

Nutrition IV

T101 Effect of pure protease enzyme and dietary protein/amino acids levels on broiler performance. A. P. Rosa*¹, A. Scher¹, C. Stefanello¹, E. Diaz¹, V. Duarte¹, N. Oichenaz¹, and J. O. B. Sorbara², ¹Laboratório de Avicultura (LAVIC) - Universidade Federal de Santa Maria, Santa Maria, RS, Brazil, ²DSM Nutritional Products, São Paulo, SP, Brazil.

Extensive research has demonstrated the importance of enzymes in poultry nutrition. However, there is limited information about the efficacy of a pure protease enzyme on broiler performance. This study was conducted to evaluate the addition of a pure protease enzyme (RONOZYME[®] ProAct, activity 75000 PROT/g) to broiler diets with different levels of crude protein/amino acids. A total of 600 Cobb male broilers chicks acquired at day-old, housed Petersime brooding units were distributed in 60 cages. A 3×2 factorial design was used, with three crude protein and amino acid (CP/AA) levels (21.50, 20.85 and 20.21 % CP, and 1.15, 1.115, and 1.08% Dig Lys and 0.82, 0.795, 0.77% Dig TSAA respectively) with and without RONOZYME[®] ProAct (200 ppm). There were 10 replicates of 10 birds each. Diets were formulated to current industry standards for starter phase (1-21 days) based on corn, soybean meal and meat bone meal. Diets with 20.85% and 20.21% CP levels were respectively three and six percent lower in CP and AA than the control (21.50% CP). Addition of protease increased (P≤0.05) body weight, weight gain, and feed intake. CP and AA reduction of 6% significantly (P≤0.05) reduced the performance of broilers, but at 3% CP and AA reduction had no effect. Birds fed diets with 6% CP and AA reduction supplemented with 200 ppm of the enzyme had similar body weight, weight gain and feed consumption as birds fed with full CP level (21.50%) in the diet. This study indicates that the protease had a positive effect on protein utilization in broilers fed protein deficient diets.

Key Words: enzyme, protease, crude protein, amino acid, performance

T102 Broiler chicken performance and ileal digestibility is improved by a protease used in corn/soybean meal/meat bone meal diet. A. Maiorka¹, A. Favero¹, R. F. P. Meurer¹, M. T. T. Moraes¹, and J. O. B. Sorbara*², ¹Universidade Federal do Paraná, Curitiba, PR, Brazil, ²DSM Nutritional Products, São Paulo, SP, Brazil.

The effect of a protease (RONOZYME[®] ProAct/activity 75000 PROT/g) on the performance, digestible energy (DE) and the ileal digestibility of crude protein (CP), fat, gross energy and amino acid (AA) was investigated in broiler chicks fed diets with (200 ppm: 15000 PROT/kg feed) or without supplementation (control diet). The diets were formulated with corn, soybean meal and meat-bone-meal. The study was a complete randomized design and treatments were replicated by eight groups of 22 birds each raised floor pens. Body weight (BW), feed intake and feed conversion ratio (FCR) were determined at 7, 21, 35 and 42 days. Insoluble ash (Celite[™]) at 1.0% was included as an indigestible marker, and at 42 days the birds were sacrificed to collect the ileal contents to determine digestible energy and nutrient digestibility. There was no significant difference (P>0.05) in body weight gain between broilers from control diet and those fed the enzyme-supplemented diet. Differences in daily feed intake were observed during the grower period (21 to 42 d of

age) and the FCR was significantly (P<0.05) improved for the enzyme-supplemented diet (1.821 kg/kg) compared with control diet (1.862 kg/kg). For the total production period (1 to 42d) the enzyme-supplemented diet improved (P<0.05) FCR (1.644 vs 1.686). Enzyme supplementation improved (P<0.05) ileal fat and energy digestibility by 4.5% and 5.8%, respectively. DE was 3.9% higher in enzyme supplemented diet than the control. Enzyme treatment improved crude protein (CP) digestibility by 7.3%. The protease increased (P<0.05) ileal AA digestibility for Met, Cys, Val and Ala by 8% or more, and for all other AA analyzed the increases in digestibility were not significant (P>0.05). In this floor pen trial protease supplementation improved BW and FCR by 1.9 and 2.2%, respectively. Consequently, enzyme supplementation should allow a cost saving through a reduction in CP and AA in feed formulation.

Key Words: enzyme, protease, amino acid, digestibility, performance

T103 Effect of processing temperature, nutrient provision and enzyme supplementation (Avizyme 1500) on performance and digestibility of broiler chickens fed corn/soy-based diets. A. Péron¹, A. J. Cowieson¹, C. E. Gilbert*¹, and V. Ravindran², ¹Danisco Animal Nutrition, Marlborough, United Kingdom, ²Massey University, Palmerston North, New Zealand.

An experiment was performed to determine the effects of Avizyme 1500 (XAP), a combination of amylase, protease and xylanase, on broiler performance and digestibility coefficients. The study followed a 2x2x3 factorial design, using two control corn/soy diets (Positive Control PC and Negative Control NC), three processing conditions (mash, pellet 80°C and pellet 90°C) and two supplementation programs (no additive or XAP). 480 day-old male Ross 308 chicks were randomly allocated to 60 cages, giving 5 replicates per treatment. The PC contained 3000 kcal ME/kg. The NC diets contained 100 kcal ME/kg less ME with similar levels of other nutrients. The XAP enzyme combination was added at 0.05% in the feed, using a liquid application system. The additive supplied a guaranteed minimum of 300 U xylanase, 400 U amylase and 4000 U protease/kg diet. All diets were formulated using 0.3% titanium dioxide as an indigestible marker. Individual BW, feed consumption and FCR were determined between 0 and 21 d of age. At 21 days, birds were killed by intracardial injection of sodium pentobarbital. Contents of the distal ileum were collected, pooled per cage, and analyzed in order to determine ileal digestibility coefficients of dry matter (DM), nitrogen (N) and gross energy (GE), and to calculate ileal digestible energy (IDE). As compared with mash, pelleted feeds resulted in an average improvement (P<0.05) of 17.0% BW and 15.5% feed intake. However, pelleting was also associated with a 1.4% reduction for nitrogen digestibility coefficient. Chickens fed PC exhibited (P<0.05) lower feed intake (2.2%) and FCR (3.4%) values than those fed NC. Addition of XAP improved (P<0.05) performance and digestibility coefficients in PC and NC-fed birds by an average of 3.1% BW, 2.5% FCR, 1.2% N digestibility, 1.7% GE digestibility and 1.7% IDE (or +60 kcal/kg). The effect of XAP was greater in NC than in PC diets.

Key Words: enzymes, broilers, amylase, protease, xylanase

T104 Response of broilers originating from extremes in breeder age to a decrease in dietary ME-P-Ca and supplementation with an amylase-phytase-protease-xylanase composite. E. T. Moran* and R. Lehman, *Auburn University, Auburn, AL.*

Amount of egg determines energy, protein, and Ca-P remaining for reserves during post-hatch development. Chicks in nature likely derive a digestive advantage from diverse enzymes assumed with coprophagy of hen cecal excreta while in the nest and thereafter. Experimentation compared males hatched from eggs of Ross 708 breeders at 25 vs 65 wks of age after vaccination for coccidiosis (CocciVac D®) and placed on used litter (25 chicks/pens-64 total). Pelleted feeds representing the control were based on corn, soybean meal, poultry fat, limestone and dicalcium phosphate to supply generally accepted nutrient requirements during 0-3, 3-6, and 6-8 wks periods. Feeds corresponding to reduced ME-P-Ca omitted fat and dicalcium phosphate such that a reduction of 100 kcal along with 0.1% P and 0.1% Ca resulted. Amylase (400u), phytase (5000u), protease (4000u), and xylanase (300u) were derived as commercial supplements (0.05% Avizyme 1502® + 0.01% Phyzyme® XP 2500TPT/kg) to simulate microbial contributions by coprophagy. ANOVA analyzed factorially arranged treatments. Chicks from 25 wk breeders weighed 33g while those at 65 were 46g. Differences in live weight attributable to breeder were perpetuated to 8 wks as well as in terms of abdominal fat and breast fillets; but, femurs had similar breaking strength. Reducing dietary ME-P-Ca had small adverse effect on live performance, regardless of breeder source, with the exception of mortality then losses were extensive during the last period with birds from young breeders. Processing of survivors that had received decreased ME-P-Ca indicated reductions in carcass weight, abdominal fat, skinless boneless meats, and femur strength in parallel with breeder age. Inclusion of the enzyme composite increased live weights and relieved all mortality. Enzyme addition also led to yield increases in carcass, abdominal fat and fillets while femurs were strengthened. Overall variance attributable to breeder age and nutrient level can be relieved by including a complimentary array of enzymes to the feed.

Key Words: breeder age, broiler feed, enzyme supplement, nutrient availability, carcass quality

T105 Evaluation of the effects of dietary enzymes on ileal amino acid digestibility in 18-day old broilers during live coccidia oocyst vaccination. C. L. Walk*¹, C. Novak⁴, A. Cowieson², J. Remus³, J. Escobar¹, and A. P. McElroy¹, ¹*Virginia Tech, Blacksburg*, ²*Danisco Animal Nutrition, Marlborough, Wiltshire, United Kingdom*, ³*Danisco Animal Nutrition, St. Louis, MO*, ⁴*Land O'Lakes, Inc., Kansas City, MO.*

An experiment was conducted to evaluate the effects of various dietary enzymes on amino acid digestibility in broilers when using a live coccidia oocyst vaccine. One-day-old, Cobb 500 straight run broilers were obtained from a commercial hatchery and half were sprayed with a live coccidia oocyst vaccine. All chicks were weighed and placed in battery brooders according to eight dietary treatments (n = 108). Dietary treatments were positive control (PC; 0.90% Ca and 0.45% nPP), negative control (NC; 0.80% Ca and 0.35% nPP), NC + phytase (NC+P), NC + protease (NC+Pr), NC + xylanase (NC+X), NC+P+Pr, NC+P+X, and NC+P+Pr+X. Chicks were weighed and feed intake measured at days 7 and 18, and ileal amino acid digestibility was measured on

days 7 and 18. As reported previously, enzyme supplementation did not significantly affect feed intake (FI) or body weight gain (BWG). Phytase supplementation improved (P < 0.05) feed conversion (FC) compared to protease supplementation at day 7. Phytase and xylanase supplementation improved FC compared to the NC and NC+Pr at day 18. Feed conversion was not different among any other dietary treatments. Coccidia vaccination reduced FI and BWG but did not affect FC. There were no diet by vaccine effects on FI, BWG, or FC. Ileal amino acid digestibility was not affected by diet or vaccination at day 7. Arginine, Glu, Pro, Tyr, Leu, and Phe ileal digestibility tended to improve in vaccinated broilers fed diets supplemented with phytase or xylanase and unvaccinated broilers fed NC+P+Pr. Ileal amino acid digestibility was affected by dietary treatments at day 18 for almost every amino acid analyzed, except Thr. Coccidia vaccination or diet and vaccine interactions did not affect ileal amino acid digestibility at day 18. These data suggest that selected dietary enzymes may improve broiler performance during live coccidia oocyst vaccination by improving nutrient utilization.

Key Words: phytase, protease, xylanase, broilers, coccidia

T106 Intermittent lighting affects efficacy of phytases differently. W. W. Saylor¹, N. E. Ward², and R. Angel*³, ¹*University of Delaware, Newark*, ²*DSM Nutritional Products, Parsippany, NJ*, ³*University of Maryland, College Park.*

The objective of this study was to determine if phytase efficacy could be improved by increasing crop residence time with an intermittent lighting program (LP). One-day-old straight-run Ross 708 broilers were fed a nutritionally-adequate diet and reared on a 23hr light:1hr dark photoperiod for 7d. On d7, 5 birds were assigned to each of 64 pens (n=320) in 4 brooder batteries. Each battery was housed in a separate environmentally-controlled room to which one of 2 LP was assigned: 1) 20:00hr light:4:00hr dark (CON) or 2) 2:30hr light:0:30hr dark (INT) throughout the 24-hr period (2 rooms per LP). Four pens of chicks per room were assigned to one of 4 diets (16 pens per diet) in a RCB design: 1) Positive Control (PC) formulated to meet or exceed NRC requirements for 0-3 wk broilers using Agristats, 2007 averages for Ca (0.95%), and non-phytate P (nPP;0.45%); 2) Negative Control (NC), as PC except for Ca (0.85%) and nPP (0.30%); 3) NC + Phytase A (PhA); and 4) NC + Phytase B (PhB). Phytase products were added to diets to replace 0.1% nPP per the manufacturer's recommendation. At 20d, weight gain (WG), feed efficiency (F/G), and percent tibia ash (TA) were determined. LP had no effect on WG (mean = 558g), but CON chicks had poorer F/G and higher TA than INT chicks (1.51 vs 1.44, SEM=.01; 49.87% vs. 48.92%, SEM=.13; P<0.001). WG was higher (P<.001) for PC-fed chicks than NC-, PhA- or PhB-fed chicks (590, 530, 560, 554, respectively; SEM=9), but there was no difference (P>0.05) between Ph treatments. F/G was improved (P<.001) in PC-fed chicks compared to those fed all other diets (1.42 vs. 1.49, SEM= .02). Across both LP, TA was highest in PC-fed chicks compared to those fed NC, PhA or PhB diets (51.64%, 46.12%, 50.17%, 49.37%, respectively; SEM=.19) with PhA being higher (P<.001) than PhB. Although there was no LP X diet interaction (P>0.05), suggesting that LP did not improve phytase efficacy in 7- to 20d broilers, TA for PhA was higher (P<.001) than for PhB under the INT but not CON LP.

Key Words: phytase, intermittent lighting, broiler

T107 Efficacy of a new coated thermostable Phytase from *Peniophora lycii* in broiler diets. S. L. Vieira^{*1}, R. N. Reis¹, J. Berres¹, M. E. C. Mayorga¹, F. V. F. Furtado¹, and J. O. B. Sorbara², ¹Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, ²DSM Nutritional Products, São Paulo, SP, Brazil.

The potential increased P replacement of the new RONOZYME[®] P phytase with the Coated Thermostable (CT) formulation was evaluated for broiler chicks with live performance, P and Ca retention and in tibia as the response variables. Four hundred Cobb x Cobb 500 broiler males were placed in 40 steel battery cages, 10 in each (0.80 x 0.90 m²). Corn-soybean meal diets were formulated using Brazilian standard levels of nutrients and energy. Experimental diets AvP levels were as follows: 0.37; 0.32; 0.27; 0.22% w/o phytase, or 0.22% supplemented with 100, 200, 300 or 400 g phytase/MT feed. Each of the eight treatments had 5 replicates. Performance was evaluated weekly to 24 d. On day 25, tibia was taken from 3 birds/cage for Ca and P determination. Total excreta collection was performed from 26 to 28 d in order to evaluate Ca and P retention. A gradual decline in performance, and reduction in tibia Ash, Ca and P, as well as Ca and P retention were observed as AvP was reduced in the diets (P≤0.05). Increased phytase supplementation completely overcame all reductions in these parameters (P≤0.05). Quadratic adjustments were obtained in all performance responses with phytase supplementation. The derivation of response curves allowed estimates of phytase levels that maximized BW (310g/ton), FC (333g/ton), FI (315g/ton), and P in tibias (341g/ton). The relationship between phytase and tibia Ash as well as phytase and P retention were linear, and therefore no maximum was reached. Retained P increased from 52% to 73% when the non-supplemented diet was compared to diets that received 400g phytase/ton. Body weight gain with 400 g/ton of phytase was statistically equal to the dietary treatment with 0.37% AvP, and therefore an improvement of 0.15% of AvP is assumed using that amount of phytase in a 0.22% AvP diet. This study confirms that the new CT formulation of RONOZYME[®] P *Peniophora lycii* at increased levels permits higher amounts of inorganic phosphate to be replaced in feed formulations.

Key Words: enzyme, phytase, performance, phosphorus retention, bone

T108 Broiler performance and phosphorus retention response of new Phytase from *Peniophora lycii* developed for mash feed. S. L. Vieira^{*1}, R. N. Reis¹, M. E. C. Mayorga¹, R. Barro¹, J. Meira¹, and J. O. B. Sorbara², ¹Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, ²DSM Nutritional Products, São Paulo, SP, Brazil.

Sources of phosphorus has been scarce and the potential increased P replacement of the new Ronozyme P phytase developed for mash feed was evaluated for broiler chicks with live performance, P and Ca retention and in tibia as the response parameters. Two hundred and twenty five Cobb x Cobb 500 broiler males were placed in 25 steel battery cages, nine in each (0.80 x 0.90m²). Corn-soybean meal feeds were formulated using Brazilian standard levels of nutrient and energy. Experimental diets AvP levels were as follows: 0.37 and 0.23% w/o phytase, or 0.23% supplemented with 37, 74, 111 g phytase/MT feed. Each of the five treatments had five replicates. Performance was evaluated weekly to 25 d. On day 25, tibia was collected from 3 birds/cage for Ca and P determination. Total excreta collection was performed from 26 to 28 d in order to evaluate Ca and P retention. A gradual decline in performance and reduction in tibia Ash, Ca and P, as well as Ca and P retention were observed as AvP was reduced in the diets (P≤0.05).

Increased phytase supplementation completely overcame all reductions in these parameters (P≤0.05). Quadratic adjustments were obtained in all performance parameters in response to phytase supplementation. The derivation of response curves allowed estimations of phytase levels which maximized BW (92g/ton), FC (85g/ton) and FI (94g/ton). The relationship between P retention and phytase was linear, and therefore no maximum was attained. Retention of P increased from 53% to 65% when non supplemented diet was compared to 111g phytase/ton. Body weight with 111g/ton of phytase was statistically equal to the dietary treatment with 0.37% AvP, and therefore an improvement of 0.14% of AvP is assumed using that amount of phytase in a 0.23% AvP diet. This study confirms that the new phytase from *Peniophora lycii* developed for mash feed at increased levels permits higher amounts of inorganic phosphate to be replaced in feed formulations.

Key Words: enzyme, phytase, digestibility, performance

T109 The effect of exogenous phytase on dietary net energy for chickens. V. Pirgozliev^{*1}, T. Acamovic¹, and M. R. Bedford², ¹SAC, Ayr, Scotland, United Kingdom, ²AB Vista, Marlborough, England, United Kingdom.

Poultry diets are routinely supplemented with phytase to increase both mineral availability and growth of the birds and to reduce environmental pollution. Although it has been hypothesised that exogenous phytase may also increase dietary net energy, data supporting this hypothesis is limited. The aim of this experiment was to determine the effect of dietary phytase on performance, dietary apparent metabolisable energy (AME) and dietary net energy retained in the carcass (NEc; MJ/kg diet DM). Forty-eight male Ross 308 broilers (from 7 to 17d age) were used and four soya-maize based diets (positive control (PC), negative control (NC), NC + 500, + 12500 FTU (phytase units/kg feed)). All diets were formulated to be adequate in protein and energy however the NC was lower in available P compared to the PC, i.e. 2.5 vs 4.7 g/kg diet. The enzyme used was derived from an evolved *E. coli* phytase (Quantum[™]). There were six replicates of each diet in a randomised block design. Feed intake, weight gain and feed conversion efficiency increased (P<0.05) in a dose dependent manner in response to dietary phytase activity, with an average response of approximately 17, 27 and 7.6%, respectively, compared to birds fed the negative control diet. Overall, the NEc of the phytase supplemented diets improved (P<0.001) by approximately 15.6% compared to the negative control, i.e. 6.15 vs 5.32 MJ/kg DM, while dietary AME was not affected. The NEc of the 12500 FTU supplemented diet was 7.8% higher than that of the 500 FTU diet (6.38 vs 5.92 MJ/kg DM). The data presented supports the view that phytase may not influence AME so much as dietary NEc. Use of AME techniques to evaluate the energy sparing effect of the use of a phytase would thus appear to be inappropriate.

Key Words: poultry, phytase, net energy

T110 An investigation of phytic acid and its various degradation products prepared by phytases for the inhibitions of pepsin-catalyzed protein hydrolysis. S. Yu^{*} and S. Dalsgaard, *Genencor Enzyme R&D, Aarhus, Denmark.*

The purposes of the experiments are: 1) to establish simpler and more sensitive methods for the monitoring of phytate inhibition on pepsin-

catalyzed protein hydrolysis; 2) to understand the inhibition extent in relation to the phosphorus esterification degree of myo-inositol; 3) to examine if phytate that inhibits protein hydrolysis by pepsin at acidic pH also inhibits the hydrolysis of peptides under such conditions; and 4) to develop a HPIC method for quantifying phytate degradation products by phytases. Results: In this study simpler and more sensitive methods were established to monitor the inhibition of phytate and its enzymatic degradation products by using caseins labeled either with chromophores or fluorophores, and by using peptides as the substrates for pepsin. The results show that the reaction volume can be reduced to 0.05 ml and the assay can be done in one single step by using one reagent. Kinetic assay, which was impossible before, was possible using these methods in stead of endpoint method. The results further showed that phytate inhibited not only pepsin-catalyzed protein hydrolysis as reported before using these methods but furthermore it showed the hydrolysis of peptides was also inhibited. The inhibition extents of various degradation products of phytate (i.e., IP2-IP5), generated by bacterial and fungal phytases, respectively, were found decreased with the decreased phosphorylation of myo-inositol. For the quantification of phytase degradation products of phytate, which was needed in these experiments, it was found that it was essential that the samples of IP1-IP6 be prepared in the solvent that has a HCl molar concentration the same as where it was eluted in the chromatogram.

Key Words: phytase, phytate, pepsin, protein hydrolysis, antinutritional factor

T111 Phytase and cocktail of carbohydrases and protease selectively improved nutrient utilization in corn-soybean meal broiler diets containing DDGS. O. A. Olukosi¹, A. J. Cowieson², and O. Adeola¹, ¹*Purdue University, West Lafayette, IN*, ²*Danisco Animal Nutrition, Marlborough, Wiltshire, United Kingdom*.

Two hundred eighty-eight 1-d old broilers were used in a 21-d trial to study effect of supplementation of phytase or cocktail of carbohydrases and protease (XAP) in a corn-based diets or diets in which DDGS replaced part of corn and soybean meal. The basal corn-soybean meal diets were supplemented with 0 or 100 g/kg DDGS and within each level of DDGS, phytase or XAP individually or in combination were added to provide per kg diet 1,000, 650, 1,650, and 4,000 units of phytase, xylanase, amylase, and protease, respectively. The experiment was a randomized complete block design with a 2×2×2 factorial arrangement. Each treatment had six replicate cages with six birds per replicate cage. Ileal digesta was collected on d 21 and excreta were collected on the last 3 d of the study. Ileal N digestibility was greater ($P < 0.01$) in diets without DDGS compared to diets that contained DDGS. Also ME was greater ($P < 0.05$) in the diets containing DDGS than in the diets without DDGS. There were no phytase × DDGS, XAP × DDGS nor a 3-way interaction. At both ileal and total tract levels, phytase improved ($P < 0.05$) DM, N, P, Ca and energy utilization whereas XAP showed no effect. Total tract DM retention was improved ($P < 0.05$) by phytase supplementation whether the diets containing 0 or 100 g/kg DDGS. Nitrogen, P and Ca retention, and ME were improved ($P < 0.05$) by phytase supplementation in diets without DDGS whereas phytase only showed a trend ($P < 0.10$) toward improving ME in diets with DDGS. In addition, XAP alone or combined with phytase improved Ca retention in diet without DDGS but had no effect in diet with DDGS. In conclusion, the absence of enzyme by DDGS interaction suggests that the influence of specific enzymes used did not depend on whether DDGS was in the diet or not

and also that only phytase appeared to have a more consistent effect on nutrient utilization at both the ileal and total tract levels.

Key Words: broiler, nutrient utilization, phytase, carbohydrases, DDGS

T112 Effects of Avizyme 1500, Phyzyme XP and distillers dried grains with solubles (DDGS) on nutrient digestibility by broilers. D. R. Ledoux¹, R. E. Kutz¹, R. Murraroli¹, and P. Plumstead², ¹*University of Missouri, Columbia*, ²*Danisco Animal Nutrition, Marlborough, United Kingdom*.

An experiment evaluated the effects of Avizyme 1500 and Phyzyme XP on nutrient utilization by broilers fed diets containing graded levels of distillers dried grains with solubles (DDGS). The 12 dietary treatments fed from day 8 to 21 included a 4 X 3 factorial arrangement of 4 levels of DDGS (0, 6, 12 and 18%) and 3 enzyme treatments (No enzymes, Phyzyme XP, Phyzyme XP plus Avizyme 1500). Phyzyme XP phytase was added at 500 FTU /kg diet and replaced 0.12% Available P and 0.1% Ca from dicalcium phosphate. Avizyme 1500 was added at 0.1% and supplied 300 U xylanase, 400 U amylase and 4000 U protease/kg diet. Six pen replicates of five Cobb 500 broiler chicks were assigned to each dietary treatment. Compared with controls, ileal Ca digestibility, and Ca and P retention were higher ($P < 0.05$) in chicks fed enzymes and were not affected ($P > 0.05$) by DDGS. Compared with controls, ileal P digestibility was higher ($P < 0.05$) in chicks fed Phyzyme and was even higher ($P < 0.05$) in chicks fed both Phyzyme and Avizyme. Ileal P digestibility was also higher ($P < 0.05$) when chicks were fed diets with 18% DDGS versus 0 or 6% DDGS. Ileal digestibility of all amino acids (AA) (including tryptophan) were lower ($P < 0.05$) in chicks fed DDGS compared with those not fed DDGS. In contrast, ileal digestibility of lysine, methionine, cysteine, threonine, arginine, glycine, histidine, isoleucine, leucine, phenylalanine, valine, alanine, tyrosine, aspartate, serine, glutamine and proline were higher ($P < 0.05$) in chicks fed enzymes compared with those fed no enzymes. Combining Phyzyme and Avizyme also consistently resulted in a higher AA digestibility versus Phyzyme added on its own. Significant enzyme by DDGS interactions ($P < 0.05$) were only observed for arginine and tryptophan. The data indicate that a combination of Phyzyme and Avizyme was most effective in improving nutrient utilization in chicks fed diets containing variable concentrations of DDGS.

Key Words: enzymes, phytase, broilers, amino acid digestibility

T113 Water-extractable (WE-AX) and water-unextractable arabinoxylans (WU-AX) as a prediction tool for AME-upgrading of raw materials with a bacterial endoxylanase. R. Mombaerts and K. Van de Mierop*, *Nutrex nv, Lille, Belgium*.

The level and characteristics of NSP in feed determine the antinutritional effect of a broiler diet, making these parameters crucial to estimate the energy value of NSP-enzymes.

AX, the most important NSP structure (w/w), are abundantly present in feed raw materials and can be split into WE-AX and WU-AX fractions, each contributing to the overall anti-nutritional effect in a different way. Ntrase Xyla proved to be effective in hydrolysing both types.

Broiler trials, using feeds with varying WE-AX and WU-AX levels (wheat and/or corn based) showed that the AME-uplift obtained by Nutrase Xyla is correlated with the level and type of AX. AX-dependant enzyme energy factors were calculated and put in the prediction model : $AME_{NX} \text{ (kcal/kg)} = AME + 100 * WE-AX \text{ (\%)} + 25 * WU-AX \text{ (\%)}$

To validate the model, diets with very low and high AX levels were made, using respectively sorghum or rye as main cereal sources. Four treatments were tested : sorghum control, sorghum +Nutrase Xyla, rye control and rye +Nutrase Xyla. Each treatment had 12 floor pens of 15 Ross 308 broilers (6 males and 6 females). Feed intake, body weight (BW) and mortality were measured at d42, weight adjusted feed conversion (WAFC) was calculated.

In the sorghum diet (0.1 % WE-AX, 2.5 % WU-AX) an enzyme effect on AME of 73 kcal/kg is predicted. Adding Nutrase Xyla improved BW gain by 6.7 % and WAFC by 2.4 % ($P < 0.05$). This equals an energy liberation of 74 kcal/kg and confirms the estimation based on the prediction model.

In the rye diet (1.4% WE-AX, 3.2% WU-AX levels) an enzyme AME increase of 220 kcal/kg is expected. Zootechnical results improved by 19.6 % for BW gain and by 9.7 % for WAFC ($P < 0.05$). Energy liberation corresponding to these zootechnical data is 301 kcal/kg. These results demonstrate that the energy uplift, calculated according to the prediction model, even underestimated the actual energy release by Nutrase Xyla. One may conclude that the model established mainly from wheat and corn trials was also valid for estimating energy upgrading in diets with extreme AX levels.

Key Words: Nutrase Xyla, bacterial endoxylanase, arabinoxylan, AME-uplift model, broiler

T114 Performance and amino acid utilization by broilers supplemented with a novel exogenous protease. S. L. Vieira*¹, D. M. Freitas¹, J. E. M. Peña¹, R. Barros¹, P. S. Xavier¹, A. C. Vian¹, and J. O. B. Sorbara², ¹Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, ²DSM Nutritional Products, São Paulo, SP, Brazil.

A total of 1,512 Ross X Ross 308 male broiler chicks were placed in 54 floor pens, 28 in each. Birds were fed diets formulated with corn, soybean meal and meat and bone meal using Brazilian standard energy and nutrient recommendations. Diets were supplemented with 0, 100, 200, 400, 800 and 1,600 g/Ton of a novel protease (RONOZYME® ProAct: 75,000 PROT/g where 1 PROT is the amount of enzyme that releases 1 µmol of p-nitroaniline from 1 mM of Suc-Ala-Ala-Pro-Phe-pNA per minute at pH 9.0 and 37°C). Treatments were distributed in a complete randomized design with 9 replications. Broilers were fed the experimental diets from placement to 40 d when eight birds per pen were taken randomly from each pen and sacrificed after electrical stunning. Ileal contents were taken from each processed bird and pooled by pen for amino acid analyses. Titanium oxide was added as a marker in the last week's diet at 1 kg/Ton. There was no significant response for body weight gain; however, FC was linearly improved ($P \leq 0.01$) as enzyme increased in the diet. Birds supplemented with the enzyme had improved ($P \leq 0.05$) uniformity in body weight at 40 d. Ileal digestibilities of methionine and histidine improved ($P \leq 0.10$) by 4 and 2%, respectively, when enzyme was added, regardless of enzyme level.

Key Words: enzyme, protease, amino acid, digestibility, performance

Pathology / Environment and Management IV

T115 Nitric oxide concentration and blood cell count in chicks challenged with LPS thymurium with the use of a plant extract. J. C. Garcia-Lopez*, H. I. Contreras-Trevino, Y. Jasso-Pineda, and G. Alvarez-Fuentes, Universidad Autonoma de San Luis Potosi, San Luis Potosi, SLP, Mexico.

Back yard poultry production in México is a very important activity for low income producers in rural areas; poultry products are used as a source of animal protein, especially for children. However, broiler production is severe affected by gastro intestinal pathogens, among them is *Salmonella spp* that has a large negative effect on reproduction and production parameters. Antibiotics are not an option because of high cost, alternatives are under study to counteract this problem, medicinal plants could be an option for this kind of producers. A complete randomized experiment was performed to test the effect of the plant *Crhysactinia mexicana* extract. 80 day old Cobb chicks were assigned to following treatments: T1 control; T2 control with LPS challenge and no plant extract; T3 control with LPS challenge and plant extract and; T4 control no LPS challenge and plant extract. Plant extract was administered oral via 20 mg/ml during 14 days, on day 15 LPS thymurium was injected intra abdominally, after five hours post injection blood samples were obtained by cardiac puncture and nitrate concentration and blood cell count was determined. There was a statistical difference ($P < 0.05$) in nitrite concentration, with the highest level in T2 with 23.3 micromolar than the one found for T3 with 9.8 micromolar, T1 and T4 had lower levels as expected. There were statistical differences ($P < 0.05$) in Erythrocyte count, T2 and T3 had the highest values versus T1 and T4, same occur in leukocyte count were T2 and T3 had the highest

values. According with these results the use on the plant extract could be a toll for the backyard poultry producers by reducing the impact of bacteria in chick performance.

Key Words: chick, *Salmonella*, plant extract, nitric oxide, leukocyte

T116 Effects of fumonisins added to feed for broilers. J. A. Fierro*¹, J. C. Medina¹, R. Perez-Franco¹, and E. Rodriguez², ¹NUTEK S.A. de C.V., Tehuacan, Puebla, Mexico, ²Investigacion Aplicada S.A. de C.V., Tehuacan, Puebla, Mexico.

Weight losses and liver lesions have been reported to occur in Brazil at levels under 50 ppm of FB1 on the diets of broilers. In order to verify the validity of this statement, an experiment was performed on broilers to demonstrate whether the concentration of 100 ppm of fumonisin B1 (FB1) produced any effects on weight gain and liver damage. 40 one day old Hubbard broilers were used, distributed into two groups of 4 birds, with 5 repetitions. The diets were identified as: Control Group (CG) and FB1 Group (FB1G). The fumonisins were collected from highly contaminated samples. The absence of other mycotoxins in the feeds was determined using analytical instruments: aflatoxins, zearalenone, T-2 toxin, ochratoxin A and deoxynivalenol. The concentration of FB1 in the contaminated feed was confirmed by HPLC.

The birds were weighed at day one of age and the individual weight was recorded on a weekly basis until the end of the experiment. The feed