

Nonruminant Nutrition: Weanling Pig - Energy & Protein

M86 The interaction between cereal source and lactose level on piglet growth performance post weaning. J. M. O'Connell*, J. J. Callan, and J. V. O' Doherty, *Department of Animal Science and Production, University College, Dublin, Ireland.*

Both barley and wheat contain anti-nutritive factors such as β -glucans and xylans, respectively. However, β -glucans have been shown to promote lactic acid bacteria in the large intestine and this would be very beneficial in the absence of in-feed antimicrobial growth promoter. A 2 x 2 factorial was used to investigate the interaction between cereal type (wheat vs. barley) and lactose inclusion (108 vs. 216 g/kg) on piglet performance post weaning. Two hundred weaned piglets (24 d of age; 6.0 kg weight) were blocked on the basis of weight and were assigned to one of four treatments. The treatments were as follows: (1) 150 g/kg lactofeed 70 (LF70); 840 g whey permeate and 160 g soybean meal/kg; Volac Feeds Ltd, U.K.) and barley, (2) 150 g/kg LF70 and wheat, (3) 300 g/kg LF70 and barley, and (4) 300 g/kg LF70 and wheat. The diets were formulated to have identical digestible energy (3.82 Mcal/kg) and total lysine (16 g/kg). The pigs were offered the diets *ad libitum* for 33 d post weaning. Pigs offered 300 g/kg LF70 had a higher ADFI than the pigs offered 150 g/kg LF70 in the diet (0.489 vs. 0.424 kg/d; SEM, 0.014; $P < 0.01$). The inclusion of 300 g/kg LF70 resulted in a deterioration in food conversion ratio (FCR; 1.29 vs. 1.15 kg/kg; SEM, 0.05; $P < 0.05$) compared to the 150 g/kg LF70 inclusions. Cereal source had no effect on ADFI or FCR. There was a significant interaction ($P < 0.05$) between cereal source and lactose levels in ADG and final live weight. In wheat-based diets, the inclusion of 300 g/kg LF70 increased ADG and final live weight compared to 150 g/kg inclusions. However, in barley-based diets, the inclusion of 300 g/kg LF70 had no effect on ADG or final live weight. In conclusion, the inclusion of 300 g/kg LF70 increased ADFI compared to 150 g/kg LF70. However, higher lactose inclusion is more beneficial in wheat-based diets than in barley-based diets.

Key Words: Pigs, Lactose, Cereal

M87 Performance and nutrient digestibility of low tannin sorghum fed to pigs from 10 to 30 kg. E. T. Fialho*, P. B. Rodrigues, J. A. F. Lima, H. O. Silva, and V. Oliveira, *University Federal of Lavras - UFLA- BRAZIL.*

Two experiments were conducted to determine the effect of corn substitution by low tannin (LT) sorghum on pig performance from 10 to 30 kg BW. In a metabolism assay, nitrogen retention, digestibility of CP (DCCP), DE and ME of diets with sorghum substitution at 0, 33, 66 and 100% for corn. The metabolism assay was carried out in two periods by using 24 pigs (Landrace x Large White; 12.5 \pm 0.7 kg BW). A 7 d period for adaptation and 5 d period for total collection of feces and urine with ferric oxide (2%) as the indigestible marker was used. In the performance assay, 96 pigs (Landrace x Large White; 9.4 \pm 0.86 kg BW) weaned at 35 days were assigned to six replicates of the same four treatments as described for the metabolism assay. The experimental period was 30 days. The data revealed no effects ($P > 0.10$) over all treatments tested for nitrogen retention (21.20% for the diet with 100% corn as the cereal vs 19.07% for diet with 100% sorghum as the cereal), DCCP (85.00% for diet with 100% corn vs 85.80% for diet with 100% sorghum), DE (3821 Kcal/kg DM for diet with 100% corn vs 3793 Kcal/kg DM for diet with 100% sorghum) and ME (3619 Kcal/kg DM for diet with 100% corn vs 3670 Kcal/kg DM for diet with 100% sorghum). The data of feed intake (1.21 kg/d for 100% corn vs 1.25 kg/d for 100% sorghum), ADG (0.648 kg for 100% corn vs 0.620 for 100% sorghum) and feed:gain (1.86 for 100% corn vs 2.02 for 100% sorghum) also revealed no differences ($P > 0.10$) among all diets tested. Corn can be replaced by LT-sorghum up to level of 100% in pig diets from 10 to 30 kg BW with no influence on nutrient digestibility or pig performance.

Key Words: Pigs, Sorghum, Performance

M88 Effect of different sources and levels of lipids on the performance of pigs postweaning. M. E. Pimenta², J. A. Lima^{*1}, E. T. Fialho¹, P. Logato¹, and L. D. Murgas¹, ¹University Federal of Lavras - UFLA-Brazil, ²Universidade de Alfenas- UNIFENAS-Brazil.

A total of 144 crossbred piglets (72 barrows and 72 gilts; initial BW 6.90 \pm 1.32 kg) were utilized at 28 days of age to determine the effect of the addition of two sources of lipids (soybean oil and coconut oil) at different levels (2, 4, 6 and 8%) on postweaning performance. A 2 x 4 factorial arrangement of treatments (sources and levels of oils) plus an additional treatment (control diet without lipids addition). The experimental diets were isocaloric, isoprotein and isolysine, formulated based on corn, soybean meal, skimmed milk powder and fish meal supplemented with minerals, vitamins and lysine. There were no interactions between sources and levels of oil tested ($P > 0.05$) for any of the performance parameters. Also, no differences were shown ($P > 0.05$) in the ADG or feed/gain of pigs fed diets supplemented with soybean oil (ranging from 0.450 - 0.470 and 1.42 - 1.65) or coconut oil (ranging from 0.400 - 0.486 and 1.57 to 1.64) at the different levels tested. Comparing the performance of pigs fed diets with 2, 4, 6, 8% soybean oil and coconut oil with the control diet (without lipid addition), it was observed higher ($P < 0.01$) daily feed intake and poorer ($P < 0.01$) feed:gain when lipid was not added to the diet. The addition of lipids in the postweaning diets is a viable option due to better pig performance.

Key Words: Pigs, Coconut Oil, Soybean Oil

M89 Piglets at weaning or three weeks post-weaning prefer rice to sorghum. D. Solà-Oriol¹, E. Roura^{*2}, and D. Torrallardona¹, ¹IRTA, Centre de Mas Bové Apartat 415, Reus, Spain, ²Lucta SA Montornés del Vallés, Barcelona, Spain.

Palatability of feed ingredients may affect voluntary feed intake particularly when sudden dietary changes such as occur after weaning. The aim of the trial was to design an experimental model to establish feed ingredient preferences. A double choice test was performed between broken rice and sorghum at different inclusion levels in the diet (25, 50 and 100%) at two different piglet ages, 28 and 48 days (12 pens each). For each age group the pigs were distributed into four blocks of initial body weight. The diets were offered *ad libitum*, in mash form and feed intake measured over an 8d period for the 25 and 50% inclusion levels and over a 6d period for the 100% inclusion level. The preference of sorghum relative to rice was calculated as the percentage contribution of the sorghum diet to total feed intake. Preference values were analysed as a complete block design with four blocks and six treatments (2 ages by 3 levels of inclusion). Treatment effect comprised the components age, inclusion level and their interaction. ANOVA was performed using the GLM procedure of the statistical package SAS. The average preference for each of the treatments was compared to a neutral value of 50% using a Student's t test. With the newly weaned pigs, the preferences for sorghum (relative to rice) at 25, 50 and 100% inclusions were 45.8, 22.7 and 27.3 % respectively. The adverse preference observed for the 50% inclusion level was significantly different to the neutral value ($P < 0.01$). In the post-weaned pigs, the preferences for sorghum (relative to rice) at 25, 50 and 100% inclusions were 12.4, 19.7 and 29.9 % respectively. The preference values were significantly different to 50 ($P < 0.01$) for the 25 and 50% inclusion levels. No statistically significant effects were observed for animal age, inclusion level of the ingredients or their interaction. In conclusion, pigs prefer rice to sorghum and this preference is not dependent on animal age or the inclusion level in the diet.

Key Words: Palatability, Rice, Sorghum

M90 Enzyme supplementation of piglets fed diets containing barley, wheat, and corn. J. Sánchez¹, A. Fuentetaja², J. C. González¹, J. Peinado¹, and M. I. Gracia^{*1}, ¹Imasde Agropecuaria, S.L. Spain, ²Copese, S.A. Spain.

A study evaluated the efficacy of a feed additive enzyme (Amylofeed, EC No 34) containing 275 U/g of endo-1,3(4)- β -glucanase (EC 3.2.1.6), 400 U/g of endo-1-4- β -xylanase (EC 3.2.1.8), and 3,100 U/g of α -amylase (EC 3.2.1.1) on performance of piglets from weaning at 28 d to 60 d of age. Five hundred and twenty eight crossbred piglets (Duroc x Large

White*Landrace, half of each sex), weighing 7.36 ± 1.29 kg, were allocated randomly to 16 replicates of 33 piglets each. A completely randomized design was applied using two experimental treatments: 1) basal diet (control), 2) basal diet with 500 mg enzyme/kg feed, the recommended dose. The experimental design was applied in both the prestarter (28 to 44 d of age) and the starter (44 to 60 d of age) periods. Diets were based on barley, wheat and corn, and had 2.4 Mcal NE/kg and 14.8 g/kg lysine for prestarter, and 2.4 Mcal NE/kg and 13.3 g/kg lysine for starter. Data were analyzed as a completely randomized design with dietary treatment and sex as main effects and weaning weight as a covariate. General performance in the post weaning period was good. There were no significant differences between treatments with regard to feed consumption, growth, mortality or piglet cleanliness. But, for the overall period (28 to 60 d of age), piglets supplemented with the enzyme had better feed conversion ratio than control animals (1.18 vs 1.32 g feed/g gain; $P=0.01$). It was concluded that the addition of the enzyme to piglet diets improved feed efficiency from weaning until 60 d of age.

Key Words: Glucanase, Xylanase, Amylase, Enzyme, Piglets

M91 Technical feasibility of processed corn and soybeans in diets of piglets from 21 to 56 days of age. P. A. Castelo Branco, J. A. Lima, E. T. Fialho*, P. V. R. Logato, and R. T. Freitas, *University Federal of Lavras - UFLA-Brazil*.

Two experiments were carried out to evaluate the use of two corn types (common corn - C1 and pre-jellied flour of corn [higher temperature starch extrusion] - C2) and two soybean types (soybean meal - S1 and micronized soybean - S2) and their combinations in diets of post-weaning pigs from 21-56 days. The performance, relative weight of the digestive organs, and duodenum and jejunum villi height and crypt depth were evaluated. A total of 112 pigs (56 barrows and 56 gilts; mean initial BW of 7.2 ± 0.8 kg) weaned at 21 days were utilized in a 2×2 factorial design with seven replicates and four pigs per replicate pen. There was no interaction among types of corn or soybean on the performance (ADG, ADFI and feed conversion). The relative weight of the liver and large intestine of piglets at 33 days of age was influenced ($P<0.05$) for the two soybean types, being the highest for those fed soybean meal and the smallest when the micronized soybean was utilized. The relative weight of the stomach was influenced by the two corn and soybean types ($P<0.05$), being the highest weight observed for the C1+S1 combination (0.912 g) and the lowest for the C2+S2 combination (0.744 g). The treatment mixtures of C1+S2 (414.6) or C2+S2 (428.7) shown higher villi height and lower (122.2 and 152.6) crypt depths ($P<0.05$) respectively. According to the results it is technically feasible to utilize the pre-jellied flour of corn and the micronized soybean in diets since they provide gut health improvements in piglets from 21 to 56 days old. The economic viability should be considered at the current market feed prices.

Key Words: Feeds, Performance, Soybean

M92 Efficacy of a vegetable-based peptide product as a replacement for plasma protein in nursery pig diets. E. C. Halbrook*¹, C. V. Maxwell¹, M. E. Davis¹, Z. B. Johnson¹, D. C. Brown¹, R. Dvorak², and R. Musser³, ¹University of Arkansas, Fayetteville, ²Alltech Inc., Nicholasville, KY, ³Hubbard Feeds, Mankato, MN.

A total of 216 pigs were fed one of three dietary treatments to evaluate the efficacy of feeding a vegetable-based peptide product (NuPro#8482) as an alternative to plasma protein in nursery pig diets. Pigs were sorted by weight, and divided into three weight blocks. Pigs within each block were allotted into equal subgroups (six pigs/pen) with equal distribution of sex and litter. Four treatments were randomly assigned to pens within each weight block (9 pens/treatment). Three dietary treatments were fed from d 0 to 7 after weaning (Phase 1) and d 7 to 21 after weaning (Phase 2) and were comprised of: 1) a basal diet consisting of a complex nursery diet containing spray dried plasma protein devoid of NuPro, 2) the basal diet with 50% of the plasma protein replaced by NuPro, and 3) the basal diet with 100% of the plasma protein replaced by NuPro. During Phase 3 (d 21 to 42 after weaning), a common diet was fed to groups previously receiving treatments 1 and 2. One half of the pigs previously fed treatment 3 (100% replacement level of NuPro) were fed the common diet received by the treatment groups 1 and 2; while the other half were fed a diet containing 1.3% NuPro during the first week of Phase 3 (d 21 to 28), followed by the common diet for the

remainder of the phase (d 28 to 42). During Phases 1 and 2, no significant differences were observed among the four dietary treatments with regard to ADG, ADFI, or G:F, regardless of level of NuPro replacement for plasma protein. During the first week of Phase 3, pigs previously fed the basal diet containing plasma protein and fed NuPro at the 50% replacement level tended to have lower ($P = 0.07$) ADFI than pigs previously fed NuPro at the 100% replacement level and pigs fed NuPro at 1.3% of the diet during the first week of Phase 3. This study indicates that NuPro maybe used as an alternative to spray-dried plasma protein in nursery pig diets without detrimental effects on growth performance.

Key Words: Growth, Protein, Swine

M93 Effect of reduced protein in weaning pig diets. M. G. Zangeronimo, E. T. Fialho*, J. A. F. Lima, P. B. Rodrigues, and L. D. S. Murgas, *University Federal of Lavras-UFLA-BRAZIL*.

In order to evaluate the effect of a reduction of the CP content in diets of weaning piglets formulated on an ideal protein concept, a metabolism assay (1), an organs characteristics weight (2) and a performance assay (3) were conducted. In Assay 1, eight barrows (LD x LW; 12 ± 2.4 kg initial BW) were utilized to evaluate four treatments with pig as the experimental unit. In Assay 2, 60 weaning pigs (8.6 ± 0.8 kg initial BW) were utilized with a factorial scheme of the 4 dietary treatments and 3 slaughter periods resulting in five replications (each pig served as an experimental unit). In Assay 3, a total of 60 weaning pigs (8.0 ± 0.7 kg initial BW) were utilized to evaluate four dietary treatments; a total of five replicate pens of three pigs each with pen as the experimental unit resulted. For all assays the dietary treatments were formulated to contain different levels of CP, being one control (21% CP, 3400 Kcal DE/kg) diet and the others with reduced levels of CP (19.5; 18.0 and 16.5%) with all diets corrected by crystalline AA (lysine, methionine and threonine) according to NRC (1998). The digestibility of dry matter (DDM); N retention (NR); liver, spleen and pancreas weight; the duodenum villi height and crypt depth; pH of the stomach and cecum contents; and pig performance were analyzed. It was found that the treatments did not influence ($P>0.05$) any of the parameters studied, except for the crypt depth in first week postweaning ($P<0.05$) for those pigs fed diet with 18.0% CP. The ADG (kg) and feed conversion were 0.378 and 1.90 for control (21% CP); 0.393 and 1.97 for the 19.5% CP; 0.452 and 1.88 for 18.0% CP and 0.420 and 1.83 for 16.5% CP, respectively. In conclusion it is technically feasible to reduce the CP in the diets for weaning pigs if the essential AA are kept at similar levels. The environmental impact should be reduced by using lower levels of CP in the diets.

Key Words: Performance, Environmental, Lysine

M94 Effects of feeding rice protein concentrate on growth performance and ileal digestibility in early weaned pigs. C. Byung-Jo*, Y. Jung-Ho, Y. Ji-Soon, C. Jae-Yong, K. Jae-Young, and L. Jayant, *Kangwon National University, Chunchon, South Korea*.

These experiments were conducted to evaluate the feeding value of rice protein concentrate (RPC) in weaning pigs. In Exp. 1, a 5-week feeding trial was conducted with a total of 126 pigs (LYD; 21 d-old; 5.32 ± 0.34 kg). Treatments were spray-dried plasma protein (SDPP; control), soy protein concentrate (SPC) and RPC (Phase 1), and dried porcine soluble (DPS; control), SPC and RPC (Phase 2). An ileal digestibility trial was also conducted to compare digestibility of amino acids in the tested protein sources. In Exp. 2, a total of 160 weaning pigs (LYD; 21 d-old; 5.65 ± 0.35 kg) were used in a 5-week feeding trial to determine the optimal inclusion level of SPC in the diet. Treatments were control (9% SPC), and three levels of RPC instead of SPC in the diet (3, 6 and 9%). During Phase 1, pigs fed SDPP had better ($P<0.05$) ADG and FCR (308 g, 1.29, respectively) compared to those fed SPC (263 g, 1.49) or RPC (266 g, 1.51), while there was no difference in ADFI among treatments. During Phase 2, however, pigs fed DPS had lower ($P<0.05$) ADG (350 g) than those fed SPC (436 g) or RPC (434 g). The apparent ileal digestibilities of His, Lys, Phe, Thr, and Met were not different among the tested protein sources. In Exp. 2, there were no significant differences in ADG and FCR when SPC was substituted with RPC up to 9% during the total period. In conclusion, based on our

experimental results, RPC can replace SPC in the complex prestarter diet.

Key Words: Rice Protein Concentrate, Soy Protein Concentrate, Growth

M95 Effect of RPC (rice protein concentration) as a substitute for protein sources in weaning pigs. O. S. Kwon^{*1}, B. J. Min¹, K. S. Son¹, J. H. Cho¹, J. D. Kim², I. H. Kim¹, S. H. Ahn³, and H. S. Ahn³, ¹Dankook University, Cheonan, Korea, ²CJ Feed Co. Ltd., Korea, ³EUNJIN International Co. Ltd., Korea.

A total of 120 pigs (LYD, 7.79 kg average initial BW) were used in a 28-d growth assay to determine the effect of RPC (Rice Protein Concentration) as a substitute for protein sources on growth performance and nutrient and amino acid digestibility in weaning pigs. Dietary treatments (Trt) included: 1) A (basal diet; Control), 2) B (replaced protein source with 3% RPC), 3) C (replaced protein source with 4.5% RPC) and 4) D (replaced protein source with 6% RPC). Through entire experimental period, pigs fed diet containing 3% RPC tended to have increased ADG compared to pigs fed diet containing 4.5% RPC ($P < 0.05$). However, there were no differences in ADFI and G/F among the treatments ($P > 0.05$). Although there was no difference in blood urea nitrogen (BUN) among all treatments ($P < 0.05$), pigs fed the basal diet were numerically higher than other treatments. Nitrogen digestibility in Trt D tended to be higher than Trts A and C ($P < 0.05$). The apparent digestibility of asparagic acid tended to be higher for Trt D compared to other treatments ($P < 0.05$). However, there were no differences in other amino acids among the treatments ($P > 0.05$). In conclusion, the results obtained from this feeding trial suggest that dietary RPC for weaning pigs can be utilized as a substitute for protein sources.

Key Words: Rice Protein Concentration, Digestibility, Pigs

M96 Influence of a soy protein hydrolysate on the productive performance of early weaned pigs under an enterotoxigenic E. coli (ETEC) colibacillosis or under a healthy status. G. Ferrini¹, E. Borda², D. Martinez-Puig^{*2}, E. Garcia-Manzanilla¹, S. Martin-Orue¹, and J. Perez¹, ¹Universitat Autònoma de Barcelona Spain, ²BIOIBERICA Spain.

There are numerous reports that suggest an association between some protein sources (as soya) and the incidence of diarrhea in early weaning piglets. The mechanisms proposed are a likely hypersensitivity reaction, and/or a disbiosis promoted by the fermentation of undigested carbohydrates or proteins. We studied the effect of three prestarter diets (CP 193 g/kg, Lys 13.7g/kg) on the productive results of 192 early weaned (21d) piglets: 96 under an ETEC colibacillosis (Experiment 1) and 96 under a healthy status (Experiment 2). Diets contained soybean ingredients: SBM (extruded soybean meal 28.9 g/kg, and soybean meal, 107.8 g/kg), SPC (a soy protein concentrate, 92.3 g/kg), or SPH (a soy protein hydrolysate, 100 g/kg). Chromium oxide was used as internal marker for digestibility measurements. Animals were placed in 32 replicates (4 animals/replicate). During Experiment 1, an ETEC colibacillosis was clinically diagnosed on d 6 after weaning. Although scours were evident in all groups on d 7, most of the piglets fed SPH and SPC recovered after antibiotic therapy on d 9, whereas those fed SBM continued having severe diarrhea. Mortality was higher with SBM (18.7%), than SPC (9.37%) and SPH (3.1%). In Experiment 2, a higher digestibility of OM was found for the SPH (87.8%) than SPC (86.6%) and SBM (84.8%; $P < 0.05$). Nitrogen digestibility was also higher for SPH (83.4%) than SPC (81.2%) and SBM (79.1%; $P = 0.11$). During the second week after weaning, the ADG of the pigs fed SPH (247 g/d) and SBM (244 g/d) were higher ($P < 0.05$) than that of the pigs fed SPC (228 g/d). The overall results suggest that the hydrolysis of soy protein improves the health and productive performance of early-weaned piglets under healthy and unhealthy environment conditions. In conclusion, SPH appears to be an excellent protein source for the early-weaned pigs.

Key Words: Soybean, Protein, Piglets

M97 Liquid diets containing vegetable proteins accelerate piglet growth above milk-protein-based diets. A. Ebert¹, A. S. Berman¹, R. H. Harrell², S. G. Cornelius¹, and J. Odle^{*1}, ¹North Carolina State University, Raleigh, ²Milk Specialties Co, Dundee, IL.

Technologies to rear suckling piglets apart from the sow recently have been implemented on large commercial farms, and success has been measured in both accelerated growth and in reduced pre-weaning mortality. However, diets formulated with cow-milk proteins can be cost-prohibitive. This experiment compared the replacement of whey protein (WHEY) with isolated soy protein (ISP), a hydrolyzed vegetable-protein mixture (HYDROL) or the latter in 50% combination with whey protein (WHEY/HYDROL) in liquid diets fed to neonatal pigs from two to 19 d of age. Pigs were housed individually in an environmentally controlled room and were offered the liquid diets ad libitum via a gravity-flow feeding device. On d 19, pigs fed the vegetable-protein diets weighed 20% more ($8,179 \pm 211$ g; $P < 0.05$) than pigs fed the WHEY diet ($6,805 \pm 244$ g). The ADG was 35% higher for pigs fed the HYDROL diet than for pigs fed the WHEY diet, and ADFI was greater for WHEY/HYDROL and HYDROL diets compared to the WHEY diet ($P < 0.05$). Overall, pigs fed the HYDROL diet had a 16% higher G/F than pigs fed the WHEY diet. Although the apparent ileal digestibilities of most amino acids were 7-10% greater for the WHEY diet, digestible amino acid intakes were about 20% greater for HYDROL and ISP diets. Carcasses of pigs fed the WHEY diet contained a higher percentage of fat and ash and a lower percentage and accretion of protein. These results are likely related to a poorer balance of amino acids (especially arginine) in the WHEY diet. Leucine aminopeptidase activity in the distal small intestine was up to 58% greater in pigs fed the WHEY/HYDROL diet than in those fed the ISP diet. Similarly, villus height ($P < 0.02$) and area ($P < 0.006$) along the small intestine were greater in pigs fed the WHEY/HYDROL diet than in those fed ISP. Collectively, these data support the conclusion that both the hydrolyzed vegetable protein and isolated soy protein are good alternatives to whey protein in liquid diets formulated for neonatal pigs and that an appropriate balance of amino acids is more important than the source of protein per se.

Key Words: Protein, Liquid Feeding, Amino Acid Digestibility

M98 Interaction between threonine and avilamycin on piglet growth performance post weaning. J. M. O'Connell^{*}, J. J. Callan, and J. V. O' Doherty, Department of Animal Science and Production, University College, Dublin, Ireland.

The amino acid Threonine (Thr) is involved in the synthesis of intestinal mucin, which plays a key role in the innate immune defence of the mucosa. Synthesis and secretion of mucin is greatest when gut inflammation is high such as at weaning. The requirement for dietary threonine may be increased in the absence of in-feed antimicrobial growth promoters (AGP). A 3 x 2 factorial was used to investigate the interaction between Thr level [55, 65 and 75% of lysine (lys)] and AGP (0 or 60 ppm avilamycin) on piglet performance post weaning. Three hundred and sixty weaned piglets (24 d of age; 5.9 kg live weight) were blocked on the basis of weight and were assigned to one of six treatments. The treatments were as follows: (1) Thr:Lys ratio of 55% and avilamycin (300 ppm Maxus, Elanco Animal Health Ltd., USA), (2) Thr:Lys ratio of 55% and no avilamycin, (3) Thr:Lys ratio of 65% and avilamycin, (4) Thr:Lys ratio of 65% and no avilamycin, (5) Thr:Lys ratio of 75% and avilamycin, and (6) Thr:Lys ratio of 65% and no avilamycin. The diets were formulated to have identical digestible energy (3.82 Mcal/kg) and total lysine (16 g/kg). The pigs were offered the diets ad libitum for 28 days post weaning. There was no interaction between Thr and avilamycin ($P > 0.05$) in any variable measured. The inclusion of avilamycin in the diet had no effect on feed intake (FI; 0.546 vs. 0.552 kg/d; SEM, 0.009), ADG (0.402 vs. 0.405 kg/d; SEM, 0.007), food conversion ratio (FCR; 1.36 vs. 1.37 kg/kg; SEM, 0.02) or final liveweight (17.2 vs. 17.3 kg; SEM, 0.2). Thr:Lys ratio had no effect on FI (0.545 vs. 0.550 vs. 0.552 kg/d; SEM, 0.010), ADG (0.399 vs. 0.411 vs. 402 kg/d; SEM, 0.008), FCR (1.37 vs. 1.34 vs. 1.38 kg/kg; SEM, 0.02) or final liveweight (17.1 vs. 17.5 vs. 17.2 kg; SEM, 0.3). In conclusion, optimum piglet performance was obtained at a Thr:Lys ratio of 55% and there was no advantage to avilamycin inclusion in the diet under current conditions.

Key Words: Pigs, Threonine, Avilamycin

M99 Developmental regulation of fructose and amino acid transporter gene expression in the small intestine of pigs. X. Xiao*, E. A. Wong, and K. E. Webb, Jr., *Department of Animal and Poultry Sciences, Virginia Polytechnic Institute and State University, Blacksburg.*

To evaluate the developmental regulation of nutrient transporter gene expression in the small intestine, piglets from each of seven sows were killed at birth (d 0), during lactation (d 1, 3, 7, 14, and 21) and post-weaning (d 22, 24, 28, and 35; weaned at d 21). Intestinal segments (duodenum, jejunum, and ileum) were collected for RNA isolation. The abundance of mRNA was determined by Northern blotting using probes specific for transporters of fructose (GLUT5), neutral amino acids (LAT2) and cationic amino acids [$b^{0,+}$ AT, ATB(0)]. During lactation, there was an interaction ($P < 0.01$) between time and segments for abundance of GLUT5 mRNA. Abundance of GLUT5 mRNA generally increased from d 1 to 7 and subsequently declined to d 14 in the jejunum and ileum. In duodenal tissue, abundance decreased from d 0 to

3 and then increased to d 21. Abundance of LAT2 mRNA declined ($P < 0.001$) linearly from d 0 to 21. The LAT2 mRNA was predominantly distributed in the ileum ($P < 0.05$). Abundance of $b^{0,+}$ AT mRNA changed quadratically ($P < 0.001$) from d 0 to 21. Abundance of $b^{0,+}$ AT mRNA was greater ($P < 0.05$) in the ileum and jejunum than the duodenum. There was an interaction ($P < 0.001$) between time and segments in abundance of ATB(0) mRNA. Abundance generally increased from d 0 to 21 in the duodenum and ileum with the change in the ileum being greater. In the jejunum, abundance increased from d 0 to 7 and then decreased to d 21. During post-weaning, mRNA abundance of all transporters dramatically increased from d 21 to 22 or 24 and then rapidly decreased to d 24 or 28. Subsequent changes varied with transporter and intestinal segment. In conclusion, gene expression of these four nutrient transporters is not only differentially regulated by age but also differentially distributed among intestinal segments.

Key Words: Pig, Intestine, Amino Acid Transporter

Nonruminant Nutrition: Weanling Pigs - Additives

M100 Evaluation of organic acid blends and antibiotics for promoting growth of young pigs. D. W. Giesting*¹, M. J. Pettitt², and E. Beltranena^{2,3}, ¹*Cargill Animal Nutrition, Minnetonka, MN*, ²*Prairie Swine Centre, Inc., Saskatoon, SK, Canada*, ³*Provincial Department of Agriculture-Alberta, Edmonton, AB, Canada*.

Two, 5-wk, post-weaning growth experiments were conducted to evaluate the effects of blended organic acids (OA) alone or in combination with antibiotics on young pig performance. In the initial study, two acidifier blends were each included at 0.4% to starter diets alone, or in combination with LS20 antibiotic (22 mg/kg each lincomycin+spectinomycin). In the first 2-wk phase, each additive treatment improved gain (ADG) and feed conversion (F/G) v. negative controls ($P < .05$). ADG was 141, 178, 185, 187, 183 and 175 g/d for pigs fed the negative control (NEG), OA Blend A, Blend B, LS20, Blend A+LS20 and Blend B+LS20, respectively. F/G was improved ($P < .05$) for each of the OA, LS20 or OA+LS20 treatments. F/G was 1.80, 1.49, 1.45, 1.50, 1.37 and 1.42, for the treatments, ordered as above. Differences were not significant in the subsequent 3-wk period ($P > .10$). In experiment 1, OA blends improved performance similarly to LS20. In the second experiment, pigs were fed OAs (Blend C or Blend D), at 0.3% inclusion rate, ASP250 (110 mg/kg each of chlortetracycline and sulfamethazine, 55 mg/kg penicillin) or ASP250+Blend C. Pigs fed Blend C had 10% higher ADG (164 g/d) v. negative controls (148) ($P > .10$); pigs fed Blend D gained 17% faster (175) v. controls ($P < .10$). ASP250 improved ADG 33% (199) ($P < .05$). ASP250+Blend C improved ADG 61% (238) ($P < .05$). F/G was 1.38, 1.29, 1.33, 1.27 and 1.16 for negative control, ASP250, Blend C, Blend D and Blend C+ASP250, respectively. Only the combination of the OA blend and antibiotic improved ($P < .05$) F/G significantly. In period 2, gain was increased 6% by either blend ($P < .10$), 17% by ASP250 ($P < .05$) and 20% by ASP250+Blend C ($P < .05$). In this study, the antibiotic produced a stronger response than the OA blends, but an additive benefit was noted when the additives were used together. In these two experiments, OA blends improved ADG and F/G and enhanced the effects of antibiotics in promoting improved performance.

Key Words: Growth, Organic Acids, Antibiotics

M101 Interaction between lactose, avilamycin and inulin on piglet growth performance and nutrient digestibility post-weaning. K. M. Pierce*¹, J. J. Callan¹, P. McCarthy², and J. V. O'Doherty¹, ¹*University College Dublin, Ireland*, ²*Volac International Ltd, UK*.

One hundred and eighty piglets (24 d, 6.0 kg BW) were used to investigate interactions between lactose, avilamycin and inulin on growth performance and nutrient digestibility in post weaned piglets. The piglets were blocked on the basis of live weight and within each block assigned to one of six dietary treatments (6 pens/trt with 5 pigs/pen). The piglets were offered diets containing either a low (175 g/kg) lactofeed (LF70; 860 g/kg whey permeate, 140 g/kg soy bean meal; Volac International, UK) (LLF) or high (350 g/kg) LF70 (HLF) level with one of the following feed additives (FA) 1) 0 supplementation 2) 60 ppm avilamycin (Maxus, Elanco Animal Health, USA) (M) or 3) 15 g/kg inulin (I) in a

3 x 2 factorial arrangement. The starter diets were fed for 21 days and all diets contained chromic oxide at 150 ppm. There was an interaction ($P < 0.05$) between LF70 and FA in daily gain (ADG) between d 0-21. The pigs receiving HLF had a higher overall ADG compared to pigs receiving LLF at 0 supplementation (368 vs 281 g/d). However, there was no difference between the LLF and the HLF when the diets were supplemented with either M or I. Inulin improved feed efficiency ($P < 0.05$) between d 0-7 compared to Maxus or 0 supplementation (1.69 vs 2.50 vs 2.35 SEM 0.250). There was an interaction between LF70 and FA in fecal organic matter (OMD) and nitrogen (ND) digestibility ($P < 0.05$). The HLF and the HLF+M treatments improved OMD (89.02 and 89.32 %) compared to the LLF and LLF+M (87.44 and 87.61 %). However, there was no difference between LLF and HLF when the diet was supplemented with I (89.31 vs 88.49 % SEM 0.49). The HLF+I resulted in a reduced ($P < 0.05$) ND compared with the LLF+I. However, there was no difference between the LLF and the HLF when the diets received 0 or M supplementation. In conclusion, HLF improved ADG compared to LLF. Inulin inclusion improved FCR in the first week postweaning. The inclusion of inulin improved the OMD of diets low in LF70.

Key Words: Pigs, Lactose, Inulin, Avilamycin

M102 Effects of probiotic supplementation on gut histometry and fecal microflora in weaned pigs. V. Bontempo*¹, A. Di Giancamillo¹, C. Domeneghini¹, M. Fava¹, C. Bersani¹, R. Paratte¹, E. Chevauux², V. Dell'Orto¹, and G. Savoini¹, ¹*Department of Veterinary Sciences and Technologies for Food Safety, University of Milan, Italy*, ²*Allemand Animal Nutrition, Blagnac, France*.

Two hundred weanling piglets averaging 25 d of age and 5.0 ± 0.5 kg initial BW were assigned to two dietary treatments to determine the effects of supplementation with *Pediococcus acidilactici* on growth, gut histometry and fecal microbiota. Piglets were fed one of two liquid dietary treatments for 42 d after weaning: 1) Control (C), and 2) Control diet + *P. acidilactici* (1×10^{10} cfu/g) (P). Piglets were weighed and fecal samples from 16 homogeneous piglets (8 per group) were collected at 0, 14 and 42 d. These piglets were sacrificed for histology and histometry at the end of the experiment. No significant difference in growth was observed within the groups. Diet affected gut histometry of the P animals: histometrical analysis revealed an increase in villi height (C: 300 μ m; P: 327 μ m; SE: 7.52; $P < .01$) and crypt depth (C: 247 μ m; P: 287 μ m; SE: 10.31; $P < .01$) of the ileum, as well as in an increase of the cecum crypt depth (C: 387 μ m; P: 423 μ m; SE: 13.07; $P < .05$). A thicker mucous gel layer in the ileum of C piglets was also observed (C: 2.95 μ m; P: 2.35 μ m; SE: 0.07; $P < .01$). Fecal *Lactobacillus* populations were increased by *P. acidilactici* addition when compared to C diet (C: 10×10^8 cfu/g; P: 27×10^8 cfu/g; SE: 9.41×10^6 ; $P < .05$), while no difference was observed in the *E. coli* populations. In conclusion, the addition of *P. acidilactici* to piglet diet resulted in positive effects on gut structure and in a greater concentration of possibly beneficial bacteria.

Key Words: Piglets, *Pediococcus Acidilactici*, Gut Histometry