

Nonruminant Nutrition: Enzymes

TH304 Bone breakage resistance of 25-kg piglets fed diets with phytase containing benzoic or butyric acid. L. M. Rufino, M. Q. Resende*, R. M. Geraldine, J. H. Stringhini, M. A. Andrade, A. G. Mascarenhas, A. C. S. Barnabé, B. P. Mota, and R. C. Nunes, *Universidade Federal de Goiás, Goiânia, GO, Brazil*.

In this paper, bone breakage resistance for 25-kg piglets fed diets containing phytase and benzoic or butyric acid was evaluated. A total of 120 piglets from commercial genetic line, weighing 6.69 ± 0.93 kg were raised until reach 25 kg in a randomized block design with 6 treatments and 5 replicates each. The mashed experimental diets were formulated based on Brazilian tables recommendations. Feed and water were offered ad libitum. Treatments were (1) Control diet with 0.41% available phosphorus; (2) Diet reduced to 0.15% available phosphorus; (3) Diet 2 plus 1.000 FYT/kg of phytase; (4) Diet 2 plus 1.000 FYT/kg of phytase with 0.3% butyric acid; (5) Diet 2 plus 1.000 FYT/kg of phytase with 0.75% benzoic acid; and (6) Diet 2 plus 1.000 FYT/kg of phytase with 0.3% butyric acid and 0.75% benzoic acid. When piglets reached 25-kg live weight, one animal per replicate were euthanized, wright leg was collected to analysis. Bones were dissected, second and third metacarpals were prepared, half of them was boiled and other half tested as a raw bone and dried in air-forced oven at 55°C. Bone breakage resistance was measured in a Instron Corporation IX Automated Materials Testing System equipment, model 4204. Data were submitted to ANOVA and compared by Tukey test (5%) with the computational program Statsoft (2001). Lower bone breakage values ($P < 0.05$) were obtained with animals fed 0.15% phosphorus content diet compared with the ones fed the same diet but added with butyric acid, benzoic acid and phytase. Boiled bones were more resistant to breakage. It is possible to conclude that in reduced phosphorus diets, the inclusion of phytase, butyric acid and benzoic acid do not affected bone breakage.

Key Words: enzyme, organic acid, phosphorus reduction

TH305 Phosphorus digestibility of triticale distillers dried grains with solubles without or with phytase supplementation determined using the regression method in growing pigs. P. C. Xue* and O. Adeola, *Department of Animal Sciences, Purdue University, West Lafayette, IN*.

An experiment was conducted to determine the true total-tract digestibility (TTTD) of phosphorus (P) in triticale distillers dried grains with solubles (DDGS) using regression method and to investigate the TTTD of P of triticale DDGS response to phytase. The triticale DDGS sample that used in this experiment contains 0.69% of total P. Six diets consisting of 3 diets without phytase and 3 diets with phytase (500 FTU/kg of diet) were formulated to contain 3 levels of DDGS (30, 40, and 50%) in which all the P was supplied by triticale DDGS at 0.21, 0.28, and 0.35% in each diet in a 2×3 factorial arrangement. Corn starch, sucrose, and soy oil were used to formulate the semi synthetic diets. Limestone was included to maintain the similar Ca:P ratio at 1.25:1 across diets. A total of 48 barrows (initial BW 22.2 ± 1.3 kg) were assigned to the 6 diets in a randomized complete block design. There was a 5-d adjustment period followed by a 5-d total collection period with chromic oxide as a marker to time the initiation and termination of fecal collection. The daily feed intake was adjusted to 4% of the average BW of each block. The results showed that the P intake, fecal P output, and digested P increased linearly ($P < 0.01$) with the increasing level of DDGS in diets. There was a main effect ($P < 0.001$) of phytase on apparent total-tract

digestibility (ATTD) of P. In diets without added phytase, the ATTD of P in triticale DDGS were determined to be 65.01, 67.70, and 63.16% for the diets with 30, 40, and 50% DDGS, respectively; the corresponding values for diets with added phytase were 77.30, 76.26, and 75.66%. By regressing daily digested P against daily P intake, the TTTD of P was estimated at 75.37 or 81.08% for triticale DDGS without or with added phytase, respectively. The estimated average endogenous P loss for diets contained phytase or not was 0.172 and 0.080 g/d, respectively. In conclusion, the TTTD of P in triticale DDGS without supplemental phytase was determined to be 75.37 and 81.08% in the presence of phytase at 500 FTU/kg of the diet.

Key Words: phosphorus, triticale DDGS, true digestibility

TH306 Performance of piglets in pre-starter phase fed diets containing organic acids and phytase. L. M. Rufino, J. H. Stringhini, M. Q. Resende*, H. H. C. Mello, A. G. Mascarenhas, N. S. M. Leandro, I. C. Di Castro, M. P. F. Silva, and R. C. Nunes, *Universidade Federal de Goiás, Goiânia, GO, Brazil*.

The addition of butyric acid and benzoic acid in diets containing phytase were studied to evaluate piglet performance from 6.69 ± 0.93 kg until 15 kg mean live weight. A total of 120 castrated male commercial piglets were allotted in a randomized block design with 6 treatments and 5 replicates. Temperature and air moisture were measured twice a day, feed and water were offered ad libitum and animals were individually weighed weekly. Variables were submitted to ANOVA and averages compared by Tukey test at 5% probability (SAS, 2008). Mashed diets were formulated according to Brazilian tables requirements, based in corn and soybean meal, considering the inclusion of butyric acid, benzoic acid and phytase. Treatments were (1) Control diet with 0.41% available phosphorus; (2) Diet reduced to 0.15% available phosphorus; (3) Diet 2 plus 1.000 FYT/kg of phytase; (4) Diet 2 plus 1.000 FYT/kg of phytase with 0.3% butyric acid; (5) Diet 2 plus 1.000 FYT/kg of phytase with 0.75% benzoic acid; and (6) Diet 2 plus 1.000 FYT/kg of phytase with 0.3% butyric acid and 0.75% benzoic acid. Piglets fed diets containing phytase and 0.75% benzoic acid increased ($P > 0.05$) average final weight in 11.5% compared with the animals in the control diet. These same animals showed higher total and daily weight gain compared with the ones fed diets reduced to 0.15% available phosphorus and the control treatments. It is possible to conclude that benzoic acid combined to phytase increase performance of piglets from 6.7 kg to 15 kg mean live weight.

Key Words: enzymes, feed conversion, phosphorus reduction

TH307 Effect of protease on growth performance of nursery pigs fed diets with different soybean meal inclusion. J. Guo*¹, P. Biggs², and S. W. Kim¹, ¹*North Carolina State University, Raleigh*, ²*BioResource International, Morrisville, NC*.

Versazyme (BioResource International, Morrisville, NC), a native protease found in *Baillus licheniformis*, has been extensively used in poultry production to improve the digestibility of protein. In vitro data has shown that Versazyme is able to hydrolyze glycinin and β -conglycinin, which are considered the major limitation factors for nursery pigs to digest soybean meal (SBM). This study was to test if dietary supplementation of Versazyme will help the growth of nursery pigs fed diets containing soybean meal to provide adequate or reduced amount of TID Lys (100

or 85% of NRC). One hundred twenty pigs (7.3 ± 0.1 kg) weaned on d 21 were allotted to 4 dietary treatments on d 25 of age based on 2×2 factorial arrangement with Versazyme (0.00% and 0.05%) and TID Lys (1.19% and 1.01%). Diets with 2 levels of TID Lys were achieved by the amount of SBM included (33% vs. 27%). The diets were fed for a period of 2 weeks. Each treatment consisted of 10 pens (5 barrow pens and 5 gilt pens) with 3 pigs per pen. ADG, ADFI, and G:F were measured at the end of each week. Pigs fed diets containing 1.19% TID Lys had greater ($P < 0.05$) ADG (267 vs. 215 g/d) and G:F (0.68 vs. 0.58) during wk 1, wk 2, and the entire 2 wk period compared with 1.01% TID Lys. There were interactions ($P < 0.05$) of TID Lys and Versazyme for ADG and ADFI during wk 2 and the entire 2 wk period indicating that ADG and ADFI of pigs in 1.19% TID Lys (33% soybean meal) were further improved by the supplementation of Versazyme whereas they were not for pigs in 1.01% TID Lys (27% soybean meal). Collectively, Versazyme can be helpful with improving ADG (282 vs. 252 g/d) and ADFI (411 vs. 375 g/d) of pigs when consuming a diet with soybean meal as high as 33%.

Key Words: nursery pig, protease, soybean meal

TH308 Effect of enzyme supplementation of mango (*Mangifera indica* L.) seed kernel- based diet on the performance of broiler chickens. A. A. Odunsi*, O. A. Olu-Arotiowa, A. O. Akinwunmi, T. A. Rafiu, T. O. Akande, and A. O. Afolabi, *Ladoke Akintola University of Technology, Ogbomoso, Oyo, Nigeria.*

The utilization of mango seed kernel (MSK) (an agro-industrial by-product) - based diet supplemented with or without exogenous enzymes (Hamecozyme, Hameco Agro Bv Holland or Maxigrain, Polchem Hygiene Laboratories India) as a replacement for maize in the diets of broiler chickens was investigated. One hundred and 20 d old unsexed broiler chicks were randomly distributed into 4 experimental dietary treatments each with 3 replicates and 10 birds per replicate using a completely randomized design. The experimental diets were the control (without MSK or enzyme), diet 2 (10%MSK without enzyme), diet 3 (10%MSK + Hamecozyme) and diet 4 (10%MSK + Maxigrain). The birds were fed the diets for a 28-d period during which data were obtained on ADFI, ADG, G:F, hematology and carcass characteristics. The results showed that broilers fed 10% MSK based diet (without enzyme) had a reduced ($P < 0.05$) ADG (-23.1%) and poorer G:F (-21.5%) when compared with those on the control diet. Addition of Hamecozyme or Maxigrain enzymes positively enhanced ($P < 0.05$) ADG (16.8% or 7.3%), ADFI (8.9% or 5.7) and G:F (7.5% or 2.3%) respectively compared with the un-supplemented group. Carcass measures (breast, neck, back, wing, drumstick and thigh) and relative weights of the

kidney, liver, heart and lungs did not significantly ($P > 0.05$) change with enzyme supplementation, and had no clear trends. However, gizzard weights were heavier ($P < 0.05$) in broilers fed MSK compared with those without MSK. Hemoglobin, packed cell volume and red blood cells of broilers were not ($P > 0.05$) influenced by dietary treatments but the white blood cells increased ($P < 0.05$) with the inclusion of MSK and enzyme in broiler diets. Conclusively, the use of Hamecozyme or Maxigrain improved ADG of broiler chicks fed MSK by 16.8 and 7.3% respectively over the unsupplemented and, reduced the amount of maize needed in the diets of starter broiler chickens by 21%.

Key Words: Mango seed kernel, enzyme, broiler chicken

TH309 Effects of exogenous enzyme supplemented to a corn and soybean meal based diets on energy and nitrogen balance in nursery pigs. Y. B. Kim* and S. W. Kim, *North Carolina State University, Raleigh.*

Supplementation of exogenous enzymes to stimulate nutrient digestion has attracted considerable interest in the pig industry. The current study was conducted to determine the effects of dietary supplementation of exogenous enzyme (Enervance, Genebiotech; major enzymes are cellulase: 5,000 U/g; and xylanase: 500 U/g) on digestibility and nutrient balance of DM, energy, and N in nursery pigs fed a corn and soybean meal based diet. Fifteen barrows (11.52 ± 0.52 kg BW) at 35 to 40 d of age were allotted to a repeated 3×3 Latin square design with 3 diets and 3 periods. The dietary treatments included (1) a corn and soybean based diet (CON), (2) CON + 0.05% Enervance, and (3) CON + 0.1% Enervance. Daily feed allowances were equal to $0.09 \times BW^{0.75}$ and were given in 2 equal meals. Chromic oxide (0.5 g/kg) was used as a marker. Each period consisted of 5 d of adaptation and 3 d of total fecal and urinal collection. Pigs fed the diet supplemented with 0.1% Enervance had greater ($P < 0.05$) apparent total tract digestibility of DM (81.2%) and GE (88.3%) compared with pigs fed the CON (79.3% and 87.2%, respectively) and pigs fed the diet supplemented with 0.05% Enervance (79.8% and 87.4%, respectively). No differences were found between dietary treatments in apparent total tract N digestibility ($P = 0.106$). Pigs fed the diet supplemented with 0.1% Enervance had greater (84.4 vs. 83.6%; $P < 0.05$) energy retention (percentage of intake) compared with pigs fed the CON. No differences ($P = 0.588$) were found between dietary treatments in N retention. In conclusion, exogenous enzyme mainly containing cellulose and xylanase had beneficial effects on energy utilization but not on N retention in nursery pigs fed a corn and soybean meal based diet.

Key Words: digestibility, energy retention, enzyme