examine the effect of oral rumen fluid supplements on calf performance and the incidence of diarrhea. The calves for this study were purchased at d 1 of age from commercial dairy farms and then transported to a calf research facility. Each calf was systematically allocated to a non-treated control group or a rumen fluid treatment group, in which 8 mL of rumen fluid was added to the milk of the afternoon feeding until d 28. Milk intake, starter intake, water intake, and fecal scores were determined daily for all experimental calves. The calves were weighed weekly and average daily gain was determined. Between d 3 and d 23, three weekly fecal samples were collected from each experimental calf. The occurrence of Cryptosporidium parvum was determined by a sucrose flotation and microscopic examination method, and fecal pH was measured. Control and rumen fluid treatment calves were not significantly different with respect to milk intake (p=0.82), feed intake (p=0.95), water intake (p=0.16), average daily gain (p=0.18), and days to weaning (p=0.96). Rumen fluid supplementation did not significantly affect the fluidity or form of calf fecal stools (p=0.83). The occurrence of C. parvum on each weekly sample did not differ between experimental groups (p=0.68, p=0.44, p=0.20, respectively). In addition, fecal pH was not significantly affected by rumen fluid supplementation (p=0.28). The present study differed from the recently published study, in that rumen fluid supplementation did not improve young calf performance or reduce the incidence of diarrhea.

Key Words: Rumen fluid, Performance, Diarrhea

683 Effects of colostrum (C) and dexamethasone (DEXA) treatment on insulin (I)-dependent glucose (G) metabolism in neonatal calves. B. Scheuer[1], L. Tappy[2], J. W. Blum[1], and H. M. Hammon*[3,1], [1]*University of Berne, Berne, Switzerland*, [2]*University of Lausanne, Lausanne, Switzerland*, [3]*Research Institute for Biology of Farm Animals (FBN), Dummerstorf, Germany*.

Feeding of C and glucocorticoid (DEXA) treatment affect G metabolism and I release in neonatal calves. We have tested whether at a high glucocorticoid status after birth and C feeding influence I-dependent G utilization. Neonatal calves were randomly separated into 4 groups of 7 calves, resp. Calves were fed C or a milk-based formula and in each feeding group, calves were either treated with DEXA (30 µg/kg BW per d) or 0.9% NaCl for the first 4 d of life. On d 5 euglycemic-hyperinsulinemic clamps were performed after an overnight period of 16 h without food. Blood samples were taken before and during the clamp for determination of plasma G and I. I [1mU/(kg BW×min)] was infused for 3 h and plasma G concentrations were kept at 5 mmol/L ±10%. Clamp studies were combined with [13C]-bicarbonate (2.82 µmol/(kg BW×min) and [6,6-2H]-G (40 µg/(kg BW×min) infusions for 5.5 h (i.e., from -150 min to 180 min, relative to the start of I infusion) to determine G flux (GFx), endogenous G production (eGP), and gluconeogenesis (GNG) before and at the end of the clamp. Data were analyzed by the Mixed Model with feeding, DEXA treatment and time as fixed effects. In the pre-clamp period plasma concentrations of G and I were higher in DEXA-treated than in non-treated calves. G infusion rates were lower ($P < 0.05$) in DEXA-treated than in non-treated calves during the whole clamp study. GFx increased ($P < 0.05$) during the clamp and was higher ($P < 0.05$) at the end of the clamp in non-treated than in DEXA-treated calves. GNG did not differ between groups, but eGP tended to be lower ($P = 0.1$) in DEXA-treated than non-treated calves at the end of the clamp study. In conclusion, I alone increased G utilization, but GNG and eGP were not affected. The high glucocorticoid status impaired I-dependent G utilization, but did not influence GNG, whereas the eGP seems to be reduced during I infusion.

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Key Words: Neonate, Glucose, Insulin

684 Nutrient restriction in cows alters the number and volume of fetal myofibers. M. Du*, M. J. Zhu, G. A. Olson, B. W. Hess, W. J. Means, and S. P. Ford, *University of Wyoming*, *Laramie*.

Twenty Angus x Gelbvieh rotationally crossed cows carrying female fetuses were blocked by BW and were fed in equal numbers to either meet NRC requirements to gain weight (average = + 4.25% of BW, Control, C) or fed below NRC (nutrient restricted, NR) to lose weight (average = - 6.8% of BW) from d 30 to d 125 of gestation. On d 125, five C and NR cows were necropsied, and the remaining 5 NR cows were realimented to achieve similar BW to C cows when necropsied on d 250 of gestation. The LD muscle of fetuses at 12th rib was removed, fixed and embedded in paraffin for histochemical examination. At d 125 gestation, maternal nutrient restriction reduced the average number of myofibers in muscle bundles of fetal LD muscle; the average number of myofibers from C cows was 12.2 ± 0.34 while that of NR cows was 10.2 ± 0.53 ($P<0.05$). Comparing to the LD muscle of fetuses from C cows at d 250 gestation, maternal nutrient restriction significantly increased the volume of myofibers and reduced the number of myofibers per square area in the fetuses from NR cows; the ratio of the average cross-section area of fetal myofibers from C cows versus NR cows was 1 ± 0.07 to 1.29 ± 0.14 ($P<0.05$). The result showed that nutrient restriction during the early gestation (d 31 to d 125) significantly affected fetal muscle development by reducing the number of myofibers in each muscle bundle. This reduction in the number of muscle fibers due to maternal nutrient restriction at early gestation could not be recovered by realimentation during the late stage of gestation (d 125 to d 250), which resulted in a muscle with reduced numbers of myofibers of larger volume. The reduced number and increased volume of myofibers in fetal muscle due to maternal nutrient restriction during early stage of gestation is expected to impact the physiological function of skeletal muscle and affect meat quality of offspring, which needs further investigation.

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Key Words: Maternal Nutrient Restriction, Cow, Fetal Skeletal Muscle

Nonruminant Nutrition: Enzyme Supplementation

685 Fate of supplemental Escherichia coli phytase in the digestive tract of young pigs. A. R. Pagano*, K. R. Roneker, and X. G. Lei, *Cornell University*, *Ithaca, NY*.

The objective of this study was to determine the functional site of a supplemental E. coli phytase and its impact on phosphorus contents of digesta in different segments of the gastrointestinal tract of pigs. A total of 18 weanling pigs (8.3 ± 0.9 kg BW) were allotted to three groups (n = 6) and were fed a low-P (0.4%) corn-soy basal diet (BD), BD + E. coli AppA2 phytase (500 U/kg), or BD + inorganic P (0.2%) for 4 wk. Individual growth performance and plasma inorganic P concentration were measured weekly. At the end of the study, all pigs were euthanized to collect digesta samples from stomach, duodenum, upper and lower jejunum, ileum, and colon. After freeze-drying, the samples were assayed for phytase activity and soluble P content. Pigs fed BD had lower ($P < 0.05$) daily weight gain, feed use efficiency, and plasma inorganic P concentrations than the other two groups. Phytase activities were similar in the digesta of stomach, duodenum, and upper jejunum, but diminished in the digesta of lower jejunum and ileum of pigs fed BD + phytase. While little phytase activity was detected in the digesta of all these segments from the other two groups, all groups had relatively high phytase activity in the colon digesta (128-267 U/kg). There was a gradual decrease in soluble P of digesta from the stomach to lower jejunum in pigs fed BD + phytase or inorganic P. Digesta soluble P in pigs fed BD was lower ($P < 0.05$) in stomach, but higher ($P < 0.05$) in upper jejunum

than that of the other two groups. In conclusion, stomach seems to be the main function site for supplemental E. coli phytase in young pigs.

Key Words: Phytase, Pigs, Digesta

686 Site of digestibility of protein and phosphorus by growing pigs fed diets without or with microbial phytase. L. L. Geraets*, M. G. Boersma, and H. H. Stein, *South Dakota State University*, *Brookings*.

An experiment was conducted to determine the site of digestibility of CP and P by growing pigs. Six growing barrows (initial BW: 39.5 kg ± 1.3 kg) were randomly allotted to one of two dietary treatments in a two-period switch-back design. Pigs on Treatment 1 were fed a corn-soybean meal based control diet (18% CP, 0.37% P) while pigs on Treatment 2 were fed the same diet supplemented with 500 FYT of microbial phytase (Rhonozyme, DSM Nutritional Products, Inc.). No inorganic P was included in the diets. Each pig was equipped with two T-cannulas, one in the proximal duodenum and one in the distal ileum. Each feeding period lasted 14 d. Fecal samples were collected on d-10, ileal samples on d-11 and d-12, and duodenal samples on d-13 and d-14. The apparent duodenal (ADD), apparent ileal (AID), and apparent total tract (ATTD) digestibility coefficients of DM, CP, and P were calculated. The digestibility of DM and CP increased as feed moved down the GI-tract with the ATTD being higher ($P \leq 0.001$) than the AID, which was higher ($P \leq 0.001$) than the ADD. The ATTD, AID, and ADD for DM were 91.2, 76.8, and 0.4% vs. 90.9, 75.7, and 1.3% for the control and phytase diets, respectively. The corresponding numbers for the digestibility of CP were 90.2, 80.7, and 13.2% vs. 89.2, 80.1, and 9.8% for the control and phytase diets, respectively. There were no differences between the two diets at any of the sites. The ATTD and the AID of P in the control diet (45.0 and 39.3%, respectively) were not different, but higher ($P \leq 0.001$) than the ADD (20.9%). For the phytase diet, the ATTD and the AID (60.0 and 56.1%, respectively) also were not different, but higher ($P \leq 0.001$) than the ADD (23.0%). Both the AID and the ATTD in the phytase diet were higher ($P \leq 0.004$) than the AID and the ATTD in the control diet. It is concluded that diets without and with microbial phytase have a low digestibility of DM, CP, and P prior to the duodenum while the majority of absorption takes place in the small intestine. There is also a significant disappearance of DM and CP in the large intestine, but that is not the case for P.

Key Words: Digestibility, Pigs, Phosphorus

687 Influence of feeding level on apparent ileal and fecal digestibilities of phosphorus and calcium in piglets fed microbial or plant phytase. T. Steiner* and R. Mosenthin, *University of Hohenheim*, *Stuttgart, Germany.*

The influence of feeding level (FL) on apparent ileal and fecal digestibilities of P and Ca in piglets fed microbial or plant phytase was investigated in a 2-period cross-over experiment. Twelve piglets (average initial BW, 7.3 kg) were individually housed in metabolism crates and surgically fitted with simple T-cannulas at the distal ileum. The animals were fed low-P (0.4%) corn-soybean meal diets supplemented with either microbial or plant phytase (550 U/kg) at a level of 2.0- (low) or 2.8-fold (high) the ME maintenance requirement, respectively. In total, there were four treatments with six observations per treatment. Fecal and digesta samples were collected during 3 d and for 24 h, respectively. Titanium oxide was included in the diets as indigestible marker. Apparent digestibilities of P were higher ($P < 0.001$) in pigs fed microbial phytase than in those fed plant phytase at the ileal (54.2 vs. 30.7%) and fecal (56.5 vs. 34.8%) level as well, demonstrating the higher efficacy of microbial compared to plant phytases. Likewise, apparent digestibilities of Ca were also higher ($P < 0.05$) in pigs fed microbial phytase compared to those fed plant phytase both at the ileal (53.8 vs. 40.7%) and fecal (59.2 vs. 50.2%) level. Increasing the FL resulted in improved ($P < 0.05$) apparent ileal (46.0 vs. 38.9%) and fecal digestibilities (46.9 vs. 44.4%) of P. Furthermore, apparent ileal P digestibility was affected ($P < 0.05$) by the interaction between FL and phytase supplementation. Apparent ileal and fecal digestibility of Ca was not improved ($P > 0.05$) by increasing FL. In conclusion, a higher FL has a positive impact on apparent ileal and fecal P digestibility in pigs fed corn-soybean meal diets containing microbial or plant phytase. Therefore, comparative studies on the efficacy of different phytases require a standardization in feed intake at a high level.

Key Words: Feeding Level, Phytase, Pigs

688 The evaluation of phosphorus feeding strategies in pigs from 12 kg to market. R. W. Fent*[1], G. L. Allee[1], D. M. Webel[2], J. D. Spencer[2], and T. S. Torrance[2], [1]*University of Missouri*, *Columbia*, [2]*United Feeds, Inc.*, *Sheridan, IN*.

An experiment using 528 barrows was conducted to evaluate diets targeted at reducing phosphorus (P) excretion from 12 kg BW to market. Pigs were allotted to one of eight dietary treatments in a wean-to-finish facility with six replicate pens/treatment (11 pigs/pen). Pigs were fed in four stages corresponding to 12-27 kg, 27-53 kg, 53-91 kg, and 91 kg-market during which dietary true digestible lysine levels were 1.30, 1.15, 0.80, and 0.65%, respectively. Treatments consisted of: 1) available phosphorus (aP) concentration at 125% of the 1998 NRC recommendation, 2) NRC dietary aP, 3) high aP early, NRC late as previously determined in our lab, 4) NRC aP to 91 kg, then no supplemental P to market, 5) high aP early, no supplemental P from 91 kg to market, 6) no supplemental P with phytase (OptiPhos™) added at 1,000 FTU/kg throughout, 7) high aP early, with 500 FTU/kg phytase replacing 0.12% aP, and 8) phytase added at 1,000, 500, and 300 FTU/kg (replacing 0.20, 0.12, and 0.10% aP) from 12-53 kg, 53-91 kg, and 91 kg-market, respectively. Metacarpal ash and breaking load were determined for one pig/pen at 53 and 91 kg BW and four pigs/pen at termination of the experiment. Removing supplemental P from the diet without phytase supplementation after 91 kg BW decreased ($P < 0.05$) ADG, ADFI, and gain:feed regardless of dietary P early in life. Gain:feed from 91 kg to market was greatest ($P < 0.05$) for those fed phytase-containing diets. Metacarpal ash and breaking load were reduced ($P < 0.05$) in pigs fed diets without inorganic P or phytase after 91 kg BW. The three phytase-containing treatments, whether replacing a portion or all of the inorganic P with phytase, resulted in similar ($P > 0.05$) growth during the final finishing stage and final bone measures with ADG similar to the 125% of NRC diet. These data suggest that removing supplemental P from the diet after 91 kg BW will affect growth performance and bone parameters regardless of prior P feeding. However, substituting some inorganic P with phytase throughout the growing-finishing period resulted in maintained weight gains and bone parameters and improved feed conversion.

Key Words: Phytase, Bone, Excretion

689 Efficacy and equivalency of an E. coli-derived phytase for replacing inorganic phosphorus in broilers and pigs. J. A. Jendza*[1], R. N. Dilger[1], J. S. Sands[2], and O. Adeola[1], [1]*Purdue University*, *West Lafayette, IN*, [2]*Danisco Animal Nutrition*, *Marlborough, Wiltshire, UK*.

Two trials were conducted to determine the efficacy of an *Escherichia coli*-derived phytase (ECP) and its equivalence to inorganic phosphorus (iP) from monosodium phosphate (MSP). Trial 1 used 1,200 day-old male broilers in a 42-d trial to assess growth and nutrient utilization. Dietary treatments were based on corn-soybean meal basal diets (B) containing 239 and 221 g/kg CP, 8.2 and 6.6 g/kg Ca, and 2.4 and 1.5 g/kg iP in the starter and grower phases, respectively. Treatments consisted of the B, B + 0.6, 1.2, and 1.8 g/kg iP from MSP, and B + 250, 500, 750, and 1,000 FTU/kg from ECP. The ECP improved weight gain, feed efficiency, and tibia ash (linear, $P < 0.05$). On d 21, Apparent ileal digestibility of P, Arg, His, Phe, and Trp increased (linear, $P < 0.05$) in response to phytase, but DM and energy decreased at 42 d (linear and quadratic, $P < 0.05$). Apparent retention decreased for DM, energy, Ile, Lys, and Val but increased for P and Trp at 21 d (linear, $P < 0.05$). Supplementation with 500 FTU/kg was determined to be equivalent to approximately 721 mg iP from MSP in broiler diets. Trial 2 used 48, 10-kg pigs in a 28-d trial to assess growth and nutrient absorption. Dietary treatments consisted of a positive control (PC) containing 6.1 and 5.6 g/kg Ca and P, respectively, a negative control (NC)

containing 4.8 and 3.9 g/kg Ca and P, respectively, the NC diet + 0.4, 0.8, and 1.2 g/kg iP from MSP, and NC + 500, 750, and 1,000 FTU/kg ECP. Daily gain improved (linear, $P < 0.05$) with ECP addition, as did apparent digestibility of Ca and P (linear, $P < 0.01$). Supplementation with 500 FTU/kg was determined to be equivalent to approximately 533 mg iP from MSP in grower pig diets. The results of these studies showed ECP to be efficacious in releasing phytate phosphorus, and addition of 500 FTU/kg to be equivalent to between 533 and 721 mg iP from MSP.

Key Words: Broilers, *E. coli* Phytase, Pigs

690 Effect of xylanase and(or) phytase supplementation on amino acid digestibility of grower pigs fed wheat-based diets containing wheat millrun. T. Nortey*[1,2], N. Trottier[3], J. Patience[1], P. Simmins[4], and R. Zijlstra[5], [1]*Prairie Swine Centre*, *Saskatoon, SK, Canada*, [2]*University of Saskatchewan*, *Saskatoon, SK, Canada*, [3]*Michigan State University*, *East Lansing*, [4]*Danisco Animal Nutrition*, *Marlborough, UK*, [5]*University of Alberta*, *Edmonton, AB, Canada*.

Wheat by-products such as millrun might be more readily included in swine diets if nutrients bound by arabinoxylans and phytate were made more available, such as through the use of exogenous enzymes. Effects of millrun inclusion level (L1, 20%; L2, 40%), xylanase supplementation (0 or 4,375 U/kg feed), and (or) phytase supplementation (0 or 500 FTU/kg feed) on amino acid digestibility were investigated in a 2 x 2 x 2 factorial arrangement together with a wheat-based positive-control diet. Diets were formulated to contain 3.34 Mcal DE/kg and 2.8 g apparent digestible Lys/Mcal DE and included 0.4% chromic oxide. Eighteen cannulated pigs (36.2 ± 1.9 kg) were fed three diets at 3 x maintenance in consecutive periods, to provide six observations per diet. Ileal digesta and then fecal samples were collected for 2 d. Millrun inclusion linearly reduced apparent digestibility of Asp, His, Ile, Leu, Lys, Phe, Thr, Tyr, Val ($P < 0.001$) and Phe ($P < 0.05$). Within millrun diets, xylanase supplementation improved digestibility of His, Ile, Leu, Phe, Thr, Tyr and Val ($P < 0.05$), but not Arg ($P > 0.05$). For L2, xylanase improved Lys digestibility by 5.1% from 78.6% to 82.6% ($P < 0.05$) and the latter value was not different from the positive-control diet (86.4%; $P > 0.10$). Phytase supplementation of L1 and L2 diets improved digestibility of Arg, His, Leu, Lys, Phe, Tyr and Val ($P < 0.05$). For Ile and Thr, digestibility was improved solely in L2 ($P < 0.05$). Generally, xylanase and phytase did not interact ($P > 0.10$). In summary, millrun inclusion caused a reduction in AA digestibility that could be partially overcome by xylanase and(or) phytase supplementation. In conclusion, the use of wheat millrun in swine diets can be enhanced by using supplemental xylanase and phytase, which might afford opportunities to reduce feed costs.

Key Words: Wheat Millrun, Xylanase, Pig

691 The effect of wheat variety and enzyme supplementation on pig performance. M. E. E. McCann*[1,2], K. J. McCracken[2], and P. H. Simmins[3], [1]*Agricultural Research Institute of Northern Ireland*, *Hillsborough, Co. Down, Northern Ireland*, [2]*The Queen's University of Belfast*, *Belfast, Northern Ireland*, [3]*Danisco Animal Nutrition*, *Marlborough, Wiltshire, England*.

Although wheat is a major component of many pig diets, it has been reported to be the most variable in terms of chemical composition and nutritive value. This variation arises from a number of factors, including variety. Wheat nutritive value can also be affected by non starch polysaccharide (NSP) content, the presence of the 1B/1R gene and endosperm hardness. The aim of this experiment was to examine the effect of wheat variety, enzyme supplementation, endosperm hardness and the IB/IR gene on the production performance of growing pigs. Six wheat varieties were formulated into 12 diets, differing in wheat variety, with or without supplementation with exogenous enzyme (Porzyme 9100; inclusion rate, 1 g/kg) and offered to a total 120 individually housed crossbred (Large White x Landrace) pigs from 8-12 weeks of age. Liveweight gain (LWG, g/d), dry matter intake (DMI, g/d) and feed conversion ratio (FCR) were determined weekly. There were no significant effects on pig performance as a result of variety, enzyme addition, endosperm hardness or the presence of the IB/IR gene. However, wide ranges in LWG, DMI and FCR were observed for pigs offered the 12 experimental diets (650-772 g/d, 1063-1171 g/d and 1.52-1.72, respectively) which may be important in a commercial situation. The lack of variety and 1B/1R gene effects can be attributed to the lack of difference in chemical composition. The results also indicated that, in contrast to previous research, hard wheat was not more efficiently utilised than soft wheat and that enzyme supplementation did not have any significant effect on pig performance.

Key Words: Wheat, Enzyme, Pigs

692 The effect of enzyme supplementation on energy and crude protein digestibility of wheat distiller's dried grains with solubles in grower-finisher pigs. G. P. Widyaratne*[1,2] and R. T. Zijlstra[3], [1]*Prairie Swine Centre Inc.*, *Saskatoon, SK, Canada*, [2]*University of Saskatchewan*, *Saskatoon, SK, Canada*, [3]*University of Alberta*, *Edmonton, AB, Canada*.

Wheat distiller's dried grains with solubles (DDGS) have a lower energy digestibility than wheat, which is likely due to an increased arabinoxylan content as a result of starch removal during ethanol production. Yet, wheat DDGS had a DE content not different than wheat. The objective of the present study was to study the effect of enzyme supplementation on total-tract energy and crude protein (CP) digestibility of wheat DDGS. Wheat-based diets with or without 40% wheat DDGS were tested with or without supplemented xylanase (4,000 U/kg feed) in a 2 x 2 factorial arrangement using eight 30-kg barrows, according to a repeated Latin square design. Following a 6-day acclimation, feces samples were collected for 2 days. The energy digestibility was 5.7% higher for wheat than wheat DDGS ($P < 0.05$). However, xylanase supplementation did not improve energy digestibility in wheat or wheat DDGS ($P > 0.10$). The DE content was similar in wheat and wheat DDGS, and was not improved by xylanase supplementation ($P > 0.10$). In contrast to the previous study, total-tract CP digestibility did not differ between wheat and wheat DDGS ($P > 0.10$), and xylanase supplementation did not improve CP digestibility of wheat or wheat DDGS ($P > 0.10$). However, the digestible CP content was 15.6% higher for wheat DDGS than wheat ($P < 0.05$), indicating that feeding wheat DDGS causes a high N absorption into the body. In summary, wheat DDGS has a lower energy and similar CP digestibility as wheat, and xylanase supplementation did not improve energy or CP digestibility in either wheat or wheat DDGS ($P > 0.10$). In conclusion, in the specific batch of wheat DDGS used in the present study, arabinoxylans might not be the limitation for energy or CP digestibility or the selected level of xylanase was not proper to increase either energy or CP digestibility.

Key Words: Pig, Enzyme, Digestibility

693 The effect of cereal type and enzyme supplementation on nutrient digestibility, intestinal microflora, volatile fatty acid concentration and manure ammonia emissions from pigs. J. M. O' Connell, T. Sweeney, C. Byrne, J. J. Callan, and J. V. O' Doherty*, *University College Dublin*, *Ireland*.

A 2 x 2 factorial arrangement was used to investigate the interaction between cereal type (wheat vs. barley) and an exogenous enzyme supplement (with or without a glucanase/xylanase mix) on apparent nutrient digestibility, large intestinal microflora, volatile fatty acid (VFA) profile and in vitro manure ammonia emissions from pigs. Urine and faeces were collected over 7 days from 16 boars (four/treatment, 80.0 kg live weight) that were housed in metabolism crates. After collections, the pigs were slaughtered and the contents of the intestinal tracts were removed for analysis. There was an interaction ($P < 0.05$) between cereal type and enzyme inclusion in apparent nutrient digestibility, gut microflora, VFA production and in vitro ammonia emissions. The inclusion of enzyme to barley diets increased DMD, OMD and N digestibility compared to unsupplemented diets, however there was no effect of enzyme inclusion in wheat diets. Pigs offered unsupplemented barley-based diets had higher populations of bifidobacteria in the caecum and colon than enzyme supplemented barley diet, however, there was no effect of enzyme supplementation in wheat-based diets. Pigs offered barley based diets had a significantly reduced acetic acid:

propionic acid ratio in the caecum ($P < 0.001$) and in the colon ($P < 0.001$) compared to wheat based diets. In the absence of an enzyme supplement, barley-based diets reduced the proportion of isovaleric acid ($P < 0.05$) and isobutyric acid ($P < 0.05$) in the caecum and colon and also reduced manure ammonia emissions during storage from 0 to 240 hours ($P < 0.05$) compared to the wheat diet, however there was no effect of cereal type in enzyme supplemented diets. In conclusion, the inclusion of an enzyme to barley-based diets increased nutrient digestibility but also increased ammonia emissions.

Key Words: Pigs, Cereal, Enzyme

694 Effect of a multi-enzyme preparation on the gut morphology of weaning piglets. S. Jakob*[1], J. Wolinski[2], R. Zabielski[2], and D. Laubitz[2], [1]*Adisseo France SAS*, *Commentry, France*, [2]*The Kielanowski Institute of Anim. Physiol. and Nutr. PAS*, *Jablonna, Poland*.

An experiment was conducted to evaluate the influence of a multi-enzyme preparation (Rovabio™ Excel LC; ADISSEO, France; 17 enzymatic activities with main activities being Endo-1.4-β-Xylanase & Endo-1.3(4)-β-Glucanase) on the gut morphology of weaning piglets. At d 28 of age, 12 piglets (9.9 ± 0.7 kg) were divided into two groups consisting of six animals each and assigned to two different treatments: 1) a basal diet based on corn and soybean meal (ME, 13.9 MJ/kg; CP, 17.5%; Lys, 11.5 g/kg) and 2) an experimental diet consisting of the basal diet supplemented with Rovabio™ Excel at a level of 200 mL/t. The piglets were housed individually, fed ad libitum the diets for 3 weeks and were euthanized on d 23. Samples from duodenum, jejunum (proximal, mid, distal) and ileum were taken. Villi length and crypt depth were determined by means of confocal microscopy. Data was analyzed by ANOVA. The enzyme supplementation increased ($P < 0.01$) the crypt depth (+10.6%, +23%, +6.3%, +10.4%, and +8.5% for duodenum, distal-, mid-, proximal-jejunum and ileum, respectively), which indicates an enhanced secretion into the lumen, presumably related to changes of the osmolarity of digesta. The enzyme supplementation mediated the hydrolysis of NSP and therefore increased the appearance of mono- or short oligomeric sugars. This could probably be the main reason for the change in osmolarity. The villi length is increased ($P < 0.01$) in the duodenum (control: 380 ± 98 um; enzyme: 470 ± 105 um) as well as in tendency ($P < 0.08$) in the proximal jejunum (control: 353 ± 82 um; enzyme: 374 ± 53 um). This enlarged the mucosa surface and therefore improved its capacity to absorb nutrients. The effect of the enzyme supplementation on crypt depth as well as on villi length was evident mostly in the proximal parts of the gut, indicating a pronounced action of the enzyme preparation on NSP in the duodenum and proximal jejunum. In conclusion, the supplementation of feed with Rovabio™ Excel influences positively the gut morphology of weaning piglets.

Key Words: Villi Length, Enzyme, Piglet

695 Effect of a multi-enzyme preparation on rheological parameters of liquid feed for pigs. S. Jakob*[1], M. Türk[2], and T. Zenke[2], [1]*Adisseo France SAS*, *Commentry, France*, [2]*ATB Bornim*, *Potsdam, Germany*.

The supplementation of feed for piglets and growing-finishing pigs with a multi-enzyme preparation (Rovabio™ Excel; ADISSEO, France; 17 enzymatic activities with main activities being Endo-1.4-β-Xylanase & Endo-1.3(4)-β-Glucanase) can decrease intestinal viscosity, and increased nutrient digestibilities and animal performance, regardless the dietary raw materials, have been observed. The aim of this in vitro study was to determine whether a supplementation with this multi-enzyme preparation decreases the viscosity of liquid feed. A wheat based meal diet (wheat, 720 g/kg; wheat bran, 47 g/kg; soy bean meal, 175 g/kg; premix, 40 g/kg) was supplemented or not with 50 g/t of Rovabio™ Excel. The two diets were mixed with water (20°C; adjusted to pH 5.2 with lactic acid) to obtain DM contents between 25 and 35%, graded into steps of 1%. A special rotary viscometer was operated with a horseshoe agitator and an internal rotating cylinder for recording mixing- or flow curves, respectively. The mixing curve, expressing the torque (mN m), has been recorded for 90 min. Using the same sample, a flow curve was established by increasing the shear rate (1/s), allowing for calculation of the apparent viscosity (Pa/s). Three curves per treatment were established. Data were analysed using repeated-measures ANOVA and post Scheffe's test. An immediate action of the enzyme was observed, as after 10 minutes, a reduction ($P < 0.01$) of the relative torque of 20% could be measured. After 90 min, the relative torque was reduced ($P < 0.01$) by 30%, indicating a continuing action of the enzyme and showing its stability in liquid feed. Dependent on the shear rate, a total reduction ($P < 0.01$) in apparent viscosity of 40 to 50% was obtained, allowing for savings on costs for pumping, maintenance of pumps and providing feed lowered in viscosity to the pigs. The flow curves show the possibility to increase dry matter contents of 2 to 2.5% without increasing the viscosity when using the enzyme preparation. Thus, reduced quantities of manure are realizable. The supplementation of liquid feed with RovabioTM Excel is influencing positively the rheological properties of liquid feed.

Key Words: Enzyme, Liquid Feeding, Pig

696 Evaluation of cellulolytic enzyme supplementation on production indices of poultry fed soyabean hull meal based diets. B. O. Esonu*[1], R. O. Izukanne[1], and O. A. Inyang[2], [1]*Federal University of Techology*, *Owerri, Imo State, Nigeria.*, [2]*Michael Okpara College of Agriculture*, *Umuagwo, Imo State, Nigeria*.

Two experiments were conducted to evaluate cellulolytic enzyme supplementation on the production indices of broilers and laying hens fed soybean hull meal based diets. In the first experiment, five broiler finisher diets were formulated to contain soybean hull meal at 0%, 10%, and 20% (without enzyme supplementation) and 10% and 20% (with 1.0% enzyme supplementation). Each diet was fed to 72, 4-week old broiler chicks for 28 days. There were significant differences ($P < 0.05$) in feed intake, feed cost/kg weight gain and feed conversion ratio among the groups. The birds on control diet (0% soybean hull meal without enzyme supplementation) performed significantly better ($P < 0.05$) than the other groups. In the second experiment, seven experimental layer diets were formulated to incorporate soybean hull meal at 0%, 10%, 20%, and 30% (without enzyme supplementation) and 10%, 20% and 30% (with 2% enzyme supplementation). Each diet was fed to 60 laying birds for 90 days. There were significant differences ($P < 0.05$) in feed intake, feed conversion ratio, egg weight, Haugh unit, hen-day production, feed cost/dozen eggs, digestibility of crude protein and crude fibre among the groups. However, there were no significant differences ($P > 0.05$) among the groups in egg yolk colour, shell thickness albumen and yolk indices and digestibility of dry matter. The results of these experiments suggest that 1.0% and 2.0% cellulolytic enzyme supplementation at 20% and 30% dietary levels of soybean hull meal for broiler and layer diets, respectively, could not significantly affect ($P > 0.05$) the performance indices of broilers and laying hens.

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Key Words: Cellulolytic Enzyme, Soybean Hull Meal, Broilers and Laying Hens