T159 Meat antioxidants, chemical composition and performance of commercial broilers is affected by Moringa oleifera leaves supplemented as feed additive Shakeel Ahmad1, Anjum Khalique1, Talat Pasha2, Shahid Mehmood1, Khalid Hussain1, Sohail Ahmad2 *University of Veterinary and Animal Sciences; 2University of Punjab

The present study was executed to determine the effect of Moringa oleifera leaf meal (MLM) dietary supplementation (at levels of 0, 0.5, 1.0 and 1.5% of MLM over and above of basal diet), on growth performance, giblet pack, serum biochemistry, and meat bioactive compound index. Two hundred day old broiler (Hubbard) chicks were assigned to four dietary treatments with five replicates of ten birds each in a Completely Randomized Design (CRD) and means were compared with Duncan’s multiple range test (DMR). Data showed that feed intake and feed conversion ratio (FCR) were significantly (P≤0.05) decreased and lowest values were observed in MLM 1.5%. Dressing percentage and carcass weight were significantly increased and highest values were observed in the group MLM 1.0%. Relative heart, gizzard and liver weights showed no difference among the groups. Breast meat and feed bioactive compounds β-carotene, Quercetin and Selenium showed a linear significant increase and highest values (0.18µg/100g, 267.34µg/100g, 79.07µg/100g & 8.93mg/Kg, 48.96mg/Kg, 0.54mg/Kg) respectively in resulting in significant (P≤0.05) improvement in antioxidant activity indicator DPPH (di-phenyl-picryl hydrazil) radicals scavenging value (36.66%). Breast meat cholesterol level (59.24mg/100g) and serum biochemical compounds Glucose, Cholesterol, SGPT and Creatinine values were linearly decreased. Antibody titers against Infectious bursal disease (IBD) showed significant improvement (P≤0.05). Outcomes of present study revealed that supplementation of MLM in broiler diets showed positive impact on growth performance, immunity and bioactive compounds of breast meat with best results at dose level of MLM 1.5% and may be an alternative to phytofeed additives.

Key Words: Moringa, Broiler, β-carotene, Quercetin, Selenium

T160 Egg antioxidants, chemical composition and performance of commercial layers is affected by Moringa oleifera leaves supplemented as feed additive Shakeel Ahmad1, Anjum Khalique1, Talat Pasha2, Shahid Mehmood1, Khalid Hussain1, Sohail Ahmad2 *University of Veterinary and Animal Sciences; 2University of Punjab

Phytogenic feed additives for animal feed production have got significant consideration during the last decade and numerous plants and their metabolites have been investigated for the said purpose. In the same context, present study aimed to evaluate effect of Moringa oleifera as feed additive on layer’s performance and egg’s bioactive compounds and nutrient profile. HyLine W36 layers (200 birds), age 50 weeks, were randomly segregated in to 4 groups, each containing 50 birds (five replicates and ten birds per replicate). Four iso-caloric (2725 Kcal/kg) and iso-nitrogenous (CP 16%) diets were formulated and supplemented with 0, 0.5, 1.0 and 1.5%, w/w of Moringa oleifera leaves. The data showed positive effect on egg production, egg mass and feed conversion ratio whereas egg quality was decreased (P ≤ 0.05). Bioactive compounds like β-carotene, quercetin and selenium content of feed and egg yolk were significantly (P ≤ 0.05) increased, and their respective values were 8.90, 48.88 and 0.54 mg/Kg in feed and 4906, 241 and 56.82 µg/100g in yolk in the group receiving feed containing 1.5% supplementation level. Linear decrease in the serum creatinine, glucose and cholesterol levels (serum and eggs) at 4th and 6th week of supplementation was recorded (P ≤ 0.05). Antibody titers against Newcastle disease were significantly improved (P ≤ 0.05). It was concluded that Moringa oleifera leaf meal can be a potent phytogenic feed additive and may affect egg production and quality along with immune status of layers.

Key Words: Moringa, β-carotene, Quercetin, biochemistry, performance

T161 Effect of AZOMITE supplementation in post-molt hens Ramon Malheiros*, Vera Moraes, Kenneth Anderson NC State University

AZOMITE® is a uniquely natural material, mined in Central Utah, USA. For over seventy years, crop producers have used AZOMITE® to support plant growth and vitality. AZOMITE® is not manufactured or chemically prepared. It is 100% naturally-derived and is completely free from additives, synthetics or fillers. The objective of this work was to evaluate the AZOMITE supplementation in layer diets as a mineral additive, during molt and post molt performance. For that, 96 W36 Hy-Line hens at the age of 67 weeks, were house in a conventional cage system, in 48 cages, divided in 2 treatments diets (AZOMITE, AZ, and Control, C). After 2 weeks of adaptation, the birds were submitted to the treatment diets. All hens submitted to 16L:8D. The diets were formulated to attend the requirements, and AZ added as a supplementation in the dose of 2.5g/kg. The hens a non-anorexic molt protocol was used, and production data collected until 85 weeks of age. Egg internal and external quality was evaluated bi-weekly throughout the experiment. The last week, ileum content, excreta and tibia bone were collected to be evaluated. No differences were observed (P>0.05) in BW, Feed Intake, FCR, shell color, egg weight, Haugh Unit, Yolk color, and Shell thickness. Feed conversion (g egg/g feed) showed a slight improvement favoring the AZ birds (0.55 vs 0.51g). At 85 week, the HH% and HD% production was better in AZ hens (90.54 AZ, vs 77.41Ct). Tibia bone showed a lower Ca and P (P=0.005) content at 85 weeks of age, in AZ hens, but no difference in ash content, Bone Mineral Density, Break Strength, and Elasticity. The ileum digestibility was improved (P=0.0192) in AZ birds (79.67 AZ vs 61.98 Ct). Chicken submitted to 16L/8D. The diets were formulated to attend the re

Key Words: Mineral, Azomite, Molt, Laying Hens

T162 Butyric acid during very late lay (86-100 wks of age) in Laying Hen Rations Effects on Shell Strength Sheila Purdum1, Josephine Foley1, Richard Sygall2 *University of Nebraska; 2Perstorp Feed and Food Corporation

A novel butyric product – butyric acid bound to glycerol forming a triglyceride was fed to an older laying hen flock from 86 to 100 weeks of age to measure effects egg production parameters and shell quality. Source of butyric acid was ProPhorce SR from Perstorp Corporation. Two treatments were fed to Bovan White Leghorn hens (control or butyric acid (500 g/ton) housed in a traditional cage unit with 12 replicate cages (3 hens/cage) for a 14 week period. Basal diets were corn/soy based diets with 10% DDGS with a total Ca level of 4.6%. Parameters measured included daily egg production, feed intake, biweekly egg wts, eggshell %, eggshell breaking strength (texture analyzer) and Ca and P digestibility marker study utilizing titanium as the marker. Results show no significant effects on rate of egg production or feed intake during this late stage of egg production. Butyric acid supplementation increased overall egg weight during the study (67.04 vs. 65.84 grams) at p<.001. This increase was noted after 3 weeks on the product with pronounced weekly effects at 7 wks during the trial. Subsequent effects on % shell were not significantly affected by the treatment, but shell breaking strength (kg force) was positively affected overall by the treatment (p<.08). Breaking strength improved from 39.501 to 42.522 kg. This effect was most prominent at the end of the trial at wk 11 (p<.06) and week 13 (p<.01) with some indication of effectiveness after 3 weeks on the product. There was a slight improvement in Ca digestibility from 25.91 to 31.94% at the end of the trial and little improvement in P digestibility (25.75 vs. 28.43%) with butyric acid supplementation. Egg quality data at point of egg collection as showed a slight reduction in soft-shell eggs produced during the trial. Overall, butyric acid supplementation
appears to improved nutrient digestion and potentially eggshell calcification and strength in end of cycle laying hens.

**Key Words:** Layers, Butyrin, Eggshell

**T163** Effects of various concentrations of butyric acid on the performance, intestinal lesion scores, and body composition of broilers raised on used litter

Nathaniel Barrett*, James Lewis, Michael Persia
Virginia Tech

An experiment was performed to determine the effects of commercial and higher concentration of butyric acid (BA) on performance, lesion scores (LS), and body composition when fed to broilers raised on dirty litter. Fifteen hundred male Heritage broiler chicks were randomly assigned to one of five treatments (trt), a positive control fed a diet without BA and raised on clean pine shaving litter (PC), a negative control fed a diet without BA and raised on dirty litter (NC), and three trt raised on dirty litter which received the same diet containing 250ppm (250BA), 500ppm (500BA), or 1,000ppm (1000BA) BA. Dirty litter was generated directly before the experiment (one week down time) by housing 20 chicks that received a cocidiosis vaccine day of hatch, until 28 days of age. Each experimental trt was applied to 12 replicate pens of 25 chicks. Body weight and mortality corrected feed conversion ratio (FCRm) were reported from the 1-14, 1-28 and 1-42 day periods. On D14, 3 birds/pen were euthanized for LS. On D42, 5 birds/pen were euthanized and de-feathered for body composition analysis via dual-energy x-ray absorptiometry. Data were analyzed using ANOVA and a Fisher’s LSD test to separate means (P<0.05). On D14, 500BA resulted in the highest body weight, while the NC fed birds had the lowest (P<0.01). At days 28 and 42, 1000BA resulted in the highest body weight (P<0.01) while the NC and PC were the lightest. There was no differences in FCRm for the first 14 days, but from days 1-28 and 1-42, the 1000BA resulted in the lowest FRCm (P<0.01). Lesion scores were only different for the duodenum, with 500BA trt resulting in the lowest score, 1000BA and NC the highest, and PC and 250BA intermediate (P<0.01). Lean mass and total mass showed similar results to BW with the 1000BA fed birds resulting in the highest lean and total mass after DXA analysis (P<0.01). In conclusion although the commercial dose (250BA) increased the body weight until D28, over the last part of the experiment this effect was lost. The higher doses had similar to better responses that resulted in the heaviest birds with the lowest FCR over the entire experiment. These data could indicate that including BA at a dose higher could be beneficial for growth of broilers on built up litter.

**Key Words:** Broiler, Butyrate, Performance, Cocidiosis, Body composition

**T164** Yeast cell wall and hydrolyzed yeast as a source of nucleotides effects on immunity, gut integrity and performance of broilers

Jose Rivera1, Lúcio Araújo1, Elizabeth Santin1, Carolina Oliva1, Liliana Borges1, Melina Bonato*1 1Universidade de Sao Paulo; 2Universidade Federal do Paraná; 3ICC Industrial Comercio Exportacao e Importacao Ltda.

A study was performed to evaluate the effects of the yeast cell wall (YCW) and hydrolyzed yeast as a source of nucleotides (YNU) compared to zinc bacitracin (ZBC) effects on the immunity, gut integrity and performance parameters of broilers. For this, 840 male Hubbard® chicks (1 d) were distributed in a CRD with 5 treatments: 1-Control; 2-Control with ZBC (50 g/MT); 3-YNU1 (Saccharomyces cerevisiae hydrolyzed yeast, 1 kg/MT up to 7 d / 0.5 kg/MT from 8-42 d, Hylises®); 4-YNU2 (5 kg/MT up to 7 d/ 0.5 kg/MT from 8-42 d); 5-YCW (from Saccharomyces cerevisiae at 0.5 kg/MT, IMWS®), with 14 reps of 12 birds each. The diets were divided into pre-initial (1-7 d); initial (8-21 d); growth (22-33 d) and final (34-42 d). The birds were housed in pens with reutilized litter from a commercial farm (2nd time used). The BWG, FI, FCR and Production factor were measured at 7, 21 and 42 d. At 21 d, 8 birds per treatment were selected and slaughtered to collect the ileum. The samples were prepared for histology and immunohistochemistry analyzes and were evaluated macrophages, CD4+, and CD8+ cells count; lamina propria (LP) and epithelial thickness; enterocytes proliferation; epithelial plasma infiltration; mixed inflammatory infiltration of LP; goblet cells; congestion and necrosis. These parameters were qualified by “I See Inside” (ISI) index methodology (Kraieski, 2017). The data were analyzed by GLM produced from SAS and the means compared by Tukey test at 5% of significance. The effects were also analyzed by orthogonal contrasts by F test at 5% of significance. Significant differences (P<0.05) were found for immunohistochemistry, where the treatment with YCW supplementation result in lower macrophages and CD8+ cells count compared to others treatments. For CD4+ cells count, the control group has the higher (P<0.05) number. Considering the ISI index, no statistical differences were found (P>0.05). Regarding the performance parameters, the YCW and YNU2 improved (P<0.05) the FCR compared to the Control and YCW has similar results to ZBC (P>0.05). The supplementation of YNU2 and YCW in the broilers diet improved the FCR at 42 d compared to Control group. However, the YCW supplementation resulted in the best response of the immune parameters analyzed.

**Key Words:** Saccharomyces cerevisiae, Antibiotic, Immunohistochemistry, Nutrition, Poultry

**T166** The effects of a dietary nucleotides-containing product YT500 on IBV antibody production and intestinal mucosal barrier functions in SPF chickens

Cheadd Wuu1, Zhenwei Yang1, Chao Liang2, Yue Zhang2, Qingmei Xie1 1South China Agriculture University; 2Guangdong Hinabiotech Co., Ltd

Sixty 1-day-old SPF chickens with the similar body weight were randomly divided into four groups, each group has 3 replicates and each replicate with 5 chickens. The Control Group (CG) was fed with basal diet, and the Low Dose Group (LG), Medium Dose Group (MG) and High Dose Group (HG) were fed with basal diet supplemented with 1, 3 and 5 kg of a dietary nucleotides product (YT500™, Hinabiotech, China), respectively. The chickens were raised in isolated chambers, and the feed and water were given ad libitum. All chickens were vaccinated intranasally with one dose of IB-D90 (SCAU, China) at 103EID₅₀/ml at day 1 and 10. IBV Ab was measured at day 1, 10, 17, 24, 31, 38 and 45, respectively by IBV Ab Elisa test kit. Data were analyzed by one-way ANOVA (SPSS 22.0). The results showed: (1) YT500 speeds up the IBV Ab to the effective level for 7 days in LG, MG and HG. Both MG and HG had statistical significance compared to CG at day 17 (P<0.05); (2) The ileal villus height of HG was higher than that of CG (P<0.05), but there were no differences in the ratio of ileal villus height/ crypt depth in LG, MG and HG (P>0.05); (3) At day 17, the expression of ZO-1 and Occludin mRNA gave a linear relationship with YT500, but only HG had significant difference (P<0.05); (4) At day 17, the expression of MUC2 and TFF3 mRNA showed higher value in LG, MG and HG than those of CG, although not significant (P>0.05); (5) At day 17, reduced value of IFN-α mRNA in LG, MG, and HG compared to CG, but IL-22 and IL-17A mRNA had no significant difference in all groups; (6) The CFUs of E. coli and S. enteritidis in MG and HG were lower than those in CG (P<0.05), while the CFUs of Lactobacillus spp. in LG, MG, and HG were higher than CG (P<0.05). In summary, this study demonstrated one week faster of IBV Ab to the effective level in the presence of YT500 under the tested condition. It also showed an improved intestinal mucosal barrier in terms of ZO-1, Occludin, MUC2, TFF3, IFN-α, IL-22 and IL-17A mRNA expression. This study provides a promising research model for better understanding the biological and economical values of YT500 in poultry.

**Key Words:** Nucleotides, Chickens, IBV, Intestinal, Mucosal

**T167** Effects of in ovo injection of L-ascorbic acid on early growth performance and systemic antioxidant capacity in broiler chickens

Saman Fatemi*, Haijun Zhang, Katie Collins Elliott, Ouweasun Duroyaje, E. David Peebles Mississippi State University

Effects of the in ovo injection of various concentrations of L-ascorbic acid (AA) on early post-hatch broiler performance and antioxidant capacity
A total of 500 one-day-old Cobb broiler chickens were assigned into 4 treatments: non-injected control, saline-injected control, or saline containing 3, 6, 12 or 36 mg AA per egg. At 17 d of incubation (doi), a 100 μL volume of sterile 0.85% saline alone or containing different levels of AA were injected by an Inovject m semi-automatic multi-egg injector. Each of the 6 treatment groups were represented in each of 10 replicate groups (block) of floor pens. In each floor pen, 14 males and female chicks were randomly placed at hatch (21 doi). Growth performance was determined from 0 to 7, 7 to 14, and 0 to 14 d of age (doi). Total plasma superoxide dismutase (T-SOD) activity and malondialdehyde (MDA) content were determined at hatch and at 7 and 14 doi by colorimetric assay. The experiment was conducted as a randomized complete block design and data were analyzed using SAS 9.4. Birds hatched from the 3 mg AA/egg treatment group had a higher BW at 7 doi (179.8 g, P=0.046) and a higher ADG from 0 to 7 doi (19.1 g, P=0.039) compared with non-injected birds (169.1 g and 17.6 g, respectively), they also had a higher ADG from 7 to 14 doi (42.9 g, P=0.037) relative to saline-injected controls (41.4 g). Chicks that received 3 or 36 mg AA/egg had reduced plasma MDA contents at hatch by 39 and 31%, respectively, and at 7 doi by 19 and 13%, respectively, compared to the non-injected control (P<0.05). Plasma T-SOD activities increased in birds that received 3 or 6 mg AA/egg compared to non-injected controls by 34 % and to saline-injected controls by 62% at 7 DOA (P<0.05). These results suggest that the i.n. injection of AA (3 to 6 mg/egg) has the potential to promote the growth and increase the systemic antioxidant capacity of broilers during the early post-hatch phase.

Key Words: vitamin, in-ovo, growth, antioxidant, broilers

T168 Discovery and in vitro characterization of a novel muramidase for use in animal feed

Marianne Cohn1, Kirk Schnorn2, Lars Skov1, Esben Schmidt1, Peter Olsen1, Steen Buskov1, Raffaella Aureli1, Estefania Pérez Calvo2, Raul Lopez-Ulibarri2, Mikkel Klausen1,1Novozymes A/S; 2DSM Nutritional Products

The microbiota in the gastrointestinal tract live in a complex ecosystem in equilibrium with the host. There, the microbial turnover (replication and death) naturally produces a diversity of microbial cell components that are released into the gut lumen. In this study, we describe the in silico and in vitro selection of a novel microbial muramidase (EC 3.2.1.17) that degrades the peptidoglycan component of microbial cell wall fragments (or bacterial cell debris).

In general, the discovery of novel enzymes involves several iterations of in silico selection of genes, expression of enzymes and in vitro characterization before large-scale production of the enzyme for study in vivo trials.

In this study, the first round of in silico gene selection, consisting of hundreds of muramidase sequences, was based on the natural microbial habitat of donor organisms, which were mainly selected from microbe-rich environments. In vitro screening of expressed candidates was applied by using a negative and positive screening approach. Candidates were deselected if clearing zones were detected in a bacterial radical diffusion assay, and were ranked based on efficacy of peptidoglycan hydrolysis, stability and expression yield. Selected candidates were tested in vivo in broiler chickens. The best muramidases were further characterized by efficacy of hydrolysis of peptidoglycan from gut-derived microbes. The single best muramidase found using this setup belongs to the glycoside hydrolase family 25 (GH25), isolated from the fungus Acremonium alcalophilum JCM 7366. The 3D structure of the muramidase has been determined using X-ray crystallography, and this can help to explain the unique catalytic properties of this muramidase.

Key Words: Muramidase, Discovery, Peptidoglycans, Characterization, Enzyme

T169 Effects of a novel muramidase supplementation on gastrointestinal functionality and growth performance in broiler chickens

Mounira Sais1, Susana Martin-Orue1, Ana Barroeta1, Raul Lopez-Ulibarri2, Estefания Perez Calvo2,1Novozymes A/S; 2DSM Nutritional Products, Universidad Autonoma de Barcelona; 3DSM Nutritional Products, Nutrition Innovation Center

The aim of the present study was to investigate the effects of dietary supplementation of the novel muramidase (Muramidase 007) on gastrointestinal functionality and performance of broiler chickens. A 35 days study was conducted in a total of 408 day-old Ross 308 which were randomly distributed into 16 floor pens of 30 birds per pen. Treatments were: Control Diet (C) and C + Muramidase 007 (MUR; inclusion at 35 000 LSU(F)/kg feed). A two-phase feeding program (starter: day 0-21 and grower: day 21-35) was used in this study. Both diets included soybean meal, corn, wheat and rye as main ingredients; no other feed enzymes, coccidostat or growth promoters were added in the diets. All birds were vaccinated against coccidiosis. Growth performance parameters were registered at day 0, 9, 21 and 35 of study. At days 9 and 35 of the study, nutrient apparent ileal digestibility, jejunal histomorphology (villus height and crypt depth), vitamin A in plasma, short chain fatty acids (SCFAs) in caecum and microbiota composition in crop, ileum and caecum was determined by plate counting and in caecum also by sequencing the 16S rRNA gene. The data obtained were analyzed using one-way ANOVA with a
Evaluation of the efficacy of a novel muramidase on performance of broiler chickens

Mojtaba Yegani1*, Bradley Turner1, Thomas Frost1, Greg Mathis2, Brett Lumpkins2, DSM Nutritional Products; 2Southern Poultry Research

Muramidases are a category of enzymes that could be used as a digestive aid to optimize availability of nutrients in the digestive tract of animals. They belong to the family of glycosyl hydrolytic enzymes with the ability to catabolize peptidoglycans. Peptidoglycans constitute a substantial portion of bacterial cell debris that exist in the digestive tract of poultry. It is hypothesized that dietary addition of a novel microbial muramidase (muramidase 007) can positively impact the functionality of the gut, resulting in improvements in performance of broiler chickens. A 42-day floor pen study was conducted to investigate the effects of addition of muramidase 007 in corn-soy diets on growth performance of broiler chickens. A total of 1,280 day old male broiler chicks (Cobb 500) were allocated to two treatments (control and muramidase). Each treatment was replicated 32 times with 20 birds per pen in a complete randomized block design with pens as the experimental unit. A three-phase feeding program (starter: day 0-21, grower: day 21-35, and finisher: day 35-42) was used in the study. All birds were vaccinated against coccidiosis with a commercial vaccine without the need to adjust the composition of the diet. For this reason, it is possible to make full use of the genetic potential and maintain the profit of poultry meat production.

Key Words: Muramidase, enzymes, peptidoglycans, nutrients, broilers

Novel muramidase improves broilers performance via higher nutrient utilization

Leticia Bittencourt*1, Vitor Fascina1, Estefania Calvo1, DSM Nutritional Products; 2estefania.perez-calvo@dsm.com

The objective of this study was to evaluate the effect of dietary inclusion of a novel muramidase (muramidase 007) on growth performance and nutrient absorption in broiler chickens, under mild challenging conditions, to mimic suboptimal farming conditions. A total of 600-day-old Ross 308, were distributed across 3 treatments, 8 replicates of 25 birds each, in a completely randomized design, using floor-pens with fresh litter for a 42d trial period. Treatments were: (1) Control (C); (2) C + Muramidase 007 level 1 (MUR 1); (3) C + Muramidase 007 level 2 (MUR 2). A three-phase feeding program (starter: day 0-21, grower: day 21-35, and finisher: day 35-42) in mash form was used in the study. Diets were based on corn and soybean meal, rice bran, and meat and bone meal were also included, to challenge the gastrointestinal function with low digestibility ingredients. All diets included phytase and a yellow carotenoid. At day 2, all birds were inoculated with a multiple dose of an anticoccidial vaccine, to create a mild challenge overall the physiological status of the animals during the starting phase. Growth performance parameters and mortality were recorded during the experimental period at 0, 21, 35 and 42 days. At day 28, blood samples were collected from 20 birds per treatment to measure total blood carotenoids content. All data were analyzed by ANOVA and means were compared by the Tukey test at 5% probability. Overall, treatments MUR 1 and MUR 2, resulted in better feed conversion ratio compared to control (1.59 and 1.59, respectively, vs 1.68; P<0.0151). In addition, broilers receiving MUR 2 had higher body weight gain compared to the control (3.40 vs 3.27 kg, P<0.05). MUR 2 supplemented broilers, showed higher levels of total carotenoids in blood, compared to control (4.38 vs 3.57 mg/L, P=0.0055), suggesting a better intestinal functionality and thus a more efficient uptake of carotenoids. These observations, collected on broilers placed under suboptimal growing conditions, confirm that muramidase 007 supplementation supports the digestive function by fostering nutrient uptake, increasing feed efficiency, and thereby contributing to sustaining growth.

Key Words: Muramidase, nutrient, absorption, conversion, weight

Lowering the incidence of Wooden Breast with a new, innovative additive

Manu De Laet2*, Rob Goedgebeure, Renato Costa Nascimento

In the past few decades, the demand for poultry meat has increased substantially, especially chicken and turkey breast fillet. This growth is related to the perceived healthy and nutritional content, suitability for further processing and the cheaper price compared to red meats. To fulfil the increase in demand there was a selection for higher growth-rate and breast-yield chicken hybrids. However, improved live performances have been accompanied by an increased incidence of muscle abnormalities. Among those is the occurrence of wooden breast: visually hard, out-bulging and pale areas on the ventral surface of the Pectoralis major muscle.

Nuscience developed and validated Q-prove®, a product to combat wood-en breast without reformulating the diet and without losing performance. A field trial was carried out on a commercial farm in The Netherlands. The farm was suffering from high incidences of wooden breast. The trial included 60 000 birds fed the control feed while 30 000 birds were fed the control diet supplemented with Q-prove® (1 kg/MT in starter, 0.650 kg/MT in grower, 0.350 kg/MT in finisher). Nuscience tested in detail 300 carcasses from the control group and 150 carcasses from the treatment group in the slaughterhouse. The scoring was performed by a Doctor of Veterinary Medicine with more than 35 years of experience in poultry carcass quality (score 0 = no wooden breast, score 1 = starting wooden breast with no financial consequence, score 2 = severe wooden breast with financial consequence). For statistical analyses, Chi square test is used. The results showed a clear effect of the treatment group on the occurrence of severe wooden breast. When Q-prove® was added to the feed, the amount of carcasses with score 1 remained the same (9.00% for the control group vs 10.00% for the Q-prove® group), but there was a significant decrease in score 2 carcasses from 13.57% (control group) to 2.67% (Q-prove® group).

Q-prove® is an additive that decreases the incidence of wooden breast without the need to adjust the composition of the diet. For this reason, it is possible to make full use of the genetic potential and maintain the profit of poultry meat production.

Key Words: wooden, Q-prove®, potential, abnormalities

The effects of Magni-Phi® in floor pen- and commercially-raised turkeys

Kenneth Bafundo1*, Mark Blakley1, Greg Mathis3, Phibro Animal Health Corporation; 2Southern Poultry Research

Magni-Phi (MP, Phibro Animal Health Corp.) is a natural feed additive that has been used in broiler chickens to improve coccidiosis control, in-
Rupt. Sci. 97 (E-Suppl. 1)

Poultry-specific synbiotic supports enhanced growth efficiency of turkeys raised in antibiotic-free conditions in experimental and field settings

Chasity Pender*1, Michaela Mohnl*2, G. Raj Murugesan1 Biomin America Inc.; 2Biomin Holding GmbH

As the poultry industry searches for solutions to reduce the use of antibiotics to alleviate concerns of antibiotic resistance and satisfy consumer and regulatory demands, probiotics have received increasing attention for their ability to improve enteric health in poultry. Two studies were conducted with the objective of evaluating effects of synbiotic (combination of probiotics and prebiotics) supplementation on performance of turkeys raised in antibiotic-free conditions. The first experiment utilized a total of 540 day-old poults that were randomly assigned to one of two groups, each consisting of 6 replicates (45 birds/pen). Groups consisted of a negative control fed a standard commercial diet free of additives or medications and group provided the same diet, but supplemented with a synbiotic (PoultryStar® sol™, Biomin Holding GmbH) through the drinking water. The trial was conducted for a period of 98 days and performance measurements were taken on days 0, 14, 40, 68 and 98. For all measurements, significance threshold was set at P<0.05. Throughout the experimental period, body weight (BW) was higher in the synbiotic supplemented group with the final BW being significantly increased in the supplemented birds. Similarly, feed intake was also significantly increased in the treated group during the day 14 to day 98 period. No statistical difference was found among the groups for FCR. Mortality and culls were also numerically reduced throughout the trial with synbiotic supplementation. The second trial was conducted at a commercial farm and utilized 17,600 day-old poults, divided evenly among two treatment groups; a negative control fed a standard commercial diet free of additives or medications and group fed the same basal diet supplemented with a synbiotic (PoultryStar® me; 500 g/t). The trial was conducted over a 118 day period and final performance parameters were measured. Final BW was increased by 5.1% while FCR was decreased in the synbiotic supplemented birds. Additionally, early poults (7 day and 14 day) and overall mortalities were reduced in the synbiotic treated group. Overall, these results suggest that supplementation of poul-

Key Words: Magni-Phi, coccidiosis control, turkey performance, ionophores

T174 Poultry-specific synbiotic supports enhanced growth efficiency of turkeys raised in antibiotic-free conditions in experimental and field settings

Chasity Pender*1, Michaela Mohnl*2, G. Raj Murugesan1 Biomin America Inc.; 2Biomin Holding GmbH

In commercial poultry production enteric disorders, such as necrotic enteritis caused by toxin producing C. perfringens strains, are leading to significant financial losses. Their impact will further increase once the use of antibiotic growth promoters (AGPs) has ceased. Alternatives like efficacious probiotics are urgently needed. In a multi-parameter screening approach B. subtilis DSM 32315 was recently identified. In numerous feeding trials B. subtilis DSM 32315 consistently improved performance of broilers reared in various feeding conditions. The current study will highlight the results of multidisciplinary in vitro studies that indicate that DSM 32315 has multiple mode of actions.

In vitro cultivation studies showed that B. subtilis DSM 32315 supernatant has the ability to inhibit field isolates of C. perfringens, E. cecorum, S. gallinaeaeus, C. septicum, C. jejunii as well as C. coli. By applying a multi-step fractionation approach, distinct sub-fractions of the supernatant were identified showing C. perfringens inhibiting activities. Structure elucidation by NMR analyses confirmed that both compounds were responsible for the inhibition activity, one of them identified as the bacteriocin Subtilisin A. These results were successfully validated in experiments using novel knock-out B. subtilis strains.

The supernatant of DSM32315 also displayed various enzyme activities, such as endo-cellulase activity, which could be involved in positive alterations to the cecal microbial populations shown in broiler trials. The supernatant also showed mycotoxin degrading activity, which eliminated 2.5 μg/mL Zearalenone within 12 h and reduced 50% of 2.5 μg/mL Alfatoxin B1 within 24 h from supplemented supernatant. Finally, superoxide dismutase and catalase enzyme systems were discovered which were shown to support the antioxidant system required for restoring homeostasis in birds after stress or disease challenge.

This study demonstrates that B. subtilis DSM 32315 is a unique probiotic strain displaying multiple modes of action which are beneficial for poultry in commercial production. The diverse activities shown may reduce the risk of gastrointestinal disorders and explain the observed consistent performance improvements of flocks reared under different conditions.

Key Words: Probiotics, DFM, Bacillus, Pathogen, MoA


Footpad dermatitis (FPD) is characterized by necrosis on the plantar surface of footpads of poultry (Shepherd and Fairchild, 2010). FPD became important for the poultry industry in the 1980s with development of an overseas market for paws. Moreover, FPD is recognized as an animal welfare issue in a number of countries. Although the causation is multifactorial, poor quality litter is highly correlated with footpad dermatitis. By maintaining good litter quality, producers can reduce losses and improve welfare (Taira et al., 2013). It is commonly observed that the heaviest broilers present severe FPD. Because probiotics and direct fed microbials (DFM) have been frequently described to increase growth, there is a potential to exacerbate footpad dermatitis. In the present study, the Bacillus subtilis strain 29784 was tested for its effects on performance and on footpad dermatitis.
A 35 days experiment was conducted to evaluate the effect of *B. subtilis* 29784 on growth performance of Ross PM3 male broilers fed corn-soy diets. 320 birds were randomly distributed into 2 treatments with 8 pen replicates of 20 birds per treatment. The 2 treatments were: 1) Control or 2) Control + *B. subtilis* 297874 (1.0E+08 CFU/kg). Body weight gain, feed intake, feed conversion ratio and mortality were measured. FPD and litter quality were scored at the end of the experiment.

At 35 days, *B. subtilis* 29784 improved BWG (+4.8%, p=0.01), FCR (-2.9%, p=0.003) and FCR adjusted (-4.8%, p=0.004). Moreover, *B. subtilis* supplementation improved litter quality: 60% of pens in the Controls had highly degraded litter (score 4), whereas this condition was observed in none of the pens of the *B. subtilis* group (p=0.031). Footpad health scores were also significantly improved by the use of *B. subtilis* with a 21% decrease of pens which scored “highly necrotic” (p=0.008) and a 11% decrease of pens with combined scores “highly and visibly necrotic” (p=0.014) vs controls.

The incorporation of *B. subtilis* 29784 into feed led to an improvement of performance and animal well-being, as reflected by improvement of litter quality and reduction of severe FPD. These results illustrate the usefulness of DFM to improve welfare of broilers while assuring high production performance.

**Key Words:** Bacillus, broiler, footpad, performance, pododermatitis

**T177 Formulation of Bacillus probiotics is key to product performance** Karoline Brinch1, Geraldine Laftite2, Adam Nelson3, Robert Plowman4 ‘Novozymes Animal Health & Nutrition; ‘Adisseo Appui Chimie Formulation; ‘Novozymes Biological, Inc.; ‘Novozymes Microbial Pilot Plant

Purpose: Probiotic-based products have received more attention in poultry production since the focus on reduction of antibiotics has increased in recent years. Several Bacillus-based products are available but often producers find a lack of consistent effects. Much focus has been on selection of the right strain but this factor is only one of several which needs to be considered in order to develop a consistent probiotic product.

In this talk we describe how a correct formulation of the probiotic strain is one of the key factors to success.

Description: A probiotic strain screened and selected for performance in broilers was assessed in a range of assays related to formulation. A simple vs an optimized formulation and commercial products were compared and analysed with respect to demixing, flowability (angle of repose) and particle size distribution (PSD) to assess the impact on homogeneity in feed and in distribution to the broiler flock.

Results: The optimized formulation had several beneficial characteristics when compared to simple formulations: The PSD was 233 um (Dv50) where other products were at either <100 or >500. In assessments of simple and optimized formulations of product showed significant differences in the demixing set up: In comparisons of bacterial counts (CFU) between bottom, middle and upper layer of a feed formulation the difference between upper and lower layer was a significant 142% (p=0.0001) in the simple formulation, while the difference in the optimized formulation was insignificant at 7%. In recovery trials from nine in vivo studies the average in-feed recovery was above 80% and the CV below 20% in all proving excellent in-feed homogeneity.

Conclusion: A careful development of the correct formulation is an often overlooked key feature to ensure product performance. Our studies have shown that an optimized formulation with a correct PSD will result in less demixing, better flowability and thus higher in-feed homogeneity - as well as more hasslefree usage. Especially in the starter feed it’s crucial that the in-feed counts of Bacillus spores are equal in each feed pellet as the chicks only ingest tiny amounts. Therefore product performance is closely linked not only to strain selection but also to formulation features of the product.

**Key Words:** Probiotics, Formulation, Bacillus

**T178 Zootechnical efficacy of diets supplemented with GalliPro® Fit, a new multi-strain direct feed microbial (Bacillus subtilis DSM 32324, DSM 32325 and Bacillus amyloliquefaciens DSM 25840), in broiler chickens** Alfred Blanch1, Florence Rudeaux1, Dorthe Sandvang1, Zahid Nasir2* ‘Chr Hansen AS; ‘Trouw Nutrition Agresearch

GalliPro Fit® is a direct feed microbial (DFM) based on viable spores of two strains of Bacillus subtilis (DSM 32324, DSM 32325) and one strain of Bacillus amyloliquefaciens (DSM 25840). This study evaluated efficacy of GalliPro® Fit-supplemented diets at two different dosages in broiler chickens: 1.6 x 10⁹ and 3.2 x 10⁹ CFU / g of feed. One-day-old healthy male broiler chickens (Ross 708) were allocated to 30 pens. There were 10 replicate pens per treatment group. Each pen had 10 chickens giving a total of 100 chickens per treatment group. The chickens were allocated to three dietary treatments (T1: Control without DFM, T2: 1.6 x 10⁹ CFU/g, T3: 3.2 x 10⁹ CFU / g) at day 0. Chickens were fed crumbled feed (starter diet) and pelleted feed (grower and finisher diets) ad libitum (Starter D0-21; Grower D21-35; Finisher D35-42). At the first day of the experiment (day 0 of study) and at defined intervals (days: 21, 35 and 42) productive performance (body weight, body weight gain, feed intake, feed conversion ratio) were determined per pen. The statistical analyses was performed with the software package Minitab and based on One-way Anova. All treatment least squares means were compared with each other by Tukey’s HSD test. Differences among least squares means with a probability of P < 0.05 were accepted as statistically significant, whereas differences with P-values ranging from 0.06 to 0.10 are accepted as trends. Overall, no significant dietary effect was observed during the starter period. However, for 35 days growth period (D 0-35), GalliPro® Fit-supplemented diets (500 and 1000 g/MT) reduced FCR, compared to the control group by 2.1% and 3.4%, respectively (T1: 1.570a; T2: 1.536ab; T3: 1.515a; p < 0.05). Likewise, in the whole experimental period (D 0-42), FCR was improved by 1.661a; T2: 1.634ab; T3: 1.614b; p < 0.05). No significant difference was observed among dietary treatments in mortality. The results of the present study suggest that GalliPro® Fit-supplemented diets were beneficial in reducing FCR of broiler chickens under commercial-like conditions.

**Key Words:** DFM, multistrain, Bacillus, chickens, performance

**T179 Effect of GalliPro® Fit, a new multi-strain direct feed microbial (Bacillus subtilis DSM 32324, DSM 32325 and Bacillus amyloliquefaciens DSM 25840), on growth performance and digestibility in broilers** Dorthe Sandvang1, Alfred Blanch2*, Florence Rudeaux1, Joren Verbeke1 ‘Chr Hansen AS; ‘PoultPharm

The use of Bacillus species as probiotic supplements is expanding rapidly and demonstrating immune stimulation, enzyme production and competitive exclusion as the most prevalent modes of action. The objective of this study was to investigate the effect of three novel Bacillus strains in the GalliPro® Fit product on performance and digestibility in broilers under floor pen conditions. Study: 960 animals were placed in 64 pens and from D1 until D22, a starter feed was ad libitum administered which was replaced by a commercial grower diet until D42. Titanium oxide was added to the feed (0.3%) and single Bacillus strains were at dose 1.0 x10⁹ CFU/gram of feed. On D42, 6 birds per pen were euthanized and ileal content were pooled. The dry matter, crude protein, crude fat, energy, ash and titanium dioxide content were determined (Wageningen University) on the ileal content, in fecal droppings and the feed to analyse effects of the probiotics on apparent ileal digestibility. Data was analyzed with RStudio (Version 0.99.467, RStudio, Inc.). Digestibility data at bird level were analyzed using linear regression models with treatment group as fixed effect (procedure lm). Body weight and daily weight gain were analyzed using linear mixed regression models. Statistical significance was assessed at P ≤ 0.05.

Performance results showed the average weight of birds(g) for all three bacillus strains were significant improved compared to the control group: for example at day 42 Bacillus amyloliquefaciens DSM 25840 average
weight was 2525g (P-value 0.009) compared to non-supplemented group of 2390g. Digestibility results showed that birds supplemented with Bacillus subtilis DSM 32324 showed a significantly higher protein digestibility (76.3%, P-value 0.05) compared to non-supplemented birds (74.1%). Birds supplemented with Bacillus amyloliquefaciens DSM 25840 showed significant improved ash (40.8% P-value 0.039), protein (76.3% P-value 0.05) and energy digestibility (67.2% P-value 0.043) compared to control birds: ash (38.2%), protein (74.1%) and energy digestibility (65.0%). In conclusion, the diets supplemented with the new Bacillus strains showed significant effects on performance parameters correlating to apparent ileal digestibility in broilers under floor pen conditions.

**Key Words:** DFM, Bacillus, performance, protein digestibility, apparent ileal digestibility

### T180 A one year field comparison between the effects of a blend of Quebracho and Chestnut tannins and a commercial antibiotic program on broiler live performance

Enzo Redondo1, Leandro Redondo1, Juan Diaz Carrasco1, octavio bruzzone1, claudio cabrall1, vitorio garces1, maximo lileiro1, michele battaglia1, mariano fernandez miyakawa1,2,3 1CONICET; 2INTA; 3silvateam s.a.; 4Granja Tres Arroyos S.A.

The removal of antibiotic growth promoters (AGPs) from animal diets has resulted in a search for cost and effective alternatives. A blend of Italian Chestnut (Castanea sativa) and Quebracho (Schinopsis lorentzii), Silaveafed® Nutri P (NP) has been shown to improve productive parameters and prevent infectious diseases (as necrotic enteritis). The objective was to compare the effect on broiler live performance of replacing a commercial program (COM) with NP (1.0 kg/MT) in a field trial on a commercial farm over a one year period. Each of six tunnel ventilated broiler houses (20,000 birds, Cobb®) was assigned to: 1) COM (AGP rotation), or 2) NP (tannins) during 6 production cycles. Body weight and mortality were obtained weekly, and feed consumption was taken at the end of each cycle. Necropsies, histomorphometry, footpad and intestinal lesions were studied in 10 birds from each group at 21 and 35, or, 42 days of age. Microbiota analysis was performed by 16S sequencing of caecal contents. Over the six cycles, average body weight gain was significantly (P<0.05) higher in NP fed birds as compared to birds fed COM diets. Differences between COM vs. NP treatments were not observed in overall mortality-corrected feed conversion ratio (P=0.05), total mortality (2.93 vs. 2.87 %) and first week mortality (0.81 vs. 0.95%). The average Production Efficiency Factor (PEF) was 1.4 % higher on the NP feed. The severity and the number of animals with gross lesions were reduced by NP compared to COM. Number of animals with duodenal lesions was not statistically different in COM vs. NP groups (6.6 vs. 4.4%) but differences (P=0.05) were observed in jejunum (18.8 vs. 12.2%) and ileum (6.6 vs. 3.3%). Footpad lesions recorded during field necropsies were lower for NP treatment but footpad inspection could not be repeated at the processing plant. Intestinal morphology was improved by NP (P<0.05). Firmicutes/Bacteroidetes ratio, Lactic Acid Bacteria and Bifidobacteria were increased by NP (P<0.01). In a one year field trial, compared to a commercial AGP program, the dietary inclusion of 1.0 kg/MT of tannins (Nutri P®) improved intestinal health and increased PEF, suggesting that addition of this specific blend can be an alternative for a healthy and sustainable poultry production.

**Key Words:** microbiota, poultry, tannins, antibiotic, growth promoter

### T181 Dose depending performance improvement of 42 d broilers fed diets containing a mixture of carvacrol, cineol, cinnamaldehyde and capsicum oleoresin compared to antibiotic growth promotants

Rafael Cabrera*,1 Jess Walls1, Mark Richards1, Henning Gerstenkorn2 1EW Nutrition, USA; 2EW Nutrition, Germany

The purpose of this study was to determine the effects of supplementing different levels of a Secondary Plant Compound (Activo®) and antibiotic growth promotants on growth performance in broilers fed for 42 d in commercial conditions. Activo® is micro encapsulated in a fat matrix and contained carvacrol, cineol, cinnamaldehyde and capsicum oleoresin. The effect of 5 different dosages of Activo® (50,100,150,200 and 250 g/ton) on live weight, feed conversion ratio and livability of broilers was compared to an antibiotic group (50 g/ton of BMD in starter and grower feed, 20 g/ton of Stafac in finisher feed) and to an untreated control. All diets were mashed based on corn, soybean meal, meat and bone meal and dried distillers grains. Each treatment had 10 repetitions with 27 straight-run Ross 308 broilers per pen. For a natural challenge, 4 pound of used, homogenized litter have been added to each pen. All birds were vaccinated with CocciVac-B at day 0. Body weight and feed intake were measured at day 0,14,28,36 and 42. Feed conversions and mortality-adjusted feed conversions were calculated. Mortality was recorded daily and cumulative mortality was determined per treatment. Response variables (Live weight, Feed Conversion Ratios (FCR), and mortality) were evaluated by Randomized Complete Block ANOVA model and the means were separated by LSD model (Statistix 10, Analytical Software, Tallahassee, FL). The study was conducted at Virginia Diversified Research Corporation from February to April. Results at 42 d showed Average Daily Gains were significantly improved with 250 g/ton of Activo® when compared to control group. 200 g/ton of Activo® yielded a significantly lower mortality-adjusted feed conversion ratio when compared to the control group. For all the parameters measured, there was no statistical difference between the 200, 250 g/ton of Activo® and antibiotic treated groups. In conclusion, the overall results of the 42 d trial indicate that dosages of 200 and 250 g/ton of Activo® lead to improved performance parameters similar to those observed in the antibiotic shuttle of BMD and Stafac group. This means that Activo® safely replace antibiotics in broiler diets in commercial conditions. The results indicate a dose dependent effect of the Activo® product.

**Key Words:** Activo, broiler, BMD, Stafac, performance

### T182 Oregano essential oil lessens the impact of enteritis in broiler chickens

Saksit Srinongkote1, Wendy Wakeman2, David Harrington* 1Animal Research Consultant; 2Anpario Plc

Eubiotics such as those based on oregano essential oil (OEO) are potential tools to help manage gut health in a poultry industry under pressure to reduce antibiotic usage. A study to determine the performance of broilers fed an OEO product when challenged with *Eimeria* spp. and *Clostridium perfringens*. A total of 168 Ross 308 broilers were assigned to 2 treatment groups (14 birds/pen, 6 replicates/treatment): 1) Control (CON): basal ration + 2) OS: basal ration + Oreg-o-Stim 300g/tonne of feed (Anpario Plc, UK). The basal ration contained meat and bone meal (3-5% depending on feeding phase) duration of 35 days. Birds were housed in floor pens on clean litter with access to food and water ad libitum. On day 7, birds were orally administered a 1ml mixture of *Eimeria acervulina, E. maxima* and *E. tenella* (15,000 oocysts/ml) followed by an oral dose on days 12, 13 and 14 of C. perfringens (3x10^9 cfu/ml, 3ml/bird). Performance was determined for 0-10, 0-24 and 0-35 days. On days 18 and 35, 2 birds/pen were euthanised to determine clostridial lesion scores (LS). Data were analysed by ANOVA and significance declared at P<0.05. Body weight [HH1] gain was similar in the period 0-10 days (0.244 vs. 0.254kg, CON vs. OS respectively) but was significantly higher in OS for the p 0-24 (0.995 vs. 1.034kg, CON vs. OS respectively) and 0-35 days (2.150 vs. 2.225kg, CON vs. OS respectively). Similarly, FCR between groups did not differ in period 0-10 days (0.122 vs. 0.122, CON vs. OS respectively), but was significantly lower in OS groups for periods 0-24 (1.00 vs. 1.03, CON vs. OS respectively) and 0-35 days (1.66 vs. 1.60, CON vs. OS respectively). LS were significantly lower in OS groups versus CON on day 18 and 35 (day 18: 0.86 and 1.22; day 35, 0.72 vs. 1.03, OS and CON respectively). In conclusion, an OEO eubiotic (Orego-Stim) significantly improved bird performance and reduced intestinal lesions associated with *C. perfringens*, the causative agents of necrotic enteritis, in an enteritis challenge model.

**Key Words:** Oregano, Broiler, Enteritis, Gut, Performance
**POSTER SESSION**

**P184 Discovering the optimal concentration of Gallipro Hatch® that enhances broiler hatchability and live performance**

Castaneda*GS1, Dana Dittoe1, Kelley Wamsley1, Christopher McDaniel1, Alfred Blanch2, Dorthie Sandvang2, Aaron Kiess1

Mississippi State University; 1Chr. Hansen AS

Concerns about bacterial resistance to antibiotics has led to the search for alternatives such as probiotics. In ovo application of probiotics has been suggested as a strategy to enhance broiler performance and welfare. Therefore, the objective of this study was to evaluate the impact different concentrations of GalliPro Hatch® (GH), an *Enterooccus faecium* based probiotic, have on hatchability and live performance when in ovo injected into fertile hatching eggs. For the study, 2,078 Ross X Ross 708 fertile eggs were obtained and incubated. The following in ovo treatments were applied on D18 of incubation: 1) a 50µL injection including Marek’s vaccine (MV) as a control, 2) MV plus 1.4x10⁵ cfu GH/50µL, 3) MV plus 1.4x10⁶ cfu GH/50µL, and 4) MV plus 1.4x10⁷ cfu GH/50µL. At hatch chicks were weighed, feather sexed and hatch residue analysis was conducted. Male chicks (640) were randomly assigned to 40 floor pens. Water and feed were supplied ad libitum. On D0, 7, 14, and 21 of the grow-out, performance data were collected. Hatchability data were analyzed using a completely randomized block design with a split plot over time. Means were separated using Fisher’s protected LSD (P≤0.05). Results demonstrated that all GH treatments reduced yolk weight compared to MV alone (P<0.0003). Differences in duodenum length were detected on D14 where the 2 higher GH doses had longer relative duodenum lengths than the other 2 treatments, but by D21 no differences in length were detected. On D0 all GH treatment tissues were heavier than control tissues; however, by D7 the opposite was detected and on D21 no differences were apparent (P>0.0001). On D14, the crop pH was lower in the 10⁵ cfu GH treatment compared to the other treatments; however, by D21 the pH of this treatment was only lower than the highest dose of GH (P=0.02). On D14, duodenum pH for the 10⁶ cfu GH treatment was lower than the other treatments; but by D21, the highest GH dose had a lower pH than the control and lowest GH dose (P<0.0001). For jejunum pH, no differences between treatments were detected on D0 or 21; but on D14, the 10⁶ cfu GH treatment had a lower pH compared to all other treatments (P<0.0001). In conclusion, in ovo application of GalliPro Hatch, even at high concentrations, should not impact hatchability and can improve broiler live performance, at least through the first 21 d of a grow-out.

**Key Words:** GalliPro Hatch, probiotic, in ovo, hatchability, FCR

---

**P185 Changes to the gastrointestinal tract and yolk sac of broilers previously in ovo injected with different concentrations of GalliPro Hatch®**

Dana Dittoe*GS1, Claudia Castaneda1, Kelley Wamsley1, Chris McDaniel1, Alfred Blanch2, Dorthie Sandvang2, Aaron Kiess1

Mississippi State University; 1Chr. Hansen AS

In ovo application of probiotics has been suggested as a novel strategy to improve broiler performance. Thus, the objective of this study was to evaluate the effect of in ovo injection of GalliPro Hatch® (GH), an *Enterococcus faecium* based probiotic, on intestinal parameters. For this study, 2,078 Ross X Ross 708 fertile eggs were obtained and incubated. The following in ovo treatments were applied on D18 of incubation: 1) a 50µL injection including Marek’s vaccine (MV) as a control, 2) MV plus 1.4x10⁵ cfu GH/50µL, 3) MV plus 1.4x10⁶ cfu GH/50µL, and 4) MV plus 1.4x10⁷ cfu GH/50µL. At hatch (D0), 640 male chicks were placed into 40 floor pens. Water and feed were supplied ad libitum. On D0, 7, 14, and 21 of the grow-out, 1 bird per pen was used to obtain yolk, crop, gizzard, duodenum, jejunum, ileum, and ceca weights, lengths and pH. Data were analyzed using a completely randomized block design with a split plot over time. Means were separated using Fisher’s protected LSD (P≤0.05). The results demonstrated that all GH treatments reduced yolk weight compared to MV alone (P<0.0003). Differences in duodenum length were detected on D14 where the 2 higher GH doses had longer relative duodenum lengths than the other 2 treatments, but by D21 no differences in length were detected. On D0 all GH treatment tissues were heavier than control tissues; however, by D7 the opposite was detected and on D21 no differences were apparent (P>0.0001). On D14, the crop pH was lower in the 10⁵ cfu GH treatment compared to the other treatments; however, by D21 the pH of this treatment was only lower than the highest dose of GH (P=0.02). On D14, duodenum pH for the 10⁶ cfu GH treatment was lower than the other treatments; but by D21, the highest GH dose had a lower pH than the control and lowest GH dose (P<0.0001). For jejunum pH, no differences between treatments were detected on D0 or 21; but on D14, the 10⁶ cfu GH treatment had a lower pH compared to all other treatments (P<0.0001). In conclusion, in ovo injection of GalliPro Hatch increases yolk absorption and decreases gastrointestinal pH. These changes may lead to improved live broiler performance observed in other GalliPro Hatch studies.

**Key Words:** GalliPro Hatch, in ovo, intestinal morphology, pH, broiler