The efficiency of 2 enzyme complexes on male broiler nutrient digestibility and performance were evaluated. A total of 120 and 840 1-d-old male broilers (Cobb 500 strain) were used in the metabolic and performance tests, respectively. The birds were distributed into 4 treatments [positive control (PC), negative control (NC), NC + enzyme complex A (xylanase, glucanase, amylase, protease and cellulase) and NC + enzyme complex B (xylanase and β-glucanase)]. In the metabolic test, 24 excreta collecting cages were utilized. The birds were caged from 14 to 21 d of age (doa) in which 3 d were for adaptation and 4 d for total excreta collection (the method of total excreta collection included the removal of feathers and spilled feed in the tray). The birds in the performance test were randomly allocated to 24 floor pens. The feeding programs were divided into 3 phases: starter (1 to 21 doa), grower (22 to 35 doa), and finisher (36 to 42 doa). Weight gain (WG), feed intake (FI) and feed conversion ratio (FCR) were measured at the end of each dietary phase. Processing yield was determined at 42 doa. The data were subjected to ANOVA and SNK test analyses. Significance was accepted at \( P < 0.05 \).

In the metabolic test, there were no significant treatments differences for any of the parameters evaluated (dry matter, apparent digestibilities of CP and fat, and AMEn). No significant treatments effects were observed for the above parameters during the starter and grower phases or for carcass, drumstick, and breast yields. During the finisher phase, the PC exhibited superior FCR and WG results in comparison to all other treatments. For the whole experimental period (1 to 42 doa), the WG of birds receiving enzymatic complex B was similar those in the NC group. Birds belonging to the PC group had a more efficient FCR in comparison to the NC group. Enzyme complex A helped male broilers to more efficiently recover nutrients from their diets than did enzyme complex B. Nevertheless, the treatment effects on performance were not mobilized by changes in the metabolic parameters evaluated.

**Key Words:** crude protein, enzyme, male broiler, metabolizable energy, nutrients

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**358P The effects of different enzyme complexes on nutrient digestibility and performance in female broilers.** T. F. B. Oliveira\(^{1,2}\), L. V. Teixeira\(^1\), D. E. Peebles\(^2\), and A. G. Bertechini\(^1\), \(^1\)Universidade federal de Lavras, Lavras, MG, Brazil, \(^2\)Mississippi State University, Starkville, MS.

The efficiency of 2 enzyme complexes on female broiler nutrient digestibility and performance were evaluated. A total of 120 and 840 1-d-old female broilers (Cobb 500 strain) were used in the metabolic and performance tests, respectively. The birds were distributed into 4 treatments [positive control (PC), negative control (NC), NC + enzyme complex A (xylanase, glucanase, amylase, protease and cellulase) and NC + enzyme complex B (xylanase and β-glucanase)]. For the metabolic test, 24 excreta collecting cages were utilized. The birds were caged from 14 to 21 d of age (doa), in which the first 3 d were for adaptation and the last 4 d for total excreta collection. The birds in the performance test were randomly allocated to 24 floor pens. The feeding programs were divided into 3 phases: starter (1 to 21 doa), grower (22 to 35 doa), and finisher (36 to 42 doa). Weight gain (WG), feed intake (FI) and feed conversion ratio (FCR) were measured at the end of each dietary phase. The data were subjected to ANOVA and SNK test analyses. Significance was accepted at \( P < 0.05 \). In the metabolic test, there were no significant differences in the dry matter or the apparent digestibilities of CP and fat between the treatments. Enzyme complex A (3,263 kcal/kg of DM) and complex B (3,155 kcal/kg of DM) had an AMEn that was similar to that of the PC (3,253 kcal/kg of DM) and superior to NC (3,161 kcal/kg of DM) and enzymatic complex B (3,155 kcal/kg of DM). There were no significant treatment effects on FI, WG or FCR during the starter phase. During the grower phase, the use of both enzyme complexes had similar effects, whereas the PC was superior in its effects on FI and WG in comparison to that of NC. Also, PC was better than the enzyme complexes regarding its effects on FCR.

Results from the final phase showed that birds receiving NC had the least efficient FCR. Both enzyme complexes and the PC similarly promoted WG. Considering the whole experimental period (1 to 42 doa), birds in the NC group had the highest FI but the least efficient FCR. Use of the enzyme complexes helped female broilers to digest nutrients for the subsequent support of optimal performance.

**Key Words:** crude protein, enzyme, female, metabolizable energy, nutrients

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**359P Determination of the apparent metabolizable energy of diets containing protein ingredients associated with enzyme supplementation for broilers in pre-starter phase.** B. D. A. Fortes\(^1\), M. B. Café\(^2\), J. H. Stringhini\(^3\), E. M. Oliveira\(^2\), and J. C. C. Carvalho\(^3\), \(^1\)Instituto Federal de Educação, Ciência e Tecnologia Goiânia, Goiânia, Goiás, Brazil, \(^2\)Universidade Federal de Goiás, Goiânia, Goiás, Brazil, \(^3\)Nutron Alimentos S.A, Campinas, São Paulo, Brazil.

The principle of exogenous enzyme utilization in poultry diets is related to the improvement in nutrient and energy availability resulting from the increased digestion and absorption rates of specific feedstuffs. In this way, an experiment was proposed to evaluate the enzymatic complex addition AXTRA, containing xylanase, amylase and protease in the values of apparent metabolizable energy corrected for nitrogen balance (AMEn) for some protein ingredients for broilers in pre-starter diets. A total of 450 male day-old Cobb 500 chicks were randomly allotted in battery cages in a completely randomized design with 9 treatments and 5 replicates of 10 birds each. The experiment was performed in a total excreta collection from 4 to 7 d of age. Treatments were: T1 – reference diet; T2 – 60% reference diet with 40% corn gluten meal 60% CP; T3 – 60% reference diet with 40% corn gluten meal 60% CP with the enzymatic complex; T4 – 60% reference diet with 40% soybean protein concentrate; T5 – 60% reference diet with 40% soybean protein concentrate with the enzymatic complex; T6 – 60% reference diet with 40% viscera meal; T7 – 60% reference diet with viscera meal with the enzymatic complex; T8 – 60% reference diet with 40% bovine dried plasma; T9 – 60% reference diet with 40% bovine dried plasma with the enzymatic complex.

No difference was observed (\( P > 0.05 \)) in increasing AMEn value of diets in 13.57%. It is possible to conclude that the enzymatic complex AXTRA was effective in increasing AMEn levels of bovine dried plasma in pre-starter diets.

**Key Words:** bovine dried plasma, corn gluten meal 60% CP, metabolizable trial, soybean protein concentrate, viscera meal
Several nutrients have high digestibility, although they are not fully degraded in the gastrointestinal tract, for example starch and protein. In this way, an experiment was designed to observe the apparent metabolizability coefficient of dry matter (CAMDR), crude protein (CAMCP) and ether extract (CAMEE) for different protein ingredients (corn gluten meal 60%, soybean protein concentrate, viscera meal and bovine dried plasma) associated with enzyme supplementation (xylanase, amylase and protease) in pre-starter diets. A total of 450 male day-old Cobb 500 chicks were randomly allotted in battery cages in a completely randomized design with 9 treatments and 5 replicates of 10 broilers each. Means were compared using SNK (Student-Newman-Keuls) and were considered significant at P < 0.05. The experiment was performed in a total excreta collection from 4 to 7 d of age. Treatments were T1) reference diet; T2) 60% reference diet with 40% corn gluten meal 60%; T3) 60% reference diet with 40% corn gluten meal 60% with the enzymatic complex; T4) 60% reference diet with 40% soybean protein concentrate; T5) 60% reference diet with 40% soybean protein concentrate with the enzymatic complex; T6) 60% reference diet with 40% viscera meal; T7) 60% reference diet with viscera meal with the enzymatic complex; T8) 60% reference diet with 40% bovine dried plasma; T9) 60% reference diet with 40% bovine dried plasma with the enzymatic complex. No difference (P > 0.05) was observed for apparent metabolizability coefficient of ether extract in any treatments. The addition of the enzyme complex was effective at improving (P < 0.05) CAMDR and CAMCP for soybean protein concentrate of 8.71% and 21.77% respectively. In addition, the inclusion of enzymatic complex in bovine dried plasma was effective (P < 0.05) in increasing CAMCP value of diets of 21.07%. It is possible to conclude that the enzymatic complex AXTRA was effective in increasing CAMDR and CAMCP for soybean protein concentrate, and CAMCP for bovine dried plasma.

Key Words: broiler, digestibility, enzyme, protein ingredients, starter phase

An experiment was carried out to evaluate the dry matter (DM), ash, organic carbon (OrgC) and nitrogen total pen intake, recovered in litter and removed on the whole body of broilers fed increasing units of phytase. Six hundred 1-d-old male B308 chicks were assigned to 6 treatments: 1) Positive control (PC) corn-soybean meal diet with normal levels of nutrients; from 2 to 6) a negative control (NC) low Ca, P and energy diet was added with 0, 500, 1,000, 2,000, and 3,000 units of phytase (UP)/kg of diet. Broilers were fed for 42 d with prestarter (7 d), starter (14 d), grower (14 d) and finisher (7 d) diets. There were 6 replicate pens per treatment with 25 broilers per pen. Pen feed intake and results of laboratory analysis of the diets were used to calculate the total mass of nutrients input to the system. At the end of the trial, 3 broilers from each pen were slaughtered to determine whole body DM, ash, OrgC, and N which were multiplied by total pen wt at 42 d to calculate the retention in broilers mass. The total litter in all pens was collected, weighed, mixed and sampled to determine the total mass of nutrient recovered in litter. Data was subjected to ANOVA and polynomial contrasts were used to analyze the increasing units of dietary phytase. The intake of DM, ash, OrgC, and N was lower (P < 0.05) in broilers fed the NC diet without added phytase compared with the rest of the treatments. The DM recovered in litter was lower for the NC + 2,000 and 3,000 UP (Quadratic effect, P < 0.05). The ash recovered in litter was higher for the PC and similar for the rest of the treatments (P > 0.05). The retention of DM, ash, OrgC, and N in the whole body was similar among treatments. There were no differences on the total balance of DM and OrgC among treatments, but the ash and N balance was lower (P < 0.05) in broilers fed the NC diet supplemented with phytase. It is concluded that in broiler chickens fed low-Ca, P and energy diets, the addition of 500 to 3000 UP did not change the nutrient recovered in the whole body of broilers but caused a reduction of the ash and nitrogen recovered in litter.

Key Words: broiler, phytase, mass balance, litter, whole body

The value of added feed enzymes in promoting growth and efficiency of nutrient utilization is well recognized in monogastric animals. However, the effects of feed enzymes on gastrointestinal microbiota are not well understood. Thus, the effects of a xylanase and β-glucanase (XB) blend on ileal and cecal microbiome in broiler chickens fed corn/corn DDGS or viscous grains based diets were investigated. A total of 140 day-old male Ross 308 broiler chicks were randomly assigned to 7 replicate cages (5 birds/cage) and fed experimental diets for 21 d. Diets were based on either corn/corn DDGS or viscous grains without or with supplemental XB. On d 21, ileal and cecal contents were obtained for microbial analysis by illumina sequencing. Data were analyzed using QiIME and partial least square discriminant analysis (PLS-DA) was used to identify taxa that were most characteristic of treatment groups. Alpha-diversity of bacterial community was calculated using different richness estimators and differences in β-diversity were tested using PERMANOVA. In total 8 and 6 phyla were observed in the ileum and cecum respectively but no differences were found between XB and non-XB treatments. Likewise, α- and β-diversity of microbiota did not differ between XB and non-XB treatments. PLS-DA analysis revealed that some taxa were associated with different treatments at genus level. In this case, ileal analysis showed that Ruminococcus, Lachnospiraceae (F), Peptostreptococcaceae (F), Clostridiales (O), Acidovorax, and Blautia were associated with XB based diet, whereas Ruminococcus, Lachnospiraceae (F), Peptostreptococcaceae (F), Clostridiales (O), and Firmicutes (C) and Clostridium were associated with XB viscous grain diet. A relatively similar microbiome clustering was observed in the cecum. Data provided significant insight on ileal and cecal microbial profile associated with the dietary types and XB. The functional roles of these taxa require further investigations.

Key Words: broiler, xylanase, β-glucanase, microbiome
effects of supplemental carbohydrases on performance of broiler chickens. 363P
R. V. Nunes1, T. S. Andrade1, J. O. B. Sorbara2, R. G. Hermes2, and I. C. Os- pina-Rojas3, 1Universidade do Oeste do Paraná, Marechal Cândido Rondon, Paraná, Brazil, 2DSM Nutritional Products, São Paulo, Brazil, 3Universidade Estadual de Maringá, Maringá, Paraná, Brazil.

A study was conducted to evaluate the effect of different enzymatic products on performance of broilers fed a corn-SBM based diet up to 42 d of age. A total of 1,008 21 d old male broilers (Cobb 500) were distributed in a completely randomized design with 6 treatments and 8 replicates of 21 birds each. Treatment diets were: negative control (NC, reducing 120 kcal ME/kg); a positive control (PC, corn-soybean meal based diet); enzymatic complex 1 (EC1, adding 100 ppm of a commercial product in the NC diet); enzymatic complex 2 (EC2, adding 200 ppm of a commercial product in the NC diet); enzymatic blend 1 (EB1, adding 100 ppm of Ronozyme WX xylanase and 200 ppm of Ronozyme A amylase in the NC diet); and enzymatic blend 2 (EB2, adding 100 ppm more amylase than EB1). Fed intake (FI), weight gain (WG), and feed conversion rate (FCR) were recorded weekly. ANOVA of data was performed using Tukey’s test to find significant differences (P < 0.05) between treatments. No significant differences were observed for FCR. The WG in kg were higher (P < 0.05) for PC (1.809) compared with NC (1.698), C1 (1.721) and B1 (1.721), but not different from C2 (1.743) and B2 (1.745). Likewise, the PC diet resulted in birds with lower FCR (P < 0.05) than broilers that received the NC, C1, C2, and B1, but did not differ to birds that were fed with the B2. Performance data suggest that the use of a combination of amylase and xylanase may allow feed reduction costs by reducing 120 kcal of AME per kg with no effect on broiler production.

Key Words: amylase, broiler, energy, xylanase

364P Comparison between different carbohydrases on ileal metabolizability of nutrients for broiler diets. 364P
R. V. Nunes1, T. S. Andrade1, J. O. B. Sorbara1, R. G. Hermes2, and I. C. Os- pina-Rojas3, 1Universidade do Oeste do Paraná, Marechal Cândido Rondon, Paraná, Brazil, 2DSM Nutritional Products, São Paulo, Brazil, 3Universidade Estadual de Maringá, Maringá, Paraná, Brazil.

A study was conducted to evaluate the effect of different enzymatic products on ileal metabolizability rate of broilers fed corn-soybean meal based diets up to 42 d of age. A total of 1,008 male broilers (21 d old; Cobb 500) were distributed in a completely randomized design with 6 treatments and 8 replicates of 21 birds each. Treatment diets were: negative control (NC, reducing 120 kcal ME/kg); a positive control (PC, corn-soybean meal based diet); enzymatic complex 1 (EC1, adding 100 ppm of a commercial product in the NC diet); enzymatic complex 2 (EC2, adding 200 ppm of a commercial product in the NC diet); enzymatic blend 1 (EB1, adding 100 ppm of Ronozyme WX xylanase and 200 ppm of Ronozyme A amylase in the NC diets); and enzymatic blend 2 (EB2, adding 100 ppm more amylase than EB1). At the end of the trial, birds were slaughtered and ileal samples were collected to analyze the dry matter (DIM, %), crude protein (ICP, %) and metabolizable energy (IME, kcal). ANOVA of data were performed using Tukey’s test to find significant differences (P < 0.05) between treatments. The IDM digestibility was improved (P < 0.05) on PC (63.0), C2 (63.9) and B2 (63.7) compared with NC (60.1), C1 (61.0) and B1 (61.1). The ICP was higher (P < 0.05) for PC (71.1) compared with all other treatments, however the C2 (78.8) and B2 (77.8) compared with B1 (74.8), but did not differ from NC (76.1) and PC (76.7). The IME was higher (P < 0.05) for PC (3249) compared with all other treatments, however the C2 (2967), B1 (2960) and B2 (3051) were significantly different from NC (2775) and C1 (2709). Presented data suggest that the use of enzymatic complex 2 and the blend 2 in a less nutritive diet may improve the metabolizability of nutrients as much as a diet with standard broilers requirements.

Key Words: broiler, carbohydrase, ileal metabolizable energy

Table 1 (Abstract 365P). Performance and digestibility

| Item     | Corn/Corn DDGS | Viscous grains | P-value | SED
|----------|----------------|---------------|---------|-----
|          | XB − | XB + | XB − | XB + | Diet | XB | Diet × XB |
| BWG      | 187.96 | 197.91 | 196.63 | 202.86 | 2.26 | 0.0004 | <0.0001 | 0.26 |
| FI       | 236.3 | 224.21 | 230.7 | 227.7 | 8.94 | 0.86 | 0.24 | 0.48 |
| FCR      | 1.256 | 1.133 | 1.171 | 1.123 | 0.04 | 0.15 | 0.015 | 0.26 |
| Viscosity | 2.00 | 1.81 | 3.64 | 2.51 | 0.16 | <0.0001 | <0.0001 | 0.0008 |
| AMEn     | 2,994 | 3,125 | 3,013 | 3,097 | 123 | 0.11 | 0.38 | 0.80 |
| Starch   | 96.72 | 95.93 | 93.31 | 96.68 | 0.73 | 0.01 | 0.02 | 0.0007 |
| NDF      | 33.06 | 35.61 | 63.2 | 65.3 | 4.5 | <0.0001 | 0.40 | 0.74 |
| ADF      | −19.52 | −19.00 | −29.82 | −23.33 | 10.9 | 0.35 | 0.65 | 0.70 |
| Fat      | 87.4 | 87.8 | 88.5 | 88.3 | 1.18 | 0.34 | 0.91 | 0.68 |
| CP       | 75.48 | 76.03 | 72.17 | 71.13 | 1.98 | 0.0008 | 0.86 | 0.57 |

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weekly and excreta were collected from d 17 to 20 for nutrients retention and AMEn measurements. On d 21, jejunal contents were collected for viscosity determination. Data were analyzed using a CRD in a 2 × 2 factorial arrangement. Birds fed viscous grains had higher (P < 0.001) BWG (3.4%) than birds fed corn-based diet while birds fed XB had better BWG and FCR than birds fed non-XB diet. Birds fed viscous grains retained higher NDF and lower CP compared with birds fed corn-based diet. There was an interaction (P < 0.001) between diet type and XB on jejunal digesta viscosity and starch retention. In this context, XB reduced jejunal digesta viscosity to a greater extent in viscous grain (−31%) than in corn-based diet (−10%). Birds fed viscous grain based diet with XB retained more (3.5%) starch than birds fed this diet without XB. Although diet affected growth performance, XB was efficacious across diet types implying that degradation of dietary fibrous components by feed enzymes may stimulate performance in young birds.

Key Words: broiler, xylanase, β-glucanase, performance

366P Evaluation of liquid and solid based commercial kits on measuring xylanase activity in poultry diets. M. Hashim1, J. Fowler1, O. Gutierrez2, and C. A. Bailey3, 1Texas A&M University System, College Station, TX, 2Huvepharma Inc, Peachtree City, GA.

The use of xylanase in poultry feeds has been found to have beneficial effects on bird performance. Measuring the enzyme activity in the feed has several limitations that depend on the origin of the enzyme and the substrate. For this study, 2 commercial kits were used to evaluate the effect of their substrate form on the measurement of xylanase activity in poultry feeds. One kit had a tablet substrate base and the second was a liquid substrate form. Assay methodology for xylanase activity was conducted using a modified procedure provided by the manufacturer. Four levels of xylanase (Hostazym-X, 15,000 units/g, Huvepharma Inc.) were included in an industry-type broiler diet at 0.1, 0.2, 0.4, and 0.8 lb/ton of feed. For the tablet kit, enzyme extraction was performed by adding 5 mL of acetic acid (0.1 M) to 0.5 g of each feed sample and vortexing. Samples were incubated at room temperature for 20 min followed by centrifugation for 10 min. Duplicate aliquots of the supernatant were transferred to glass test-tubes. Substrate tablet was added to each tube and placed in a 50°C water bath for 30 min. After incubation, 5 mL of Trizma solution was added, vortexed, and stored at room temperature for 5 min followed by centrifugation for 5 min. The absorbance of the supernatants was measured at 590 nm against a reaction blank. A similar procedure was used with the liquid substrate kit except that Na acetate was used as the extraction buffer and the reaction was ended using ethanol followed by 10 min centrifugation. Standard curves were constructed using Hostazym-X, diluted with celite at the same levels of the inclusion as the feed samples. The absorbance values for the standard curves and feed samples were subjected to linear regression analysis (r² > 0.90). The results indicated that liquid assay kit was better at estimating the enzyme activity than solid kit when enzyme level was low (0.1 and 0.2 lb/ton). While results were similar between the 2 kits at higher concentrations. These results suggest that measuring xylanase activity in feeds can be influenced by the form of substrate in a given assay.

Key Words: xylanase, enzyme activity

367P Evaluation of feeding Victus, a multi-component enzyme, on live performance of broilers fed a wheat-based diet and reared under commercial conditions. L. Mejia*, D. Teitge, N. E. Ward, L. Fox, and M. de Beer, DSM Nutritional Products, Parsippany, NJ.

A completely randomized design study evaluated the supplementation of Victus, a multi-component enzyme that adjusts for bird age and dietary substrate, on the live performance of broilers during a 35-d grow-out period. One hundred and 92 Ross 308 d-old male broilers were allotted to 16 pens of 12 broilers each. The 3-phase crumbled and pelleted diets were composed of wheat, soybean meal, porcine meal and corn DDGS with the inclusion of a phytase enzyme, and were formulated to simulate commercial nutritional specifications. Fed across all dietary phases, the treatments were (1) Control (C), and (2) Control + Victus (C + Victus). Broilers had ad libitum access to feed and water. Broilers and feed were weighed on d 7, 21 and 35, total BW and feed consumption were measured, and feed conversion ratio (FCR) was calculated. When significant differences (P < 0.05) existed among treatments, Fisher’s least significant difference option of SAS was used to separate means. Mortality was unaffected (P > 0.05) by the dietary treatments. Total BW and FCR were improved (P < 0.05) when broilers were fed Victus. Under the current conditions, feeding Victus improved total BW by 6.50% and FCR was reduced by 5.40%. Feeding a multi-component enzyme that is designed to meet specific age and substrate related needs of the chick has the potential to be a viable alternative to optimize live performance parameters and reduce feed cost.

Key Words: multi-component enzyme, substrate, wheat, live performance, feed cost

368P Efficacy of a xylanase (Hostazym X) on broiler performance from 1 to 18 days of age over the course of three broiler trials. M. A. Barrios1, J. Payne1, D. Morris1, A. Kenyon1, L. Fuller1, A. Bata1, and R. Beckstead1, 1University of Georgia, Athens, GA, 2Huvepharma Inc, Peachtree City, GA.

Enzyme inclusion to improve broiler performance is considered standard practice because feed cost is the single greatest expense of the poultry industry. Corn and soybean meal have anti nutritional factors such as non-digestible carbohydrates and pentoses; consequently, an opportunity exists to improve feed digestibility. The objective of these studies was to determine the efficacy of Hostazym X (xylanase) on growth performance of broilers fed corn-soybean meal based rations from 1 to 18 d of age. Three independent trials were conducted using day-old Cobb 500 by-product male chicks. Broilers were raised in Petersime batteries and feed and water were provided ad libitum. Chicks were maintained on a 24-h lighting schedule in thermostatically controlled rooms. Each experimental treatment was comprised of 12 pens, each containing 6 chicks for a total of 72 broilers. Trial 1 consisted of 4 treatments: positive control (PC), negative control (NC; reduced energy), and Hostazym X added to either of these diets (PC+X and NC+X, respectively). In trial 2 there were 6 treatments: PC, NC1 (reduced energy), NC2 (reduced energy and protein), plus these with Hostazym X. There were 3 treatments in trial 3: PC, NC (reduced energy), NC with Hostazym X. Diets in trial 2 contained 8% distillers dried grains with solubles; trials 1 and 3 did not. Data were subjected to ANOVA as a completely randomized design by using the general linear model. In trial 1, no significant differences (P > 0.05) were found across treatments. In the second trial, individual body weight gain was increased in broilers in treatments PC+X and NC1+X. Broilers consuming PC+X had the best feed efficiency, while the worst feed efficiency was found in NC2. In trial 3, the PC and NC+X treatment groups had statistically similar individual body weight gain, and feed efficiency was improved in chickens fed the NC+X diet as compared with the controls. Results from these 3 trials indicate that the addition of Hostazym X can improve growth performance of broilers fed corn-soybean meal based rations up to 18 d of age.

Key Words: Hostazym X, xylanase, enzyme, broiler, feed efficiency
369P The efficacy of a next-generation microbial phytase on apparent ileal amino acid and crude protein digestibility in broiler chicks fed non-phytate phosphorus-deficient corn-soybean meal based diets. M. K. Manangi1, B. Wueellinger1, N. Odetallah1, M. Vazquez-Anon1, and A. Solbak2, 1Novus International Inc., St. Charles, MO, 2Verenium Corp., San Diego, CA.

A 19 d experiment was conducted to evaluate the effect of supplementation of a next generation microbial phytase (Cibenza Phytavarse; phytase-A) and a modified E. coli phytase (phytase-B) on apparent ileal digestibility of amino acids (AA) and crude protein (CP) in broiler chicks fed non-phytate phosphorus (npp) deficient corn-SBM diets. A total of 512 Ross-308 male broiler chicks were assigned to 8 treatments with 8 cages/treatment and 8 chicks/cage. Treatments consisted of 0.23% npp, T1 (-ve control); 0.28% npp, T2; 0.33% npp, T3; 0.38% npp, T4; 0.45% npp, T5 (+ve control); T1+250 units of phytase-A/kg diet, T6; T1+500 units of phytase-A/kg diet, T7; T1+500 units of phytase-B/kg diet, T8. Diets were formulated to have 0.93% Ca. All the diets were pelleted at 85°C and crumbled. Dicalcium phosphate was used as source of npp for T1 to T5. The data were analyzed using 1-way ANOVA and means were separated using LSDs at P ≤ 0.05. End of the trial outcome indicated a significant treatment effect (P < 0.05) for CP and 18 measured AA except tyrosine (P = 0.77). Supplementation of phytase-A to T1 at 250U/kg diet significantly (P < 0.05) improved digestibility of CP and AA such as His, Ile, Leu, Met, Phe, Thr, Val, Cys, Gly, and Pro. Supplementation of phytase-A to T1 at 500U/kg diet significantly (P < 0.05) improved digestibility of CP and AA such as Arg, His, Ile, Lys, Met, Phe, Thr, Trp, Val, Ala, Asp, Cys, Glu, Gly, Pro, and Ser. However, supplementation of phytase-B to T1 at 500U/kg diet (T8) did not improve any of the measured 18 AA and CP. Overall in comparison to the negative control (T1), for 250 U of phytase-A/kg diet (T6) the total essential AA improvement of 1.54 percentage points and CP of 1.85 percentage points were observed, whereas for 500 U of phytase-A/kg diet (T7) the total essential AA improvement of 2.85 percentage points and CP of 2.99 percentage points were observed. In summary, the next generation microbial phytase showed significant improvement in apparent ileal digestibility of almost all AA and CP when supplied at 500U/kg diet.

Key Words: phytase, broiler

370P Leaky gut and the liver: The role of Bacillus subtilis direct-fed microbial in reducing bacterial translocation in neonate poults fed with a rye-based diet. J. Blankenship1, H. Lester2, D. Lester1, C. Laster1, J. D. Latorre1, A. D. Wolfenden1, M. H. Kogut2, J. L. Vicente3, R. Wolfenden2, X. Hernandez-Velasco4, L. S. Bielke1, B. M. Hargis1, and G. Telle2, 1University of Arkansas, Fayetteville, AR, 2USDA-ARS, College Station, TX, 3Pacific Vet Group, Fayetteville, AR, 4FMVZ-UNAM, Mexico City, Mexico.

Rye contains high concentrations of non-starch polysaccharides (NSP), leading to reduced digestibility. Because poultry have little or no intrinsic enzymes capable of hydrolysing these NSP, the use of exogenous xylanases as additives are used in an attempt to reduce these anti-nutritive factors. Previously, we have reported that dietary inclusion of selected direct-fed Microbial (DFM) candidates that produce endogenous phytase, lipases, proteases, cellulases and xylanases in NSP diets significantly reduced both viscosity and Clostridium perfringens proliferation when compared with control diets without the DFM in vitro. In the present study, starter rye-soybean-based diets with or without DFM (n = 12) were administered ad libitum to 1-d-old poults in 2 independent experiments. At d 10, all poults in both groups were humanely killed and liver sections were aseptically collected to determine counts (cfu/g) of coliforms in MacConkey agar plates. Intestinal contents from duodenum to cloaca were collected to determine viscosity. Data were subjected to ANOVA and mean separation using Duncan’s multiple range test. In both experiments, a significant reduction (P < 0.05) in the total number coliforms in the liver as well as intestinal viscosity was observed in the group of poults fed the rye-base diet with DFM when compared with the control non-treated diet. Changes in the composition of the micro-biome or alterations in gut permeability are associated with bacterial translocation (BT) in the portal and/or systemic circulation in several types of leaky gut. Detoxification of microbial products from gut-derived microbes is a major role of the liver. The results of the present study suggest that the NSF from rye-based diets can both enhance bacterial translocation and intestinal viscosity, but these adverse effects can be prevented by the inclusion of selected DFM candidates. Studies to evaluate the possible inflammatory effects of the NSF in rye-base diets as well as the morphological changes in different sections of the gastrointestinal tract, performance and microbial profiles are currently being evaluated.

Key Words: Bacillus, DFM, enzyme, bacterial translocation, viscosity

371P Enzyme effects on energy utilization of soybean meal from different Brazilian areas. S. L. Vieira1, C. Stefanello1, B. Mallmann1, C. Pontin1, J. O. Sorbara2, and R. G. Hermes2, 1UFRGS, Porto Alegre, RS, Brazil, 2DSM Nutritional Products, São Paulo, SP, Brazil.

A study was conducted to evaluate the effects of different enzymes on soybean meal (SBM) grown in 2 geographic areas in Brazil (south or north). A total of 336 Cobb 500 male broilers were placed in 48 battery cages, with 6 treatments and 8 replicates (7 birds each). Birds were fed the same diets to 14 d. Experimental diets were provided from 15 to 24 d. South and north SBM had, respectively, 44.8 and 46.7% CP, 5.0 and 3.9% crude fiber, and 3.9 and 1.6% fat. A test diet (55.5% SBM, 40.8% corn starch, 0.96% dicalcium phosphate, 1.1% limestone, 0.15% mineral and vitamin premixes, 0.5% salt, 0.01% phytase (Ronozyme HiPhos GT) and 1% Celite) was prepared with each SBM source. Two enzyme products were individually added to the basal diet: a carbohydrase blend (Ronozyme VP, 100 Fungal β-glucanase units/kg) and a Protease (Ronozyme ProAct, 15,000 PROT units/kg). Data were submitted to ANOVA and means are compared by contrasts and Dunnet test (5% significance). Total excreta were collected from 21 to 24 d whereas all birds were slaughtered at 24 d for ileal content collection. Feed, excreta and ileal contents were submitted to combustion using an IKA calorimeter as well as analysis of dry matter (DM) to calculate their metabolizability coefficients, AME and apparent ileal digestible energy (AIDE). No difference was found for AME for the 2 SBM (south = 3,077 kcal/kg and north = 3,098 kcal/kg). North SBM had higher (P < 0.05) AIDE (3,157 kcal/kg) compared with south SBM (3,050 kcal/kg). Supplementation with the carbohydrase blend and the protease did not affect AME of south SBM but led to improvements in AIDE of 126 kcal/kg and 162 kcal/kg, respectively. Carbohydrase blend and protease effects on north SBM led to improvements of 74 and 80 kcal/kg, respectively. Carbohydrase blend did not affect AME of south SBM but led to improvements in AIDE of 126 kcal/kg and 162 kcal/kg, respectively. Carbohydrase blend and protease effects on north SBM led to improvements of 74 and 80 kcal/kg, respectively. Carbohydrase blend led to significantly improved energy utilization of south SBM. In conclusion, the carbohydrase blend is a potential tool for improving energy utilization of SBM from south Brazil.
372P  Effect of phytase derived from Butiaxiaella species on performance and tibia ash in turkeys. Y. Dersjant-Li1, D. Swan1, A. Amerah1, and P. Lescoart2. 1Danisco Animal Nutrition, DuPont Industrial Biosciences, Marlborough, United Kingdom, 2INRA, Nouilly, France.

The effect of a 6-phytase derived from Butiaxiaella spp. expressed in Trichoderma reesei on performance and tibia ash characteristics in turkeys was evaluated. Five dietary treatments were tested in a randomized design using female (B.U.T. Big 9) day-old turkey poults, with 8 replicates (12 birds/pen) during 1–43 d. Treatments were (1) a positive control (PC); (2) a negative control (NC) with low available P and Ca (PC reduced in AvP by 0.21% and 0.24%, Ca by 0.22% and 0.34% in phase 1 and 2 diets, respectively); (3–5) NC + 250, 1,000, and 2,000 FTU/kg of feed of Butiaxiaella phytase, respectively. Diets were based on corn/soybean meal, pelleted and fed ad libitum. Phase 1 and 2 diets were fed from 1 to 29 d and 30 to 43 d, respectively. Pouls were weighed and feed intake (FI) was measured in each phase. On d 43, both tibia were removed from 3 poult per replicate for determination of bone ash and strength. Treatment means were compared using Student’s t-test. In each phase and overall of 43 d, NC reduced FI and body weight gain (BWG) (% < 0.05) compared with PC. NC + 250 FTU/kg phytase improved (P < 0.05) FI and BWG compared with NC and did not differ from PC. Supplementation of 1,000 and 2,000 FTU/kg phytase to NC diet improved BWG (P < 0.05) compared with PC. Overall 43-d data showed that feed conversion ratio (FCR) was lower (P < 0.05) in NC + 1,000 and NC + 2,000 FTU/kg phytase treatments compared with NC and PC; this converted to a reduction in caloric conversion by 94 and 102 kcal/kg BWG, respectively versus NC. Tibia ash (% dry matter) and tibia strength improved (P < 0.05) in all phytase treatments compared with NC, with NC + 1,000 FTU/kg phytase treatment being similar to PC for tibia strength and NC + 2,000 FTU/kg phytase treatment being similar to PC for tibia ash. Based on percentage tibia ash, 2,000 FTU/kg phytase can replace 0.21 to 0.24% AvP in turkey’s diet during 1–43 d. However, nonlinear curve fitting with BWG and tibia strength data indicated that 500 FTU/kg phytase is equivalent to 0.21 to 0.24% AvP.

Key Words: performance, phytase, protease, sorghum, xylanase

374P  Effects of nutrient variability in corn associated with geographical location and yam inclusion on energy utilization and volatile fatty acid profiles. J. Pieniazek1, T. A. Wickens2, H. V. Masey3, T. York3, and J. T. Lee3. 1Poultry Science Department, Texas AgriLife Research, Texas A&M University, College Station, TX, 2Animal Science Department, Texas AgriLife Research, Texas A&M University, College Station, TX, 3AB Vista Feed Ingredients, Marlborough, United Kingdom, 4AB Vista Feed Ingredients, Chesterfield, MO.

The objective of this study was to determine the effect of corn source and xylanase addition on nutrient digestibility, volatile fatty acid (VFA) profiles, and the interaction between these 2 factors. Six samples of corn were obtained from 6 regions of the US to represent the variability in corn available to feed manufacturers. Corn and soy-based diets were fed in 3 dietary phases: starter (d 0–18), grower (d 19–31) and finisher (d 32–41). The 12 treatments were derived using corn source as the variable, with each corn diet being fed with or without xylanase at 16,000 BXU/kg. The diets were fed to 2160 broilers with 10 replicates, each containing 18 birds per treatment from 0 to 41d of age. On d 18 and 41, ileal and fecal contents were collected and pooled per replicate pen for the determination of ileal digestible energy (IDE), energy and nitrogen digestibility coefficients (IEDC and INDC), and nitrogen corrected apparent metabolizable energy (AMEn). Cecal and large intestine contents were collected simultaneously for the determination of VFA profiles in the ileum, large intestine, cecum, and fecal contents. Data were analyzed via a 6 × 2 factorial ANOVA. Corn source influenced IEDC and INDC for both days of sampling. A range of 152 and 213 kcal/kg for IDE was observed on d 18 and 41, respectively (P = 0.005 and 0.001). The range of AMEn for the 6 corn sources was 175 kcal/kg on d 18 of age and increased to a difference of 192 kcal/kg on d 41 of age. Additionally, INDC was influenced by corn source with an observed range of 4.4 and 6.1% on d 18 and 41, respectively, among all corn sources (P < 0.05). Inclusion of xylanase increased (P = 0.031) the concentration of butyrate in the cecum on d 18. Corn source influenced fecal isobutyrate concentration (P = 0.002), isobutyrate percentage (P = 0.022), and ileal isovalerate concentration (P = 0.05). On d 41, an interaction between corn source and xylanase inclusion was observed with isovalerate percentage in the cecal contents (P = 0.038). This is evident that varying nutrient profiles of corn and xylanase inclusion influence nutrient digestibility and VFA profiles.

Key Words: corn, phytase, protease, sorghum, xylanase

Allzyme SSF is a naturally fermented product with multiple enzyme activities including carbohydrate, protease and phytase. A study was conducted to investigate the effect of supplementing Allzyme SSF in diets containing alternative feed ingredients with varying nutrient densities on the performance of broiler chicks. A 2 x 3 factorial diet treatment structure was used with 2 enzyme levels: no enzyme or +0.02% Allzyme SSF and 3 types of diet: corn-soy diet with low nutrient density; corn-soy-DDGs diet with normal nutrient density; corn-soy-DDGs diet with low nutrient density. The normal nutrient density diet contained 3050 Kcal ME/kg, 22% CP, 0.45% available P and 1.0% Ca while the low nutrient density diet was designed to contain 75 kcal/kg less ME, 2.0% less CP and 0.1% less Ca and available P. A total of 288 1-d old chicks were randomly assigned to 6 dietary treatments with 8 replicate groups of 6 chicks. The chicks were raised in pullet cages in an environmentally controlled room for 21d with free access to feed and water. Data were subjected to ANOVA for a 2 x 3 factorial design using the linear model of Statistix V. 9. Mean differences were determined using Fisher’s LSD test. No interactive effects were detected between the 2 factors. Chicks fed the low nutrient corn-soy diet had lower (P < 0.01) weight gain and gain to feed ratio during both the 1–14d and 1–21d periods compared with those fed normal nutrient density DDGs diet. Chicks fed the low nutrient DDGs diet had lower (P < 0.01) weight gain and gain to feed ratio compared with those fed low nutrient corn-soy diet. Dietary supplementation of Allzyme SSF increased (P < 0.01) gain to feed ratio of chicks during entire 21d period. Data from this trial indicate that supplementation of Allzyme SSF in both corn-soybean meal diet and corn-soy-DDGs diet can improve growth performance of broiler chicks.

Key Words: broiler chick, performance, DDGs, Allzyme SSF, enzyme

376P  Effect of NSPase on growth performance, ileal digestible energy, and intestinal viscosity of male broilers fed a reduced energy diet. R. E. Latham*, M. P. Williams, K. Smith, and J. T. Lee, Texas A&M University, College Station, TX.

An experiment was conducted to investigate the effect of NSPase (Enspira) inclusion on male broiler growth performance, energy digestibility, and intestinal viscosity in reduced energy diets. A randomized complete block designed study included 3 treatment groups with 15 replicates of 40 male broilers per replicate for a 49-d experiment for a total placement of 1,800 broilers. The 3 dietary treatments included a positive control (PC) diet, a negative control (NC) diet (~97 kcal/kg in AME), and NC + NSPase (350 U/kg of xylanase). Corn and soy based diets were fed in 3 dietary phases. Diets were transitioned after each bird received 0.45 kg/bird of starter, 1.80 kg/bird of finisher, and withdrawal for the remainder of the growout. Growth performance was monitored on a weekly basis and ileal contents collected on 17 and 37 d of age to determine ileal digestible energy and intestinal viscosity. Titanium dioxide was used as an indigestible marker for the determination of ileal digestible energy. Ileal contents were centrifuged and supernatant collected for viscosity determination using a Brookfield cone and plate viscometer. The data were analyzed via a one-way ANOVA and separated with Duncan’s multiple range test at P = 0.05. The PC treatment maintained significantly higher average body weight when compared with the NC diet through 42 d of age (P < 0.05) indicating that the reduction in energy was sufficient to reduce body weight. The inclusion of NSPase achieved similar body weight to the PC through d 28. Reduction in dietary AME increased (P < 0.05) cumulative mortality corrected FCR in the NC diet as compared with the PC throughout the experiment. Inclusion of NSPase significantly improved FCR (P < 0.05) as compared with the NC diet through the first 2 wk. No differences were observed in intestinal viscosity. Improved performance could be contributed to a 111 kcal/kg increase in ileal digestible energy as compared with the NC diet. The inclusion of NSPase improves body weight and FCR of broilers when fed reduced energy diets.

Key Words: broiler performance, ileal digestible energy, DDGS

377P  Improving broiler performance in reduced-energy diets with exogenous enzymes. J. Fowler, A. M. Alsadwi*, M. Hashim, R. A. Abdaljaleel, and C. A. Bailey, Texas A&M University System, College Station, TX.

Rising prices for calorie-sources in poultry diets can be potentially offset by coupling the inclusion of exogenous enzymes with a reduction in the energy content of the diet. This study evaluates the inclusion of 2 commercially available enzyme formulas (Dyadic International Inc.) when included in a full-term (45 d) broiler feeding program with reduced energy. A total of 640 Ross-308 broiler chicks were randomly distributed among forty 6’ x 6’ floor pens (16 birds per pen). Four dietary treatments were assigned to pens such that each would be represented equally from east to west across the rearing facility. This study utilized a 4-phase rearing program (16-d starter, 14-d grower, 6-d finisher, and 9-d withdrawal). All feeds were fed as a crumble for the first phase and as a pellet thereafter. All but the withdrawal diets contained salinomycin. The negative control (NC) basal diets were formulated as a 148 to 157 kcal/kg reduction (relative to the positive control, PC) by replacing fat with diatomaceous earth in all phases. The NC diets were then sub-divided into 3 treatments. Enzyme formula 1 was a xylanase, amylase, and protease cocktail, and formula 2 was a single fermentation product with xylanase, cellulase, and β-glucanase activities. Body weight and feed consumption were collected at the end of each phase and a broiler productivity index was calculated. Data were analyzed as a one-way ANOVA, and significant means were separated using Duncan’s multiple range tests (P ≤ 0.05). There were no differences (P > 0.05) between treatments in the starter phase. By the end of the grower phase, the reduced energy NC treatment had lower (P < 0.05) BW when compared with the PC. There was an increase in FCR (P < 0.05) with the NC treatment, and both enzyme diets had similar FCR to the PC. In the finisher and withdrawal phases, the BW of formula 1 was significantly higher (P < 0.05) than the NC treatment, comparable to the BW of PC. Formula 2 was intermediate, different from neither NC nor PC. The productivity index at termination showed that, overall, the energy reduction significantly reduced broiler performance (P < 0.05) and both enzyme treatments were sufficient to recover this loss in performance.

Key Words: enzyme, energy, broiler

378P  Combined effect of near infrared spectroscopy and carbohydrases on performances of broilers fed two qualities of wheat-based diets. R. N. Montanini*, M. Franceschi, F. Rouffineau, C. Gady, and A. Preynat, 1Adisseo France SAS, Commentry, France, 2IRTA, Constanti, Spain.

This study was carried out to evaluate the combination effect of near infrared spectroscopy (NIRS) and the addition of non-starch polysaccharide (NSP) enzymes on growth performance of broilers fed wheat-based...
diets. A completely randomized block design with a $2 \times 2 \times 2$ factorial arrangement of treatments and their interactions was used, evaluating the carbohydrase effect (Rovabio Excel LC), the wheat/soybean meal quality (low or standard) and the formulation’s nutritional matrix (INRA’s tables or NIRS values). Diets without enzyme supplementation were formulated to address nutritional requirements, whereas diets with enzymes were reformulated with 85 kcal less of AME/kg of feed. Diets were fed ad libitum to Ross 308 male broilers (7 replicates × 40 birds per pen). The LS means were separated using Fisher’s LSD test. On the overall period (35 d), considering table formulated diets, BWG and FCR of broilers fed low quality were significantly mitigated (−3.4 and 4.7%) compared with animals fed standard quality, and without affecting FI. The utilization of NIRS values significantly increased FI and BWG in both diets. BWG improved better when low quality diet was used: 13% vs. 6% for standard quality. The NIRS specifications only improved FCR on low quality diets (−5.3%; interaction quality × formulation, $P < 0.01$). Whatever the formulation matrix, the addition of enzymes on reformulated diets significantly increased the BWG (6%) and FI (7.3%) only on standard quality diet. FCR was improved by enzyme addition only on low quality diet (−1.3%; interaction quality × enzyme, $P < 0.03$). In conclusion, on standard quality diets, enzymes partially compensated energy reduction, whereas with low quality diets the enzymes had a potential above the 85 kcal considered. The use of nutrient values coming from NIRS improved performances for both quality diets, but with higher gain in the case low quality ingredients. The best performance and economical profitability was obtained when NIRS values and NSP-enzymes were combined (186 USD/t of birds).

**Key Words:** NSP enzyme, broiler, NIRS, ingredient quality, nutritional matrix