Effect of two phytase activity products and their combination with other feed enzymes on broiler productive performance.


To compare 2 phytase activity sources: *Citrobacter braakii* (Ronozyme HiPhos, CB) and *Escherichia coli* (EC), both in combination with a xylanase-protease blend (Ronozyme Blend 400, B400), 1,800 1-d-old-Ross 308 male and female broilers were randomly allocated to 14 treatments, 10 with 6 replicates and 4 with 3 replicates of 25 chicks each. Chicks were housed in floor pens. Results were analyzed as an unbalanced RCBD (3 block; blocking criteria, period on experimental facilities), on a factorial arrangement 2 (sex) by 7 (feed enzyme treatments), with 2 or 1 replicates at the interaction; block $\times$ sex $\times$ feed enzyme treatment (FET). FET were as follows: T1 = a positive control sorghum-SBM-DDGS-canola diet formulated to fulfill Ross 308 straight-run broiler requirements (PC); T2 = negative control 1 (NC1), as T1 but formulated with 100% feed formulation matrix values (FFMV); T3 = negative control 2 (NC2), as T1 but formulated with 50% FFMV; T4 = as T2 + CB/B400, T5 = as T2 + EC/B400; T6 = as T3 + CB/B400; and T7 = as T2 + EC + B400. FFMV for T2 and T3, represented as NC1/NC2, were as follows (as Mcal/MT or ppm); ME; 135/68; CP; 10,318/5,159; Lys; 306/153; SAA; 430/215; Thr; 510/255; Arg; 689/345; and Trp; 95/48. The male chicks fed the 50% FFMV added with any of the FET showed a performance on WG and WG/FI equal ($P < 0.0001$) to that of PC. The female birds fed 50% FFMV added with any of the FET showed an equal ($P < 0.0001$) response for WG/FI. We concluded that FFMV are an important factor to achieve the expected broiler performance. More research needs to be done regarding the effect of FFMV for female broilers.

### Table 1 (Abstract 161). Interaction of sex by feed enzyme treatment results

<table>
<thead>
<tr>
<th>Group</th>
<th>PC</th>
<th>NC1</th>
<th>NC2</th>
<th>NC1</th>
<th>NC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male WG, kg/c</td>
<td>3.36ab</td>
<td>2.90c</td>
<td>3.20bc</td>
<td>3.14c</td>
<td>3.15c</td>
</tr>
<tr>
<td>Fem WG, kg/c</td>
<td>3.07cd</td>
<td>2.71f</td>
<td>2.84</td>
<td>2.87c</td>
<td>2.89c</td>
</tr>
<tr>
<td>Male WG/FI, g/kg</td>
<td>543a</td>
<td>488de</td>
<td>538bc</td>
<td>504cd</td>
<td>512bde</td>
</tr>
<tr>
<td>Fem WG/FI, g/kg</td>
<td>504de</td>
<td>476e</td>
<td>489de</td>
<td>489de</td>
<td>529abc</td>
</tr>
</tbody>
</table>

WG SEM = 0.066 ($P < 0.0001$), WG/FI SEM = 16.3 ($P < 0.00001$).

**Key Words:** phytase, xylanase, protease, broiler

Beneficial phytase and protease effects on gene for gut-level immunity and cellular integrity in male broilers reared under challenge conditions.

Oluyinka A. Olukosi, Fidelis Fru-Nji, and Aaron J. Cowieson, Monogastric Science Research Centre, SRUC, Edinburgh, United Kingdom, DSM Nutritional Products Ltd., Basel, Switzerland.

A total of 720 broilers at day old were allocated to 9 treatments to study the influence of enzymes in a P-deficient (NC) diet. The NC diet was without or with phytase, protease or phytase plus protease. The diets were fed to birds reared on clean or dirty litter thus producing a 2 $\times$ 2 factorial plus a P-adequate diet. Each treatment had 8 replicates and 4 with 3 pen replicates of 25 chicks each. Chicks were fed to birds reared on clean litter but a reduction ($P < 0.05$) in TLR4 expression in birds raised on dirty litter was shown by greater ($P < 0.05$) ileum there was litter effect and litter $\times$ phytase interaction ($P < 0.05$) digesta pH in phytase-supplemented diets for birds raised on new litter but no phytase effect in birds raised on dirty litter. In the ceca, protease supplementation increased ($P < 0.05$) production of heptanoic and hexanoic acid, and tended to increase ($P < 0.10$) the production of isobutyrate and isovalerate. At the cecal tonsil, there was greater ($P < 0.01$) expression of IL-1$\beta$ and lower expression of IL-6 in birds raised on dirty litter. Litter $\times$ protease interaction was shown by no effect of protease on TLR4 expression in birds raised on clean litter but a reduction ($P < 0.05$) in TLR4 expression in birds raised on dirty litter. There was only protease $\times$ phytase interaction ($P < 0.05$) for occludin expression, which was explained by no effect of phytase supplementation on occludin expression in diets without protease but an increase ($P < 0.05$) in occludin expression in birds receiving combination of phytase and protease. It was concluded that supplementation of phytase and protease in diets limiting only in P enhanced production of beneficial SCFA and lowered systemic inflammation and that some of the effects are mediated by protease improving the cellular integrity of the gut and hence mitigating possible colonization of the gut by harmful microorganisms.

**Key Words:** broiler, phytase, protease, litter type, gut health

Interactive effects of graded levels of phytase and decreasing dietary levels of available P on performance, bone parameters, and litter moisture of broilers from 1 to 21 d.


The aim of this study was to evaluate the effect of different doses of an evolved *Escherichia coli* phytase (Phy) on performance, tibia ash percent (TAP) and litter moisture (LM) of broilers fed with diets with graded levels of available P (avP). In total, 2,208 male day-old Ross 308 broilers were distributed to 12 treatments with 8 pen replicates each in a factorial arrangement with 4 dietary avP levels (starter: 0.50, 0.40, 0.30 and 0.20%; grower: 0.450, 0.365, 0.280, 0.195%; monocalcium phosphate used as P source) and 3 Phy doses (0, 500, and 1500 FTU/kg, Quantum Blue). Diets were wheat and soybean-meal based, steam pelleted, and fed ad libitum in 2 phases, from 1 to 11 d (crumbled,
164 Assessment of P equivalency of an evolved _Escherichia coli_ phytase when birds were fed the dietary treatments at day-old or after a 5-day adaptation period. Gilson A. Gomes*,1, Agnès Narcy2, Xaviere Rousseau1, and Robert A. H. M. ten Doeschate1,1*, 1AB Vista, Marlborough, Wiltshire, United Kingdom, 2INRA, Paris, France.

The aim of this study was to evaluate the effect of adaptation period on performance and bone parameters of broilers fed graded levels of available P (avP) and its interactions with phytase (Phy) supplementation. One hundred forty-four male day-old Cobb 500 broilers were randomly distributed to 12 treatments with 12 cage replicates each in a factorial design with 4 dietary avP levels (0.45, 0.35, 0.25, 0.15% - monocalcium phosphate as P source) and 2 adaptation periods; birds going on treatment diets at d 1 (AD0) or birds being fed 0.45% avP from d 1 to 5 before going on treatment (AD5). Two dosages of Phy were used (400 and 800 FTU/kg, Quantum Blue) and added on top of the lowest avP diet. Dietary calcium content was also decreased providing 0.90, 0.79, 0.68, and 0.57%, respectively. Diets were corn and soybean-meal based, steam pelleted following by crumbling, and fed ad libitum up to 19 d. Body weight gain (BWG) and feed intake (FI) were measured and feed conversion ratio corrected for mortality was calculated. At 19 d of age all birds were killed, left tibias excised, and bone parameters (bone breaking strength, BBS; tibia diameter, tibia length, tibia dry weight, tibia ash in g/bone, TAG; and tibia ash percent, TAP) measured. Two-way ANOVA was performed (JMP Pro 12) to evaluate main factors interactions. Logarithmical regressions were performed and P equivalency of Phy assessed. No effects on mortality were seen (P > 0.05). Interactions occurred on BWG (P < 0.01), FI (P < 0.01) and TAP (P < 0.01). Statistical differences on FI, BWG and TAP among the 2 Phy dosages were just noticed when compared at the lowest avP level (P < 0.01). The inclusion of 1,500 FTU/kg of Phy in broiler diets was able to ameliorate any detrimental effects of decreasing levels of avP on FI, BWG and TAP. No interactions were seen on mFCR or LM (P > 0.05). Phy inclusion improved mFCR (P < 0.01) and tended to decrease LM (P = 0.08), whereas lower avP levels worsened mFCR (P < 0.01). Calculated P equivalency, based on BW, FI and TAP, were 0.168 and 0.214% for 500 and 1500FTU/kg of Phy, respectively. In conclusion, increasing levels of Phy ameliorated the impaired performance seen with lower levels of avP. In intermediate to high avP levels, the inclusion of 1,500 FTU/kg increased broiler performance.

Key Words: Ca:avP ratio, tibia ash, P equivalency

165 Phosphorus-releasing efficacy of a 6-phytase for broiler performance and bone mineralization compared with monocalcium phosphate. Maria Franchescl, Peter A. Adel2, Dieter Feuerstein2, and Michael B. Coelho3,1*, 1IRTA, Monogastric Nutrition, Spain, 2BASF SE, Lampertheim, Germany, 3BASF Corp., Florham Park, NJ.

The efficacy of a novel 6-phytase, derived and composted from 3 bacterial species, was investigated at graded dose levels and compared with graded levels of monocalcium phosphate (MCP) added to a negative control each. Performance and bone ash were used as response criteria. A total of 1,575 Ross 308 broilers were used in a randomized complete block design with 9 treatments in 7 blocks. Treatments consisted of the NC without inorganic P (iP), (6.63 g/kg Ca and 4.42 g/kg total P); NC +0.6, +1.1, +1.6 and +2.1 g/kg of iP from MCP. CaCO3 was adapted for a constant Ca/total P ratio of 1.5. Groups with phytase were NC +125, +250, +500 and +750 FTU/kg of Natuphos E. Performance from 7 to 22 d and tibia ash at 23 d were measured. Linear and quadratic responses to supplemental iP from MCP and phytase were characterized, using dose of iP or phytase as independent variables. Phytase and iP increased weight gain, feed intake, tibia dry matter, tibia dry weight, tibia ash % and tibia ash weight linearly and quadratically (P < 0.05), and improved FCR linearly (P < 0.05). Quadratic equations provided the best fit, except for FCR, and bone mineralization had higher r2 than performance variables. By solving the quadratic equations the equivalences between 1 g iP/kg of feed and phytase were 253 (weight gain), 349 (tibia dry weight), 344 (tibia ash %), and 349 (tibia ash weight) FTU/kg. The P equivalence values for 500 FTU of novel 6-phytase/kg of feed were 1.68, 1.13, 1.26 and 1.17 g iP/kg feed for weight gain, tibia dry weight, tibia ash % and weight, respectively. In summary, phytase was efficacious in increasing performance and bone ash in broiler chickens fed a reduced P and Ca diet, and the response to phytase was dose dependent. The equivalences between iP and phytase per kg of feed ranged from 253 to 349 FTU per g of iP or from 1.1 to 1.68 g iP per 500 FTU phytase, respectively, depending on the response criteria.

Key Words: novel 6-phytase, performance, bone ash, broiler, monocalcium phosphate equivalence

166 Manipulation of dietary phytic acid, myo-inositol, and exogenous phytase levels influence the blood insulin to glucose ratio but not their overall concentration. Laura A. Beeson1,2, Carrie L. Walk2, Peter M. Hastie2, Kolapo M. Ajuwon4, Michael R. Bedford2, and Oluyinka A. Olukosi3,1*, 1Monogastric Science Research Centre, SRUC, Edinburgh, United Kingdom, 2AB Vista, Marlborough, Wiltshire, United Kingdom, 3University of Glasgow; Glasgow, United Kingdom, 4Purdue University, West Lafayette, IN.

The aim of the experiment was to study the extra-phosphoric effects of phytase in broilers receiving diets supplemented or not with phytic acid (PHYT) or myo-inositol (MYO) on concentrations of glucose (GLU), insulin (INSU) and MYO in the blood. The experiment was a randomized complete block design and a 2 x 3 factorial arrangement. Treatments were formulated based on a nutrient adequate control (C) diet, to which MYO (0.1%) or PHYT (1.5%) were added to increase the MYO and inositol phosphate ester content, respectively. To each of the 3 diets, phytase was added at d 0 or 1500 FTU/kg. A total of 384 Ross 708 broilers were allocated to the 6 dietary treatments, with 8 replicates per treatment. Feed and water were provided ad libitum throughout. On d 21, immediately following euthanasia, one bird per pen was used for blood collection by cardiac puncture. Plasma was separated and GLU, INSU and MYO quantified by ELISA. There were no treatment effects on GLU, INSU or MYO concentrations in the blood, however, the insu-
lin: glucose ratio (I:G) increased \( P < 0.01 \) with phytase in the PHYT treatment, but phytase had no effect on I:G when added to the C and MYO treatments. The increased dietary MYO was not reflected by an increase in blood concentration, suggesting MYO either passed through the body unabsorbed, or the rate of uptake in the tissues matched the rate of absorption of additional MYO from the intestine. Overall INSU and GLU concentrations were not influenced by treatment; however, the resulting increased I:G ratio when phytase was added to the PHYT treatment \( P < 0.01 \) suggests there may be an influence on insulin sensitivity or efficacy following phytase supplementation in diets containing high phytate levels. As high glucose levels are needed to induce insulin release in birds, phytase addition may increase the sensitivity of the birds to insulin secretion in diets rich in phytate, as seen by changes in the I:G ratio, however these cannot be attributed to increased MYO release and suggests phosphate release may be involved.

**Key Words:** phytate, super-dosing, insulin, glucose, myo-inositol

167 **Interactive effects of P, Ca, and phytase supplements on InsP \(_{6}\) degradation and myo-inositol release in broiler chickens.** Vera Sommerfelder\(^1\), Margit Schollenberger\(^1\), Imke Kühn\(^2\), and Markus Rodehutscheid\(^3\).\(^1\) University of Hohenheim, Stuttgart, Germany; \(^2\) AB Vista Feed Ingredients, Darmstadt, Germany.

The objective of this study was to distinguish between effects of P and Ca supplements on prececal myo-inositol hexakisphosphate (InsP\(_{6}\)) degradation when added with or without microbial phytase. Dietary treatments were arranged in a \( 2 \times 2 \times 2 \) factorial and included diets without \([P\leq 4.1 \text{ g P/kg dry matter (DM)}]\) or with \([P> 6.9 \text{ g P/kg DM}]\) monosodium phosphate supplementation, without \([\text{Ca} < 6.2 \text{ g Ca/kg DM}]\) or with \([\text{Ca}> 10.4 \text{ g Ca/kg DM}]\) limestone supplementation, without and with or with supplementation of 1500 FTU/kg of a modified, *Escherichia coli*-derived 6-phytase (Quantum Blue). Titanium dioxide was included as the indigestible marker. At 27 d of age, digesta from the posterior 2 thirds of the lower ileum was collected, immediately put on ice, pooled on a pen basis, freeze-dried, and subsequently analyzed. InsP isomers were determined by ion exchange chromatography, myo-inositol was analyzed by GC after derivatization and P, Ca and Ti were determined by ICP-OES after wet digestion. Results were analyzed by a 3-factorial ANOVA. Prececal InsP\(_{6}\) degradation was 56% in P-Ca- without phytase and significantly reduced \( P < 0.001 \) by P supplementation alone (40%) or in combination with Ca supplementation (21%). Phytase supplementation significantly increased prececal InsP\(_{6}\) degradation (87%) irrespective of P supplementation \( P < 0.001 \). However, Ca tended to reduce prececal InsP\(_{6}\) degradation in the presence of phytase (77%). Interactions indicated that the ideal myo-inositol concentration was increased upon phytase supplementation from 1.4 to 2.8 g/kg DM in Ca- and from 0.8 to 1.6 g/kg DM in Ca+ \( P = 0.012 \). P supplementation reduced ideal myo-inositol concentrations irrespective of Ca and phytase supplements \( P < 0.001 \). We conclude that P and Ca supplements differentially affect InsP\(_{6}\) degradation by exogenous phytase or endogenous phytases (epithelial and microbiota-associated phytases). Added phytase facilitates InsP\(_{6}\) degradation to myo-inositol, but complete degradation is hampered by Ca and P supplements. The relevance of these effects on intestinal myo-inositol contents concerning absorption and metabolism needs to be elucidated.

**Key Words:** phytate, degradation, ileum, interaction, broiler

168 **Wheat-arabinoxylan produced by enzymatic pretreatment improve the performance and digestive health of wheat-fed broilers.** Nadia Yacoubi\(^1\), Luc Saulnier\(^1\), Estelle Bonnin\(^1\), Estelle Devillard\(^1\), Lamya Rhayat\(^1\), Richard Ducatelle\(^2\), and Filip Van Immerseel\(^2\).\(^1\) INRA UR1268 Biopolymers Interactions Assemblies, Nantes, France; \(^2\) Department of Pathology, Bacteriology and Avian Diseases, Faculty of Veterinary Medicine, Ghent, Belgium; \(^3\) Adisseo France SAS, Commeny, France.

Carbohydrate degrading multi-enzyme preparations (MEP) are widely used as feed additives. Their mode of action is complex and remains not fully comprehended. In the present study we investigated the effect of wheat-fractions produced by MEP pretreatment on broiler performance and intestinal health and microbiota, during a 2-week in vivo experiment. Water-soluble fractions were isolated at pilot scale from wheat grain with (WE) and without (WC) MEP treatment. Sub-fractions were further obtained from WE and WC by graded ethanol precipitation. Sub-fractions WE-1 and WC-1 were recovered in 65% ethanol and sub-fractions WE-2 and WC-2 in 80% ethanol. The fractions were incorporated at 0.1% in a wheat-based diet to feed 480 Ross PM3 broilers distributed in 5 groups of 96 (12 broilers × 8 pens), one negative control group (NC) and 4 treatments groups. Body weight gain (BWG) and feed conversion ratio (FCR) were calculated. At d 14, all the animals were euthanized and from 24 animals/group ileal and cecal contents and tissue samples were collected. MEP degradation increased the solubility of arabinoxylans (AX) and reduced their Mw and polymerization degree (DP), albeit not below 10. The AX represented 50% of WE-1 vs. 15% of WE-2, whereas they represented 45% of WC-1 vs. 1% of WC-2. The WE-1 significantly \( P < 0.05 \) increased BWG by 14% after the first week post hatch and 6% throughout the 2 weeks, increased bacteria of the *Lachnospiraceae* family, increased short-chain fatty acids (SCFA) production in ceca (mainly butyrate and acetate), decreased the T-lymphocytes infiltration in the ceca and ileum and increased the L-cell density in the ileal mucosa, when compared with WC-1. The WE-2 had no significant effect on BWG, FCR, T-lymphocyte infiltration, L-cell density and SCFA production when compared with WC-2. To conclude, MEP degradation products improved broiler performances and digestive health during the first 2 wk post-hatch.

**Key Words:** enzyme, T-lymphocyte, L-cell, short-chain fatty acids, body weight gain

169 **Amylase improves broilers performance in pelleted diets.** Vinicius Gonçalves Schramm\(^1\), Lucas Newton Ezaki Barrilli\(^1\), Josiane Carla Panissio\(^1\), Chayane Rocha\(^1\), José Otavio Berti Sorbini\(^2\), and Ananda Portela Félix\(^1\).\(^1\) Federal University of Paraná, Curitiba, Paraná Brazil; \(^2\) DSM Nutritional Products, São Paulo, São Paulo, Brazil.

The objective of this study was to evaluate the effects of interaction between α-amylase and pelleted diets on growth broiler performance. Eight hundred eighty male Cobb broilers were used and divided into 4 treatments with 10 replicates of 22 broilers each. The experimental design was a completely randomized with a factorial arrangement of 2 diets physical form (mash and pelleted) × 2 amylase (with 80 KNU/kg feed of Ronozyme HiStarch and without enzyme). Broilers were fed with the same diets until 35 d of age, then were fed the experimental diets. Birds were placed in boxes and had ad libitum access to water and feeds. Feed intake (FI), body weight gain (BWG) and feed conversion ratio (FCR) corrected for the weight of dead birds were determined. Data was submitted to a 2-way ANOVA and significance was accepted at \( P < 0.05 \). Otherwise, there was no interaction between physical form and amylase supplementation. It was observed amylase supplementation improved FI and BWG \( (1,520 \text{ g vs. } 1,559 \text{ g and } 866 \text{ g vs. } 906 \text{ g, respectively; } P < 0.05) \). The same effect was observed in pelleted diets \( (1,469 \text{ g vs. } 1,617 \text{ g and } 828 \text{ g vs. } 944 \text{ g, respectively; } P < 0.05) \). Otherwise, there was no
effect of treatments on FCR ($P > 0.05$). In conclusion, the amylase and pelleted diets improved broiler performance.

170 The effect of two carbohydrate complexes in reformulated corn-, corn DGGS- and soybean meal-based diets on broiler performance. Roberto Montanhini Neto$^1$, Robert B. Shirley$^2$, Adam Davis$^3$, Elisabeth Freeman$^2$, Pierre-André Geraert$^1$, and Aurélie Preymat$^1$,$^4$, Adisseo France S.A.S., Antony, France, 2Adisseo USA Inc., Alpharetta, GA, 3University of Georgia, Athens, GA.

A new generation carbohydrate (Rovabio Advance) was developed by enhancing the xylanase and arabinofuranosidase activities in a former generation of carbohydrate (Rovabio Excel). The objective of this study was to determine how 0–35 d broiler performance is affected when corn-, corn DGGS-, and soybean meal (SBM)-based diets are supplemented with one of the enzyme products. This trial was carried out in floor pens using 1,440 d-of-hatch, male Cobb 500 chicks, randomly distributed into 4 treatments with the addition of Rovabio Advance L (200 mL/MT). Performance parameters (BW, BWG, FCR) were measured at d 14, 28, and 42. The nutritional reduction in NC1 did not result in a significant reduction in performance compared with the PC ($P > 0.05$) in any of the feeding phases; however, a significant increase in FCR ($P < 0.01$) was observed in the starter and grower phases for NC2 and NC3. The addition of CC only improved the FCR of NC1 and NC2 to the level observed with the PC ($P < 0.10$) in these phases. Across the entire growout, the nutrient reductions in NC3 resulted in a significant reduction in BWG and increase in FCR compared with the PC ($P < 0.05$). Using contrast analysis, the addition of CC promoted a significant improvement ($P < 0.05$) in BWG and FCR for all NC feeds, improving BWG by +1.77% ($P < 0.01$) and FCR by −1.23% ($P < 0.05$). In conclusion, supplementing CC improves performance through higher nutrient availability when diets are formulated with 3% less AME and dAA, and 5% less avP.

**Key Words:** arabinofuranosidase, broiler, nutritional matrix, Rovabio Advance, xylanase

171 Efficacy of a carbohydrate complex enriched in xylanases and arabinofuranosidases on the performance of broilers fed corn-, corn DGGS-, and soybean meal-based diets, with different digestible amino acid reductions. Roberto Montanhini Neto$^1$, Robert B. Shirley$^2$, Adam Davis$^3$, Elisabeth Freeman$^2$, Pierre-Andre Geraert$^1$, and Aurélie Preymat$^1$, Adisseo France S.A.S., Antony, France, 2Adisseo USA Inc., Alpharetta, GA, 3University of Georgia, Athens, GA.

The degradation of arabinoxylan by xylanases (Xyn) and arabinofuranosidase (Abf) improves the accessibility to several nutrients (i.e., starch, fat, protein and minerals) that are trapped within NSP that are surrounded by cell wall. The objective of this study was to evaluate the 0 to 42 d performance of broilers fed corn-, corn DGGS-, and soybean meal (SBM)-based diets that differed in the level of apparent metabolizable energy (AME), available phosphorus (avP) and digestible amino acids (dAA), with the addition of a carbohydrase complex (CC) enriched in Xyn and Abf. This trial was carried out in floor pens, using 2,112 d-day-of-hatch male Cobb 500 chicks randomly distributed across 8 treatments (11 replicates of 24 chicks each): T1 = Positive control (PC), formulated based on typical nutritional levels used in North America; T2 = Negative control 1 (NC1), a 3% reduction in AME and 5% reduction in avP; T3 = NC2, NC1 with a 3% reduction in dAA; T4 = NC3, NC1 with a 6% reduction in dAA; T5, T6, T7 and T8 consisted of the first 4 treatments with the addition of Rovabio Advance L (200 mL/MT). Performance parameters (BW, BWG, FCR) were measured at d 14, 28 and 42. The nutritional reduction in NC1 did not result in a significant reduction in performance compared with the PC ($P > 0.05$) in any of the feeding phases; however, a significant increase in FCR ($P < 0.01$) was observed in the starter and grower phases for NC2 and NC3.

**Key Words:** arabinoxylan, xylanase

172 Performance of broilers fed corn-, corn DGGS-, and soybean meal-based diets with the addition of a carbohydrase complex enriched in xylanases and arabinofuranosidase. Roberto Montanhini Neto$^1$, Robert B. Shirley$^2$, Adam Davis$^3$, Elisabeth Freeman$^2$, Pierre-Andre Geraert$^1$, and Aurélie Preymat$^1$, Adisseo France S.A.S., Antony, France, 2Adisseo USA Inc., Alpharetta, GA, 3University of Georgia, Athens, GA.

Arabinoxylan chain is recognized to be the most important constituent of cereal cell walls. The breakdown of this chain depends on both xylanase, for depolymerization of the xylan backbone, and arabinofuranosidases, to remove the arabinose branches. The objective of this study was to compare the performance of broilers fed corn-, corn DGGS-, and soybean meal (SBM)-based diets with the addition of carbohydrase complex (CC) enriched in xylanases and arabinofuranosidases (Rovabio Advance), with reduced of apparent metabolizable energy (AME) and digestible amino acid (dAA) content. The trial was carried out in floor pens, using 1,440 d-old Cobb 500 chicks, randomly distributed into 3 treatments (20 replicates of 24 chicks each): T1 = positive control (PC), formulated based on typical nutritional levels used in North America; T2 = negative control (NC), PC with a 3% reduction in AME and dAA; T3 = NC with the addition of Rovabio Advance L (200 mL/MT). Performance parameters (BW, BWG, FCR) were measured at d 14, 28, 35, and 42. Significant differences ($P < 0.05$) between PC and NC were observed during the grower and finisher phases. CC allowed restoration of performance losses of NC to the same level of that observed for PC, in all feeding phases ($P > 0.05$). In the overall period, the NC with CC had similar ($P > 0.05$) BWG and FCR than the PC and significantly better than NC. CC could entirely recover the performance losses resulting from the reduction of 3% in AME and dAA content of corn-, corn DGGS-, and SBM-based diets for broilers, between d 0 and 42. The performance improvement indicates that the CC enriched in xylanases and arabinofuranosidases can provide more nutrients available to birds, improving energy and dAA retention in the order of 3% as well as enhancing the potential of growth performance and feed efficiency.

**Key Words:** arabinoxylan, xylanase

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A study was conducted to evaluate form and dose effect of a newly developed thermostable xylanase (Cibenza Xylaverse, Novus International, Inc.) on growth performance, digesta viscosity, intestinal weight, and digesta xylanase activity of broilers fed wheat based diets. The study consisted of 6 dietary treatments arranged in a randomized complete block design: positive control, negative control with 100 kcal/kg less ME, granulated xylanase 250 and 500 U/kg, and liquid xylanase 250 and 500 U/kg. Each treatment was fed to 12 replicate battery pens of 8 Ross 308 male broilers. All diets were pelleted at 85°C and then crumbled; both xylanases were added before pelleting in the mixer. Body weight, feed intake, FCR, and mortality were determined on d 7, 15, and 21. On d 22, 2 birds per pen were killed to collect small intestine digesta for viscosity measurement. Empty small intestine was weighed. On d 23, another 2 birds were killed to collect jejunal digesta for xylanase activity determination. Data were analyzed with one way ANOVA and a P-value ≤0.05 was considered significantly different. Xylanase supplementation significantly increased 21-d body weight (3.6–6.1%) and improved 0–21 d FCR (3.5–5.4 points) with there being no difference among the xylanase treatments. Xylanase reduced digesta viscosity significantly by 23.0 to 34.6%. Granulated xylanase at 500 U/kg resulted in lower digesta viscosity in comparison to granulated xylanase at 250 U/kg; neither was significantly different from liquid xylanase at 250 or 500 U/kg. Xylanase decreased small intestine relative weight of broilers by 6.6 to 11.3% regardless of form or dose. A significant amount of xylanase was recovered in jejunum digesta in a dose dependent manner regardless of xylanase form. In summary, the study demonstrated that the newly developed xylanase was efficacious in increasing body weight, improving FCR, and reducing digesta viscosity and small intestine weight of broilers fed wheat-based diets. The newly developed xylanase was efficacious as low as 250 U/kg, and the liquid form performed as well as the granulated form in terms of both performance and gut parameters.

Key Words: thermostable xylanase, broiler, form, dose

Nitrogen-corrected apparent metabolizable energy of an exogenous carbohydrase added to diets formulated with low-fat distillers dried grains with solubles (LF-DDGS) from 0 to 28 d in broilers. Elizabeth J. Kim*, Michael E. Persia2, Jonathan Broomhead3, Xuimei Li3, Philip Lessard3, and Mike Lanahan3, 1ARS-USDA Poultry Research Unit, Mississippi State, MS, 2Virginia Tech University, Blacksburg, VA, 3Agrivida Inc., Medford, MA.

The objectives of this trial were to determine the effects on apparent metabolizable energy (AME) of diets formulated with low-fat distillers dried grains with solubles (LF-DDGS) and the inclusion of an exogenous carbohydrase. Four dietary treatments were fed: a corn/soybean meal control diet or a corn/soybean meal based diet with 12% LF-DDGS, both with or without enzyme inclusion. Diets were formulated to be isocaloric, isonitrogenous, with titanium dioxide added as an indigestible marker to determine AME of the diets. On day of hatch, 320 male Ross × Ross 708 broilers were randomly allocated to 32 battery cages in groups of 10. Battery cages were located in a solid-sided building with complete environmental control. Each of the experimental diets was fed from 0 to 28 d of age to 8 replicate cages. All birds and feed were weighed on a weekly basis to determine live performance parameters. On d 11 and 25, all excreta pans were cleaned and excreta were collected over a 72 h period. On d 14 and 28, excreta subsamples were collected, dried, ground, and analyzed for titanium, nitrogen and gross energy to calculate AME of the total diets. All experimental diets were also analyzed for titanium, nitrogen and gross energy. All AME and performance data was analyzed as 2 × 2 factorial design in PROC GLIMMIX of SAS. The main effect of diet type, enzyme inclusion and interactions were analyzed as well as pairwise comparisons of the diets with or without enzyme inclusion. Significance was set at 0.05. Weekly body weight, gain and feed consumption for birds fed the LF-DDGS diets were significantly (P < 0.05) higher and FCR lower than the corn/soybean meal control diets. The addition of the carbohydrase was found to significantly (P < 0.05) increase AME at both 14 and 28 d for diets formulated with 12% LF-DDGS. The enzyme addition was found to increase AME of LF-DDGS diets by 108 kcal/g and 237 kcal/g at 14 and 28 d, respectively. The results of this study indicate that the addition of a carbohydrase was found to significantly increase the AME of diets formulated with a LF-DDGS.

Key Words: metabolizable energy, carbohydrase, low-fat distillers dried grains with solubles, broilers