial started at d10 and finished at d70 of age for 60 days. Body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) were measured at d25, d40, d55 and d70 of KNC. Apparent nutrient utilisabilities (%) were measured at d70 by indicator method. There were no significant differences between high and low ME diets in BWG (2,284 vs 2,256 g) and FI (5,446 vs 5,554 g) of KNC. Further, FCR of high ME diet was better (p=0.0016) than that of low ME. However, during d26-40, high ME diet resulted higher (p=0.0002) BWG, higher FI and better (p<0.0001) FCR compared to low ME diet. It suggested that the KNC on d26-40 was likely to spend more portion of ME on locomotion than birds on other periods. Overall BWG and FI of male KNC were higher (p<0.0001) than those of female birds. However, exceptionally during d26-40, there was no such a difference although the FI by male bird was higher (p=0.0095) than that by female. Therefore, d26-40 FCR of the female was better (p=0.0042) than that of male although overall and other period FCRs were similar. There were no differences in nutrients utilization between high and low ME diets. Exceptionally, fat utilization of low ME diet was higher (p=0.0001) than that of high ME diet. Both crude protein and total carbohydrate utilization by male bird were higher than those by female. This study showed that low ME diet did not exert a significant decrease in BWG although it induced poor FCR due to increased FI. This result implied that the ME level of KNC diet could be lowered by comparatively weighing between cost due to additional intake and unit cost of the low ME diet.

Key Words: Korean native chicken, dietary ME levels, sex, performance

P179 Effect of Protein Source on the Development of Footpad Dermatitis in Broiler Chickens Reared on Different Flooring Types  
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The objective of this study was to examine the influence of protein source and flooring type on footpad dermatitis (FPD) incidence and severity in broiler chickens. A total of 750 4-old female chicks were reared to 49 d of age in a 2x3 design consisting of 2 protein sources (all vegetable and vegetable plus animal-mixed) and 3 flooring types (new pine shavings bedding, raised wire floor, or wood-board floor). Chicks were randomly allotted to 6 treatments with 5 replicate pens of 25 birds per pen. A three-stage feeding program, consisting of a starter, grower, and withdrawal feeds, was used. Feed and water were provided.
ad libitum and lighting was continuous throughout the study. In addition to live performance, the feet were scored on all birds at 20, 34, and 49 d of age, and the severity of FPD lesions was recorded. Data were statistically analyzed for treatment effects and interactions by the GLM procedure of SAS.

Mixed protein source diet increased BW (677 vs. 641 g) and improved AFE (1.31 vs. 1.36) significantly (P<0.0001) at 20 d of age. Feed conversion ratio of birds reared on wood floor also improved significantly (P<0.01) at 20 d of age. However, these effects on performance were not seen among the treatments at the end of the study (P>0.05). Footpad lesions were significantly affected by both protein source and flooring type. The incidence (at 20, 34 and 49 d of age) and severity (at 34 and 49 d of age) of FPD was highest (P<0.001) in birds reared on wood-board floor. Moreover, the incidence (35 vs. 15%, P<0.01) on d 34 and the incidence (55 vs. 26%, P<0.05) and severity (23 vs. 7%, P<0.001) on d 49 were highest on treatments receiving all vegetable protein sources. These results indicate that flooring type has a direct influence on the development of this contact dermatitis in broiler chickens. Similarly, nutritional factors also play significant role in the etiology of FPD.

Key Words: broiler, floor type, protein source, footpad dermatitis, performance

P180 Effect of dietary energy density on performance, carcass measures, serum cholesterol and glucose in broilers at d 56

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Three energy levels (2800, 3000 and 3400 kcal ME/kg diet) were used to formulate 5 broiler diets with the objective being to determine the effect of change in energy content in the diets at starter and finisher phases on performance and carcass quality. Diet 1 (Control) contained 3000 kcal ME/kg at starter and 2800 kcal ME/kg at finisher phases respectively. Diet 2 contained 3000 kcal ME/kg at both starter and finisher phases; diet 3 (3000 kcal ME/kg and 3400 kcal ME/kg); diet 4 (3400 kcal ME/kg and 3000 kcal ME/kg) at starter and finisher phases respectively and diet 5, 3400 kcal/kg at both phases. The crude protein contents in the diet at starter and finisher phases were 226 and 200 g/kg respectively. One hundred and sixty 1-d-old Arbor Acre broiler chicks were weighed and allocated to 20 pens each with 8 birds. The average weights in the pens were equalized. A group of 4 pens were then randomly assigned to each diet. The chicks were fed the starter diets up to d 28 and from d 29 the diets were switched to the finisher diets till d 56. Feed intake (FI) was calculated per pen as difference between amounts offered and refused. The temperature of the poultry house was about 30°C. Cloacal temperature of the birds was taken weekly. On d 56, the birds were weighed, euthanized by decapitation, blood samples obtained from which serum was harvested and the birds dressed for carcass measures. Up to d 56 FI was similar in the control diet and diet 2 but was significantly (P<0.05) reduced in the rest diets. Increasing the dietary energy level above 3000 kcal ME/kg either at the starter or finisher phase significantly (P<0.05) reduced body weight (BW) gain and feed conversion ratio (FCR). No effects of diet were observed for liveability and cloacal temperature. Abdominal fat, serum cholesterol and glucose were significantly (P<0.05) increased in the test diets compared with the control.

Results of the present study suggest that dietary energy levels above 3000 kcal ME/kg in diets for broilers reared to d 56 at 30°C resulted in reduced performance, increased abdominal fat, cholesterol and glucose.

Key Words: Dietary energy, performance, carcass measure, broilers

P181 Impact of early-life restricted mineral nutrition on mRNA profiles of the jejenum in 21-day old broilers

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Chicken adaptation to low-nutrient diets, especially in early life, has long been recognized. However, the impact of restricting trace minerals in early life on gene expression is unknown. To evaluate the impact of restricted mineral (Zn, Cu, Mn) nutrition in early life on gene expression patterns in the jejenum, broiler chicks were randomly assigned to one of 3 treatment groups. Diets consisted of a corn-soy ration with organic Zn, Cu, and Mn (Bio-PlexTM, Alltech Inc.) provided at 100% (normal), N or 20% (low, L) of NRC requirements. Treatments consisted of N and/or L diets fed in 2 intervals (d 1-5, d 6-21) as follows: 1) Control (N-N), 2) N-L, or 3) L-L. On d 21, birds were euthanized, jejenum tissue was collected, and gene expression profiles were analyzed using the Affymetrix Chicken Genome Array. Compared with N-N birds, N-L and L-L birds had lower mRNA levels (P<0.05) of metallothionein 3 (-1.7 and -1.78-fold, respectively) and 4 (-1.81 and -2.27-fold, respectively). Regardless of diet consumed d 1-5, birds fed the L diet d 6-21 experienced down-regulation (P<0.05) of zinc transport proteins 6 and 10, which function to lower intracellular zinc. ZIP10 (Zrt-, Irt-like protein 10) was unchanged in N-L birds but was upregulated 1.47-fold (P<0.02) in L-L birds. Expression of digestive enzymes, such as sucrase and alpha-glucosidase, was upregulated 2.07-fold and 1.21-fold (P<0.05), respectively, in N-L birds but remained unchanged in L-L birds. These results indicate that mineral restriction can result in changes in expression of genes involved in mineral transport and mineral ion binding in the jejenum. In addition, feeding either N or L mineral levels d 1-5 results in differences in gene expression levels at d21, even when birds are fed the same diet d 6-21.

Key Words: broiler, gene expression, zinc, copper, nutrigenomics

P182 Influence of vitamin supplementation on the first week of life and breeder age on the performance of broilers

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We performed an experiment to evaluate the effect of vitamin supplementation on performance of broilers from breeders of different ages. We used 2880 one day old chicks, the Cobb with eight replicates per treatment in a 2x3 factorial, with two ages of the matrix (29 and 44 weeks) and three inclusion levels of vitamin complex (without inclusion, including at the level recommended by provider and include 50% above recommended). We evaluated the performance characteristics of animal husbandry and mortality (7 and 42 days) and carcass yield. No difference (P>0.05) in parameters as a function of supplemental vitamins. Breeder age influenced broiler performance only at 7 days old, and the best results for birds from breeders of 44 weeks of age.

Key Words: broiler, performance, vitamin complex, vitamin supplementation, breeder age

P183 N,N-dimethyl glycine on feed broiler

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Poult. Sci. 91(Suppl. 1)

N,N-dimethyl glycine (DMG) is an intermediary metabolite in cellular choline to glycine metabolism. The objective of this study was to determine the effect of dietary DMG (Taminizer® D; Taminco) in order to evaluate the performance and carcass characteristics of broilers. This study was carried out at Poultry Laboratory at The Federal University of Santa Maria – Brazil. A total of 1920 1-day-old broiler ( Cobb-500) were raised until 42 days of age. Birds were randomly assigned in three treatments with ten replicate pens of 64 birds each. Used diets with two addi-
tion levels (0 and 1,000 mg DMG/kg feed), without antibiotic growth promoter (AGP), and a diet with AGP were used. Diets were formulated to current Brazilian industry standards based on corn and soybean meal. The data were submitted to ANOVA and Tukey test. There were no significant differences (P > 0.05) in the performance parameters (body weight gain, adjusted feed intake, feed conversion rate, Productive Efficiency Index and mortality). But the study of carcass demonstrated effect of treatments. Birds fed with N,N-Dimethyl glycine had better carcass yield (74.98%) than birds without DMG (73.58%) in their diets (P = 0.0195). Also the use of this product increased the percentage of breast meat (P = 0.0034) with 1.16% compared to birds fed without DMG and decreased the percentage of abdominal fat (P = 0.0427) in 0.27% compared to birds fed a diet with AGP. Results of these studies show that N,N-dimethyl glycine (DMG) had positive effect on carcass characteristics of broilers.

Key Words: carcass, breast, abdominal fat, performance, broiler


A study was conducted to evaluate the response of additional amino acid cocktail in order to determine whether any response was due to the lysine per se or to other essential amino acids in broiler finisher diets formulated with ideal protein concept. Nine basal diets were formulated using a composite Ideal Protein to provide digestible Lys (dLys) levels from 0.70 to 1.10%. Matrix values used for the corn and soybean meal were based on suggested total and digestible values reported by a major amino acid producer. Experimental diets were prepared by mixing the low (0.70%) and high (1.10%) lysine diets to get the intermediate levels of lysine diets and aliquots supplemented with either no amino acids or an amino acid cocktail containing 0.10% Met, 0.15% Thr, 0.05% Trp, 0.10% Val, and 0.20% Arg. This mixture would provide the diet with the lowest calculated Lys level (0.75) sufficient amounts of the other essential amino acids to meet the NRC (1994) estimated needs for these amino acids. Corn starch was used in the non-supplemented diets in the same amount as the supplemental amino acids. This resulted in a total of 18 experimental diets. Male chicks (Cobb 500) were grown to 35 d on nutritionally complete diets. At 35 d, each of the 18 diets was fed to seven replicate pens of four broilers. Body weights by pen were obtained at 35 and 49 d of age with feed consumption determined during the test period. At the conclusion of the study two birds per pen were processed to determine dressing percentage and parts yield. There was significant effect of dietary Lys levels on FCR (P≤0.005); there was no significant effect of dietary Lys levels on BW (P>0.005) but numerical differences were observed that near statistical significance(P>0.051). There were significant effects (P≤0.005) of additional amino acid cocktail on BW and FCR. No significant interactions were observed between Lys and additional amino acid cocktail in BW, and FCR (P>0.005). Neither dietary Lys levels nor additional amino acid cocktail had significant effects (P>0.005) on parts yield and dressing percentage, but the dressing percentage with amino acid cocktail was numerically higher than the ones without amino acid cocktail. Results of this study suggested that, when formulating on the Ideal Amino Acid basis, the response is not only coming from increased lysine levels but in fact is also coming from other essential amino acids that are increased with each increment of lysine.

Key Words: lysine, broilers, ideal protein, amino acids


The success of formulating poultry diets based on the concept of an Ideal Ratio is contingent upon deriving the proper ratio of the various essential amino acids to lysine. When evaluating the requirement for digestible lysine, it must be considered that all other amino acids are being increased or decreased with changes in digestible lysine. A composite Ideal Ratio (CIR) derived from ten literature references was used to formulate diets with digestible lysine (dLys) levels from 0.80 to 1.30% in increments of 0.10%. Diets were also formulated using 10% less (-10% CIR) than the CIR and 10% more (+10% CIR) than the CIR. Corn and soybean meal of known composition were used as intact protein sources; supplemental sources of methionine, lysine, and threonine were used to bring as many of the ratios as close to minimum level as possible. All diets were isocaloric with the crude protein and metabolizable energy contributions of the synthetic amino acids considered. Each of the 18 diets was fed to 12 replicate pens of five male chicks of a commercial strain (Cobb 500). Body weight and feed conversion to 16 d of age was determined. Body weight (BW), feed intake (FI) and feed conversion (FCR) were all significantly influenced by the level of dLys, by the different ratios, and by the interaction of the different ratios with dLys level. For BW, birds fed diets with +10% CIR were significantly heavier than those fed the CIR who were in turn significantly heavier than those fed -10% CIR. The peak BW was at 1.10% dLys. The interaction was most noticeable at the lower levels of dLys when chicks fed -10% CIR were much lighter than those fed the CIR and chicks fed the +10% CIR were much heavier; the differences in BW were not as noticeable at higher levels of dLys. Similar responses in FCR were also noted with peak FCR occurring at 1.2% dLys. These data indicate that when formulating to a ratio the response to increasing levels of dLys may be attributed as much to increases in the other essential amino acids as to the dLys and point out the importance of meeting all essential amino acid needs on a quantitative basis.

Key Words: Lysine, broilers, amino acids, ideal ratio


Supplementing broiler diets with synthetic amino acids lowers overall crude protein levels as well as reducing the total quantity of many of the essential and nonessential amino acids. As additional amino acids become available, critical levels of some amino acids might be reached that were not previously considered to be a dietary limitation. This study was conducted to evaluate the need for digestible lysine and associated amino acids in broiler starter diets when extended amino acid supplementation is used. A series of diets were formulated using corn and soybean meal of known amino acid composition. Digestion coefficients suggested by a major amino acid supplier (Ajinomoto Heartland) were used. Diets were formulated to contain from 0.7 to 1.2% digestible Lys in increments of 0.10% using Ideal Ratios derived from a composite of literature reports. One series contained synthetic forms of methionine, lysine, and threonine. The second series contained the same amino acids plus valine. The third series contained all four of these amino acids plus glycine. As a result, the dietary crude protein level was subsequently reduced with each series of amino acid supplements. A diet with 24% crude protein and 1.2% digestible lysine served as the positive control. All diets were analyzed for crude protein content with the low and high lysine diets in each series analyzed for total amino acids. Each diet was fed to six replicate pens of five male chicks of a commercial strain (Cobb 500) maintained in electrically heated battery brooders. Performance on the diets with reduced crude protein was similar to that of birds fed the diet with 24% fixed crude protein. There were no significant differences in BW, feed intake (FI) or
feed conversion (FCR) related to the different amino acid series used, demonstrating that dietary protein can be effectively reduced with the proper amino acid supplementation. The BW and FCR, but not FI, were significantly influenced by increasing the digestible lysine in association with the other essential amino acids in a ratio to lysine. Broken-line linear regression indicated that BW peaked at approximately 1.10% digestible lysine while FCR peaked at approximately 1.14% digestible lysine when diets were formulated using the Ideal Protein concept. These data indicate that valine and glycine could be supplemented in broiler diets without loss of performance.

**Key Words:** broilers, ideal protein, lysine, amino acids

**P187 Evaluation of calcium levels in broiler diets with normal or extended phytase supplementation**

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The use of phytase has become almost universal in U.S. broiler diets. The combination of reduced phytase prices and increased cost of P has stimulated use of higher phytase levels. Considerable work has been done to establish P release values (PRV) for phytase but more work is needed to determine proper Ca levels to be used with different PRV values, as higher levels of phytase are used. The objective of this study was to determine the optimum Ca level to be utilized with different PRV values for phytase. Four diets (Lo-P/Lo-Ca; Lo-P/Hi-Ca; Hi-P/Lo-Ca; Hi-P/Hi-Ca) provided digestible amino acids suggested by Rostagno et al. (2011). After analysis, these were blended to provide experimental diets. One group was fed 0.45% nonphytate P (NPP) with 0.6, 0.8, or 1.0% Ca with no phytase. Three groups were fed diets with 500, 1000, or 2000 FTU/kg phytase (QP2, ABVista, Marlborough, UK) using PRV values of 0.13, 0.17, and 0.20% NPP respectively (Target) as suggested by the manufacturer. Diets were also fed with ± 0.05% of target values. For each of these test levels, Ca levels of 0.5 to 0.9% were fed. Each diet was fed to six pens of 5 male birds. At 18 d birds were weighed and killed by CO₂ inhalation; tibia from three birds per pen were collected for bone break force (BBF) determination. For the 0.45% NPP group, those fed 1.0% Ca had significantly better BW and BBF than those fed 0.6 or 0.8% and were used as the positive control (PC) to compare performance of the test groups. For birds fed 500 FTU/kg the BW of birds fed the target PRV did not differ the PC when fed diets with 0.6% or more Ca; BBF of birds fed the target PRV was significantly less than the PC unless 0.9% Ca was fed. For birds fed 1000 FTU/kg the BW of birds fed the target PRV did not differ in BW or BBF from the PC when diets contained 0.7% or more Ca. For birds fed 2000 FTU/kg the BW and BBF was significantly less than the PC until 0.9% Ca was fed. Based on tibia break force it appeared that the target PRV values for 500 and 2000 FTU/kg may have been accurate. These data indicate that different broiler strains may respond differently to changes in dietary nutrient density.

**Key Words:** broilers, genotype, strain differences, dietary energy

**P189 Tryptophan levels on performance of white layers diets**

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The aim of this work was objective to evaluate the digestible tryptophan: digestible lysine ratio constant for white layers diets. Two hundred sixty white layers with 29 weeks of age had been used, distributed in an experimental delineation entirely randomized, with 5 treatments, 13 replicates and 4 birds for experimental unit. The diets had been equal energy and consisted of a basal diet, formulated to the base of corn and soybean meal, supplemented with the industrial amino acids L-Lysine, DL-Methionine, L-Threonine, L-Tryptophan, L-Isoleucine and L-Valine with intention to supply increasing levels of these amino acids, so that the ratio between them if kept constants in accordance the recommendations of Brazilian Tables of Poultry Recommendations (Met+Cys:lysine - 91; Thr:Lys - 66; Iso:Lys - 83; Val:Lys - 90), except for digestible tryptophan: digestible lysine that was fixed in 24.5%, where this level was esteem in a previous experiment, with increasing digestible lysine ratios. On evaluation period, the feed intake (FI, g/bird/day), egg production (EP, %/bird/day), egg weight (EW, g/egg), egg mass (EM, g/bird/day), mass conversion (MC, kg/kg) and dozen conversion of eggs (CED, kg/12) were evaluated. After analysis of the data, it was verified that only the feed intake was not influenced by the treatments and perceived that optimum performance of the white layers was verified when the level of amino acids increased, showing a quadratic effect. Thus, it was esteem in 0.213% of digestible tryptophan, keeping a constant ratio of 24.5% of digestible tryptophan: digestible lysine for white layers in production.

**Key Words:** amino acid profile, ideal protein, productive efficiency
P190 Nutritional requirement of available phosphorus for laying hens post-peak production
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This research was conducted to estimate the nutritional requirement of available phosphorus for laying hens in post-peak production. An experiment was realized with 180 Dekalb White hens (64 week of age). The assay lasted for 112 days, using the completely randomized design, consisting of five treatments (five levels of available phosphorus: 0.14, 0.22, 0.30, 0.38, 0.46%) and six replicates of six hens. The performance and egg quality parameters were evaluated: egg production (%), feed intake (g), egg mass (g/birds/day), feed conversion ratio (g:g and g:dz), egg weight (g), yolk weight (g), albumen weight (g), shell weight (g), percentages of yolk (%), shell (%) and albumen (%) and egg specific gravity (g/l). To determine the optimum level of available phosphorus in the diet, the results were submitted to polynomial regression analysis. Considering the adjustment of the data by the quadratic model, the estimates of available phosphorus for egg production (Y = -156.27x²+102.02x+40.69; R²=0.58), feed conversion by gram (Y = 4.71x²-2.95x+2.3; R²=0.43) and by dozen (Y = -1.99x²+1.37x+1.06; R²=0.27) of eggs varied from 0.31% to 0.35%. In relation to the eggs quality parameters, only, eggs specific gravity (Y = 0.076265x²-0.048467x+1.09; R²=0.92) and percentage of shell (Y = 0.076265x²-0.048467x+1.09; R²=0.92) showed quadratic behavior. Therefore, from the biological responses presented by the hens in post-peak production, the recommended requirement is 0.32% available phosphorus in the diet, without cause problems for the production and quality of the shell and albumen.

Key Words: albumen, feed conversion, feed intake, performance, shell

P191 Evaluation of methodology to determine TMEn of feed ingredients
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Allzyme SSF is a naturally fermented product with activities of multiple enzymes. The recommended inclusion may impact the TME, content of feedstuffs and diets composed of those feedstuffs for poultry. Corn meal, DDGS, SBM, canola meal, corn-SBM diet, corn-SBM diet with 70% replacement of SBM by DDGS and wheat-SBM diet were prepared with and without Allzyme SSF. Twenty-four roosters were housed individually in metabolism cages with an individual tray for excreta collection. Six birds were randomly assigned to one of four dietary treatments within each of four trials. Roosters were trained to a single 1 h ad libitum feeding period per day until feed intake was at least 30 g. Birds were fasted for at least 24 h before feeding for 1 h which was immediately followed by 24 h excreta collection which was started after feed withdrawal (collection day 1). Feeding and collection was repeated similarly on day 2. Finally, excreta was collected from fasted birds for 24 h to determine endogenous losses (collection day 3). Results from excreta collection days were not different, therefore results were pooled by diet. Endogenous excreta were pooled by diet. Feed intake exceeded or equaled 30 g per d. There were no differences in feed intake (P=0.19) with or without Allzyme SSF in the diets, except feed intake was greater (P<0.05) for birds fed DDGS without Allzyme SSF (47.7 vs. 37.1 g/d). Excreta weights before or after drying were not different (P=0.06) due to the inclusion of Allzyme SSF, except the weight of excreta from birds fed corn meal with Allzyme SSF was greater (P<0.01) before drying. True ME digestibility was greater (P<0.03) for birds fed canola meal with Allzyme SSF than without (57.3 vs. 51.5%); there were no other differences. Energy digestibility ranged from 51 to 90% for the individual feedstuffs. Birds appeared to adjust their feed intakes according to the energy digestibility of the diets. Inclusion of DDGS in the corn-SBM diet very slightly reduced energy digestibility (83.3 vs 81.0%; P<0.01). The TME, (kcal/g) was not different due to the inclusion of Allzyme SSF in any of the diets (P=0.13). Therefore, it appears that using intact (non-cecetomized) roosters to determine the effect of Allzyme SSF on the TME, of individual feedstuffs or diets is not a viable experimental approach.

Key Words: enzymes, TMEn, energy, digestibility, roosters

P192 Tryptophan: lysine ratio on the performance of Japanese quails diets
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The aim of this work was objective to evaluate the best tryptophan: lysine ratio for fed Japanese quails with different tryptophan: lysine ratio. Two hundred eighty Japanese quails had been used, distributed in an experimental delineation entirely randomized, with 5 treatments, 7 replicates and 8 birds for experimental unit. The diets, equal protein and energy, had consisted of a basal diet, formulated to the base of corn and soybean meal, supplemented with the industrial amino acids L-Lysine, DL-Methionine, L-Tryptophan, L-Isoleucine and L-Valine of form to take care of the requirements nutritional for Japanese quails, except for tryptophan, where the evaluated levels had been 0.15, 0.17, 0.19, 0.21 and 0.23%, corresponding tryptophan: lysine ratio of 15, 17, 19, 21 and 23%. The feed intake was evaluated, egg production, egg weight, egg mass, egg mass conversion and dozen of eggs conversion. After analysis of the data, was verified that the feed intake and egg mass were influenced (P<0.05) by the ratios, the variables were decreasing conform the tryptophan was increasing in the diets. The egg production, egg mass conversion and egg dozen conversions had been a quadratic behavior, esteeming in 19.07, 20.13, 20.92, respectively. The dates show an increment of Japanese quails performance in tryptophan increasing in the diet. In conclusion, it was esteem in 21% of the tryptophan: lysine ratio for Japanese quails.
cific gravity. The results showed quadratic effect of threonine levels on egg production and linear effect on egg mass and egg dozen conversion and percentage of shell. The level recommended was 0.495% digestible threonine, which corresponds threonine: digestible lysine ratio of 76.5%.

Key Words: amino acid, egg production, egg quality, ideal protein

P194 Performance of chicks fed diets with different levels of sodium and electrolyte balance in pre-starter phase. Jose Henrique Stringhini1, Monica Schaitl Thorn1, Marcos Barcellos Cacé1, Maria Auxiliadora Andrade1, Nadja Susana Mogya Leandro1, Roberto de Morais Jardim Filho2 1Universidade Federal de Goias, Goiania, Goias, Brazil, 2Abatedouro Sao Salvador, Itaberai, Goias, Brazil

In hot climates, sodium and the electrolyte balance are considered in order to prevent heat stress with an effect on water intake. In newly hatched chicks, it can be important to estimate water intake and help with nutrient absorption specially amino acids, vitamins and monosaccharides. Based on this, an experiment was carried out in order to evaluate chick performance until 21 days of age consuming diets containing different electrolyte balance and sodium levels in a corn-soybean pre-starter ration. A total of 330 Cobb 500 day-old chicks were allotted in heated batteries in a randomized block design and factorial arrangement 3 x 2 (electrolyte balance Na + K - Cl - 200, 240 and 310 mEq/kg of diet and 0.2 and 0.4% sodium levels) with six replications of 11 chicks each. Performance variables were evaluated (weight gain, water and feed intake and feed conversion from 1 to 7 and 1 to 21 days of age). No significant interaction was observed for the variables evaluated. A significant effect was observed for weight gain for 0.4% Na compared to the low level tested (0.2% Na). A quadratic effect was observed for weight gain with the electrolyte balance levels tested and it was possible to estimate that 236 mEq/kg at 3 days of age gave the best results. But when the birds completed 7 days of age, a linear negative effect was observed for the same levels. For feed intake, a linear negative effect was observed for electrolytic balance at 7 days of age and a higher feed intake. For feed conversion, better results were observed for 0.4% levels at 3 and 7 days of age, with no effect for electrolyte balance. Water intake increased linearly for electrolyte balance levels and relation of water:feed intake was higher for 0.4% Na compared to 0.2% Na. It is possible to recommend 236 mEq/kg and 0.4% Na in pre-starter ration for better performance.

Key Words: weight gain, feed intake, number of Mongin, water intake, starter development

P195 Digestible tryptophan:lysin to layers in third cycle of production. Fernando Perazzo Costa1, Anilma Cardoso1, Eduardo Nogueira2, Edgar Ishikawa2, Clariana Santos1, Rafael Souza1, Sarah Pinheiro1, Angelica Lopes1 1Federal University of Paraíba, Areia, Paraíba, Brazil, 2Ajinomoto Animal Nutrition, Sao Paulo, Brazil

The objective of this work is to determine digestible tryptophan: lysine for laying hens diets in the third production cycle. Were used 240 laying hens of brown-egg lineage Dekalb Brown, a period from 74 to 90 weeks of age, distributed in a completely randomized design with five increasing levels of tryptophan (0.142; 0.149; 0.156; 0.163 e 0.170 % ), with six replications and eight hens/replicate. The treatments consisted of diets isonitrutives and level of 0.648 % of digestible lysine estimated according the equation recommendations suggested by Rostagno et al. (2005). After obtaining the lysine, the diets were formulated keeping relations amino acids: lysine, except for tryptophan, which had growing relations in 22, 23, 24, 25 and 26%. Feed intake ( g / bird / day ), production ( % ), weight ( g ), egg mass ( g / bird / day ), egg mass conversions ( kg / kg ), egg dozen conversions ( kg / dz ), weight ( g) and percentage ( % ) of yolk, albumen and shell, shell thickness (mm ), specific gravity were evaluated. It was observed a quadratic effect of tryptophan levels to egg production and egg mass. The level recommended is 0.153% digestible tryptophan, which corresponds digestible tryptophan: lysine of 24 %.

Key Words: amino acid, egg production, egg quality, requirement

P196 Reduce feed cost and maintain performance. Anée Berg Kehlet1 Chr. Hansen A/S, Denmark

The aim of the present work was to investigate the effect B. subtilis on digestibility and performance in recommended and energy reduced diets for broilers. Moreover the ability of B. subtilis to maintain performance in energy reduced diets was investigated. Two digestibility trials and three performance trials were conducted using a 2x2 factorial design with the factors being ± addition of B. subtilis DSM 5750 8+E5 cfu/g of feed (GalliPro® Max, Chr. Hansen A/S). And energy level (+ reduction of 100 Kcal/kg by replacing 2% soy oil with corn). In the digestibility trials 160 male Cobb broilers were randomly distributed with 8 replicates and 5 birds per cage. The diets were added a marker (0.5% Cr2O3) for determination of dry matter and crude protein digestibility. The trials were running from day 31 to 36 of age. In the performance trials 640 male Cobb broilers were distributed into floor pens with 8 replicates and 20 birds per pen. The experimental period was from day 1 to 42 of age. At day 42 weight gain and feed intake were recorded and feed conversion was determined. B. subtilis resulted in a better digestibility in both the recommended energy group and in the reduced energy group in both trials. The average digestibility of dry matter in the two trials were 67.51% in recommended energy level (T1), 71.68% in recommended energy level + B. subtilis (T2), 69.64% in reduced energy level (T3) and 70.82% in reduced energy level + B. subtilis (T4). The average digestibility of protein was 76.67%, 79.70%, 77.64% and 79.80% for T1-T4 respectively. In the performance trials B. subtilis also showed an advantage over the control groups in all three trials. The average weight gain was 2.65 kg, 2.71 kg, 2.58 kg and 2.66 kg for T1-T4 respectively. The average FCR was 1.70, 1.65, 1.75 and 1.71 kg/kg for T1-T4 respectively. The average weight gain was 2.65 kg, 2.71 kg, 2.58 kg and 2.66 kg for T1-T4 respectively. The average weight gain was 2.65 kg, 2.71 kg, 2.58 kg and 2.66 kg for T1-T4 respectively. The average FCR was 1.70, 1.65, 1.75 and 1.71 kg/kg for T1-T4 respectively. Performance was equal in the recommended control (T1) and in the diet with reduced energy added B. subtilis (T4). Based on this study it can be concluded that applying B. subtilis improves energy utilization by 100 Kcal/kg. This will result in a feed cost saving of $14-15 US/2000LB including the cost of the B. subtilis product.

Key Words: Bacillus subtilis, Digestibility, Broilers, Energy reduction, Feed cost saving

P197 Accuracy of nonlinear feed formulation for broiler chickens: Maximising broiler profit. Manoel Garcia-Neto2, Camila Angélica Gonçalves, Sergio Vieira-Filho, Max José de Araujo Faria-Junior, Marcos Franke Pinto UNESP - Univ Estadual Paulista, Araçatuba, SP, Brazil

The modeling technique is simple, useful and practical to calculate optimum nutrient density to maximize profit margins, using nonlinear programming by predictive broiler performance. To demonstrate the influence of the broiler price could interact with nutrient density, the experiment aimed to define the quadratic equations for consumption and weight gain, based on modeling, to be applied to nonlinear programming, to be applied to nonlinear programming. To demonstrate the influence of the broiler price could interact with nutrient density, the experiment aimed to define the quadratic equations for consumption and weight gain, based on modeling, to be applied to nonlinear programming, to be applied to nonlinear programming. To demonstrate the influence of the broiler price could interact with nutrient density, the experiment aimed to define the quadratic equations for consumption and weight gain, based on modeling, to be applied to nonlinear programming, to be applied to nonlinear programming.
P198 Effects of aflatoxin on growth performance, organ weights, and serum chemistry of broilers, and the efficacy of Calibrin-A and Calibrin-Z enterosorbetes to ameliorate those effects. S. L. Johnston1, L. M. Brand2, D. R. Ledoux2, G. R. Goss3, E. D. DeBoer4, F. Chi1

A study was conducted to evaluate the effects of 2 ppm dietary aflatoxin on broilers and the ability of two clay adsorbent to ameliorate those effects. A total of one-hundred-sixty day-old chicks (Ross 308) was allotted to 4 treatments and fed assigned diets for 21 d (8 reps X 5 chicks). Treatments were: 1) control (CON); 2) CON + 2 ppm aflatoxin (AFL); 3) AFL+ 0.5% Calibrin-A (CAA); and 4) AFL+ 0.5% Calibrin-Z (CAZ). A T-test was used to determine statistical differences. AFL decreased (P <0.05) feed intake (FI), weight gain (WG), and feed efficiency (FCR), and increased (P <0.05) relative liver weight compared to CON birds. Adding CAA or CAZ to the AF diet did not improve (P >0.05) FI. AFL+ CAA improved (P <0.05) WG, and FCR, and reduced (P <0.05) the increase in relative liver weight. CAZ improved (P <0.05) WG, but only numerically improved FCR and reduced the increase in relative liver weight. Absolute bursa weight of AFL birds was numerically lower than CON (P <0.09; 2.0 vs 2.4g), but was improved by CAA and CAZ treatments (2.3 and 2.2 vs 2.0g); however, relative bursa weights were not different (P >0.05) among treatments. Mortality rate was 2.5, 10, 2.5 and 5% for CON, AFL, CAA and CAZ, respectively. Birds fed AFL had lower (P <0.05) albumin, globulin, and total protein in the serum compared to birds fed the CON diet. Serum glucose of AFL birds tended to be lower (P <0.06) than CON birds, whereas CAA birds were similar to CON, and birds fed CAZ were not different from CON or AFL birds. CAA and CAZ birds had serum globulin concentrations that were not different (P >0.05) from CON or AFL treatments. Results confirmed the detrimental effects of AFL on broiler growth performance, target organ weights, and serum chemistry. Calibrin-A or Calibrin-Z can effectively ameliorate the detrimental effects of AFL in broiler chickens.

Key Words: Broiler, Aflatoxin, Clay Adsorbent, Calibrin-A, Calibrin-Z

P199 Increasing productive performance of Bovans White hen at the beginning of the cycle María de los Ángeles Tepox-Perez1, Benjamin Fuente-Martínez2, Tomas Jiménez-Mendez2, Ernesto Avila-González2 Centro de Enseñanza, Investigación y Extensión en Producción Avícola (CEI-EPa), Mexico City; México DF. Del. Coyoacán, Mexico, 2FMVZ, UNAM. Av. Universidad 3000, Mexico City, México DF. Del. Coyoacán, México

In order to evaluate the productive performance of Bovans White hen at the beginning of the cycle, were used different levels of metabolizable energy (ME) and digestible methionine + cystine (AAD) to reduce the number of small eggs (<42 g). 384 hens of 18 weeks old were used in a randomized design with 4 X 2 factorial arrangement. The first factor was the level of EM (2700, 2800, 2900, 3000 kcal / kg), and the second one, the level of 0.45 or 0.61% AAD. Each treatment had 4 replicates of 12 hens. Records were kept weekly: percentage of stance, average egg weight, feed intake, egg mass / bird / day and feed conversion, in addition, the egg was classified by weight. The small egg percentage decreased with 2900 and 3000 kcal / kg and increased the percentage of large egg with 0.61% AAD (P <0.05). It suggests using diets with 2900 kcal / kg ME and 0.61% of AAD in sorghum-soybean diets.

Key Words: productive performance, beginning of the cycle, number of small eggs, laying hen, metabolizable energy

P200 Growth Modulation as an Alternative for the Control of Ascites Syndrome at 2700 M.A.S.L. Diego Rodriguez-Saldana1, Carlos Lopez-Coello2 Balanceados El Granjero, Cuenca, Azuay, Ecuador, 2Dpto. de Medicina y Zootecnia de Aves, Mexico City, Distrito Federal, Mexico

The study estimated the effect of feed restriction on productive parameters of Cobb 500 male broilers chicks until they reach a target weight of 2.7 kg. There were applied four levels of feed restriction with 7 replicates of 50 birds each: 1) Ad libitum, 2) 97.5%, 3) 95.0%, and 4) 92.5%. The feed intake for treatments 2, 3 and 4 were estimated based on a commercial table of consumption, it was developed in the area where the experiment was done (2700 m.a.s.l., Cuenca, Ecuador) and restriction programs began in the 15 day of age for all treatments. The management program was in line with established broiler production practices, the feed was formulated based on the requirements of broilers in three phases, the presentation was crumble feed and consisted of a corn-soybean meal. The studied variables were registered in weekly bases until the birds reached the target weight and were feed intake (FI), weight gain (WG), feed conversion (FC), mortality, ascites mortality and production cost per kg of live chick. Statistical analysis of all variables indicate statistical differences (P <0.01) when comparing the ad libitum group with restricted groups, however when we compare the restriction treatments, there was not statistical significance between them, but numerical difference suggests that the best treatment was the 95% level restriction, which had the following results: The target weight was reached at day 44 (2.756 Kg), the accumulated FI 4.577 Kg., the commercial FC 1.698, the FC adjusted for mortality 1.655; 3.15% of mortality, ascites mortality 2%, and production cost per kg of live chick $ 1.48 USD. In conclusion, feeding restriction is an interesting alternative to modulate the growth of broilers chicks at high altitudes, it has a beneficial effect on productive parameters, mortality and production costs, but the key to the application of these programs is the control over the variation of temperature during brooding as well as environmental quality in terms of ventilation.

Key Words: Broiler Production, Feed Restriction, Ascites Syndrome, Growing Modulation

P201 Utilization of the Maxi-Mil® program to enhance feed manufacturing profitability. Ferdie Nel, Simon Parker, Richard Oldman, Jose Ramirez, Dale Kotzur, Jim Wilson Anitox Corporation, Lawrenceville, GA

The costs associated with feed manufacturing have been rising steadily as the cost of energy has increased. Moisture lost (shrink) during feed processing can result in significant monetary losses. Feed manufacturers are in need of tools that can be used to help offset these rising energy costs and reduce shrink in order to assist them in improving their feed plant profitability. Ninety separate field studies were conducted in commercial feed mills over a two year time period. These studies were performed in the regions of Asia-Pacific, Europe Middle East and Africa, Latin America, and North America. These studies were designed to test for improvements in feed manufacturing efficiency, pellet quality and ultimately profitability by using the Maxi-Mil® (MM) program. The MM program consists of specialized liquid application equipment, the liquid product, and technical assistance. The MM liquid product is a combination of organic acids and a surfactant that is blended with water and applied into the mixer via the specialized application equipment. For each field study the control data was collected using the feed mills normal manufacturing processes. The evaluation criteria for the control and
MM program were energy usage (kwh/ton), feed production rate (tons/hour), pellet durability index (PDI), percent fines, processing temperature change, delta T, and feed moisture. The data was averaged across all regions. Through the use of the MM program energy usage was decreased by 8.77% and the tons/hour was increased by an average of 7.60%. The pellet durability index was improved 3.82% while the fines were reduced by an average of 14.66% with the inclusion of the MM program. The feed processing temperature was able to be increased by 4.18%, the delta T was decreased by 39.63% and feed moisture retention was improved by an average of 42.11% by using the MM program. Based on the results of these studies feed manufacturing profitability can be enhanced by using the MM program.

Key Words: Maxi-Mil®, Feed Manufacturing, Shrink, Pellet Durability Index, Energy Usage


Intense genetic selection has significantly improved meat production in the last 50 years but this selection has altered the relative growth of different organs in the selected birds compared to the heritage lines that reflect the old broiler. In this study a Heritage line (HER) of New Hampshire x Columbian WPR that had been maintained since the 1950’s was compared to three modern production lines (Ross 308, Ross 708 and a Test Product (TP) from Aviagen) for 8 weeks post hatch. One hundred and sixty two male birds of each line were randomly allocated to battery brooders. Each strain of birds had nine replications. Birds were fed diets that met average nutrient level in the U.S. poultry industry (Agri-stats, Fort Wayne IN). Feed and water was provided ad libitum. Every week, one bird per pen was killed and the relative weight of breast, leg, wing and internal organs were compared. The Ross 308 had the highest body weight (BW) until 42 days; after that BW of Ross 708 and TP was similar to Ross 308. The HER BW was lighter all through the experiment. Feed conversion was confounded due to the number of birds necropsied. Breast relative weight was significantly lighter for HER from day 7 to the end of the trial. The TP showed a heavier relative and absolute breast weight at day 56. Leg relative weight was lighter at 56 days for Ross 708 and TP. Heart relative weight was significantly heavier in HER than in the modern lines from 28 days until the end of the experiment. Gizzard relative weight was significantly heavier in HER all along the experiment. When HER was compared with a modern line of the same weight, gizzard relative weight was still heavier than the modern one. Tibia diameter was smaller in modern lines than in HER when similar weight birds were compared. These data indicate that modern breeds have changed in different aspects from the older strains as a secondary effect to genetic selection. At the same time breast meat yield continues to increase with continuing selection.

Key Words: broiler genotypes, relative weight, breast meat, genetic selection

P203 Wet Feed Nutrition to Broiler Chickens Cristiane Araujo1, Lucio Araujo2, Michael Kidd3 University of Sao Paulo - Animal Production and Nutrition Department, Pirassununga, SP, Brazil, 2University of Sao Paulo - Animal Science Department, Pirassununga, SP, Brazil, 3University of Arkansas, Fayetteville, AR

This study examined hatchery feeding of starter diets differing in moisture on live performance measurements up to 42d and processing measurements at 43 d. Ross 708 chicks (1,800) were randomly distributed across 6 treatments representing a control (no feed), hatchery feed representing 450 g of a starter diet, or four treatments of a starter feed plus 45 mL, 90mL, 135 mL, and 180 mL respectively, of potable water added to the crumbles 5 min before administration in the trays. Chicks received feed treatments in trays until placement (5 h of total tray feeding). After placement water and feed were provided ad libitum, and performance and carcass were measured. BW and FC were not affected by starter diet moisture at hatchery (P>0.05). In the same way, carcass, breast meat, and tender meat yield were not affected by dietary treatments, but abdominal fat was lowest in straight-run broilers fed with start diet plus 180 mL water. In contrast, no differences were found among birds allocated on treatment control (no feed) and birds fed starter diet without water addition of water. However, birds fed start diet plus 180 mL showed highest carcass yield (P<0.047). These results demonstrated that birds can be impacted when receiving starter diet with different moisture at hatchery.

Key Words: Chick, Hatchery feeding

P204 Validating the Fung Double Tube for use with broiler chicken intestinal contents Miguel Barnett1,2, Jasdeep Saini, Christopher Rude, Scott Beyer, Daniel Fung Kansas State University, Manhattan, KS

Clostridium perfringens is Gram-positive, anaerobic, spore-forming bacterium. C. perfringens is the causative agent of necrotic enteritis. This disease results in decreased feed efficiency and increased mortality in chickens. Necrotic enteritis has been estimated to cost $2.6 billion to the poultry industry every year worldwide. C. perfringens is one of the most common causes of food borne illnesses in the United States infecting nearly one million people in the US every year. The purpose of this study was to validate the Fung Double Tube (FDT) method to detect and enumerate C. perfringens in chicken intestinal contents. Eighteen broilers were selected and euthanized at 21 and 42 days of age. The jejunum and ileum were harvested and inoculated into two methods and three different media arranged in a 2 x 3 factorial for a total of six treatments. The two methods were FDT and petri plates, and the three media consisted of: Shahidi Ferguson Perfringens (SFP) with egg supplement, polymyxin B (p), and kanamycin (k) (E); SFP with p and k (P); and SFP with cycloserine (C). At 21 days of age, counts using media C with FDT (4.51 log colony-forming units, CFU/g) and plates (1.58 log CFU/g) were higher (P<0.05) than using media E or P. At 42 days of age, there were no differences among plate treatments and media E had the highest counts (0.75 log CFU/g). Out of all the FDT, media C (5.35 log CFU/g) had the highest counts, followed by media P (3.54 log CFU/g). The FDT has been shown to detect C. perfringens at similar and higher levels than petri plates. The Fung Double Tube method is effective, inexpensive, rapid, and selective providing a novel instrument to detect and enumerate C. perfringens. Therefore, this method should be implemented and further explored by laboratories around the world.

Key Words: Clostridium perfringens, Necrotic enteritis, Broiler, Fung double tube

P205 Evaluation of selected plant extracts for anti-oxidant and anti-inflammatory properties using tissue culture for quantification of nitrite Gopala Kallapura1,2, Olivia Faulkner, Alissa Pickarski, Kentu Lassiter, Neil Pumphord, Walter Bottje, Billy Hargis, Guillermo Tellez-Isaias Department of Poultry Science, University of Arkansas, Fayetteville, AR

Four plant extracts - Cat’s claw (CC), black walnut (BW), Clove, and Senna were evaluated for their anti-inflammatory and anti-oxidant properties by measuring nitric oxide (NO) production in vitro. Nitric oxide is a free radical with cytotoxic effects that is produced during an inflammatory response. Nitrite (NO2−) is an indirect measurement for NO and can be used to evaluate the anti-inflammatory and anti-oxidant properties of plant extracts. Lipopolysaccharide (LPS), or Gram negative bacteria cell wall components, stimulate macrophages and monocytes, or peripheral blood heterophils to produce NO2− within 24- to 72-h. We have developed a rapid tissue culture method measuring increased NO2− within 3 h of LPS stimulation in vitro in Salmonella-challenged chicks. Ileal cross-sections (0.5 cm) were collected from chicks that were challenged with 107 cfu/mL of S. Enteritidis continuously in the drinking water for three consecutive days. Explants were incubated with the plant extracts for 3 h and then stimulated with S. Enteritidis LPS. Nitrite was measured using the Griess reaction method and standards ranging from 1.25 to 90 µM NaNO2. Ileal sections that were collected from S. Enteritidis challenged chickens and then LPS-stimulated in vitro produced 200µM NO2−. CC, BW, and clove reduced NO2− production to 70µM, 75µM and 100µM nit-
Carboxyfluorescein diacetate succinimidyl ester (CFDA-SE) is an intracellular vital dye that fluoresces only in live cells, potentially allowing microscopic adhesion to enteric mucosal cells. Lactobacillus salivarius (LS) was stained with CFDA-SE and evaluated for in vitro ability to adhere to mucosal epithelial explants in vitro. In experiment 1, an overnight LS culture was combined with 0.1, 0.33, or 1 mM concentrations of CFDA-SE. Each concentration was incubated in fresh media with or without shaking for 2 h. After incubation, cells were washed to remove unabsorbed CFDA-SE and observed under UV light microscope for evaluation of fluorescence and background. LS combined with 1 mM CFDA-SE and incubated on a shaker provided the highest fluorescence with little background. This method was used to prepare a culture for experiment 2, in which CFDA-SE LS cells were combined with mucosal explants from the crop and ileum of neonatal chicks. Explants, consisting of epithelial or villus sheets, were immediately placed in cell culture medium, combined with CFDA-SE LS, and incubated at 37°C. Adhesion of stained LS to cells of explants were qualitatively observed at 0, 1, 6, and 24 h. At 0 h, LS adhered to cells of the crop; however, the number of LS observed in association with explants decreased throughout the 24 h period. Adherence of LS to ileal explants gradually increased through 6 h, with a substantial decrease at 24 h. Since CFDA-SE does not replicate, the 24 h decrease may be due to lower concentrations as a result of dilution by binary fission. This low-cost technique may provide for a rapid in vitro method for identifying beneficial probiotic candidates or screening for compounds that may interfere with pathogen binding.

Key Words: probiotic, gastrointestinal, adhesion, Lactobacillus, fluorescence

P207 In ovo supplementation of Primalac and the effects on performance and innate immunity genes in broiler chicks Tiffany Bell1,2, Chasity Cox1, Lindsay Summers1, Sungwon Kim1, Mark Young2, Rami Dalloul1

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Probiotics are live, nonpathogenic microorganisms known to have a positive effect on the host by improving the natural balance of gut microflora. The objective of this study was to determine the effects of administering probiotics (Primalac) in ovo on broiler chick hatchability, and post-hatch performance and intestinal immune-related gene expression. At embryonic day 18, 360 eggs were injected with PBS (sham), 1x10^1, 1x10^2, or 1x10^3 (P1, P2, and P3 respectively) probiotic bacteria. Another 90 eggs remained un.injected to serve as a negative control. On day of hatch (DOH), birds were individually tagged, placed into floor pens, and provided water and standard starter feed ad libitum. Measurements and ileal samples were taken on DOH and days 4, 6, 8, 15, and 22. No significant differences were seen among groups for hatchability, cumulative body weight gain, or feed intake; however, body weight of P2 was significantly higher than that of the negative control on day 6. On DOH, Toll-like receptor (TLR) 2 expression was upregulated in the ileum of all supplemented birds. TLR2 expression was downregulated on day 6 in the P3 group only when compared to the negative control, but was upregulated by day 22 in this group and on day 8 in the P1 and P2 birds.

While TLR4 expression was downregulated on day 6 in P1 birds, its expression was enhanced on DOH and day 22 in P3, and on day 8 in P1 and P2 groups. Inducible nitric oxide synthase (iNOS) expression was augmented in P3 on DOH but downregulated on day 6 in all groups when compared to the negative control. Expression of iNOS was enhanced in the sham, P1, and P2 groups on day 8 and in the P3 group on day 22. Trefoil factor family 2 (TFF2) expression was decreased in P1 and P3 chicks on day 6, but upregulated in P1 and P2 birds on day 8 and the P3 group on day 22. Taken together, these results indicate that in ovo supplementation of the probiotic product Primalac does not impact hatchability, and modulates ileal gene expression possibly an indication of a primed innate immune system.

Key Words: probiotics, chicken, innate, immunity, in ovo

P208 The effect of Bacillus subtilis on mucosa immune response of broilers challenged with Salmonella Minnesota Larissa Pickler1, Mariana Lourenço, Leonardo Migliolo, Eduardo Muniz, Antônio Leonardo Kraieski, Elizabeth Santin Federal University of Parana, Curitiba, Parana, Brazil

The aim of the study was to evaluate the effect of Bacillus subtilis on mucosa immune response in broilers challenged with Salmonella Minnesota (SM). Forty birds from 1-35 days were randomly assigned to 2 treatments: Control and Control + B. subtilis (2.13 x 106 CFU/g of feed) (Gallicpro®, Chr. Hansen A/S). At 15 days of age, all birds were orally challenged with a Salmonella Minnesota 108 CFU per bird. At 7 and 35 days of age 5 birds per treatment were euthanized and cecum was aseptically collected for Salmonella analysis and enumeration of goblet cells, CD4+ and CD8+ cells. For the statistical analysis, Salmonella colony counts were Log 10 transformed, and for goblet cells, CD4+ and CD8+ cell count ten microscopical squares were used. The results were analyzed by ANOVA (P=0.05) and Fisher’s exact test. At 7 days of age, cecum of the control group showed lower number of goblet cells and CD4+ cells (10.30±2.34; 8.30±3.30) compared to the B. subtilis group (15.70±2.54; 13.00±4.52). There was a significant difference in the count of CD8+ cells. At 35 days of age, there were no significant differences between the treatments in goblet cell and CD4+ cell count, but CD8+ cell count was statistically higher in the cecum of the control group (21.90±klplusmn;5.68) compared to the B. subtilis group (13.10±klplusmn;4.22). B. subtilis in the diet reduced the excretion of Salmonella in cecum significantly at 35 days of age (1.63 ± 1.10) compared to the positive control group (4.30±2.48). The results suggested that at 7 days of age, before SM challenge, B. subtilis resulted in increased expression of goblet cells and CD4+ cells, representing an activation of immunity. After challenge with SM there was an increase in the expression of CD8+ cells in the cecum of birds that did not receive probiotics. The above findings suggest that there is a direct relationship between the increase in the specific cellular immunity in birds fed probiotics and the presence of SM.

Key Words: B. subtilis, Salmonella count, chicken, microbiology, probiotics

P209 Bacillus subtilis significantly reduces Salmonella Minnesota in broilers and in the surrounding environment Larissa Pickler1, Mariana Lourenço, Leonardo Migliolo, Lenoardo Kuritza, Patrick Westphal, Eduardo Muniz, Elizabeth Santin Federal University of Parana, Curitiba, Parana, Brazil

The aim of the study was to evaluate the ability of Bacillus subtilis to control Salmonella Minnesota in broiler chickens and in the surrounding environment. Forty birds from 1-35 days of age were randomly assigned to 2 treatments: Control and Control + B. subtilis (2.13 x 106 CFU/g of feed) (Gallicpro®, Chr. Hansen A/S). At 15 days of age, all birds were orally challenged with Salmonella Minnesota 108 CFU per bird. Cloacal swabs were collected 48 hours after inoculation. At 35 days of age, 10 birds per treatment were euthanized and necropsied and the crop and cecum were aseptically collected. The environmental sampling was performed by collecting drag swabs from all pens on day 21 and 35 of age. All samples were analyzed for total Salmonella colony count. For statistical analysis, Salmonella colony counts were Log 10 transformed and the results were analyzed by ANOVA (P=0.05)
P210 Development of a Real Time PCR for Salmonella gallinarum detection in Mexican poultry
Julieta Ramirez\textsuperscript{a}, Emilio Venegas\textsuperscript{a}, Joaquín Delgadillo\textsuperscript{a}, Gerogina Robles\textsuperscript{a}, R Cruz\textsuperscript{b}
\textsuperscript{a}National Center of Diagnostic Services in Animal Health, Laboratory Biosafety Level 2 of Molecular Biology. \textsuperscript{b}Laboratory Biosafety Level 2 of Molecular Biology (BSL-2) of The National Center of Diagnostic Services in Animal health (CENASA in spanish). This laboratory belongs to SENASICA- SAGARPA. For the design of the probe and primers was used as reference gene RFBs, specific to Salmonella group D, which in its sequence shows a polymorphism that distinguishes Salmonella serotype S. gallinarum from the other serotypes of the D group. The results of this study showed that this technique can detect the DNA between 10 and 100 bacteria in tissue samples and at least 1 pg of genomic DNA. Based on these results, this test can be considered as an effective molecular tool for rapid detection and differentiation of Salmonella gallinarum from other Salmonella serotypes, with the advantage that it is possible to detect low concentrations of bacterial DNA in tissues and swabs samples.

Key Words: salmonella gallinarum, Real time PCR, Genomic DNA, Detection, Bacteria

P211 Effect of hyperimmune egg yolk immunoglobulin Y in Broiler chickens
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\textsuperscript{a}INVESTIGACIÓN APLICADA S.A. DE C.V. Puebla, Tehuacan, Mexico
Avian coccidiosis is an intestinal disease caused by several distinct species of Eimeria protozoa and is the most economically significant parasitic infection of the poultry industry worldwide. Different control methods are needed due to increasing concerns with drug use and high cost of vaccines, the use of the hyperimmune egg yolk immunoglobulin Y as an alternative control is the passive immunization using hyperimmune, parasite specific antibodies. In this study 69,000 broilers were fed during 5 weeks a normal standard diet with this hyperimmune IgY antibodies and supplemented with the same hyperimmune IgY antibodies in water during the third week. Body weights gains and oocyst numbers were measured. In this study, the protective effect of oral IgY from eggs of hens hyperimmunized with mixed Eimeria oocysts was evaluated on experimental coccidiosis. After the administration broilers exhibited increased body weight gains, 40 grams compared with the historical weights in the same farm and after the third week reduced fecal oocyst shedding, there was not a coccidiosis problem in the farm. This study demonstrated beneficial effect of using an immune enhancing supplement like hyperimmune IgY antibodies to passively provide significant protection against avian coccidiosis.

Key Words: Avian coccidiosis, Eimeria, Hyperimmune egg yolk, Immunoglobulin Y
P214 Field evaluation of a protected combination of sodium butyrate and essential oils (Natesse®) Juan José Mallo*, Mónica Puyalto, Iván Kis Norel S.A., Madrid, Spain

Sodium butyrate is a contrasted growth promoter and regulator of the intestinal microflora, its combination with essential oils improve those effects, due to the synergy between those active principles. However, for both compounds to work appropriately, it is necessary to ensure that a part of them can reach the distal parts of the gastrointestinal tract, and this can be done with vegetable fat; the part of the active substances that is protected with the fat is released only after it is digested. The benefits of the combination of sodium butyrate and essential oils protected with vegetable fats (Natesse®) on animal health (immune response, resistance to necrotic enteritis, etc.) has been described in the literature, but the effect that it has on practical zootecnic parameters is not so well referenced. The aim of the study was to evaluate the effects that Natesse® has on the production of broiler chickens in a field trial. One farm with two buildings of 1.800 m² each was used for the trial. In the control building, 34.480 broilers were allocated at the beginning of the trial, with a density of 19’15 broilers per m²; these broilers received the normal starter-finisher feeding program used by the integrator. In the experimental building, a total of 35.740 broilers were allocated for the trial, with a 3’65% higher density (19’85 broilers per m²). These animals received the same feeding program as the control animals with the addition on top of Natesse® at 1 kg/ton of feed in the starter feed and at 0’5 kg/ton of feed in the finisher feed. The animals in the control group were sent to the slaughterhouse at day 41’08, with an average final body weight of 2.336 g. The animals in the experimental group were sent to the slaughterhouse with 2.371 g of body weight (1’49% higher than control) at day 40’76 (0’77% less time). The feed conversion ratio of the control group was 1’852, 14 grams worst (0’76%) than the FCR of the experimental group, 1’838. There were differences in mortality as well, the control group had a mortality of 6’27%, and the experimental group had 6’69% less mortality, 5’85%. A total of 75.485 kg of broiler were sent to the slaughterhouse from the control building, whilst a 5’67% more was sent from the experimental group, 79.770 kg. The combination of these differences produced a better European Production Efficiency Factor of the experimental group, 298, 3’54% better than the control group EPEF, 288. It is concluded that the use of Natesse® on broiler feeds improves growth, reduces FCR, decreases mortality of the animals and produces better EPEF in broiler flocks.

Key Words: Natesse, Sodium butyrate, Essential oils, Broilers, Field trial

P215 An improved procedure for enumeration of Clostridia from Feeds Lenka Derome*, Lenka Guarino, Julio L Pimentel, Kurt Richardson, Don Wilson Anitos, Lawrenceville GA

Feed has been reported as a vector to Clostridia transmission to the animal. Enumeration of Clostridia using the Bacteriological Analytical Manual (BAM) procedure resulted in a high degree of variation within replicate samples analyzed on the same day (CV ≈ 25%) and within replicate samples analyzed on separate days (CV = 19%). This variation was associated with an agglutination of viable clostridial cells during the mixing/suspension stage of the analysis. Trehalose, maltodextrin and Tween-80 were evaluated to determine if the agglutination effect could be overcome. In the first study, the addition of trehalose at 0.1% or maltodextrin at 0.1% or 1.0% to peptone water improved the recovery of clostridia and decreased the variation within repetitions. In the second study, three concentrations of Tween 80 (.001%, .01% and .1%) were added to peptone water. The addition of 0.1% tween-80 improved the recovery of clostridia and decrease the variability from 70% to 7.5%. In the third study, 0.1% of trehalose, maltodextrin and tween-80 were added to peptone water maltodextrin resulted in higher average Clostridia recovery but with higher variability than Tween-80, 31% as compared to 17% respectively. The weekly variation by using 0.1% Tween-80 was 4% in the first week and 8% in the second week of testing.

Key Words: clostridia enumeration, tween-80, trehalose, maltodextrin

P216 Production characteristics of Hy-Line W36 laying hens hatched from white and discolored eggs E.J. Kim*, J.L. Purswell, J.D. Evans, S.L. Branton ARS-USDA Poultry Research Unit, Mississippi State, MS

Eggshell color can greatly influence visual appeal of table eggs and within the U.S., table eggs are normally sorted and marked according to eggshell color to maximize consumer appeal. Recently, table egg producers noted the presence of “off-color” or discolored (DC) eggs derived from breeder hens. Concern was expressed as to whether hatching these DC eggs would result in commercial pullets that could produce DC eggs and differ in production characteristics from birds hatched from non-discolored (NDC) eggs. Therefore, the objectives of this study was to determine the production characteristics of laying hens hatched from different colored eggs. Hy-Line W36 eggs were obtained from a commercial hatchery. Eggs were tested for color using a Minolta colorimeter prior to incubation. Color was tested against a “true” white (L = 100, a = 0, b = 0) and eggs closest to white were placed into a NDC group and eggs farthest from true white were placed into a DC group. Treatment groups were placed into separate hatching trays. On d 1, birds from each treatment group were individually wing-banded and recorded. At 18 weeks, pullets were randomly allocated into cages, based on their treatment groups. Birds were placed into individual cages, split amongst 4 identical rooms, each room containing 80 cages. Five consecutive cages consisted of a replicate. Each treatment was replicated 24 times throughout the four rooms for a total of 120 birds per treatment. Birds were fed a nutritionally complete layer diet. A production trial was conducted from 18-34 wks of age. Birds were weighed every 4 weeks until completion. An average weekly egg production was calculated. Feed intake (FI), egg weights (EW), and egg color was analyzed biweekly. Birds hatched from DC eggs had significantly increased BW, FI, and hen-day egg production when compared to the NDC treatment. Eggshell color was also found to be significantly different for the NDC and DC groups with DC eggs being significantly further from true white. Selection of progeny based on eggshell color may be a criterion for white egg layers as layers hatched from DC eggs resulted in more off-color eggs, which may affect consumer preferences for buying white table eggs.

Key Words: laying hens, egg production, eggshell color

P217 Evaluation of the adjuvant properties of chitosan in combination with a Salmonella enteritidis bacterin Srichaitanya Shivaramaiah*, Neil Pumford, Marion Morgan, Amanda Wolfenden, Guillermo Tellez, Billy Hargis University of Arkansas, Fayetteville, AR

Chitosan is a linear polysaccharide and is an important component of the exoskeleton of crustaceans. It has a number of uses in agriculture, biomedical, industrial and food processing industries. Presently, we evaluated the effect of chitosan, either alone, or with specific modifications as adjuvants for enhancing mucosal IgA, serum IgG and Salmonella clearance when administered with a Salmonella enteritidis (SE) bacterin. Day-of-hatch broiler chicks were randomly neck-tagged and divided into the following groups: 1) Control; 2) Chitosan; 3) Chitosan + Heat labile enterotoxin from E. coli; 4) Chitosan + B-sub unit of cholera toxin; 5) Chitosan + Lipid A from Salmonella; 6) a proprietary modification of chitosan V1; 7) a proprietary modification of chitosan V2; 8) Chitosan DW and 9) Chitosan + saponin. Groups 2-9 received...
of DCM in chickens. Broiler males (n=280) were individually weighed and randomly assigned to experimental diets containing 0, 200, 400, 500, 600 and 700 parts per million (ppm) furazolidone. The diets comprised 3,200 and 3,275 kcal ME/kg, and 20 and 23% CP at 0-3 and 4-8 weeks of age (WOA), respectively. The diets were replicated four times and feed and water were provided at free choice. Mortality was recorded as it occurred and body weights (BW) and feed consumption (FC) were measured weekly. At 8 WOA, blood serum was obtained from 20% of birds from each treatment and analyzed for metabolic profiles. The birds were sacrificed and heart, liver, spleen, gall bladder and abdominal fat (AF) were excised and weighed. Feeding 200-700 ppm furazolidone did not change FC, BW gain, feed conversion ratios and organ weights of broilers. However, weight of AF was lower (P<0.05) and the hearts exhibited dilated left ventricular chambers in birds fed furazolidone at 500-700 ppm. Serum glutamic oxaloacetic transaminase was elevated while glucose and bilirubin levels were decreased in birds fed diets containing furazolidone. These changes in morphology of the heart and metabolic indices are associated with DCM; hence the condition was successfully induced in broilers by feeding 500-700 ppm furazolidone.

Key Words: Cardiomyopathy, poultry, chickens, furazolidone

P221 Type of litter and incidence of carcass lesions in broiler chickens

The aim of this study was to evaluate the effect of the internal temperature variation, minimum temperature (MinT), maximum (MaxT), medium (MedT), operating (OT), and the coefficient of variation (CV), on body weight (BW), feed intake (FI), feed conversion (FCR) and the mortality rate (M) in broilers. There were used 2800 broiler chicks (Ross 308) and were maintained until 21 days of age, randomly allotted into two treatments with different CV of the internal temperatures (12% vs 21%), each treatment had 14 repetitions of 100 birds. Each treatment had 3 digital thermometers located at the height of the birds, which were set to record the temperature every hour. For the lower CV environment, the results indicate a better BW (P<0.01) (730 vs. 658 g.) and a lower OT (31, 30 and 30.8 vs. 34, 33.2 and 33.7°C during the 1st, 2nd and 3rd week respectively in each treatment), the better BW could be influenced by the FI (P<0.01) from each treatment (1123 vs. 1034 g.), while there were not statistical differences (P<0.05) for the FCR and for the M rate. We conclude that maintain temperatures with CV below 12% during brooding, helps to express the genetic potential of broilers.

Key Words: Broiler Production, Environmental Management, Brooding Temperature Variation

P218 Palatability of Tannin-rich Sericea Lespedeza fed to broilers
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As parasites become resistant to available medications new methods of control are needed. New drugs take a long time to develop in addition to being expensive; therefore, there is increasing interest in finding and using natural alternatives. Additionally, natural remedies are needed for the organic sector as man-made drugs are not allowed and birds with outdoor access are likely to encounter parasites. Sericea Lespedeza (SL, Lespedeza cuneata) is a common perennial deciduous legume found in pastures across the southern US that has been shown to be effective at controlling parasitic nematodes in small ruminants due to its condensed tannins content. Diets that are high in condensed tannins are often unpalatable to poultry. Therefore to determine their potential in controlling parasites in poultry, SL was added to a standard broiler feed to mimic birds with outdoor access consuming SL. Diets were added with 0% (C), 5% (SL5), 10% (SL10) or 20% (SL20) SL, and fed from hatch until harvest of DCM in chickens. Broiler males (n=280) were individually weighed and randomly assigned to experimental diets containing 0, 200, 400, 500, 600 and 700 parts per million (ppm) furazolidone. The diets comprised 3,200 and 3,275 kcal ME/kg, and 20 and 23% CP at 0-3 and 4-8 weeks of age (WOA), respectively. The diets were replicated four times and feed and water were provided at free choice. Mortality was recorded as it occurred and body weights (BW) and feed consumption (FC) were measured weekly. At 8 WOA, blood serum was obtained from 20% of birds from each treatment and analyzed for metabolic profiles. The birds were sacrificed and heart, liver, spleen, gall bladder and abdominal fat (AF) were excised and weighed. Feeding 200-700 ppm furazolidone did not change FC, BW gain, feed conversion ratios and organ weights of broilers. However, weight of AF was lower (P<0.05) and the hearts exhibited dilated left ventricular chambers in birds fed furazolidone at 500-700 ppm. Serum glutamic oxaloacetic transaminase was elevated while glucose and bilirubin levels were decreased in birds fed diets containing furazolidone. These changes in morphology of the heart and metabolic indices are associated with DCM; hence the condition was successfully induced in broilers by feeding 500-700 ppm furazolidone.

Key Words: Salmonella, chitosan, adjuvant, mucosal, vaccine

P219 Furazolidone-induced cardiomyopathy in broiler chicks
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Dilated Cardiomyopathy (DCM) is a heart disease associated with rapid growth, high metabolic processes and mortality in poultry. Little is known of the causes of DCM in chickens (Gallus domesticus). Hence, the objective of this study was to develop a model for future studies of DCM in chickens. Broiler males (n=280) were individually weighed and randomly assigned to experimental diets containing 0, 200, 400, 500, 600 and 700 parts per million (ppm) furazolidone. The diets comprised 3,200 and 3,275 kcal ME/kg, and 20 and 23% CP at 0-3 and 4-8 weeks of age (WOA), respectively. The diets were replicated four times and feed and water were provided at free choice. Mortality was recorded as it occurred and body weights (BW) and feed consumption (FC) were measured weekly. At 8 WOA, blood serum was obtained from 20% of birds from each treatment and analyzed for metabolic profiles. The birds were sacrificed and heart, liver, spleen, gall bladder and abdominal fat (AF) were excised and weighed. Feeding 200-700 ppm furazolidone did not change FC, BW gain, feed conversion ratios and organ weights of broilers. However, weight of AF was lower (P<0.05) and the hearts exhibited dilated left ventricular chambers in birds fed furazolidone at 500-700 ppm. Serum glutamic oxaloacetic transaminase was elevated while glucose and bilirubin levels were decreased in birds fed diets containing furazolidone. These changes in morphology of the heart and metabolic indices are associated with DCM; hence the condition was successfully induced in broilers by feeding 500-700 ppm furazolidone.

Key Words: Cardiomyopathy, poultry, chickens, furazolidone
Two treatments were assessed: 1) low drinker height (the bird does not stretch its neck and drinks by the side of the beak); and 2) higher height (the bird stretches its neck, lifts its chest and drinks with the point of its beak). The study had 5 repetitions of 7 birds each, using a total of 35 Ross 308 line males. Nipple drinker height was adjusted twice a week based on visual observation of birds while drinking and drinking water temperature was kept between 17 and 20 °C. Handling and lodging were based on broiler chicken recommendations; photoperiod was natural and population density was 10 birds per m². Variables were recorded weekly. At 42 days of age there was a numeric difference between treatments. Body weight, with lower drinker height, was 57 g heavier in relation to the other treatment, 2.776 Kg and 2.719 Kg (p=0.33); conversion index among groups was determined between 1.47 lower nipple drinker and 1.53 the higher one (p=0.11). Accumulated mortality, for the lower drinker treatment was 11.4% and 25.7% for the higher drinker (P<0.05); in the second group most of the birds died due to ascites. Final uniformity of the birds was 90.40% for the lower treatment and 78.80% for the higher one; variation coefficient was 6.3 and 8.4 respectively. Also, accumulated average water consumption per bird was estimated for the lower treatment in 3.05 liters/bird and for the higher one, 2.70 liters/bird. Results suggest that nipple height does not affect productive parameter, nevertheless, with a lower height the bird has easier access to water, therefore it is less stressful and consumption is higher, which is very important where heat conditions require availability and free access to fresh water.

Key Words: Broiler, Nipple, Productive parameters, Drinker
P226 Effects of cage-free housing system on performance, egg quality, and bone health in White Leghorn laying hens. P. E. Eusebio-Balcazar, S. E. Purdum

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The aim of this study was to evaluate the effects of cage-free and conventional cage housing systems on hen performance, egg quality, and bone health. For this purpose, at 33 wk of age, 264 Bovan White laying hens were randomly allocated to eight wood shaving litter pens or eight conventional cages located in the same room. Each floor pen contained 29 hens and each cage contained 4 hens. All eggs from cages and 15 eggs from each floor pen were collected to obtain egg weight, percentage of egg components and solids, and Haugh Units at 37 and 43 wk of age. The same number of eggs was collected to measure eggshell breaking strength at 37, 41 and 47 wk of age. Hens were individually weighed and inspected for keel bone deformities using a 4-point scale (1=Normal, 4=Severe) at 38, 42, 46 wk of age. At 48 wk of age, two randomly selected hens per replicate were determined to obtain in- vivo bone mineral density (BMD) using dual-emission x-ray absorptiometry (DEXA). Data was analyzed using a completely randomized design. Floor-raised hens had lower BW (P<0.05) and hen-day egg production (P<0.001) compared to caged hens during 33 to 47 wk of age. Caged eggs contained heavier yolks and smaller albumen than eggs from floor-raised hens at 37 (P<0.1) and 43 wk of age (P<0.05). At 37 wk of age, floor eggshells were stronger than those from caged eggs (P<0.05); however, the opposite was observed at 41 wk of age (P<0.05). The overall keel bone deformities tended to be more severe in floor hens compared to cage hens (1.97 vs. 1.80, P=0.119). Feed intake, BMD, egg weight, eggshell percentage, Haugh Units were not different between floor pen and cage system (P>0.05). Thus, cage-free housing system influenced hen BW, egg production and quality, and keel bone deformities in laying hens.

Key Words: Keel bone deformities, eggshell breaking strength, laying hens

P227 Effects of environmental enrichment strategies on floor eggs and heterophil to lymphocyte ratio of broiler breeders reared under thermoneutral and heat stress conditions

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In spite of the purported benefits associated with enriched housing, some concerns have been expressed regarding the possibilities of increased floor eggs associated with this management plan. The objective of this experiment was to evaluate the effects of perch structures and sand on floor eggs and the heterophil/lymphocyte (H/L) as a measure of stress in broiler breeder birds reared in thermoneutral (TNE) and heat stress environments (HSE).

At 21-weeks of age, Cobb 500 broiler breeders (288 females and 48 males) were assigned to 4 treatments in each of 2 rooms. One room was maintained at 23°C (TNE) while the other room cycled between 23°C and 30°C (HSE). Treatments were 1) no enrichment (2) sand (3) perch and (4) sand and perch. The 4 treatments were replicated 3 times with 12 females and 2 males per replicate. Eggs were collected daily and the number of floor eggs counted. Blood samples were collected at 24, 32 and 40 weeks of age and H/L determined.

The data were analyzed using completely randomized design with repeated measures. Response variables were analyzed with the mixed model analysis of variance (ANOVA) procedure of SAS 9.2 and least square means was used to determine significance (P<0.05). The results indicate that (1) birds in the control treatment tended to lay more floor eggs compared to other treatments (P=0.0937); (2) There was a significant difference in percentage floor eggs across the weeks (P=0.0188); (3) H/L was significantly lower in week 24 compared to weeks 32 and 40 (P< 0.001); (4) at week 40, H/L was significantly higher in HSE (P=0.0206) and (5) sand tended to reduce H/L (P=0.08)

Key Words: Environmental enrichment, Heat stress, Broiler breeders, Heterophil /lymphocyte ratio, Floor eggs

P228 Most Frequent Diseases, Probable Causes and Their Effects on Companion Birds’ Behavior. Lorena Moreno-Soto, Jose A. Quintana, Juan Carlos Morales, Alberto Tejeda, Karina Acevedo-Whitehouse

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Eight-hundred and thirty-six clinical histories from poultry that were seen from the first of July 2010 to the 30th of June 2011 were analyzed. These birds belong to 12 orders, most of which belonged to the Psittaciformes order with 72%, followed by 14% from the Passeriformes order. Of the diagnosis obtained during this year, 52% were related to food disorders, 22% to respiratory disorders and 18% to trauma, which corroborates that more than 80% of illnesses in captive birds are related to inappropriate nutrition and handling as well as adverse environments. Situations such as isolation, climate changes, separation from companion, forced exercise, fear, hunger, manipulation, toxins and abnormal physical conditions such as infections, trauma and pain, cause “negative emotional states”, that is to say, these are stressful factors that induce behavioral alterations such as aggression, flight attempts, vocalizations, feeding and drinking changes, feather picking, depression, repetitive movements and reproduction suppression. Some diseases that used to be attributed solely to infectious agents may in reality have diverse causal or contributing factors such as metabolic, genetic and behavioral alterations. This calls for more information and better health care of birds that are maintained captive.

Key Words: Birds, Adverse Environment, Disease, Behavior

P229 A novel chromogenic plating medium for the isolation of Campylobacter jejuni and Campylobacter coli

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Campylobacter jejuni and C. coli account for more than 99% of human isolates associated with campylobacteriosis. Some bacteria are inhibited by selective ingredients and/or microaerophilic conditions however; a large array of false-positive isolates can interfere with Campylobacter isolation using current, traditional plating media testing procedures. This investigation developed and tested a selective/differential plating medium to reduce false positive isolates using a chromogenic substrate to identify the C-2 esterase activity in C. jejuni and C. coli. C. jejuni, C. coli, and C. lari isolates were grown under microaerophilic conditions at 41-42°C for 48 h in a modified Bolton broth (without inhibitors or blood). Other bacteria were grown in nonselective broths at 35°C for 24 to 48 h. After incubation, the broths were streaked on the Campylobacter jejuni/C. coli Chromogenic Plating Medium (CCPM) and incubated microaerophilically at 41-42°C for 48 h testing a total of 188 microbial strains. C. jejuni (54 strains) and C. coli (38 strains) produced flat to convex, dark salmon colonies, 1.0 to 2.0 mm diameter with and without a clear ring and no swarming, whereas C. lari (5 isolates) colonies were flat to convex, beige to off-white, 1.0 to 2.0 mm in diameter with a clear ring and no swarming. The enterics (except for one strain of generic Escherichia coli and Enterobacter aerogenes produced scant growth and off-white pinpoint colonies), and most other Gram negative, Gram positive bacteria and yeast did not grow. Only one strain each of Acinetobacter calcoaceticus and Acinetobacter baumannii produced similar morphologies to C. jejuni/C. coli. The CCPM had a 100% inclusivity and 98% exclusivity for organisms tested. The chromogenic effects on Companion Birds’ Behavior.
P230 Relationship of daily egg moisture loss during incubation to hatch time and egg size in experiments evaluating storage temp and warm-up of broiler eggs. M. J. Wineland*, D. T. Ort, K. M. Mann, F. W. Edens North Carolina State University, Raleigh, NC

In the poultry industry, there have been conflicting reports on the optimal egg room temperature during short-term storage (HOLD) and egg warm-up (WARM) prior to incubation. Objectives were to evaluate if HOLD or WARM for 4 days prior to incubation have an impact on hatch time or daily moisture loss of eggs and if there is a relationship between daily moisture loss and hatch time of hatching eggs in two trials from breeder flocks (Ross 708) that were 48 or 55 WOA respectively. Two environmentally controlled rooms were maintained (HOLD) at 15.5° and 23.9° C for 4 days prior to incubation. Relative humidity was approximately 60%. Prior to setting, eggs were pre-warmed (WARM) for either 3 or 15 hours at 26.6 degrees C. 560 eggs per treatment group were used for each trial designed as a 2 x 2 factorial with main effects HOLD and WARM. Daily moisture loss and hatch time were analyzed using the Proc GLM of SAS. Correlation was determined between daily moisture loss and hatch time and egg size. In both trials there was no significant difference (P>0.05) in hatch time for either HOLD or WARM treatments. In experiment 1 there was a significant difference for the main effects with regards to daily moisture loss and in experiment 2 there was an interaction. In both experiment 1 and 2 there was a significant correlation between daily moisture loss and initial egg weight but not with hatch time. There was a significant difference between hatch time and initial egg weight. These results suggest that holding temperature during storage or pre warm may have an effect upon daily moisture loss during incubation but there is no significant effect upon hatch time.

Key Words: hatch time, moisture loss, storage temperature, pre warm, incubation


Several factors can affect the performance of broilers, such as genetics, nutrition, management and thermal environment. There are also factors such as breeder's age and eggs storage duration that can influence, even though before incubation, on the early development of birds, bringing consequences to their entire rearing period. Thus, this work aimed to evaluate the influence of the age of the breeder and egg storage duration on performance and carcass yield of broilers reared up to 42 days old. A total of 2916 male Ross 308® broiler chicks were distributed in a completely randomized 3x3 factorial design, related to the ages of breeders (33, 43 and 61 weeks) and three eggs storage time (24, 72 and 120 hours) and had the parameters, initial body weight (IBW), the final body weight (FBW), the body weight gain (BWG), feed intake (FI), feed conversion (FC), mortality (MORT) and carcass yield assessed in a weekly basis. In the comparative analysis, the IBW was the parameter that showed interaction between factors (P<0.05) in most of the weeks. In the evaluation between 1 to 42 days FBW and BWG showed no interaction (P>0.05). The parameters that showed interaction were the IBW, FI, FC and MORT. The IBW of broilers from breeders at the age of 61 weeks showed the highest values while that from breeders at the age of 33 weeks showed the lowest values and both times did not differ in 24 and 72 hours. FI in the storage time of 72 hours, the ages of 61 and 43 weeks were significant (P<0.05). FC and MORT, both were significantly different between the broilers from breeders at the ages of 33 and 43 weeks in a storage time of 120 hours. Values for carcass yield before chilling process (hot carcass) and after (cold carcass) and the yield of head, feet, heart, gizzard, did not show effects of the different treatments (P=0.05). According to the conditions of this work was carried out, it is concluded that there was interaction between the age of the breeder and egg storage duration on the performance of broilers for some weeks of rearing period, however the same was not observed for the yield of the carcass of broilers.

Key Words: breeder age, eggs storage, performance, carcass yield

P232 Influence of incubation temperature on susceptibility to poult enteritis and post-hatch intestinal development of commercial turkeys. Jennifer Sottosanti*1,2, James GuY1, Bill Pierson1, Rami Dalloul1, Audrey McElroy1 1Virginia Tech, Blacksburg, VA, 2NC State, Raleigh, NC, 3Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, VA

Exposure of commercial turkeys to stressors during early development may affect performance, susceptibility to pathogenic challenges, and mortality. Temperature stress during incubation, particularly during the oxygen consumption plateau at which time both temperature and hypoxic stressors are present, may influence intestinal development and maturation. Consequences may include reduced intestinal function and impaired mucosal immunity, thus impacting the bird’s response to post-hatch challenges. Turkey coronavirus (TCV) is a viral inducer of poult enteritis with damaging effects on intestinal epithelium and enterocyte absorptive capacity, thereby leading to malabsorption, poor performance, and mortality. The severity of enteritis may be impacted by intestinal maturation; thus, stressors that delay or negatively impact development and maturation could predispose the poult to enteric infection. This study examined the effects of incubation temperature stress during the oxygen consumption plateau (ED24-28) and post-hatch TCV challenge on poult intestinal development. Hybrid turkey eggs were incubated at the following shell temperatures between ED24-28: low(L, 36°C), standard(S, 37.5°C), or high(H, 39°C). From E0-24, all eggs were incubated at S. Half of the pouls from each incubation group were inoculated with TCV (3000 EID₅₀/0.1mL) at d5 post-hatch. Duodenum and jejunum samples were collected at 0 days post inoculation (dpi) and 6dpi for evaluation of villus height, crypt depth, and villus height:crypt depth (VCR). There were no differences in duodenum at 0dpi; however TCV challenge increased (P<0.0001) crypt depth and decreased (P<0.0001) VCR at 6dpi. Jejunum villi were longer (P=0.05) at 0dpi in L incubation group compared to S, and crypts were deeper (P=0.0031) in H and L compared to S. Challenge with TCV increased (P<0.0001) jejunum crypt depth and decreased (P=0.0025) VCR at 6dpi. There were no interactions between temperature and challenge; however, these results provide insight regarding the independent effects of incubation stress and post-hatch TCV challenge.

Key Words: incubation, enteritis, poult
P233 The effects of egg room temperature and pre-warming prior to incubation on embryo growth and broiler performance D.T. Ort*, M. J. Wineland, K. M. Mann, F. W. Edens North Carolina State University, Raleigh, NC

In the poultry industry, there have been conflicting reports on the optimal egg room temperature during short-term storage and egg warm-up prior to incubation. The objectives of this study were to evaluate embryonic growth, metabolism, and broiler performance using two different short-term storage temperature treatments. Additionally, questions arise as to how long eggs should be warmed in the setter hall before setting.

Two environmentally controlled rooms were maintained (HOLD) at 15.5°C and 23.9°C for 4 days prior to incubation. Relative humidity was approximately 60%. Prior to setting, the eggs were pre-warmed (WARM) for either 3 or 15 hours at 26.6 degrees C. Eggs from two breeder flocks, Ross 708 that were 48 or 55 WOA, were used for each trial designed as a 2 x 2 factorial with main effects HOLD and WARM. Embryo body weights (BW), with yolk and without yolk, were recorded. Heart and liver tissues were collected at 18E, 20E, and from hatch to adolescents for glycogen determination. Statistical analysis was performed by PROC GLM procedure in SAS. There was a significant HOLD effect at 18E for BW, with and without the yolk in trial 1, but with no differences in trial 2. BW at external pipping (20E) and at hatch was not different across all treatments in both trials. There were no significant differences in relative heart or liver weight at hatching across all treatments across all treatments groups. Even though FCR did not differ at 6 weeks of age, those eggs held at 23.9°C were 6 points lower than those eggs held at 15.5°C in trial 1. BW was not significant at 6 weeks of age in trial 1. In conclusion, these results suggest that holding eggs for 4 days at 15.5°C or 23.9°C prior to setting have no effect upon the embryo parameters or broiler performance. Additionally, a pre-warm period of 3 or 15 hours prior to incubation provided similar results.

Key Words: embryo, incubation, egg storage, pre-warm

P234 The age of the breeder and egg storage time on the embryonic developmental characteristics. A total of 900 eggs were incubated and analyzed according to a completely randomized 3x3 factorial design, related to the ages of the breeders (33, 43 and 61 weeks) and three eggs storage time (24, 72 and 120 hours). All eggs came from a same commercial heavy breeder strain of broiler chickens. The eggs incubation and analysis were made at the Animal Science Laboratory from FCA/UFMG and were evaluated at 11, 13, 15, 17 and 18 days of embryo development. The findings showed no interaction between age of the breeder and egg storage time on any of the days of embryonic development. However, it was observed the influence of the age of the breeder (p <0.05) on the egg weight, and also on weight of egg yolk. The age of the breeder at 61 weeks presented the highest values when compared to the age of 33 weeks, but sometimes did not differ from breeder at the age of 43 weeks. Thus, breeder at the age of 33 weeks produced the lowest egg weight and also weight of yolk. The embryonic mortality did not present interaction between age of the breeder and egg storage time either. However, the mortality at the intermediate stage of embryo development occurred more often.

Key Words: breeder age, egg storage, embryonic development, broiler, incubation

P235 Specific gravity, shell thickness and calcium level of egg shells prior to and after incubation of eggs from 46 weeks-old Leghorn hens Luis Abarca*, Jose A. Quintana, Maria Teresa Casaubon, Sergio Gómez Universidad Nacional Autonoma de Mexico, Mexico D. F. Mexico

Egg shell quality is based on its thickness and weight. There are several methods that measure shell thickness and specific gravity whereby density is established. During its development the chick embryo mobilizes calcium from sources outside itself, mainly from the diverse egg structures; egg shells contain around 372.88 mg/g of calcium. Fertile eggs from forty-six weeks old hens of the Bovans White line were placed in two groups; the first group of 25 was used for study and the second for incubation. Eggs and their shells without membranes were weighed on a digital scale and their thickness measured with a digital micrometer. Specific gravity of the shell was estimated by the Archimedes Method. A gram of shell was submerged in a graduated cylinder with water at 26 °C and the amount of displaced water was recorded. Also four samples were taken per group to determine calcium by atomic absorption technique. Eggs of Group 1 had an average weight of 59.75 g, SD 1.65; shells weighed 5.13 g, SD 0.39, representing 8.58% of the total and shell thickness was 0.336 mm, SD 0.02; Group 2 had an average weight of 59.56 g, SD 2.86, with shell weight of 4.61 g, SD 0.50, corresponding to 7.74% of total weight, with 0.302 mm, shell thickness, SD 0.02. In the density test, Group 2 displaced 4% more water due to the fact that a larger amount of shell was required to complete one gram. During calcium analysis, Group 1 had 358,115 ppm with SD 10729.23 and Group two, 358,221 ppm with SD 17167.93. Even though it has been described that the embryo takes close to 75% of its Ca requirements from the shell, there were no differences observed prior to and after incubation. There were significant differences (p<0.05) in shell thickness and density prior to incubation.

Key Words: Shell, calcium, thickness, embryo, incubation

P236 The effect of pre-storage warming on pre-peak broiler breeder eggs Rachael Horril*, Dennis Ingram Louisiana Agricultural Experiment Station Louisiana State University Agricultural Center, Baton Rouge, LA

This experiment was conducted to determine if pre-storage warming affects the hatchability of eggs laid by pre-peak broiler breeder hens. Two trials were completed using 1,800 freshly laid eggs from Ross 708 breeder breeders between 28 and 30 weeks of age. For each trial, the eggs were transported for approximately four hours to LSU, where they were numbered, randomized, and placed into a cooler set at 15°C with 60% relative humidity, until treatments began 24 hours later. The eggs were then warmed for either: 0, 3, 6, 9, 12 or 15 hours. All the eggs, except for the control treatment, were warmed in a Natureform® Set-ter 2000 at 27°C and 60% relative humidity for the specified duration and then placed directly back into the cooler. After the warming period, the eggs were stored for three days and then set in a Natureform® Set-ter at the same temperature/humidity used during the treatments. On the 7th and 14th day, the eggs were candled and the infertile and fertile dead eggs were removed. These eggs were broken to determine true fertility. On the 18th day, the remaining eggs were transferred into a Natureform® Hatcher at 37°C and 75% relative humidity. After 21
days of incubation, all unhatched eggs were broken to determine time of embryo mortality. A randomized block design was used for statistical analysis. A block, which contained an individual level in the incubator, consisted of an experimental unit of 30 eggs each for all treatments. Before analysis, all percentages underwent arcsine conversion. Trials 1-2 were combined since no trial by treatment interactions were significant. In all trials, percent early, mid, late, total dead, pips, fertile hatchability, and total hatchability were measured. Both fertile hatchability and total hatchability were significantly ($P = 0.05$) increased in the 12-hour warming period. Pips also were significantly ($P = 0.06$) decreased in response to the 6 and 12 hour warming periods. Regression analysis was conducted and the resulting line showed 12 hours of pre-storage warming produces the highest fertile hatchability. Thus, fertile hatchability can be increased by pre-storage warming when used in this manner with this strain and age.

**Key Words:** Broiler breeder, Egg warming, Fertile hatchability, Egg storage, Embryo mortality

**P237 Effects of photoperiod and light intensity on growth performance and carcass characteristics of broilers grown to heavy weights.** Hammel A. Olanrewaju, Joseph L. Purswell, Stephanie D. Collier, Scott L. Branton USDA-ARS, Strakville, AR

This study investigated the effects of photoperiod and light intensity and their interaction on growth performance and carcass characteristics of heavy broilers in 2 trials. Five hundred and forty Ross × Ross 708 chicks were randomly distributed into 9 chambers at 1 d of age, provided 23L:1D with 20 lx of intensity to 8 d, and then subjected to the following treatments. The treatments consisted of 3 photoperiod (long/continuous [23L:1D] from d8-d56; regular/intermittent [2L:2D], and short/non-continuous [8L:16D] from d8-d48 and 23L:1D from d49-d56, respectively) and exposure to 3 light intensities (10, 5.0 and 0.5 lx) from day 8 through d 56 at 50% RH. Feed and water were provided ad libitum. Birds were provided a four phase-feeding program (Starter: 0-14 d, Grower: 15-28 d, Finisher: 29-42 d, and Withdrawal: 44-56 d). Birds and feed were weighed on 0, 14, 28, 42, and 56 d of age for growth performance. At 56 d of age, 20 (10 males and 10 females) birds from each chamber were processed to determine weights and yields. Broilers subjected to short/non-continuous photoperiod significantly ($P < 0.05$) had poorer BW, BW gain, FI, carcass weight, and pectoralis major and minor weights compared with values obtained at long and regular/intermittent photoperiods. There was no effect of light-intensity on all examined variables except on live weight and tendon weight. Feed conversion and mortality were not affected by treatments. Also, there was no photoperiod × light intensity interactions observed for all variables. In addition, corticosterone concentrations were not significantly affected by treatments, suggesting an absence of physiological stress. These results indicate that long/continuous and regular/intermittent photoperiod improved broiler performance comparable with that of short/non-continuous photoperiod, but minimal effect due to light intensity treatments.

**Key Words:** broiler, light intensity, photoperiod, carcass yield, stress

**P238 Histological changes in the broiler embryonic pipping muscle between days 15 and 19 of incubation** R. Pulikanti, E. D. Peebles, A. O. Sokale, W. R. Maslin Mississippi State University, Mississippi, MS

Nutritional and metabolic changes in the avian pipping muscle have been discussed by previous researchers. The current experiment was conducted to examine histological changes in the pipping muscle of a modern broiler strain between d 15 and 19 of incubation, as the embryo prepares for hatch. Ross × Ross 708 broiler hatching eggs were incubated on 8 replicate tray levels of an incubator. On d 15 and 19 of incubation, 2 embryos per level were extracted and their head and neck portions were preserved. The tissues were processed and stained using standard histological techniques. Subsequently, longitudinal and transverse sections of the embryonic pipping muscles on each of those days were examined under 2×, 4×, 10×, 20×, and 40× magnifications. In preparation for hatch between d 15 and 19 of incubation, muscle fiber thickness increased, suggesting protein accretion and nutrient accumulation in the individual muscle fibers. Intra-fascicular muscle fiber density decreased; and the inter-fascicular spaces widened and were filled with more cellular and fluid components, suggesting the active and selective infiltration of lymph into the pipping muscle from the surrounding lymph glands. In addition, the inter-fascicular spaces were filled with more cellular debris, which may be a result of muscle cell disintegration, necrosis, or associated apoptotic changes in the actively growing pipping muscle. Results of the current experiment provide an insight into the morphological changes in the pipping muscle during embryogenesis in a modern broiler strain. These together with the other associated changes in the nutritional profiles and the proteome compositions of the pipping muscles, as previously reported from our laboratory, facilitate a more detailed and comprehensive understanding of the various orchestrated cellular, metabolic and physiological events that occur in the pipping muscle of a modern broiler strain during the later part of incubation as the embryo prepares for hatch.

**Key Words:** broiler, embryo, histology, lymph, pipping muscle

**P239 Increased CO2 During Early Stages of Incubation Changes the Plasma Cortisol Profile and Embryonic Developmental of the Chicks** Marco Antonio Juárez Estrada, Sonia López Córdova, Ana Delia Rodriguez Cortez Universidad Nacional Autonoma de México, México, Distrito Federal, Mexico

In order to evaluate the effect of non-ventilation condition of the incubator during the first 10 days of embryo development on plasma cortisol, T₃, T₄ levels, T₃/T₄ ratio and quality of one-day-old Leghorn chicks, were carried out one experiment. Two different incubation conditions were created; one incubator (n=42, fertile eggs from Leghorn breeder hens of 40 weeks of age) was kept at standard conditions with adequate ventilation (V) according to manufacturing directions for incubation at higher altitudes (7,316 ft) like the location where this research was done, and the second one incubator was non ventilated (NV) during the first ten days of incubation, allowing the CO₂ to rise near to 20,000 ppm. Every treatment had three replicates. After the first 10 days, both incubation continued under standard conditions. Chicks from NV incubator start to hatch at 491 ± 5.77 hours and the chicks from V incubator at 492±5.29 h. Hatchability in the NV group was of 50.0±3.33%, higher (p<0.05) than 43.33 ± 3.33% of the V incubator. The one-day-old chicks from NV incubator had a higher (P<0.05) length (17.0±0.49 cm) compared to the V chicks (16.73±0.40 cm). The ELISA triiodothyronine plasma concentration determined in the one-day-old chicks from NV incubator was of 725.55±899 ng/µl lower (P<0.05) than the 2,900±2,331 ng/µl observed in the V group; whereas cortisol plasma levels showed a significant NV group effect with 119.45±74 ng/µl, higher (P<0.05) of 84.43±38 ng/µl recorded in V incubator chicks. NV group showed lower level of plasma T₃, consequently T₃/T₄ ratio was modified, its together with the rising plasma cortisol measured, contribute to modified the developmental trajectory into this NV group. Higher levels of CO₂ during the first ten days of incubation had a stimulatory effect on embryonic development improved hatchability and quality of the chicks from NV treatment.

**Key Words:** Hatchability, Triiodothyronine, Thyroid hormones, Non-ventilation, O2
P240 Parthenogenetic development in incubated unfertilized Chinese Painted Quail eggs alters pH and ion concentrations in egg albumen Priscilla Rosa*SC, Holly Parker, Aaron Kiess, Chris McDaniel Mississippi State University, Mississippi State, MS

Parthenogenesis is a form of embryonic development that occurs without fertilization. Recently parthenogenesis has been reported in Chinese Painted Quail eggs. In Japanese quail, it has been shown that albumen pH of incubated fertile eggs is lower than that of incubated infertile eggs. However, it is unknown if alterations, similar to those in incubated fertile eggs, occur in albumen pH or ion concentrations within unfertilized eggs exhibiting parthenogenetic development. Therefore, the objective of this study was to determine if any differences in pH or ion concentrations exist between incubated unfertilized eggs containing parthenogenetic development versus unfertilized eggs with no development. In this study, eggs were collected daily from Chinese Painted Quail hens that were separated from males at 4 wks of age, prior to sexual maturity. Eggs were stored for 0 to 3 d at 20°C and incubated at 37.5°C. To determine egg weight loss, eggs were weighed prior to setting and then again after 10 d of incubation. After 10 d of incubation, 0, Ca2+, Na, and Cl concentrations as well as pH were obtained from the albumen of each incubated egg. For unfertilized eggs containing parthenogens, there was less egg weight loss when compared to unfertilized eggs with no development. Albumen from unfertilized eggs with parthenogenetic development also exhibited a lower pH as well as less 0, and Cl when compared to the albumen of unfertilized eggs with no development. However, albumen from unfertilized eggs with parthenogenetic development yielded higher concentrations of Ca2+ and Na when compared to the albumen of unfertilized eggs with no development. In conclusion, it appears that parthenogenetic development alters the ionic composition of albumen from unfertilized eggs as compared to the albumen from unfertilized eggs with no parthenogenetic development.

Key Words: Parthenogenesis, albumen, pH, ion concentrations

P241 Proteome profile of pipping muscle lymph in the broiler embryo A. O. Sokale*SC, E. D. Peebles, R. Pulikanti, K. Pendarvis, T. Pechan Mississippi State University, Mississippi State, MS

During embryonic development, the pipping muscle enlarges in size prior to hatching, due to the infiltration and accumulation of serous fluid within and between the muscle fibers. This serous fluid, which has been referred to as lymph, occurs maximally by d 20 of incubation, and begins to withdraw from the muscle after pipping. We employed a reproducible method to characterize the fluid component of the pipping muscle by identifying its key proteins under normal physiological conditions. Ross × Ross broiler embryo pipping muscle was extracted on d 20 of incubation, washed in physiological saline, immediately snap-frozen in liquid nitrogen, and stored at -80°C. Protein extraction was performed in buffer containing 50 mM ammonium bicarbonate and 10 mM dithiothreitol in 3 different pressure cycle programs: 1 cycle at 5000 psi for 3 sec; 7 cycles at 5000 psi for 10 sec per cycle; and 5 cycles at 10,000 psi for 5 sec per cycle. The resulting samples were analyzed on a LTQ mass spectrometric analyzer. A total of 128 proteins were identified. The plasma proteome was used as an indicator of lymph proteins. The identified proteins were summarized based on Gene Ontology (GO) annotations obtained from the AgBase database. For molecular function classification, 122 proteins had assigned 115 diverse functions, summarized into 17 GO slim categories. The protein distribution based on cellular compartments revealed a total of 118 proteins belonging to 143 cellular compartments, summarized into 12 GO slim categories. A total of 121 proteins had 207 designated biological processes, fused into 18 GO slim categories. The protein expression profile in this study confirms that the pipping muscle is infiltrated with lymph during embryonic life. This is also the first study to provide a proteome profile of chicken embryo lymph.

Key Words: Orbitrap-MS/MS, Animal proteomics, Embryo, Lymph, Gallus

P242 Effects of in ovo injection of caffeine and theophylline on hatchability of broilers S. Silva*SC, W. Zhai2, E. D. Peebles1 *University of São Paulo, Pirassununga, São Paulo, Brazil, 1Mississippi State University, Mississippi, MS

Effects of in ovo injection of 2 types of stimulants (caffeine and theophylline) at various concentrations on hatchability of Ross × Ross 708 broilers were investigated. On d 18.5 of incubation, embryonated eggs were injected in the amnion using an automated multiple-egg injector for the delivery of the caffeine at concentrations of 100, 20, 4, 0.8, and 0.16 mM and theophylline at concentrations of 20, 4, 0.8, and 0.16 mM in 0.1 mL of 0.9% physiological saline. Also, a non-injected control, a dry punch control, and a saline-injected control were included. A one-way ANOVA was used to test for parameter differences among treatments with treatment designated as a fixed effect and tray level as a random effect. The results showed that hatch time or BW relative to set egg weight was not affected by the injection of caffeine or theophylline at 20, 4, 0.8, or 0.16 mM concentrations when compared to all 3 controls. The injection of 100 mM caffeine decreased hatchling BW relative to set egg weight, hatchability, and hatch time as compared to the saline-injected control group (P<0.05). However, there was no difference in residual yolk sac weight among treatment groups. A lower BW relative to set egg weight in association with an unaltered yolk sac weight may have resulted from the induction of a higher metabolic rate in embryos injected with 100 mM caffeine with an associated degradation of somatic tissues other than yolk as an energy source. It is further suggested that in order to accelerate hatching without affecting hatch performance, stimulants in combination with various nutrients may be considered as means to compensate for the increased energy requirements of embryos when injected with stimulants.

Key Words: broiler, caffeine, in ovo injection, hatchability, theophylline

P243 Persistence of Salmonella Typhimurium on chicken carcasses exposed to kosher salt Erin Bilgili*SC, Manpreet Singh Auburn University, Auburn, AL

The antimicrobial activity of kosher salt was investigated against Salmonella Typhimurium (ST). In experiment 1, the effect of varying concentrations of kosher salt (0.0, 1.0, 3.0 and 8.0% in beef-heart infusion; BHI) on ST was investigated at 37°C for up to 36 h. Samples were taken every hour for the first 12 h and then at 24 and 36 h; serially diluted, and plated on Tryptic Soy Agar (TSA) to develop growth and/ or death curves. For experiment 2, nine chicken carcasses were inoculated with ST (Ca ~10^7 CFU/ml), immersed in 1.5 L of 8.0% kosher salt solution and refrigerated at 4°C for up to 60 min. At 0, 30, and 60 min, carcasses were rinsed with 200 ml of 0.1% Buffered Peptone Water. The rinsates were then serially diluted, plated onto Plate Count Agar (PCA) and incubated at 37°C for 24 h. The colonies were enumerated and counts were reported as CFU/ mL of the rinsate.

For the first experiment, 0% and 1% salt produced similar growth results, with exponential growth starting at 4h and 3h, respectively. For 3% salt, the lag phase was extended (P<0.05) and exponential growth started at 12h. For 8% salt, a reduction in colonies was observed, suggesting a death curve. For experiment 2, exposure of the inoculated chicken carcasses to 8% salt solution for 0, 30, and 60 min did not yield any differences (P>0.05) in the ST populations suggesting that, although death of cells was observed in laboratory media, similar results were not observed on chicken carcasses that can be attributed to organic
Factors associated with the skin. More research needs to be conducted using higher concentrations of salt and longer exposure times.

Key Words: Salmonella Typhimurium, Kosher salt, poultry, antimicrobial

P244 Extrinsic factors affecting water absorption in chilling of broiler chicken carcasses Marcos Franke Pinto¹, Juliana Pampana Nicolau, Elisa Helena Giglio Ponsano, Silvia Helena Venturoli Perri, Manoel Garcia-Neto ¹Univ Estadual Paulista, Araçatuba, São Paulo, Brazil

Brazil occupies an outstanding position as a producer and exporter of chicken meat, and the maintenance and expansion of this position require a constant evolution, especially in variables which determine quality. An important quality parameter of poultry meat is the amount of water absorbed by the carcass during processing. In Brazil, carcasses chilling is done by immersion in chilled water. In this process, the carcass is rehydrated and the water lost during transport and initial operations is replaced. At this stage, some care is needed to prevent the absorption of water above the level allowed by Brazilian law. This project aimed to evaluate extrinsic factors that can influence the absorption of water by the chicken meat. For this, 144 Cobb chickens divided into 24 groups of six birds were used. At 42 days of age, one chicken of each group, with weight ranging up to 10% more or less from the average of the group, was slaughtered in an experimental pilot scale abattoir where slaughter procedures were conducted under strictly controlled conditions. The chilling procedure was performed following a completely randomized design with factorial arrangement 3x2, where the factors were: three temperatures in the first section of the chilling system (4, 10 and 16°C) and two degrees of water hardness (hard and soft water), with six treatments and four replications. Brazilian law provides that the water temperature in the first section of the chiller must not be higher than 10°C, and the length of the carcasses in this section shall not exceed 30 minutes. All carcasses remained in the first section of the chiller for 30 minutes and then were transferred to another tank with water at 4°C, remaining there until reaching 7°C. The carcasses were weighed before and after chilling, to evaluate the percentage of water absorbed. The water absorption was influenced by the initial temperature of the water in the chiller and by the water hardness. When initially immersed in water at 4°C, carcasses water absorption averaged 2.70%, significantly lower absorption than the values found for the carcasses that were initially immersed in water at 16°C, 3.83% (p<0.05). The carcasses immersed in water at 10°C had mean water absorption of 3.66%, not differing from the means observed in the other two treatments (p>0.05). In hard water, the average water absorption was 2.46% and, in soft water, 4.33% (p<0.05). In all treatments, the water absorption did not exceed the limit established by Brazilian legislation, which is a maximum of 8%. This information is important to control the absorption of water by carcasses in chicken meat processing, preventing consumers from being harmed.

Key Words: quality control, legal parameters, immersion chilling, water chilling, poultry meat

P245 Bacterial oxytocarotenoids added into broiler chickens ration modify breast meat color Elisa H. G. Ponsano¹, Saulo V. Avanço², Manoel Garcia-Neto², Maria Clara S. Minello¹, Thiago L. M. Grassi², Edson F. E. Santo², Alstyn W. M. Costa¹, Marcos F. Pinto² ¹UNESP, Univ Estadual Paulista, Araçatuba, Brazil, ²Univ Estadual Paulista, Araçatuba, Brazil

Some markets around the world demand for well pigmented poultry products, what justifies the intentional use of synthetic additives in rations during breeding. The inconvenience for that practice most times is the elevated price of these products, beyond the argument of being chemicals, which may not be viable for some production systems. So, the aim of this experiment was to check on the ability of natural red oxytocarotenoids produced by R. gelatinosus to modify broilers breast meat color. Bacterial biomass containing oxytocarotenoids were added into Cobb broilers finisher diets at 0, 1.0, 2.0 and 3.0 g/kg and fed during 10 days (35-45 d). Five replicates (10 birds each) were performed. At days 35, 37, 39, 41, 43 and 45, 100 birds were slaughtered scalded, defeathered and eviscerated. Data on live and carcass weights were recorded. After cooling, color parameters of meat were determined on breast surface using a HunterLab XE Plus colorimeter calibrated with black and white standard tiles. Regression analysis was used for the investigation of relationships between days of consumption and biomass concentration on color values, live weight and carcass yield. Results showed that redness of breast meat was significantly influenced by the biomass concentration in a linear effect (P=0.0056) and also by the time of consumption, in a quadratic effect (P=0.0232). Days of consumption also affected yellowness and lightness with significant quadratic responses (P=0.0225 and P=0.0001, respectively). Birds live weight increased significantly during the application of the experimental diets (P<0.0001), showing no negative influence of the biomass administration. Also no deleterious effects derived from the application of the product were observed on carcass yield. So we concluded that R. gelatinosus oxytocarotenoids present in the bacterial biomass can modify broilers breast meat color, performing as an alternative pigment additive in poultry production.

Key Words: Rubrivivax gelatinosus, biomass, redness, lightness, carcass yield

P246 Frequency of black bone syndrome in drumsticks of broilers Rodrigo Garófallo Garcia¹, Ibiara Correia de Lima Almeida Paz¹, Fabiana Ribeiro Caldana², Grace Alessandra Araújo Baldo¹, Carlos William Gavilan¹, Marilínia Carvalho Figueiredo Alves¹, Viviane Maria Oliveira dos Santos Ferreira¹, Márcio Pilleco¹ ¹Universidade Federal da Grande Dourados, Dourados, Mato Grosso do Sul, Brazil, ²Universidade Federal da Grande Dourados - Faculdade de Ciências Agrárias, Dourados, Mato Grosso do Sul, Brazil

This experiment aimed to evaluate the incidence of black bone syndrome in chilled and frozen drumsticks of broilers. To assess the frequency of the black bone syndrome and its influence on meat quality, we analyzed the brightness of the bone (*L*), appearance of the flesh and its sensory characteristics. It was possible to characterize black bone syndrome through confidence intervals for values of *L*, and bones with this value below 37.5 can be characterized as black bone syndrome and those above this value are normal bones (37.5 - 40). The flavor of the thighs was not influenced by the treatments, the appearance, odor and tenderness were not affected by freezing or cooling of the meat, only by the degree of black bone syndrome in which they fit. Freezing worsened the black bone syndrome in the bones.

Key Words: black bone syndrome, broiler, meat quality, black bone, drumsticks

P247 Anti-listerial effects of sodium metasilicate in pure Listeria monocytogenes culture suspensions and on ready-to-eat turkey ham Chander Shekhari Sharma¹, Sally Williams², Gary Rodrick²¹Mississippi State University, Mississippi, MS ²University of Florida, Gainesville, FL

Listeria monocytogenes is a foodborne pathogen of high public health significance and frequently encountered in ready-to-eat foods. Sodium metasilicate (SMS) is a USDA-approved antimicrobial for use in ready-to-eat meat and poultry products. The purpose of this study was to determine effectiveness of SMS for inactivating L. monocytogenes in pure culture suspensions and on ready-to-eat turkey ham. L. monocytogenes Scott A strain was exposed to 0 (positive control), 1, 2, 3, 4, 5 and 6% SMS solutions for 1, 10 and 30 min at room temperature. In a second
experiment, turkey ham samples were inoculated with L. monocytogenes (Scott A) and treated with SMS to yield final concentrations of 300 and 600 ppm, vacuum packaged, stored at 4°C and analyzed after 0, 7, 14, 21 and 28 days for presence of L. monocytogenes and pH. Negative and positive controls were also included. Both experiments were replicated three times and all the samples were analyzed in duplicate. In Experiment 1, no significant reduction in L. monocytogenes (P > 0.05) was observed with 1 min exposure to 1.0 and 2.0% SMS. Concentrations of 1.0, 2.0 and 3.0% SMS reduced L. monocytogenes by more than 5 log after 30 min. Exposure for 1 min to 4.0 and 5.0% SMS reduced L. monocytogenes by more than 5 log. L. monocytogenes was not detected after 1 min exposure to 6.0% SMS. In Experiment 2, 600 ppm SMS was not effective in reducing L. monocytogenes populations (P > 0.05) in turkey ham, and pH values were similar (P > 0.05) for all treatments. L. monocytogenes was susceptible to SMS in pure culture. Susceptibility of L. monocytogenes to SMS was reduced significantly when L. monocytogenes was inoculated onto ready-to-eat turkey ham, which suggested that higher concentrations of SMS may be needed to control growth of L. monocytogenes on ready-to-eat poultry products.

Key Words: Sodium metasilicate, Listeria monocytogenes, turkey ham, ready-to-eat poultry products

P249 Evaluation of the stability of B. subtilis and B. licheniformis in pelleted feed at different temperatures Anée Berg Kehlet†1, Merete Moerk Jensen1, Alicia Lay2, Robert Lantz2, Adam Fahrenholz3 1Chr. Hansen A/S, 2970 Hoersholm, Denmark, 2Chr. Hansen A/S, Milwaukee, WI, 3Department of Grain Science and Industry, Kansas State University, Manhattan, KS

The aim of the present work was to evaluate the stability of B. subtilis (DSM17299) and B. licheniformis (DSM17236) in pelleted feed at different temperatures. The study was carried out at Kansas State University, Department of Grain Science and Industry. The test articles B. subtilis (GaliliPro® Max, Chr. Hansen A/S) and B. licheniformis (GaliliPro® Tect, Chr. Hansen A/S), were each mixed into a corn-soybean based standard meal feed at a dose of 2.2 kg per 1000 kg of feed, corresponding to 5.0+E6 and 1.4+E7 CFU/g feed respectively. The feed was mixed in a Forbjerg Paddle mixer for 5 min. Ten samples from the meal diet were taken within approximately the same time interval in a free flowing stream before the heat treatment. The mixture of test articles and standard meal feed was pelletized at two different temperatures: 85°C and 90°C. When the conditioner temperature of the mash feed was stable after one min at 85°C, five samples of pelleted feed were collected with a one minute interval and hereafter immediately transferred to a batch cooler where the temperature was recorded. After cooling two samples were collected from each tray (in total 10 samples/product). The above was repeated for the 90°C samples. The hot pellet reached a maximum temperature of 94.6°C. Viable cell count of the samples was tested both in the mash feed and in the pelletized feed. The average spore count in the mash diets was 5.7+E6 and 1.3+E7 in the B. subtilis and B. licheniformis samples respectively. In the diets pelleted at 85°C the average spore count was 5.2+E6 and 1.2+E7 and at 90°C the average spore count was 5.4+E6 and 1.1+E7 in the B. subtilis and B. licheniformis samples respectively. The above findings show that B. subtilis and B. licheniformis are stable in pelleted feed and can withstand temperatures up to 94.6°C.

Key Words: Bacillus subtilis, Bacillus licheniformis, heat stability, pelleting, feed

P250 Qualitative aspects of commercial eggs subjected to different storage conditions Rodrigo Garofallo Garcia*, Iliara Correia de Lima Almeida Paz, Fabiana Ribeiro Caldara, Leonardo Willian de Freitas, Leonardo de Oliveira Sena, Viviane Maria Oliveira dos Santos Ferreira, Gisele Aparecida Felix Universidade Federal da Grande Dourados, Dourados, Mato Grosso do Sul, Brazil

The objective of this study was to evaluate the effects of temperature and storage time on egg quality of laying hens. The design was factorial 3x3 with three temperatures (room temperature - 26 °C, refrigerator - 10 °C and cold - 3 °C) and three storage periods (7, 14 and 21 days) with 6 replicates , arranged in a completely randomized where each egg represented an experimental unit. The variables were the weight loss of eggs (%), specific gravity, percentage of yolk and albumen, yolk color and sensory evaluation. The eggs kept under refrigeration temperatures (refrigerator, and cold) showed less weight loss and better values for specific gravity and color of raw egg yolk during storage (14 and 21 days). For percentage of yolk and albumen eggs showed no difference (p> 0.05) among storage times, regardless of the temperature at which it was submitted. The eggs kept under refrigeration better sensory characteristics than those kept under room temperature. We conclude that, in this experimental conditions, the eggs must be kept at refrigeration temperature (30 - 10 °C) to maintain its quality preserved.

Key Words: temperature, egg quality, storage time, specific gravity, sensory evaluation

Poult. Sci. 91(Suppl. 1)
P251 The role of house fly as a vector of avian influenza subtype H5N1
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In this study, the house fly (Musca domestica Linnaeus) was determined as the potential vector of avian influenza subtype H5N1. One hundred and fifty laboratory-reared house flies were equally allocated into 3 groups. Flies of group 1 were allowed to consume H5N1-free feed serving as negative control, whereas flies of groups 2 and 3 were experimentally exposed to H5N1 virus by allowing flies to consume infected feed containing with H5N1 virus for 15 min. After exposure, the infected feed was removed and was placed with the H5N1-free feed. Flies of group 2 were euthanized by put in the dry ice box, whereas flies of group 3 were held at room temperature for 24 h. At 24 h post exposure, flies were euthanized. All flies of each group were determined by inoculation into 3 groups of 4-week-old layer chickens via oral route in separate isolator in BSL-3 facility. Five flies were pooled as an inoculum per chicken. Morbidity and mortality were observed for 14 days.

The oropharyngeal swabs (OS) and cloacal swabs (CS) were daily collected to determine by real-time reverse transcription polymerase chain reaction (RRT-PCR) assay and virus titration. The histopathology and immunohistochemistry (IHC) against nucleoprotein of influenza virus type A were used for the collected tissue samples. The results revealed that all chickens of groups 2 and 3 died during 2 - 7 days post inoculation. The OS had higher amount of virus shedding compared with CS determined by RRT-PCR and virus titration assays. Moreover, chickens of group 2 had higher amount of virus shedding than chickens of group 3 did. The histopathology showed diffuse necrosis of several tissue samples of inoculated chickens. The severe heterophilic and mononuclear inflammatory infiltration, deciliation and sloughing of epithelial cells in trachea, mild to moderate diffuse pulmonary congestion, multifocal to coalescing necrosis of the pancreas, perivascular infiltration of mononuclear cell at duodenum and necrotizing splenitis were observed. The IHC could detect nucleoprotein of influenza virus type A in all collected tissue samples including trachea, duodenum and pancreas. This study demonstrates that the house flies could serve as a vector of H5N1 virus under experimental laboratory conditions.

Key Words: House fly, Potential vector, H5N1 avian influenza virus, Chickens

P252 The pathogenesis of low pathogenic avian influenza viruses in Mallards
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Mallards are important natural hosts for the epidemiology of low pathogenic avian influenza viruses (LPAIVs). This study characterizes the pathology, viral antigen distribution and viral shedding patterns of LPAIV in intranasally infected Mallards at different time points after infection. Mallards were infected with 10^6 embryo infectious dose of either A/Mallard/MN/199106/99 (H3N8) or A/Mallard/MN/35577/99 (H5N2). Histopathology and immunohistochemistry were performed on the respiratory and gastrointestinal tract tissues and bursa of Fabricius in the first 3 to 6 days post inoculation (dpi). Oropharyngeal, cloacal and fecal viral shedding were analyzed by virus isolation and Real Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) and were detected from 1 dpi with higher cloacal viral shedding detected at 2 and 3 dpi. Peak infectious titer exceeded 10^8 EID 50 /gram of feces at 2 to 3 dpi in birds infected with H3N8 LPAIV. Moderate lymphocytic trachitis and laryngitis were observed in the birds euthanized on 1 and 2 dpi. Avian influenza virus (AIV) antigen was detected in rare epithelial cells of the larynx and trachea only at 1 dpi in the birds infected with H3N8 LPAIV. In the gastrointestinal tract, expression of AIV antigen was detected in the cytoplasm and nuclei of surface enterocytes in the ileum, ceca and colon from 1 to 4 dpi. AIV antigen was also expressed in epithelial cells of the bursa of Fabricius at 2 to 3 dpi. The ciliated cells in the trachea and the enterocytes of the lower intestinal tract abundantly express α2,3 sialic acid receptors in this species. Our study shows that viral antigen distribution in tissues correlates with viral shedding patterns of LPAIV and α2,3 sialic acid receptor distribution in Mallards. We also conclude that the main sites of AIV replication in this species are the surface enterocytes of the lower intestinal tract and epithelial cells of the bursa of Fabricius.

Key Words: Mallards, low pathogenic avian influenza, immunohistochemistry, viral shedding, histopathology

P253 Are Vaccine Viruses Developed for Pandemic Preparedness a Risk for Poultry?
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Highly pathogenic avian influenza (HPAI) viruses are important agricultural pathogens and some have been transmitted to humans, especially H5N1, causing severe disease and death. Various HPAI viruses have the potential to become pandemic, and therefore national and international public health organizations are developing vaccine seed viruses that match the antigenic characteristics of the circulating viruses. These viruses are derived by reverse genetics to i) include A/Puerto Rico/8/34 (PR8) genes that maximize their growth in eggs and ii) delete the HA polybasic cleavage site to minimize their pathogenicity. We evaluated HPAI vaccine candidate viruses to assess their virulence and infectivity for 4-to-6 week old chickens, by intravenous (IV) inoculation of 10 specific-pathogen-free chickens to determine the intravenous pathogenicity index (IVPI) per OIE protocol, which records clinical signs/death for 10 days. Another group of 10 birds was inoculated intranasally (IN). At 2 or 3 days post challenge, oropharyngeal and cloacal swabs are collected from all IN-challenged, and two are euthanized and tissues were collected for histopathology, immunohistochemistry, and virus isolation. At 14 days post challenge, birds were euthanized and bled for serology, with agar gel immune diffusion or ELISA test used to evaluate anti-influenza antibodies. Six recombinant viruses (subtypes H5N1, H5N2) and one wild type (H5N1) were tested. None of the vaccine candidate viruses showed evidence of infection after IN challenge (no virus isolated in tissue samples at 3 dpi, shedding, no detectable antibodies, no clinical signs or lesions), neither the IV challenge group showed any evidence of clinical disease. The wild type H5N1 was the only one to replicate, induce 100% mortality, virus shedding, typical lesions and immunohistochemistry antigen detection in tissues after IN challenge. The reassortment of avian viruses with a PR8 backbone, associated with the deletion of the cleavage site reduces the virulence inhibiting the ability of the viruses to infect chickens, generating safe vaccines that represent minimal risk for the poultry industry.

Key Words: Avian Influenza, Vaccine, PR8, Safety Test, Pathotyping

P254 Development of a novel in vivo experimental model to determine antigenic differences between infectious bursal disease viruses
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Infectious bursal disease virus (IBDV) is a double stranded RNA virus causing infectious bursal disease (IBD) in chickens. IBDV targets proliferating B-lymphocytes in the bursa of Fabricius (BF). IBDV undergoes antigenic drift likely due to selection based on existing immunity in Poul. Sci. 91(Suppl. 1)
the field. Thus, characterizing the antigenicity of IBDV plays an important role in selecting the right vaccine candidates. In this study, we developed an in vivo experimental model to differentiate antigenic variations in IBDV based on the antigenic predominant strain in the USA, the E/Del strain. Our objective was to find if a selected field strain was antigenically either similar or different from E/Del strain. As a first step, hyper immune serum was generated in SPF chickens using the E/Del-type virus. In the next step, a standard volume of the hyper immune serum was serially diluted and injected in SPF birds using different routes such as intravenous, subcutaneous, and intramuscular. The chickens were bled at different time points in order to study the dynamics of virus neutralization titers (VNT). Based on the results, chickens were injected with different serum dilutions by the subcutaneous route. Twenty four hours later, chickens were bled and then challenged with 100 CID50 of the E/Del virus and a field virus of interest. VNT assay was conducted to determine the VNT. Chickens were necropsied 7 d p.i. to remove the BF and histopathological analysis was conducted to determine the bursal lesion score (BLS) which was used to determine the breakthrough titer in the in vivo chicken model. The advantage of this system was that the breakthrough titer value was determined based on the lesions in the primary target of IBDV, the BF. This model displays the most sensitive model for virus infection with non-tissue culture adapted IBDV.

Key Words: IBDV, antigenic variations, in vivo experiment, bursal lesion score, virus neutralization assay

P255 Vector HVT-IBDV efficacy against classical, variant and vvIBDV in SPF birds and commercial layers. Francisco Perozo 1 Universidad del Zulia, Maracaibo, Zulia, Venezuela

This work aims to assess the efficacy of a vector HVT vaccine expressing the 52/70 Faragher strain VP2 (vaccine A) against classical, variant E-like and very virulent infectious bursal disease virus (vvIBDV) in specific pathogen free (SPF) birds and commercial layers. Results were compared with a vector HVT vaccine expressing variant E strain VP2 (vaccine B) and with live IBDV vaccination. SPF birds were vaccinated with the vector vaccines at day 1 and challenged at 22 days with either classical Winterfield, variant E-like or vvIBDV from Philippine. A second trial compared efficacy against a vvIBDV challenge (California isolate) in 35 days old commercial layers for the vector vaccines (day 1) and live IBDV vaccination (days 14 and 21). Mortality, gross lesions, bursal index and histopathology were evaluated as protection criteria. Protection against the classic Winterfield strain and the Philippines’ vvIBDV was 95% and 75% for the vaccine A and vaccine B, respectively. Both vector vaccines protected properly and equally against the Philippines variant E-like strain. For the California vvIBDV challenge in commercial layers both vector vaccines yielded significantly higher (P<0.05) bursal indexes than live IBDV vaccination. Nevertheless, no gross bursa lesions were observed in the vaccine A group, but showed in 56% of vaccine B and in 100% of the live IBDV vaccinated. The lowest bursal histopathology grading was observed with vaccine A, additionally no challenge virus RT-PCR detection was possible in bursas from this group, suggesting optimal protection against the California vvIBDV. Overall, the results demonstrated that vaccine A provided equal protection against variant strains and was more efficacious against classical and vvIBDV, when compared with vaccine B and live IBDV vaccination.

Key Words: Infectious bursal disease virus, vector HVT-IBDV, vaccination, variant strains, vvIBDV

P256 Persistence of IBV Arkansas vaccine virus and the genetic characterization of S1 gene Ha-Jung Roh 1,2, Deborah Hilt, Mark Jackwood University of Georgia, Poultry Diagnostic and Research Center, Athens, GA

It is common practice to deliver multiple serotypes of live attenuated IBV vaccines to commercial broilers in the hatchery. In recent studies, the persistence of Arkansas viruses in vaccinated birds was observed. To determine if vaccine interference plays a role in the persistence of Arkansas, we vaccinated one-day-old broilers in a spray-cabinet with either single vaccine (Ark-DPI, Ma5, or GA98) or a combination of two vaccine strains of IBV and the birds were challenged with homologous serotypes on day 30. Tracheal swabs, tears, serum, and trachea tissue were taken on sample days. The presence of virus was determined by real-time RT-PCR using RNA extracted from tracheal swabs and tears. Our data indicate that inadequate protection against Arkansas was observed in the Arkansas-only-vaccinated group and instead of interference, it appears that other IBV vaccine types slightly enhance the protection against Arkansas. We analyzed the S1 gene sequences of the Ark-DPI vaccine virus, Ark-DPI challenge virus, and the vaccine virus isolated from Arkansas-only-vaccinated group. The genetic relationship between the viruses will be presented.

Key Words: Infectious bronchitis virus, Arkansas, vaccine, S1 gene

P257 Newcastle Disease Post-Challenge Antibody Response in Vaccinated White Leghorn Laying Hens - Higher GMT at 10 to 15 Weeks Maintains Healthy Egg Production Levels Ruben Merino 1, Alejandro Rojas 2, Ramon Ochoa 2 1Departamento de Medicina y Zootecnia, FMVZ, UNAM, Coyoacon, Mexico, 2Merial Mexico, El Marques, Queretaro

Vaccination is the main measure to control Newcastle disease where the virulent strains are endemic. The aim of this study was to measure the antibody response and productive performance of vaccinated White Leghorn laying hens challenged with the Mexican Chimalhuacan ND strain at 25 weeks old. Three groups of vaccinated laying hens were challenged. The vaccination program included live LaSota strain at 1, 3, 5, 6 and 15 weeks of age, and killed vaccines at 5, 10 and 15 weeks. Group A received no vaccine after 10 weeks old. Groups B and C received a different killed strain at 10 and 15 weeks old (B= P2005, C= Uster). After challenge, all hens were observed for 4 weeks for clinical signs, egg production, weight and external quality of the egg. Serum samples were collected at challenge, 1, 2 and 4 weeks post challenge, and then tested by ELISA (AffiniTech, LTD, Arkansas, USA). The ELISA geometric mean titer (GMT) previous to challenge and one week post challenge, respectively reported Group A titer results (109 v. 416) were lower (P<0.05) than in groups B (8,966 v. 16,082) and C (10,394 v. 17,961). Seroconversion was detected from one week post-challenge to the end of the study. Group A showed the most severe clinical symptoms after challenge, but a relative low mortality of 12%. This study shows that ELISA GMT as low as 109 can protect an estimated 90% of the laying hens against mortality; however, cannot avoid the ill affect on egg production. In contrast, the ELISA GMT about 9,000 and above 10,000 protected 96% and 100% against mortality (groups B and C, respectively). Egg production was above 90% at challenge, for all groups; the mean egg production in the 4 weeks post challenge period was lower (P<0.05) in group A (28.18%) than in B (78.04%) and C (82.72%) groups. Shell-less eggs were higher (P<0.05) in group A (25.75%) than in groups B (2.6%) and C (1.52%). The finding is that there was no statistical difference in egg weight from all groups. Vaccination program in group A protected 88% of the hens to survive the challenge, but did not avoid the drop in egg production and quality. This finding reinforces the need of having a high antibody titer before the onset of egg production. The vaccination program in group C fully protected against mortality and maintained egg production above 80% and reduced the production of shell-less eggs. The ELISA test was useful to detect the infection by seroconversion in flocks with high humoral immunity against Newcastle disease. A Newcastle disease vaccination program for White Leghorn laying hens should be based on the degree of immunity necessary, the costs involved and the exposure to local field viruses.

Key Words: Newcastle disease, ELISA titer, Chimalhuacan strain, laying hen
P258 Exchange of Newcastle disease virus F and HN genes into a vaccine backbone: effects on virulence Stivalis Cardenas García1, Leonardo Susta1, Diego Die11, Eduardo Lucio Decanini1, Angel Absalon1, Corrie Brown1, Qingzhong Yu1, Patti Miller1, Claudio Alfonso1 1Investigación Aplicada S.A., Tehuacán, Puebla, Mexico 2The University of Georgia, College of Veterinary Medicine, Athens, GA 1Southeast Poultry Research Laboratory, Athens, GA 2Centro de Investigación y Desarrollo Agroalimentario, Irapuato, Gto., Mexico 3Investigación Aplicada S.A., Tehuacán, Puebla, Mexico

Newcastle Disease Virus (NDV) is the causative agent of Newcastle disease (ND), a very important infection that causes significant economic losses to the poultry industry. Currently, viruses of genotype V, VI, and VII circulate worldwide causing significant mortality in poorly vaccinated chickens. The most widely used ND control method is the live LaSota vaccine, based on a virus of Class II, genotype II. Recombination between the LaSota vaccine and virulent viruses of genotype VII has been reported in Asia. However, the effect of those genetic exchanges on virulence has not been evaluated. Because of the possibility of additional natural genetic exchanges between the LaSota live vaccine viruses and circulating virulent NDV, it is important to understand the potential risks of exchanging virulent genes into vaccine backbones. Here we describe the replacement of the F and HN genes from a mesogenic virus representative of genotype VI, and from three velogenic viruses representative of genotypes V, VIIa, and VIIId, respectively into the LaSota backbone. These virulent recombinant constructs were rescued by reverse genetics and the pathogenicity was compared with the pathogenicity of their correspondent wild type viruses. Mean Death Time in eggs (MDT), Intracerebral Pathogenicity Index (ICPI) assay, and survival of naïve adult birds were analyzed.

Key Words: NDV, virulence, vaccine, reverse genetics, recombination

P259 The development of a multiplex PCR to identify plc, cph, iA, cpe, tepL and netB toxin encoding genes in Clostridium perfringens MA Bailey1,2, KS Macklin, MA Liles, JT Krehling, ZT Williams Auburn University, Auburn, AL

In recent years, the role of the Clostridium perfringens (CP) alpha-toxin in the pathogenesis of necrotic enteritis has come into question. The recently discovered NetB toxin has been demonstrated to be important for the development of necrotic enteritis with certain strains of CP. Despite this revelation, there has been limited research inquiring into the occurrence of the NetB toxin gene among strains isolated from outbreaks of necrotic enteritis in the United States. In addition, previous studies used separate PCR reactions to test extracted DNA for toxin encoding genes. One multiplex reaction detects the plc, cph, iA, cpe, and cpe genes which encode for the alpha-, beta-, iota-, epsilon- and enterotoxins, respectively and two single PCR detect the pteL and netB genes which encode for the TpeL and NetB toxins, respectively.

Key Words: Clostridium perfringens, NetB, TpeL, toxins, multiplex PCR

P260 The requirement for mixing live Mycoplasma gallisepticum vaccines during spray administration to maintain vaccine homogeneity Spencer Leigh1, Jeff Evans, Scott Branton USDA-ARS Poultry Research Unit, Mississippi State, MS

Spray application of live Mycoplasma gallisepticum (MG) vaccines is the fastest and least expensive method of application for MG vaccines. Many different types of spray application systems are in use for vaccine administration. One difference among the various sprayer systems is the ability to recirculate and continuously mix the vaccine. This study was designed to analyze the need for continued mixing of the vaccine solution in order to maintain a homogeneous solution during vaccine application. Commercial F-stain vaccine (AviPro® MG F) was rehydrated and diluted in phosphate buffered saline in accordance with field practices. Dextrose was added to the solution to maintain MG viability without growth during the experiment. The vaccine solution was poured into columns, and samples from the static solution were taken from 1, 25, and 50 cm above the base of the column. Samples were taken at 15, 30, 60, and 120 minutes and compared to a control that was mixed prior to sampling. Results indicate that no significant sedimentation occurred over the course of the experiment when comparing the mixed control to any of the samples. These results suggest that there is no need for continuous MG vaccine mixing if vaccine is applied within the measured 2 hour time frame.

Key Words: Maternal antibody, decay, half-life, chickens