

## Nonruminant Nutrition: Feeder Pig and Sow Nutrition I

**T186 Effect of dietary P level and pectin infusion on bacterial P incorporation, activity and composition in pigs.** B. U. Metzler<sup>\*1</sup>, W. Vahjen<sup>2</sup>, T. Baumgärtel<sup>3</sup>, M. Rodehutschord<sup>3</sup>, and R. Mosenthin<sup>1</sup>, <sup>1</sup>*Institute of Animal Nutrition, University of Hohenheim, Stuttgart, Germany*, <sup>2</sup>*Institute of Animal Nutrition, Free University of Berlin, Berlin, Germany*, <sup>3</sup>*Institute of Agricultural and Nutritional Sciences Halle-Wittenberg, Halle (Saale), Germany*.

Two experiments were conducted to determine the effects of different P levels, phytase supplementation and the intracecal application of pectin on the chemical composition of fecal mixed bacterial mass (MBM), ileal and fecal levels of VFA as well as bacterial species composition. A total of 16 barrows, initial BW of about 30 kg, fitted with a simple T-cannula at the distal ileum, were assigned to 2 experiments in incomplete 4x2 Latin square design. In Exp. 1, the diets were a low-P corn-soybean meal based control diet (Con; 3g P/kg) or the Con supplemented with MCP (monocalcium phosphate; 7g P/kg). In Exp. 2, the pigs received Con or the Con supplemented with 1000 FTU phytase/kg. Additionally, in both experiments, two pigs of each diet and period received an intracecal infusion of pectin (60g/d) via the ileal cannula. After a 15d adaptation, feces were collected for 5d followed by collection of ileal digesta during 2x12h. Counts for total bacteria in ileal digesta and feces and specific bacterial groups in ileal digesta were determined by quantitative realtime PCR. MCP increased the P content in MBM and the proportion of bacterial P in feces (P<0.05), while phytase reduced the P content in MBM (P<0.05). MCP tended (P=0.12) to stimulate the production of total ileal VFA, while pectin tended (P=0.07) to increase fecal VFA. Phytase tended to reduce (P=0.1) total fecal VFA. The interaction pectin x phytase increased (P=0.07) fecal total bacterial counts. MCP tended to reduce (P=0.12) the growth of lactobacilli, while pectin enhanced (P=0.08) the growth of bifidobacteria in ileal digesta. In conclusion, the bacterial P incorporation, fermentative activity and species composition is influenced by both dietary P level and pectin as fermentable substrate.

**Key Words:** Phosphorus, Pectin, Bacteria

**T187 Effects of adding water into the mixer on pellet quality of expander processed barley-oats-soy-based diets for finishing pigs.** K. K. Lundblad<sup>\*1,2</sup>, J. D. Hancock<sup>2</sup>, M. Sørensen<sup>3,4</sup>, K. C. Behnke<sup>2</sup>, E. Prestløkken<sup>1</sup>, and L. J. McKinney<sup>2</sup>, <sup>1</sup>*Felleskjøpet Fôrutvikling, Trondheim, Norway*, <sup>2</sup>*Kansas State University, Manhattan*, <sup>3</sup>*University of Life Sciences, Aas, Norway*, <sup>4</sup>*AKVAFORSK, Aas, Norway*.

A barley-oats-soy-based formula was used to determine the effects of adding water into the mixer on pellet quality of expander-processed diets for finishing pigs. The barley (67% of the diet) and oats (15% of the diet) were ground to a mean particle size of 600 um and blended with soybean meal (9% of the diet), choice white grease (5% of the diet), crystalline amino acids, vitamins, and minerals creating a diet with 0.8% total lysine and 10% total moisture. Treatments were none, 1.5, 3, 6, and 12% water added into the mixer after a 'dry-mix' time of 60 sec. Total mix time was 240 sec. The mixed mash was steam conditioned at 82°C for approximately 20 sec prior to passing through

a 100 hp Amandus-Kahl expander. Cone pressure (14 kg/cm<sup>2</sup>) and production rate (1.1 t/h) were held constant to eliminate the effects of varied cone pressure and throughput on pelleting characteristics of the diet. The conditioned mash was passed through a pellet press (CPM Master Model HD) equipped with a 32-mm thick die having 4 mm openings. Cone temperature (cubic effect, P<0.02) and kWh/t (quadratic effect, P<0.03) increased as water addition into the mixer was increased from none to 12%. Pellet durability index (tumbling box technique) and modified pellet durability index (five hexagonal nuts added into the tumbling box) increased (linear effects, P<0.003) as water addition into the mixer was increased from none to 12%. Means for the none, 1.5, 3, 6, and 12 % additions of water into the mixer were 93, 93, 94, 94 and 95% for pellet durability index and 91, 92, 93, 93 and 94% for modified pellet durability index. In conclusion, expanding barley-oats-soy-based diets resulted in greater pellet durability index although the high durability index for the control diet (93%) left little room for improvement in pellet quality when water was added into the mixer.

**Key Words:** Pellet, Expander-Conditioning, Pig

**T188 Optimal true digestible Ca:P ratio in corn-rough rice-soybean meal-based diets for growing pigs.** S. X. Wang<sup>\*1</sup>, Y. L. Yin<sup>1</sup>, R. L. Huang<sup>1</sup>, T. J. Li<sup>1</sup>, X. F. Kong<sup>1</sup>, M. Z. Fan<sup>2</sup>, and G. Y. Wu<sup>1,3</sup>, <sup>1</sup>*Institute of Subtropical Agriculture, the Chinese Academy of Sciences, Changsha, Hunan, China*, <sup>2</sup>*University of Guelph, Guelph, Ontario, Canada*, <sup>3</sup>*Texas A&M University, College Station*.

Three experiments were conducted to determine an optimal ratio of true digestible Ca:P in diets for barrows. In Experiment 1, 12 barrows (BW 30.6±1.2 kg) were assigned randomly to be fed two corn-rough rice-soybean meal-based diets containing either 0.32% true digestible P and 0.60% total Ca or 70% of their values for 8 d (6 pigs/diet). Endogenous outputs of Ca and P in feces were 0.85 and 0.57 g/kg DM intake, and the true digestibilities of dietary Ca and P were 78 and 66%, respectively. In Experiment 2, 25 barrows with BW of 32.2±1.8 kg were used to determine Ca and P balances. The diets were formulated to contain 0.32% true digestible P as in Experiment 1, except that the amounts of limestone were adjusted to obtain 5 levels of total Ca: 0.29, 0.45, 0.60, 0.75 and 0.90% (n = 5 pigs/diet). Pigs were fed their diets for 8 d. Based on the true digestibilities of dietary Ca and P in Experiment 1, the ratio of true digestible Ca and P in the five diets were 0.89, 1.37, 1.82, 2.29, and 2.75, respectively. The apparent digestibilities of Ca and P were reduced (P<0.05) with increasing dietary Ca:P ratios. Pigs fed a diet with a Ca:P ratio of 1.82 retained more Ca and P than pigs fed diets with higher Ca:P ratios (P<0.05). In Experiment 3 (a 35-d feeding trial) involving 25 barrows with initial BW of 20.9±0.95 kg, pigs were fed the diets as described in Experiment 2. Barrows fed diets with a true digestible Ca:P ratio of 1.82 exhibited higher (P<0.05) values for feed intake, ADG, and the gain:feed ratio, compared with pigs fed diets with true digestible Ca:P ratios of 2.29 and 2.75. These results suggest that a true digestible Ca:P ratio of 1.82 is optimal for P utilization and growth performance of barrows fed corn-rough rice-soybean meal-based diets.

**Key Words:** Calcium, Phosphorus, Piglets

**T189 Effects of adding water into the mixer on pellet quality of expander-processed corn-soy-based diets for finishing pigs.**

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A corn-soy-based formula was used to determine the effects of adding water into the mixer on pellet quality of expander-processed diets for finishing pigs. The corn (76% of the diet) was ground to a mean particle size of 600 µm and blended with soybean meal (17% of the diet), choice white grease (5% of the diet), crystalline amino acids, vitamins, and minerals creating a diet with 0.8% total lysine and 11% total moisture. Treatments were none, 1.5, and 3% water added into the mixer after a 'dry-mix' time of 60 sec. Total mix time was 240 sec. The mixed mash was steam conditioned at 82°C for approximately 20 sec prior to passing through a 100 hp Amandus-Kahl expander. Cone pressure (14 kg/cm<sup>2</sup>) and production rate (1.1 t/h) were held constant to eliminate the effects of varied cone pressure and throughput on pelleting characteristics of the diet. The conditioned mash was passed through a pellet press (CPM Master Model HD) equipped with a 32-mm thick die having 4 mm openings. Cone temperature was increased by 17% (linear effect,  $P < 0.03$ ) and kWh/t was increased by 36% (quadratic effect,  $P < 0.03$ ) as water addition into the mixer was increased from none to 3%. There was a trend for fines generated during pelleting to be reduced ( $P < 0.07$ ) but pellet durability index (tumbling box technique,  $P > 0.4$ ) and modified pellet durability index (five hexagonal nuts added into the tumbling box,  $P > 0.2$ ) were not affected by water addition into the mixer. Means for the none, 1.5%, and 3.0% additions of water into the mixer were 4.5, 4.0, and 3.7% for fines, 92, 93, and 94% for pellet durability index, and 90, 91, and 92% for modified pellet durability index. In conclusion, expanding corn-soy-based diets resulted in a pellet durability index of 92% for our control diet leaving little room for improvement in pellet quality when water was added into the mixer.

**Key Words:** Pellet, Expander-Conditioning, Pig

**T190 Effects of fermented wild-ginseng culture by-products on growth performance, blood characteristics, meat quality and ginsenoside concentration of meat in finishing pigs.**

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This study was conducted to evaluate effects of fermented wild-ginseng culture by-product on growth performance, blood characteristics, meat quality and ginsenoside concentration of meat in finishing pigs. Forty-eight pigs (Landrace × Yorkshire × Duroc, 76.26 ± 1.06 kg average initial body weight) were used in 49d growth assay. Dietary treatments were included 1) CON (basal diet), 2) FWG1 (basal diet + 2.5% fermented wild-ginseng cultures by-product replaced lupin in basal diet) and 3) FWG2 (basal diet + 5.0% fermented wild-ginseng cultures by-product replaced lupin in basal diet). The pigs were allotted into three treatments with four replicate pens per treatment by completely randomized design. No differences were found among treatments for ADG, ADFI and gain/feed from 0 day to 49 day of the

experiment ( $P > 0.05$ ). Dry matter digestibility was greater in FWG1 treatment than CON treatment ( $P < 0.05$ ). In cholesterol concentration of blood, HDL cholesterol was significantly higher in CON treatment than FWG1 treatment ( $P < 0.05$ ). In meat quality, TBARS was significantly lower in FWG1 and FWG2 treatments than CON treatment ( $P < 0.05$ ). In sensory evaluation, marbling was significantly higher in CON treatment than FWG1 treatment ( $P < 0.05$ ). Firmness in FWG2 and CON treatments were higher than FWG1 treatment ( $P < 0.05$ ). In meat color, L\*-value of m. longissimus dorsi muscle was increased in FWG1 treatment compared to CON and FWG2 treatments ( $P < 0.05$ ). a\* and b\*-value of m. longissimus dorsi muscle were increased in CON and FWG1 treatments compared to FWG2 treatment ( $P < 0.05$ ). Ginsenoside concentration of meat was significantly higher in FWG2 treatment than CON treatment ( $P < 0.05$ ). In conclusion, fermented wild-ginseng culture by-product was effective for improving dry matter, TBARS, firmness, meat color and ginsenoside concentration of meat in finishing pigs.

**Key Words:** Fermented Wild-Ginseng Cultures By-product, Meat Quality, Pigs

**T191 Effect of dietary *Bacillus subtilis* on growth performance, immunological cells change, fecal NH<sub>3</sub>-N concentration and carcass meat quality characteristics in finishing pigs.**

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This experiment was conducted to investigate the effects of dietary *Bacillus subtilis* on growth performance, nutrient digestibility, immunological cells change, fecal noxious gas and carcass meat quality characteristics in finishing pigs. The dietary treatments were: 1) CON (basal diet), 2) BS0.1 (basal diet + 0.1% *Bacillus subtilis*) and 3) BS0.2 (basal diet + 0.2% *Bacillus subtilis*). Sixty crossbred (Landrace × Yorkshire × Duroc) pigs (89.5 ± 0.11 kg average initial body weight) were used in a 42 days growth trial. The pigs were assigned to the treatments according to body weight and each treatment had 5 replicates of 4 pigs per pen in a randomized complete block design. Through the entire experimental period, ADG and ADFI were not significantly different among the treatments. Pigs fed BS0.1 diet significantly increased their gain/feed compared to pigs fed CON and BS0.2 diets ( $P < 0.05$ ). Also, dry matter (DM) and nitrogen (N) digestibilities were greater in the pigs fed BS0.1 diet than those fed CON diet ( $P < 0.05$ ). There were no significant differences in fecal NH<sub>3</sub>-N concentration among the treatments. In blood assay for immunological cells change investigations, red blood cells (RBC) counts increased in the pigs fed BS0.2 diet compared to pigs fed CON and BS0.1 diets. There were no significant differences in carcass pH, drip loss, marbling and firmness. However, sensual color and a\* (redness) value of meat in the pigs fed BS0.2 diet were higher than in pigs fed CON diet ( $P < 0.05$ ). Therefore, this experiment suggested that *Bacillus subtilis* supplementation could improve nutrient digestibility, RBC counts and carcass meat color of pigs.

**Key Words:** *Bacillus Subtilis*, Carcass Meat Quality Characteristics, Pigs

**T192 Evaluation of dietary L-carnitine or garlic powder on growth performance, dry matter and nitrogen digestibilities, blood profiles and meat quality in finishing pigs.** Y. J. Chen<sup>\*1</sup>, J. H. Cho<sup>1</sup>, I. H. Hwang<sup>2</sup>, Y. Hyun<sup>2</sup>, T. G. Go<sup>2</sup>, and I. H. Kim<sup>1</sup>, <sup>1</sup>Dankook University, Cheonan, Choongnam, Korea, <sup>2</sup>Easy Bio System Inc, Cheonan, Choongnam, Korea.

The effects of dietary L-carnitine or garlic powder supplementation on growth performance, dry matter (DM) and nitrogen (N) digestibilities, blood profiles and meat quality were investigated in this study. A total of 80 [(Landrace×Yorkshire)×Duroc] pigs with an initial BW of 59.14 kg were randomly assigned to four dietary treatments with five replications per treatment and four pigs per pen. Corn-soybean meal based diets were formulated as control diet and other treatment diets were supplemented with 250 mg/kg L-carnitine, and 1 g/kg or 2 g/kg garlic powder, respectively. After the feeding period, pigs which reached marketing body weight were collected meat samples from slaughter house. During the feeding period, growth performance was not affected by dietary treatments. Both the DM and N digestibilities were improved in 1 g/kg garlic powder supplemented treatment compared to control treatment ( $P<0.05$ ). White blood cell (WBC) and lymphocyte concentrations were positive influenced by L-carnitine addition whereas garlic powder supplementation did not affect any tested parameter of blood profiles. Backfat thickness was decreased and muscle percentage was increased by the L-carnitine supplementation ( $P<0.05$ ). Pigs administrated with 1 g/kg garlic powder also tended to decrease backfat thickness and had better meat color, pH value and water holding capacity. In conclusion, dietary supplementation of L-carnitine can increase WBC and lymphocyte concentrations and decrease backfat thickness while garlic powder supplementation can improve the nutrients digestibility and meat quality in finishing pigs.

**Key Words:** L-carnitine, Garlic Powder, Finishing Pigs

**T193 Effects of dietary *Lactobacillus brevis* supplementation on growth performance, dry matter and nitrogen digestibilities, blood cell counts and fecal odor emission compounds in growing pigs.** Y. J. Chen<sup>\*1</sup>, B. J. Min<sup>1</sup>, J. H. Cho<sup>1</sup>, Q. Wang<sup>1</sup>, J. S. Yoo<sup>1</sup>, J. D. Kim<sup>2</sup>, and I. H. Kim<sup>1</sup>, <sup>1</sup>Dankook University, Cheonan, Choongnam, Korea, <sup>2</sup>CJ Feed Inc, Incheon, Gyeonggi, Korea.

This study was conducted to investigate the effects of dietary *Lactobacillus brevis* ( $3.4 \times 10^8$  CFU/g) supplementation on growth performance, DM and N digestibilities, blood cell counts and fecal odor emission compounds in growing pigs. Ninety six crossbred [(Landrace×Yorkshire)×Duroc] pigs with an initial BW of  $24.60 \pm 1.28$  kg were used for 42-d feeding trial according to a randomized complete block design. Three corn-soybean meal based dietary treatments included: 1) CON (basal diet); 2) LB1 (basal diet + *Lactobacillus brevis* 0.2%) and 3) LB2 (basal diet+ *Lactobacillus brevis* 0.4%). There were three dietary treatments with eight replicate pens per treatment and four pigs per pen. Through the entire experimental period, ADG, ADFI and gain/feed were not significantly different among the treatments ( $P>0.05$ ). Nitrogen digestibility was increased in LB1 and LB2 treatments compared to CON treatment (linear effect,  $P<0.05$ ), however, DM digestibility was not significantly different among all the treatments ( $P>0.05$ ). The WBC, RBC and lymphocyte concentrations in whole blood were not affected by treatments ( $P>0.05$ ). Fecal  $\text{NH}_3\text{-N}$  and  $\text{H}_2\text{S}$  concentrations were

significant decreased in LB2 treatment compared with CON treatment (linear effect,  $P<0.05$ ). Fecal VFA (acetic acid and propionic acid) concentration was also reduced in LB2 treatment compared to CON treatment (linear effect,  $P<0.05$ ). In conclusion, *Lactobacillus brevis* ( $3.4 \times 10^8$  CFU/g) supplementation at the level of 0.4% can improve nitrogen digestibility and decrease the concentrations of fecal odor emission compounds in growing pigs.

**Key Words:** *Lactobacillus Brevis*, Odor Emission Compounds, Growing Pigs

**T194 Effects of feeding rye silage with different periods on growth performance, blood characteristics and carcass quality in finishing pigs.** S. O. Shin<sup>\*1</sup>, J. H. Cho<sup>1</sup>, Y. J. Chen<sup>1</sup>, J. S. Yoo<sup>1</sup>, J. W. Kim<sup>1</sup>, Y. G. Han<sup>2</sup>, and I. H. Kim<sup>1</sup>, <sup>1</sup>Dankook University, Cheonan, Choongnam, Korea, <sup>2</sup>Sungkyunkwan University, Suwon, Gyeonggi, Korea.

This experiment was conducted to evaluate effects of feeding rye silage with different periods on growth performance, blood characteristics and carcass quality in finishing pigs. A total of sixteen [(Duroc×Yorkshire×Landrace)] pigs (90.26kg in average initial body weight) were used in individual cage for 30 days assay. Dietary treatments included 1) CON (basal diet), 2) S10 (basal diet for 20 days and 3% rye silage for 10 days) 3) S20 (basal diet for 10 days and 3% rye silage for 20 days) 4) S30 (3% rye silage for 30 days). During the overall periods, there were no significant differences in ADG and gain/feed ratio among treatments ( $P>0.05$ ). However, ADFI was higher in CON treatment than others treatments ( $P<0.05$ ). DM digestibility was higher in S20 treatment than S30 treatment ( $P<0.05$ ). In blood characteristics, pigs fed rye silage were significantly decreased cortisol concentration compared with pigs fed CON diet ( $P<0.05$ ). Backfat thickness was higher in CON treatment than S20 and S30 treatments ( $P<0.05$ ). In fatty acid contents of leans, C18:0 and total SFA were significantly higher in CON treatment than others treatments ( $P<0.05$ ). However, C18:1n9, total MUFA and U:S ratio were significantly lower in CON treatment than other treatments ( $P<0.05$ ). In fatty acid contents of fats, C18:1n9 and MUFA were similar in S20 and S30 treatments. However, these were higher than CON or S10 treatments ( $P<0.05$ ). In conclusion, feed intake, DM digestibility, cortisol concentration, backfat thickness and fatty acid composition of pork were affected by 20 d of rye silage feeding.

**Key Words:** Rye Silage, Carcass Characteristics, Finishing Pigs

**T195 Effects of phytogetic substances on growth performance, nutrients digestibility, fecal noxious gas content, blood characteristics, milk characteristics and reproduction in sows and litters performance.** Q. Wang<sup>\*</sup>, H. J. Kim, J. H. Cho, Y. J. Chen, J. S. Yoo, and I. H. Kim, Dankook University, Cheonan, Choongnam, Korea.

A total of forty sows (Landrace×Yorkshire) were used to determine the effects of phytogetic feed additive (PFA) on growth performance, nutrients digestibility, fecal noxious gas content, blood characteristics, milk characteristics and litters performance. Dietary treatments included: 1) Control (CON; basal diet), 2) PFA (basal diet + 0.04% phytogetic feed additive). Through the entire experimental period,

ADFI, backfat loss and return-to-estrus intervals were not affected by the treatments ( $P>0.05$ ). Digestibility of DM was increased ( $P<0.05$ ) in sows fed PFA diet compared with sows fed the CON diet. Fecal ammonia nitrogen ( $\text{NH}_3\text{-N}$ ) measured at the end of experiment was reduced ( $P<0.05$ ) in sows fed PFA diet. No statistical differences ( $P>0.05$ ) were found in total protein, albumin, immunoglobulin G (IgG), red blood cells (RBC) counts, white blood cells (WBC) counts and lymphocyte on the day of farrowing. On d 1 of lactation, albumin and lymphocyte were decreased ( $P<0.05$ ) whereas WBC was increased significantly ( $P<0.05$ ) for sows fed the PFA diet. On d 21 of lactation, blood characteristics (RBC and WBC) of sows were increased ( $P>0.05$ ) in PFA treatment. IgG content in milk was increased by PFA on day of farrowing ( $P<0.05$ ). Milk protein and solid concentrations were lower in colostrum ( $P<0.05$ ) for sows fed the CON diet. Furthermore, lactose, IgG and IgA in colostrum increased considerably for sows fed PFA diet. There was no difference in piglet performance between treatments ( $P>0.05$ ). In conclusion, feeding 0.04% of PFA improved DM digestibility, RBC and WBC concentrations in blood, and lactose, IgG and IgA production in colostrums and decreased noxious gas concentration.

**Key Words:** Phytogetic Additives, Sows, Litters

**T196 Effects of supplemental humic substances on quality and fatty acid profile of meat in finishing pigs.** Q. Wang\*, J. H. Cho, Y. J. Chen, J. S. Yoo, and I. H. Kim, *Dankook University, Cheonan, Choongnam, Korea.*

A total of forty-eight finishing pigs were used to determine the effects of humic substances (HS) on growth performance, blood characteristics and meat quality. Finishing pigs were randomly assigned by weight to three treatments. Dietary treatments included: 1) Control (CON; basal diet), 2) HS1 (basal diet +5% humic substances) and 3) HS2 (basal diet + 10% humic substances). During the entire experimental period, results showed that addition of 100 g  $\text{kg}^{-1}$  HS to diet significantly increased ADG and G:F ( $P<0.05$ ). At the end of experiment, lymphocyte of pigs fed HS1 or HS2 diet was higher ( $P<0.05$ ) than that for pigs fed CON diet. The Minolta color parameter  $a^*$  for pigs fed HS2 was similar to that for pigs fed HS1, however, it was higher ( $P<0.05$ ) than that for pigs fed CON diet. Inclusion of either 5 or 10% HS decreased backfat thickness ( $P<0.05$ ). Marbling score was increased ( $P<0.05$ ) in diets supplemented with HS at level of 10%. In the lean samples, HS1 increased ( $P<0.05$ ) the concentrations of C16:0, C18:0, saturated fatty acid (SFA) and unsaturated fatty acid (USFA) and decreased ( $P<0.05$ ) the concentration of C20:0. HS2 diet increased ( $P<0.05$ ) the U:S ratio. In contrast to fat samples, HS2 diet increased ( $P<0.05$ ) the concentrations of C14:0, C18:2. HS1 diet increased ( $P<0.05$ ) the concentrations of C18:0 and SFA and decreased ( $P<0.05$ ) UFA and U:S ratio. The results suggest that HS could be used as feed additive in diet. It could improve growth performance, immunity system and meat quality.

**Key Words:** Humic Substance, Meat Quality, Finishing Pigs

**T197 Effects of dietary herbs and coral mineral complex on growth performance, nutrients digestibility, blood characteristics and meat quality in finishing pigs.** Y. Wang\*, J. H. Cho, Y. J. Chen, J. S. Yoo, Q. Wang, and I. H. Kim, *Dankook University, Cheonan, Choongnam, Korea.*

Eighty crossbred ([Landrace×Yorkshire]×Duroc) pigs (initial BW of  $58.06 \pm 1.47$  kg) were used to evaluate the potential effect of supplemental herbs and coral mineral complex (HC), which including 40% herbs: *Semen Ziziphi Spinosae* (Spina Date Seed) 10%, *Pollen Pini* (Pine Pollen) 5%, *Cortex Mori* (White Mulberry Root-bark) 5%, *Semen Plantaginis* (*Plantago asiatica*) 5%, *Radix Achyranthis Bidentatae* (*Achyranthes* root) 5%, *Rhizoma Acori Tatarinowii* (Grassleaf Sweelflag Rhizome) 5% and *Herba Capsellae* (Shepherdspurse Herb) 5%, 50% coral mineral (Ca 22%, P 2%, Mg 3%, Mn 0.5%, Na 2%, Cl 1%, Zn 0.5%, Fe 1.5%, Se 1% and other 16.5%) and 10% chromophore, on growth performance, nutrients digestibility, blood characteristics and meat quality in a 8 wk growth trial in finishing pigs. There are 4 pigs per pen and 5 replicates per treatment. Dietary treatments included: 1) CON (control; basal diet), 2) HC0.05 (basal diet + 0.05% HC), 3) HC0.1 (basal diet + 0.1% HC) and 4) HC0.2 (basal diet + 0.2% HC). Average daily feed intake decreased linearly with increasing HC level during wk 4-8 ( $P<0.01$ ) and overall period ( $P<0.05$ ). However, this decrease did not affect ADG and linearly increased G:F during wk 4-8 ( $P<0.05$ ) and overall period ( $P<0.10$ ). Digestibility of DM and N were not affected by dietary treatments ( $P>0.05$ ). Also, IgG concentration was linearly increased with an increasing HC level ( $P<0.01$ ). Cortisol concentration tended ( $P<0.10$ ) to be influenced linearly by level of HC. Supplementation of HC did not improve any measured meat quality ( $P>0.05$ ). Our data indicate that HC inclusion can increase the G:F, as well as IgG and cortisol concentration, however, it had no effects on nutrients digestibility and meat quality.

**Key Words:** Herb, Coral Mineral, Finishing Pigs

**T198 Effects of dietary supplemental Megazone® on growth performance, nutrients digestibility, blood characteristics, meat quality and carcass traits in weaning-to-finishing pigs.** Y. H. Kim<sup>1</sup>, Y. Wang<sup>2</sup>, J. C. Park<sup>1</sup>, H. J. Jung<sup>1</sup>, J. H. Cho<sup>2</sup>, Y. J. Chen<sup>2</sup>, J. S. Yoo<sup>2</sup>, I. C. Kim<sup>1</sup>, S. J. Kim<sup>1</sup>, and I. H. Kim<sup>2</sup>, <sup>1</sup>*National Livestock Research Institute, RDA, Cheonan, Choongnam, Korea,* <sup>2</sup>*Dankook University, Cheonan, Choongnam, Korea.*

This study was conducted to investigate the effects of Megazone® (an aluminosilicate mineral mix, which include 30% quartz, 30% feldspar, 30% ceramic and 10% biotite) supplementation on growth performance, nutrients digestibility, blood characteristics, meat quality and carcass traits in weaning-to-finishing pigs. A total of 48 crossbred ([Landrace×Yorkshire]×Duroc) pigs with initial BW of  $4.46 \pm 0.18$  kg were used in a 21 wks trial. Pigs were randomized allocated to two dietary treatments. There were 6 pens per treatment and 4 pigs per pen. Dietary treatments included: 1) CON (basal diet) and 2) MT (basal diet + 0.8% Megazone®). Through the entire experimental period, there were no effects of dietary Megazone® supplementation on growth performance, nutrients digestibility, blood characteristics and meat quality ( $P>0.05$ ). Also, market weight and backfat thickness were

not different between the two treatments ( $P>0.05$ ). However, carcass weight and carcass ratio in MT treatment were improved compared with CON treatment ( $P<0.05$ ). In conclusion, supplementation of Megazone<sup>®</sup> can increase carcass weight and carcass ratio in weaning-to-finishing pigs, however, it had no effects on growth performance, nutrients digestibility, blood characteristics and meat quality traits.

**Key Words:** Megazone<sup>®</sup>, Aluminosilicate, Carcass

**T199 Interaction of dietary nutrient density and crowd density on growth performance, nutrients digestibility, blood characteristics and hormone concentration in growing pigs.** Y. Wang\*, J. H. Cho, Y. J. Chen, H. J. Kim, J. S. Yoo, Q. Wang, Y. Huang, and I.H. Kim, *Dankook University, Cheonan, Choongnam, Korea.*

A study was conducted to determine the interaction of feeding a high nutrient diet (3,350Mcal/kg, Crude protein 19%, Lysine 1%, Ca 0.8%, P 0.7%) vs. a low nutrient diet (3,350Mcal/kg, Crude protein 18%, Lysine 0.9%, Ca 0.7%, P 0.6%), as well as the crowd density (3, 4 or 5 pigs per pen), on growth performance, nutrients digestibility and blood characteristics. Ninety six crossbred ([Landrace×Yorkshire]×Duroc) pigs (initial BW of 23.47±1.35 kg) were assigned to a 2×3 factorial arrangement of treatments. Growth data were collected at d 0, d 18 and d 36. Overall the experiment, nutrient density main effect were observed on ADG, ADFI and G/F ( $P<0.05$ ). Also crowd density main effect and nutrient density×crowd density interaction were observed on G/F. Both the DM and N digestibility were higher in the high nutrient diet treatment compared with low nutrient diet treatment ( $P<0.05$ ). Neither the dietary nutrient density nor crowd density main effects were found on blood characteristics ( $P>0.10$ ) in this experiment. Epinephrine and norepinephrine concentrations were higher ( $P<0.05$ ) in high nutrient diet treatment compared with low nutrient diet treatment. Neither the dietary nutrient density nor crowd density main effects were found on cortisol concentration ( $P>0.05$ ). Our data indicate that significant interaction between nutrient density and crowd density treatments for G/F, ADG and ADFI, as well as epinephrine and norepinephrine concentration have significant nutrient density main effect. Neither the dietary nutrient density nor crowd density effects were found on blood characteristics as well as cortisol concentration in this experiment.

**Key Words:** Crowd Density, Nutrients Density, Growing Pigs

**T200 The effects of environment-friendly diets on the growth performance, nutrient digestibility, fecal excretion, nitrogen excretion and emission gas in swine manure of growing pigs.** J. S. Yoo\*<sup>1</sup>, J. H. Cho<sup>1</sup>, Y. G. Chen<sup>1</sup>, H. J. Kim<sup>1</sup>, Q. Wang<sup>1</sup>, Y. Hyun<sup>2</sup>, T. G. Ko<sup>2</sup>, C. S. Park<sup>3</sup>, and I. H. Kim<sup>1</sup>, <sup>1</sup>*Dankook University, Cheonan, Choongnam, Korea*, <sup>2</sup>*Dodram B&F Inc., Eumseong, Gyeonggi, Korea*, <sup>3</sup>*EASY BIO System, Inc, Seoul, Korea.*

Two experiments were conducted to determine the effects of environment-friendly diets on growth performance, fecal excretion, N excretion and emission of gas in manure for pigs. In Exp. 1, 96 cross-bred pigs were allocated into four treatments. Treatments were 1)AME(adequate ME diet, 3,265 kcal/kg), 2)LME (lower ME diet, 3,100 Kcal/kg), 3)LME 0.05(lower ME diet+ $\alpha$ -galactosidase &

$\beta$ -mannanase0.05 %) and 4)LME 0.1(lower ME diet+ $\alpha$ -galactosidase &  $\beta$ -mannanase0.10 %). ANE had lower ADFI than others( $P<0.05$ ). DM digestibility in AME and LME 0.1 had greater than LME( $P<0.05$ ). Energy digestibility is higher in pigs fed AME and LME 0.1 than others( $P<0.05$ ). In Exp. 2, 24 crossbred pigs(Avg. 33.71 kg) were used for a 14d trial. Treatments were 1)CP 18% without *Bacillus* sp., 2)CP 18%diet+*Bacillus* sp.0.05%, 3)CP 14% without *Bacillus* sp. and 4)CP 14% diet+ *Bacillus* sp.0.05%. N intake was higher for CP 18% diets than CP 14% diets ( $P<0.05$ ). DM, N, and energy digestibility were affected by probiotics ( $P<0.05$ ). With the high CP in diets, energy and N digestibility, urinary N %, urinary N excretion and total N excretion were increased compared with low CP in diets ( $P<0.05$ ). Among the treatments, DM and N digestibilities, fecal N excretion and N absorption were decreased ( $P<0.05$ ), however, fecal excretion, fecal N, urinary N percent, urinary N excretion and total N excretion were increased ( $P<0.05$ ) when pigs fed without probiotics diets compare with pigs fed with probiotics diets. DM and N digestibility, fecal excretion, fecal N excretion, urinary N percent, urinary N excretion, total N excretion, N absorption and N adsorption ratio were CP × probiotic interactions in ( $P<0.05$ ). Ammonia( $P<0.01$ ) and H<sub>2</sub>S( $P<0.05$ ) in manure were lower in CP 14% diets than CP 18% diets. Also, ammonia and H<sub>2</sub>S in manure were CP × probiotic interactions in ( $P<0.05$ ). In conclusion, low energy and reduction of CP dietary added enzyme and probiotics improved nutrient digestibility and reduced odors emission in manure for growing pigs.

**Key Words:** Environment-Friendly Diets, Carbohydrase, Probiotics

**T201 Growth performance in boars fed diets supplemented with organic selenium.** S. M. Speight\*, M. J. Estienne, and A. F. Harper, *Virginia Polytechnic Institute and State University, Blacksburg.*

The objective was to compare growth performance in boars fed diets supplemented with selenium from either organic or inorganic sources. Crossbred boars (n = 117; 8.3 kg BW) weaned at approximately 28 d of age, were blocked by BW, placed in nursery pens (three boars/pen) and assigned from within block to three treatments: I. a basal diet with no supplemental selenium (controls), II. basal diet supplemented with 0.3 ppm organic selenium (Sel-Plex; Alltech, Inc., Nicholasville, KY) and, III. basal diet supplemented with 0.3 ppm sodium selenite (Premium Selenium 270; North American Nutrition Co., Inc., Lewisburg, OH) (n = 13 pens/treatment). Boars had ad libitum access to feed and water during the 5-wk trial. Among groups, ADG (471 g), ADFI (895 g) and feed/gain (1.9) were similar ( $P > 0.1$ ). Blood selenium concentrations (ppb) were higher ( $P < 0.01$ ) for boars consuming Sel-Plex (107.5 ± 4.8) or sodium selenite (114.7 ± 4.8) compared to controls (28.4 ± 4.8). Boars were moved to a grower-finisher barn and continued to receive, on an ad libitum basis, either a basal diet or a basal diet supplemented with either 0.3 ppm Sel-Plex or sodium selenite (n = 11 pens/treatment). The trial ended when boars averaged 136.7 kg. Among groups, ADG (1045 g) and ADFI (2716 g) were similar ( $P > 0.1$ ). Feed/gain was affected by treatment ( $P = 0.02$ ) and was lower ( $P < 0.06$ ) for boars fed Sel-Plex (2.65 ± 0.03) compared with boars fed sodium selenite (2.72 ± 0.03) or controls (2.76 ± 0.03). Backfat thickness (tenth-rib; 12.6 mm) and loin depth (67.0 mm), determined by ultrasound (Sonograde; Renco Corp., Minneapolis, MN), was not affected by treatment ( $P > 0.1$ ). Blood selenium concentrations (ppb) were higher ( $P < 0.01$ ) in boars consuming Sel-Plex (198.9 ± 5.5) than in boars consuming sodium selenite (171.4 ± 5.4) or controls (26.7 ± 5.4). In summary, an organic

source of selenium failed to alter ADG or feed consumption in growing boars, but enhanced feed conversion efficiency during the grower-finisher phase of production. (Funded by Alltech, Inc.)

**Key Words:** Boars, Selenium, Growth

**T202 A polymorphism in the calcitonin receptor alters metabolic response to dietary phosphorus deficiency.** L. S. Alexander\*, S. A. Cutler, M. F. Rothschild, and C. H. Stahl, *Iowa State University, Ames.*

While much research has examined methods for reducing the need for dietary phosphate (P) supplementation, little has examined how genetics may affect this need. We have identified a polymorphism in the calcitonin receptor gene, which based on previous work in our laboratory, influences the response to dietary P deficiency. Gilts (42, 8.1+ 2 kg BW) were selected based on this genotype and fed either a P adequate diet or a 20% P deficient diet over a 15 wk period. Each of the genotypes (11, 12, and 22) was evenly distributed across diets. At the end of the trial, radial and metacarpal bones from one leg per pig were collected for bone strength analysis and determination of ash %. Data was analyzed using the GLM procedure of SAS with diet, genotype and genotype\*diet treated as fixed effects. Initial BW and final BW were used as covariates for growth performance and bone strength, respectively. Our diets caused a minor P deficiency detectable by reduced ( $P < 0.05$ ) plasma P by 8wk, which remained throughout the study. At 8wk, a significant ( $P < 0.01$ ) genotype\*diet effect was seen in plasma levels of  $1,25(\text{OH})_2\text{D}_3$ ; however, by 14wk only a diet effect remained with the P deficient animals having higher ( $P < 0.05$ ) levels in plasma. Dietary P deficiency lowered bone strength (load at yield and Young's modulus) and ash % ( $P < 0.05$ ), and there tended ( $P < 0.1$ ) to be genotype\*diet interactions in these measures in the metacarpals. It appears that during P adequacy, the 11 and 12 genotypes tended to have stronger bones with higher ash % than their 22 counterparts. However under dietary P deficiency, the 11 and 12 genotypes had much greater losses ( $P < 0.05$ ) in all of these bone measures than the 22 pigs. There were no differences in growth performance based on diet, genotype, or the interaction of the two, suggesting that minor P deficiency still has a significant impact on bone integrity, and that this genotype is associated with pigs' response to P deficiency.

**Key Words:** Phosphorus, Polymorphism, Pig

**T203 Evaluation of different additives in weaned pigs.** K. J. Touchette\*, M. D. Newcomb, and D. W. Giesting, *Cargill Animal Nutrition, Elk River, MN.*

A trial was conducted with 48 weaned pigs (17 d,  $5.41 \pm .11$  kg) to evaluate the effect of non-antibiotic additives alone or in combination with antibiotics on nursery performance. Pigs were weaned and individually housed and assigned to one of 4 treatments in a 2x2 factorial arrangement in a RCBD with 2 levels of antibiotics (AB, none or added) and 2 levels of additives (ADD, none or added). The antibiotic used in this study was carbadox fed at 55 mg/kg. A nonspecific stressor was used in this trial. Twelve late nursery pigs that had been reared in an on-site, continuous pig flow environment were housed with nose-to-nose access with test pigs used in this project.

Previous work has shown that this stressor application dramatically increases the responsiveness to antibiotic inclusion. The additives used in this study were a combination of enzymes, sweetener, and a *Bacillus* DFM. Pigs were fed a 3-phase 40 d nursery program with diet changes on days 11 and 20. In the first 11 d, both AB ( $p < .06$ ) and ADD ( $p < .12$ ) improved ADG. There was an interaction ( $p < .07$ ) for ADFI, with ADD improving ADFI when AB were in the diet, but no improvement was seen without AB. Feeding AB improved ( $p < .13$ ) G/F. For phase 2, ADD ( $p < .11$ ) improved ADG, AB ( $P < .16$ ) improved ADFI, while there was an interaction ( $p < .05$ ) for G/F, with ADD improving G/F without AB in the diet, and having no effect on G/F with AB in the diet. For phase 3, there was no effect of trt on feed intake, while there were interactions for both ADG ( $p < .12$ ) and G/F ( $p < .01$ ). ADD improved both ADG and G/F in diets without AB, while having no effect in diets with AB. For the entire 40 d nursery trial, both ADD ( $p < .05$ ) and AB ( $p < .03$ ) improved ADG, and AB ( $p < .11$ ) improved ADFI, while there was an interaction ( $p < .01$ ) for G/F. ADD improved G/F without AB in the diet, while ADD did not affect G/F with AB in the diet. This study demonstrates that this additive mixture and carbadox improve nursery performance, with the best response to ADD coming in diets without AB.

**Key Words:** Swine, Antibiotics, Additives

**T204 Effect of an *Escherichia coli*-derived phytase on bone mineralization, and total and soluble phosphorus in growing pigs fed corn-soybean meal based diets.** C. T. Kadzere\*<sup>1,4</sup>, E. van Heugten<sup>1</sup>, J. S. Sands<sup>2</sup>, R. Maguire<sup>1,3</sup>, and M. Morrow<sup>1</sup>, <sup>1</sup>*North Carolina State University, Raleigh*, <sup>2</sup>*Danisco Animal Nutrition, Marlborough, UK*, <sup>3</sup>*Virginia Polytechnic and State University, Blacksburg*, <sup>4</sup>*PDT Global Institute, Inc., Greensboro, NC.*

The effect of an *Escherichia coli*-derived phytase (Phyzyme XPTM 5000L) on bone mineralization, soluble phosphorus P (SP), and total phosphorus P (TP) in feces was evaluated in a 43-d, RCBD study using 30 male, castrated growing pigs (starting BW = 25 kg) fed corn-soybean meal based diets. Pigs were placed in individual pens and assigned to 5 groups of 6 animals each and fed one of 5 diets. A positive control diet (PC) contained NRC (1998) recommended levels of 0.49% TP and 0.52% Ca. TP and Ca in the negative control (NC) diet were reduced to 0.36% and 0.43%, respectively. Diets 250, 500, and 1000 were the same as NC with phytase included at 250, 500, and 1000 U/kg phytase, respectively. Pigs were weighed weekly and had free access to feed and clean water. On d-21 and d-43 fecal grab samples were collected and analyzed for SP, and TP was analyzed in pooled samples collected on d 36, 37, and 38. Pigs were slaughtered on d 43, the right foot removed, and the metacarpal bone taken and analyzed for bone ash. In addition, bone mineral content (BMC), and bone mineral density (BMD) were determined using dual X-ray absorptiometry. Fecal TP ( $P < 0.0001$ ) and SP ( $P < 0.0001$ ) decreased linearly with increasing phytase dose. Bone ash increased linearly with increase in phytase dose to 1000 FTU/kg, while only 500 FTU/kg phytase was required to restore bone ash to that of the PC diet. In contrast, the response in BMC and BMD was quadratic in nature with no further improvement above additions of 250 FTU/kg. The results suggest phytase allows dietary Ca and TP in swine diets to be reduced without compromising bone mineralization while decreasing SP and TP excretion.

**Key Words:** Phosphorus, Phytase, Bone Mineralization

**T205 Synthetic lysine inclusion rates in pigs from 1.5 to 5.5 kg fed liquid diets.** A. E. Ikard\*<sup>1</sup>, R. J. Harrell<sup>2</sup>, J. Odle<sup>1</sup>, L. R. Gast<sup>1</sup>, and J. H. Eisemann<sup>1</sup>, <sup>1</sup>North Carolina State University, Raleigh, <sup>2</sup>Novus International Inc., St. Louis, MO.

This experiment was designed to determine the amount of synthetic lysine (SL) that could replace protein and maintain performance similar to animals on a control diet containing no SL. Pigs (1.62 ± 0.20 kg BW; age 1d) were randomly allotted to treatments which replaced 0 to 40% of lysine from protein with SL, while maintaining similar amounts of GE and total lysine. The diets were fed on a restricted (RT) basis (n=4/treatment) in order to reduce intake differences among treatments. An additional group was fed the 0% SL diet ad libitum (AL; n=5) to determine feed intake level. Intake for RT pigs was restricted to 80% of AL and adjusted on a daily basis. Pigs fed the AL diet had greater (P<0.01) ADG, G:F, water, CP, fat, and ash accretion than pigs fed RT diets. ADG, G:F, water, CP, and ash accretion decreased (P<0.05) linearly as SL increased in RT diets. CP accretion also showed a quadratic effect (P<0.05) as the accretion decreased more rapidly at greater SL inclusion. Fat accretion increased (P<0.05) linearly as SL increased in RT diets. BUN concentration did not differ (P>0.05) among pigs fed RT diets, but was greater (P<0.01) for pigs fed the AL than RT diets. ADG and CP accretion data were fit to a quadratic equation to estimate the level of SL inclusion that would produce ADG or CP accretion at 95% of the 0% SL diet. These values were 14.8% and 19.0% SL, for ADG and CP accretion, respectively.

**Table 1: Effect of SL inclusion (%) on ADG (g/day), G:F, and accretion (g/day)<sup>1,2</sup>**

	0%	10%	20%	30%	40%	0% AL
ADG <sup>3</sup>	286	283	268	252	229	363
G:F <sup>3</sup>	1.12	1.14	1.07	0.97	0.86	1.15
Water <sup>3</sup>	180.6	172.8	171.3	155.9	134.2	220.2
CP <sup>3,4</sup>	38.6	38.1	35.4	32.7	26.3	48.7
Fat <sup>3</sup>	16.4	19.6	22.5	25.6	28.4	27.7
Ash <sup>3</sup>	5.4	4.6	4.9	4.5	3.6	6.2

<sup>1</sup>Least square means. <sup>2</sup>RT and AL diets differ for all variables (P<0.01). <sup>3</sup>Linear response to SL level within RT (P<0.01). <sup>4</sup>Quadratic response to SL level within RT (P<0.05).

**Key Words:** Liquid Diet, Lysine, Pigs

**T206 Effect of an *Escherichia coli*-derived phytase on nutrient digestibility in corn-soybean meal based diets for growing pigs.** C. T. Kadzere\*<sup>1,4</sup>, E. van Heugten<sup>1</sup>, J. S. Sands<sup>2</sup>, R. Maguire<sup>1,3</sup>, and M. Morrow<sup>1</sup>, <sup>1</sup>North Carolina State University, Raleigh, <sup>2</sup>Danisco Animal Nutrition, Marlborough, UK, <sup>3</sup>Virginia Polytechnic and State University, Blacksburg, <sup>4</sup>PDT Global Institute, Inc., Greensboro, NC.

The effect of an *Escherichia coli*-derived phytase (Phyzyme XP™ 5000L) on nutrient digestibility was evaluated in a 43-d, RCBD study using 30 male castrated pigs fed corn-soybean meal based diets. Pigs were placed in individual pens and six animals assigned to each of 5 diets: A positive control diet (PC) with NRC (1998) recommended levels of 0.49% total P (TP) and 0.52% Ca, respectively. Ca and TP

in a negative control (NC) diet were reduced to 0.36% and 0.43%, respectively. Diets 250, 500, and 1000 were created by adding phytase to the NC diet to achieve 250, 500, and 1000 U/kg of phytase in feed, respectively. Pigs were weighed weekly and had free access to feed and clean water. Fecal grab samples were collected on 3 consecutive days (d-36, 37, and 38) and pooled. Ileal samples were collected from euthanized pigs on d-43. Feed, fecal, and ileal samples were analyzed for DM, GE, N, Ca, P, Na, K, Cl, amino acids (AA), phytase activity, and acid insoluble ash (indigestible marker). Growth performance was not affected by treatment (P > 0.10). Increasing phytase dose increased the apparent fecal digestibility of P (P < 0.001), fat (P < 0.03) and Cl (P < 0.03). Increasing phytase dose increased the apparent ileal digestibility of P, fat, ash, and Cl in a linear manner to the highest phytase dose of 1000 FTU/kg (P < 0.05). Improvements in ileal DM and CP digestibility with added phytase approached significance (P < 0.07). The apparent ileal digestibility of AA was not different between the NC and PC diets (P > 0.10). However, increasing phytase dose increased digestibility of all AA in a linear manner, being greatest for diets with 1000 FTU/kg phytase and exceeding that of both NC and PC diets. These findings suggest that phytase increases phytate P and trace mineral availability, and has additional benefits, including improved digestibility of DM, CP, fat, and AA.

**Key Words:** Pigs, Phytase, Nutrient Digestibility

**T207 Improving fat utilization by the weanling pig: effects of emulsification, diet physical form and fatty-acid-chain-length on growth performance.** K. Price\*<sup>1</sup>, L. Xi<sup>1</sup>, E. van Heugten<sup>1</sup>, G. Willis<sup>2</sup>, and J. Odle<sup>1</sup>, <sup>1</sup>North Carolina State University, Raleigh, <sup>2</sup>Milk Specialties Co., Dundee, IL.

Previous research indicates that dietary fat utilization by the newly-weaned pig is low, while fat digestive capabilities prior to weaning are very high. Sow milk contains approximately 40% fat whereas nursery diets are rarely formulated to contain more than 5%. The aim of this experiment was to determine if emulsification (plus or minus Tween-80), physical form of the diet (liquid vs dry) or fatty acid chain length (medium vs long chain triglyceride) effect fat utilization by the newly weaned pig. Pigs (N= 96) were weaned at 20 ± 0.30 d of age (6.8 ± 0.03 kg) and fed one of eight treatments for 14 d according to a 2x2x2 factorial design. The MCT fat contained primarily C8 and C10 fatty acids while the LCT fat was supplied by choice white grease. Each fat was spray dried with or without the inclusion of Tween-80 emulsifier (at 2% w/w) and comprised 12% of the final diets. Diets were otherwise formulated to exceed NRC nutrient requirements. Liquid diets were reconstituted with water to 13% dry matter and were offered ad libitum via milk-replacer feeders (Kane Manufacturing). Diet physical form greatly accelerated piglet growth (P<0.05), with liquid-fed pigs (488 g/d) out gaining dry-fed pigs (333 g/d) by 47%. Triglyceride chain length also impacted growth (P<0.05), with pigs fed LCT outperforming MCT-fed pigs by 23%. Effects of emulsifier were not detected (P>0.1). Accelerated growth was accompanied by elevated feed intake which was 15 % greater for liquid-fed than for dry-fed pigs and was 22% greater for pigs fed LCT vs MCT. Accordingly, gain:feed was improved by 28% in liquid-fed pigs (P<0.05). Collectively, we infer that feeding liquid diets containing long chain triglycerides will enhance weanling pig growth performance.

**Key Words:** Weanling Pigs, Milk or Dry Diet, FA Chain Length

**T208 Reproductive response of replacement gilts to dietary beta-carotene supplementation.** C. A. Mejia-Guadarrama<sup>1,2</sup>, I. Ordoñez-Reyes<sup>2</sup>, E. Villagómez-Amezcuca<sup>3,2</sup>, J. A. Rentería-Flores<sup>1,2</sup>, and J. A. Cuarón-Ibargüengoytia<sup>1,2</sup>, <sup>1</sup>CENID-Fisiología Animal INIFAP, Queretaro, Mexico, <sup>2</sup>FESC-Universidad Nacional Autónoma de México, Queretaro, Mexico, <sup>3</sup>CENID-Microbiología INIFAP, D.F., México.

To determinate the effect of beta-carotene (BC) on the ovulation rate and embryo survival in gilts, a total of 30 LND x DRC gilts were used with an initial weight and age of 130±3.5 kg and 270±0.5 days, respectively. Estrous were synchronized using Regumate in feed for 18 days. Gilts were allotted to two treatments: 1) SBC (BC free) or 2) WBC (BC 255mg/day in feed). Diets were fed starting on day 22 before AI and until day 31 pos-breeding. During the phase previous to AI, gilts received 3 kg/day of a single growing feed (3.2 Mcal ME/kg and 17.5% de CP), containing or not BC (85 mg/kg). Once gilts were inseminated, they were fed 2.2 kg/day of a single gestation feed (3 Mcal ME/kg and 15% CP), containing or not BC (115 mg/kg), until sacrifice. Estrous detection was made twice a day. Gilts were artificially inseminated, and weighed at the beginning of the experiment, after AI, and a day before sacrifice. All gilts were slaughtered at day 31±2, after inseminated, to collect the reproductive tract (ovaries and uterus). Data were analyzed by ANOVA for a completely randomized design. The live body and ovaries weights of gilts were similar (P>0.45) between treatments. Addition of BC to the diet did not modify (P>0.80) the ovulation rate or the ovulation quality (presence of cysts) of the gilts. The potential loss of embryos was lower (P=0.06) in WBC gilts than in SBC gilts (2.2 vs. 3.3 embryos, respectively). When the relative risk of potential loss of embryos was calculated, we found that using BC reduced the loss of embryos 56% compared to SBC. We conclude that BC intake does not alter ovulation rate, but may decrease the risk of embryo losses by 44% compared to gilts not fed BC in diet.

**Key Words:** Beta-carotene, Embryo Survival, Gilt

**T209 The effects of Quantum™ phytase on pig bone ash percentage and performance.** A. L. Wagner<sup>1</sup>, A. F. Harper<sup>1</sup>, M. J. Estienne<sup>1</sup>, M. E. Persia<sup>2</sup>, M. R. Bedford<sup>2</sup>, and J. Escobar<sup>1</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, <sup>2</sup>Syngenta Animal Nutrition, Research Triangle Park, NC.

Fat-free metacarpal bone ash percentage (FFBAP) is a sensitive measure of the phosphorus (P) adequacy of swine diets. Two experiments were conducted to determine the effects of two doses of Quantum™ phytase (QP) on FFBAP and performance of pigs fed reduced available P (AP) diets. The positive control diet (PC) met or exceeded NRC (1998) recommendations for all nutrients. The negative control diet (NC), which was similar to PC but deficient in AP, was supplemented with 0, 250 or 500 FTU of QP/kg diet. Pigs were fed a common diet until they reached 10 kg BW, after which experimental diets were fed until the unsupplemented NC group reached 20 kg BW. All pigs (Exp. 1) or four pigs per pen (Exp. 2) were killed and the front right foot was collected for FFBAP analysis. Data were analyzed using ANOVA and means separated using specific pre-planned contrasts. In Exp. 1, 24 pigs per treatment (3 pigs per pen of mixed sex) were used. A reduction (P < 0.01) in FFBAP (5.5% units), ADFI (119 g), and ADG (155 g) was measured in pigs fed unsupplemented NC compared to PC. Addition of QP to NC increased FFBAP (2.2 and 2.6% units, P < 0.003), ADFI (76 and 81 g, P < 0.06) and ADG (63 and 49 g, P < 0.04) for the 250 and 500 FTU/kg diets, respectively. In Exp. 2, 120 pigs per treatment

(12 pigs per pen, split sex with 5 pens of barrows and 5 of gilts per treatment) were used. A reduction (P < 0.0001) in FFBAP (5.6% units), ADFI (159 g), and ADG (141 g) was measured in pigs fed unsupplemented NC compared to PC. Addition of QP to NC increased FFBAP (1.8 and 2.8% units, P < 0.003), ADFI (18 g, P = 0.19 and 23 g, P = 0.07) and ADG (18 g, P = 0.17 and 50 g, P = 0.004) for the 250 and 500 FTU/kg diets, respectively. These data demonstrate the ability of QP to increase bioavailability of phytate P and consistently increase pig FFBAP, as well as to increase ADFI and ADG in pigs fed AP deficient diets.

**Key Words:** Pig, Phytase, Bone Ash

**T210 Effect of substitution of sorghum by corn on performance of growing/finishing barrows and gilts.** H. Bernal-Barragán<sup>1</sup>, E. Castellanos-Martínez<sup>2</sup>, E. M. Romero-Treviño<sup>2</sup>, E. Gutiérrez-Ornelas<sup>1</sup>, M. A. Cerrillo-Soto<sup>3</sup>, A. S. Juárez-Reyes<sup>3</sup>, H. Morales-Treviño<sup>1</sup>, and J. Colín-Negrete<sup>1</sup>, <sup>1</sup>Fac. de Agronomía UANL, Marín N.L., México, <sup>2</sup>Instituto Tecnológico de Altamira, Altamira, Tamaulipas, <sup>3</sup>Fac. de Medicina Veterinaria y Zootecnia UJED, Durango, Dgo, México.

One 35-d trial was conducted to determine the effects of four type of grain mixtures (sorghum or corn) on productive performance of growing pigs. A total of twenty-four crossbred (Landrace x Yorkshire x Duroc) pigs, 12 barrows and 12 gilts (initial body weights of 47.2 ± 4.2, and 43.6 ± 3.8 kg, respectively) were randomly allocated into a 4 x 2 factorial treatment experiment. Pigs were individually fed in 1.5 x 2.2 m pens, daily feed intake and pig's weight were recorded every 7 days. Treatments were related to the grain mixture of diet: 1) 100% sorghum, 0% corn (C0), 2) 65% sorghum, 35% corn (C35), 3) 35% sorghum, 65% corn (C65), and 4) 0% sorghum, 100% corn (C100). Diets were formulated with 16.2% CP, 0.80% Lysine, 0.62% Ca, and 0.50% P. Metabolizable energy content for treatments 1 to 4 were 3.22, 3.26, 3.31 and 3.37 Mcal/kg, respectively. Results were analyzed with the General Linear Model of SPSS, and means were compared using the Duncan test. Barrows had higher (P<0.1) ADG than gilts when they received C65 (1.085 vs 0.818 kg/d) and C35 diets (0.995 vs 0.839), but ADG was similar (P>0.1) between gender when diets contained either only sorghum (0.912 vs 0.919 kg) or corn (0.914 vs 0.974 kg/d for barrows and gilts, respectively). No treatment effects (P>0.05) were found for ADFI (3.602 kg/d) and F:G (3.95:1). The highest economic return by animal (P<0.1) was obtained for barrows fed the C35 diet, the lowest for gilts receiving C35 and C65 diets. In conclusion, feeding barrows with diets including a mixture of sorghum and corn, and gilts with either only sorghum or corn may improve the performance and economic return of swine production units.

**Key Words:** Pigs, Sorghum, Corn

**T211 The effects of feeding diets naturally-contaminated with Fusarium mycotoxins on protein metabolism in late gestation and lactation of sows and the efficacy of a polymeric glucomannan adsorbent in preventing these effects.** G. Diaz-Llano\*, C. Caballero-Cortes, R. M. Friendship, and T. K. Smith, *University of Guelph, Guelph, ON, Canada.*

The feeding to swine of grains naturally contaminated with *Fusarium* mycotoxins reduces feed intake and increases body weight loss in



lactation. An experiment was conducted to investigate the effects of feeding grains naturally contaminated with *Fusarium* mycotoxins on the metabolic state of skeletal muscle of sows during late gestation and lactation, and to test the efficacy of a polymeric glucomannan mycotoxin adsorbent (GMA, Mycosorb, Alltech, Inc., Nicholasville, KY) in preventing these effects. A completely randomised block design, 32 sows, 8 sows per treatment was employed. Diets were corn, wheat and soybean meal based and were fed from 91 days of gestation until weaning on d 21 post farrowing. The treatments were: (1) control (C), (2) contaminated grains (CG) (3.6 ppm DON + 0.3 ppm 15-acetyl DON + 0.2 ppm zearalenone), (3) contaminated grains + GMA and (4) restricted to 80% of feeding control (RF). The studied variables were feed intake, body weight gain, gain: feed, total serum protein, urea and ammonia, and the ratios of RNA: DNA and protein: DNA in the triceps *bracii* muscle. Means were compared by contrasts and significance was declared at  $P \leq 0.05$ . Serum protein, urea, ADFI and ADG were not affected by diets, but ammonia was increased with CG and RF treatment and it was reduced with GMA in gestation. In lactation, ADFI was reduced with the feeding of CG and GMA. There were no effects of diet on RNA: DNA ratios in lactation. Protein: DNA was reduced in RF compared to C ( $P = 0.04$ ). In conclusion the feeding of diets contaminated with *Fusarium* mycotoxins increased serum ammonia, and dietary supplementation with GMA prevented this effect. The reductions in muscle protein: DNA, an index of protein synthesis, were caused mainly by reductions in feed intake and were not directly caused by feed borne *Fusarium* mycotoxins.

**Key Words:** Gestating Sows, *Fusarium* Mycotoxins, Lactating Sows

**T212 Effects of heat processing of corn and rice on serum ghrelin concentrations in young pigs.** D. Menoyo<sup>1</sup>, D. G. Valencia<sup>1</sup>, V. Barrios<sup>2</sup>, M. P. Serrano<sup>1</sup>, B. Vicente<sup>1</sup>, R. Lázaro<sup>1</sup>, J. Argente<sup>2</sup>, and G. G. Mateos\*<sup>1</sup>, <sup>1</sup>Universidad Politécnica de Madrid, Spain, <sup>2</sup>Servicio de Endocrinología, Hospital Infantil Universitario Niño Jesús, Spain.

Human and animal studies suggest a role for high glycemic index (GI) diet on feed intake mediated by endocrine signals. Ghrelin is a peptide with potent appetite-stimulating activity that might affect voluntary feed intake. In addition, ghrelin has the specific characteristic of having an acylated group on one of its serine residues (Ser 3), which affects its activity. We have previously reported that type (rice vs. corn) and processing (raw vs. cooked) of the cereal of the diet increases GI in young pigs. This effect might partially explain the increases in feed intake observed when rice replaces corn in pig diets. The present study was designed to elucidate the effects of cereal type and heat processing of the cereal on dynamics of serum ghrelin after a short-term fasting and re-feeding trial. Weanling pigs (BW =  $8.10 \pm 1.2$  kg, n=9 per treatment) were individually penned and fed their respective experimental diets based on milk products, fish meal, and 52% of corn or rice either raw or cooked. Pigs received their experimental diets for two weeks and then they were deprived of food for 12h (start of the experiment, 0h). Afterwards they were re-fed *ad libitum* for 3h and deprived again of food for 6 extra-hours. Blood was collected at 0h, 3h, 6h, and 9h of the experiment. Ghrelin levels were quantified by RIA (Linco Research, St-Charles, MO). Ghrelin levels were not affected by dietary treatment ( $P > 0.10$ ), but were modified ( $P < 0.01$ ) by time, with a maximum (532 pg/ml) at 6h of the experiment. Analysis of the acylated ghrelin levels

will provide further insights on the implication of this hormone in the appetite stimulating effects of rice.

**Key Words:** Weanling Pigs, Ghrelin, Heat processing

**T213 Citric acid and thymol influence gastrointestinal microflora in pigs at weaning.** A. Piva<sup>1</sup>, E. Grilli\*<sup>1</sup>, M. R. Messina<sup>1</sup>, S. Albonetti<sup>2</sup>, V. Pizzamiglio<sup>1</sup>, I. Cipollini<sup>1</sup>, P. P. Gatta<sup>1</sup>, and G. Zaghini<sup>1</sup>, <sup>1</sup>DIMORFIPA, Ozzano Emilia, Bologna, Italy, <sup>2</sup>DSPVPA, Ozzano Emilia, Bologna, Italy.

Aim of this study was to investigate the role of citric acid (CA) and thymol on growth performance and gastrointestinal microflora in weaning pigs. Ninety-six Landrace  $\times$  Duroc piglets weaned at 22 days of age ( $6.7 \pm 0.8$  kg BW) were divided into four groups of 4 replicates of 6 animals each and assigned to experimental dietary treatments: control diet (T1) or the control diet added with microencapsulated CA (T2), microencapsulated thymol (T3), and a microencapsulated blend providing the same amounts of CA and thymol of the other groups (T4) (EP 1391155B1; US 20040009206A1; Vetagro srl, Italy). Piglets were fed a two-phase diet (0-21 d, 22-42 d) and at 42 days 6 animals per treatment were sacrificed, the GI tract was removed and the contents of stomach, proximal jejunum, distal jejunum, caecum and colon were collected to be analysed for pH, NH<sub>3</sub>, VFA, and lactobacilli, coliforms, and *C. perfringens* counts. Live weight at 0, 21 and 42 days was recorded; average daily gain, feed intake and feed conversion rate between 0-21, 22-42 and 0-42 days were calculated. All data were analyzed by ANOVA and differences were considered statistically significant at  $P < 0.05$ . Thymol increased feed intake throughout the study (0-42d, +12.6% T3 vs T1,  $P < 0.05$ ); final weights were not different. Microencapsulated CA (T2) or thymol (T3) failed to change bacterial counts along the GI tract, whereas only the microencapsulated blend (T4) significantly reduced by 4 Logs coliforms in caecum compared to control fed piglets (T1 =  $6.73 \pm 0.61$ , T4 =  $2.81 \pm 3.12$ , Log CFU/g,  $P = 0.04$ ). These data suggests that microencapsulated thymol improved feed intake throughout the crucial 42 days of the post weaning period and that the individual microencapsulated compounds at the supplemented dose were not inhibitory, whereas properly coupled substances may exert a synergistic activity in modulating cecal microflora.

**Key Words:** Citric Acid, Thymol, Weaning

**T214 Use of different soybean and fish meal protein sources in diets for young pigs.** M. T. Sánchez<sup>1</sup>, D. G. Valencia<sup>1</sup>, M. P. Serrano<sup>1</sup>, J. Sánchez<sup>2</sup>, R. Lázaro<sup>1</sup>, and G. G. Mateos\*<sup>1</sup>, <sup>1</sup>Universidad Politécnica de Madrid, Spain, <sup>2</sup>Imasde Agropecuaria, Spain.

A trial was conducted to compare three soybean protein (SOY) sources (SPC, a soy protein concentrate with 54.3% CP; SoyMAX, a high quality soybean meal from Owensboro crushing plant with 48.5% CP, and RSBM, a regular soybean meal with 46.8% CP), and three fish meal (FM) sources (LTFM, a FM spray dried at 70 °C with 71.2% CP; HQFM, a FM steam dried at 80 °C for 50 min with 64.9% CP, and SFM, a FM steam dried at 110 °C for 120 min with 60.7% CP) in piglet feeds on productivity from 23 to 43 d of age and apparent total tract digestibility (ATTD) of nutrients at 34 and 43 d of age. The

protein source tested replaced 5% of the protein provided by RSBM in all the diets. Each treatment was replicated six times (six piglets per replicate). Comparisons were performed to study the effect of protein source (SOY vs. FM), SOY source (SPC vs. SoyMAX vs. RSBM), and FM source (LTFM vs. HQFM vs. SFM). From 23 to 34 d of age pigs fed SOY were more efficient than pigs fed FM (0.91 vs. 0.96 g/g;  $P < 0.05$ ) but no effects were observed thereafter. For the entire experiment source of SOY did not affect performance, but the incidence of diarrhea tended to be lower in pigs fed SPC ( $P < 0.10$ ). Pigs fed LTFM were more efficient than pigs fed SFM, with pigs fed HQFM intermediate (1.04 vs. 1.16 vs. 1.10 g/g;  $P < 0.05$ ). The ATTD of dietary components increased with age. Pigs fed FM had better ATTD of ether extract than pigs fed SOY ( $P < 0.001$ ), but no effect was observed for the other nutrients. The ATTD was better for pigs fed SoyMAX than for pigs fed SPC ( $P < 0.01$ ), with RSBM intermediate. Also, ATTD of FM was the best for pigs fed LTFM ( $P < 0.01$ ). In summary, soy protein concentrate does not improve growth or nutrient digestibility as compared with soybean meal. Pigs fed spray dried fish meal are more efficient and have better digestibility of nutrients than pigs fed fish meal steam dried at 110°C for 120 min.

**Key Words:** Fish Meal Processing, Soy Protein Concentrate, Piglet Feeding

**T215 Segregated early-weaning down regulates the expression of the small intestinal alkaline phosphatase.** D. Lackeyram\*, C. Yang, T. Archbold, and M. Z. Fan, *University of Guelph, Guelph, Ontario, Canada.*

The digestion of non-phytate organic sources of phosphates is effected by the small intestinal alkaline phosphatase (IAP). This enzyme also participates in the absorption of triglycerides as such it is also regarded as a marker enzyme for the functional development of the small intestine. The objectives of this study were to: (i) partition the tissue IAP activity into the brush border membrane (BBM) and intracellular fractions; (ii) examine IAP enzyme abundance in these cellular fractions and (iii) investigate changes in IAP mRNA expression. Ten suckling (SUC) and 10 weaning SEW) piglets, balanced for gender with an average BW of 3kg were used. The SUC group was marked at d 10 and allowed to suckle for 12 d and the SEW group was fed a corn and soybean meal starter-I diet for 12 d. In vitro enzymatic kinetic experiments of jejunal tissue using P-Nitrophenyl phosphate (0-10 mM) was used for enzymatic kinetic experiment incubations. Quantitative real time RT-PCR was performed on intestinal tissues using the Quantitect SYBR Green RT-PCR kit with a Smart Cycler (Cepheid, CA). Weaning decreased ( $P < 0.05$ ) the maximal specific activity ( $V_{max}$ ,  $\mu\text{mol}/\text{mg protein}\cdot\text{min}$ ,  $n = 60$ ) of IAP (SEW,  $0.35 \pm 0.02$  vs. SUC,  $0.44 \pm 0.04$ ; SEW,  $0.66 \pm 0.01$  vs. SUC,  $0.73 \pm 0.01$ ) in both the tissue homogenate and the BBM, respectively. Similar decreases ( $P < 0.05$ ) were observed in the IAP protein abundance (arbitrary units) in the tissue homogenate (SEW,  $1.75 \pm 0.27$  vs. SUC,  $3.33 \pm 0.70$ ), intracellular (SEW,  $0.79 \pm 0.06$  vs. SUC,  $1.69 \pm 0.17$ ) and BBM fractions (SEW,  $0.69 \pm 0.12$  vs. SUC,  $1.89 \pm 0.48$ ). Furthermore, SEW reduced ( $P < 0.05$ ) the IAP mRNA abundance (arbitrary units relative to  $\beta$ -actin) by 2.4 fold (SEW,  $0.06 \pm 0.01$  vs. SUC,  $0.14 \pm 0.01$ ). Pearson correlation analyses demonstrated correlations ( $P < 0.05$ ) between  $V_{max}$  and IAP protein in both tissue homogenate and BBM fractions and between IAP protein and mRNA levels. In conclusion, early weaning

down regulates gut IAP expression at the transcriptional and protein processing levels in the pig.

**Key Words:** Early Weaning, Intestinal Alkaline Phosphatase, Gene Expression

**T216 The phosphorus-releasing efficacy of an *E. coli*-derived phytase in young pigs is dose-dependent and is not affected by the addition of a lipid-based coating added for pelleting stability.** N. R. Augspurger\*<sup>1</sup>, A. M. Gaines<sup>1</sup>, J. R. Danielson<sup>2</sup>, and L. L. Southern<sup>3</sup>, <sup>1</sup>JBS United, Inc., Sheridan, IN, <sup>2</sup>University of Wisconsin, Madison, <sup>3</sup>LSU Agricultural Center, Baton Rouge, LA.

Two trials were done to determine the effect of increasing phytase activity on quantitative P-releasing efficacy of a bacterial-derived phytase (OptiPhos, JBS United, Inc.) in nursery pigs. Individually-fed pigs ( $n = 8$  per treatment, initial BW = 10.2 [Trial 1] and 9.8 kg [Trial 2]) were fed P-deficient corn-soybean meal diets (0.075% available P, 0.60% Ca) supplemented with inorganic P (iP, monosodium phosphate) or phytase. At the end of each trial, a fibula was collected from each pig for determination of bone ash (% [BAP] and milligrams [BAC]). Standard-curved methodology was used to calculate P-release values for phytase. Trial 1 had 4 iP concentrations (0, 0.066, 0.133, or 0.20%) and 250, 500, or 1,000 FTU/kg phytase. In this trial, iP and phytase supplementation increased ( $P < 0.01$ ) ADG, BAC, and BAP over the basal diet. Phytase at 250, 500, and 1,000 FTU/kg released 0.124, 0.140, and 0.179% P, respectively. Trial 2 had 3 iP concentrations (0, 0.075, or 0.15%) and 250, 500, or 1,000 FTU/kg of the phytase with a lipid-based coating that enhances thermo-tolerance at 85 °C, compared to 250 FTU/kg of the uncoated phytase. Supplementation of iP resulted in linear increases in ADG ( $P = 0.051$ ) and BAC and BAP ( $P < 0.01$ ). There was no difference ( $P > 0.10$ ) between the uncoated or coated phytase at 250 FTU/kg for any response. For the coated phytase, BAC was increased ( $P < 0.05$ ) with each increase in activity concentration, but BAP was greater ( $P < 0.05$ ) for pigs fed diets containing 500 and 1,000 FTU/kg coated phytase compared to 250 FTU/kg. Quantitative P-release values for 250, 500, and 1,000 FTU/kg of an *E. coli*-derived phytase with a lipid-based coating were 0.132, 0.169, and 0.223%, respectively; 250 FTU/kg of the uncoated phytase released 0.130% P. These data demonstrate dose-dependent increases in quantitative P-releasing efficacy for an *E. coli*-derived phytase in pigs. The addition of a lipid-based coating to the phytase for pellet stability did not affect its efficacy in pigs.

**Key Words:** Phytase, Phosphorus, Pigs

**T217 Evidence of a preference in piglets for an animal protein hydrolysate.** D. Martínez-Puig\*<sup>1</sup>, M. Anguita<sup>2</sup>, F. Baucells<sup>2</sup>, E. Borda<sup>1</sup>, J. F. Pérez<sup>2</sup>, and C. Chetrit<sup>1</sup>, <sup>1</sup>Bioiberica S.A., Barcelona, Spain, <sup>2</sup>Dpt. Ciència Animal i dels Aliments, Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain.

The transition in piglets from suckling to eating solid feed is associated with a critical period of underfeeding, suboptimal growth rate and increased risk of diarrhea. The objective of the current study was to investigate if the piglets may show a preference for the intake of

diets containing a specific protein concentrate ingredient. To test this hypothesis, we compared a hydrolysate of animal protein (Palbio Inicium™), and a hydrolysate of soy protein, or spray dried porcine plasma (SDPP). 96 piglets were weaned at 21 days of age and randomly subdivided into 3 groups of 32 pigs each. Piglets were distributed into 24 pens (8 replicates of pigs per group). Every group of piglets had the choice between two diets, resulting in three comparisons. In comparison 1, a diet containing SDPP (4%) was tested against a diet containing a soy protein hydrolysate (4%); in comparison 2, a diet containing the animal protein hydrolysate (Palbio Inicium™; 1%) and 3% of a soy protein hydrolysate was compared against the soy diet (4%); and in comparison 3 the diet containing Palbio Inicium™ (1%) was compared against the SDPP diet (4%). Feed intake was registered daily during 7 days after weaning. The percentage of preference (%) was calculated as the accumulated intake of the tested diet divided by the total intake. During the whole period no preference for SDPP diet (46.3%) compared to the soy diet was observed. Contrarily, the animal protein hydrolysate diet was significantly preferred to the soy diet from day 4 (59%;  $P < 0.05$ ) until day 7 (65.4%;  $P < 0.05$ ). Choice for the animal protein hydrolysate diet was numerically higher compared to the SDPP diet (58%) but differences failed to reach statistical significance. These results suggest that the palatability of a postweaning diet can be improved by incorporating a 1% of an animal protein hydrolysate.

**Key Words:** Piglet, Preference, Animal Protein Hydrolysate

**T218 Effect of coarse ground corn, sugar beet pulp and wheat bran on the colonic morphology in growing pigs.** M. Nofrarias<sup>1,2</sup>, M. Anguita<sup>2</sup>, M. Roca<sup>1,2</sup>, J. F. Pérez<sup>2</sup>, and N. Majó<sup>1,2</sup>, <sup>1</sup>Centre de Recerca en Sanitat Animal (CRESA), Bellaterra, Spain, <sup>2</sup>Universitat Autònoma de Barcelona, Bellaterra, Spain.

The aim of this work was to evaluate the influence of different types of dietary fiber on the colonic digesta characteristics and intestinal morphology in growing pig. A total of 96 pigs (15±0.2 kg) were fed four experimental diets including a control group (CT) or the same diet including coarse milled corn (CC), 8% sugar-beet pulp (SBP) or 10% wheat bran (WB). Three experimental periods were considered (7, 21 and 42 days) and 8 animals per treatment killed at the end of each period. Proximal colonic digesta was analyzed for cytolytic capacity of the water digesta and microbial diversity. Histological study was performed in tissue samples from proximal colon. Cytolytic capacity of the colonic water tended to increase with the inclusion of WB in the diet ( $P = 0.091$ ). Moreover, in the third period, WB-fed pigs had a decrease in the colonic microbial diversity ( $P < 0.05$ ). In the early stages (day 7), diets with higher amount of fiber (CC, SBP and WB) increased the presence of inflammatory cells between crypts compared to CT fed pigs (2.42 vs. 1.85 cells;  $P < 0.05$ ). However, with time (days 21 and 42), inclusion of SBP in the diet lowered numbers of lymphocytes in the epithelium and in the lamina propria, and the presence of lymphoid nodules in the mucosa of the colon compared with other diets ( $P < 0.05$ ). The thickness of tunica muscularis was lower for SBP and WB pigs in the proximal colon ( $P < 0.05$ ), whereas no changes in crypt depth and numbers of mitoses were observed. The incorporation of fibrous ingredients in growing pig diets may induce changes on the digesta properties and histology of colonic mucosa. While WB reduced microbial diversity, the incorporation of SBP favoured the adaptation of the animals to the growing pig

diet, as suggested by the lowering effect on indicators of mucosa inflammation.

**Key Words:** Dietary Fiber, Intestinal Histology, Pig

**T219 Duodenal infusion of pancreatin to growing pigs fed phytase-supplemented, sorghum-soybean meal diets: Apparent ileal amino acid digestibility.** S. Fierro, M. Cervantes\*, W. Sauer, A. Morales, N. Torrentera, and A.B. Araiza, ICA - Universidad Autonoma De Baja California, Mexicali, BC. Mexico.

Phytates in feed ingredients appear to inhibit the activity of pancreatic enzymes in pigs. This experiment was conducted to determine if duodenal infusions of pancreatin, a mixture of lyophilized pancreatic enzymes, improves the apparent ileal digestibility (AID) of amino acids in pigs fed sorghum-SBM diets added with phytase. Eight barrows (Yorkshire-Landrace-Hampshire), average body weight of 38.3 ± 2.8 kg, fitted with two T-cannulas (one in duodenum and other in terminal ileum) were used. Treatments (T) were as follows: T1 = basal sorghum-SBM diet, 13.1% CP; T2 = basal diet supplemented with 1,000 phytase units per kg diet; T3 = as T1 plus pancreatin infusion (591 mg kg<sup>-1</sup> of diet); T4 = as T2 plus pancreatin infusion (591 mg kg<sup>-1</sup> of diet). Pancreatin was infused into duodenum at every feeding time using a 25-cc syringe. The study was conducted as a replicated 4x4 Latin square design. All diets were added with vitamins and minerals to meet the 1998 NRC standards for growing pigs. Chromic oxide was added to all diets as a digestibility indicator. The AID of essential AA for T1, T2, T3, and T4 were: Arg, 77.8, 78.1, 77.3, 79.0; His, 72.1, 71.4, 69.9, 72.2; Ile, 72.7, 72.1, 70.3, 71; Leu, 77.5, 76.8, 75.3, 76.9; Lys, 63.4, 64.0, 61.8, 60.7; Met, 69.6, 68.2, 66.0, 67.6; Phe, 75.7, 75.0, 73.5, 74.7; Thr, 57.0, 55.2, 54.9, 57.7; Val, 68.3, 67.5, 66.3, 67.4, respectively. There was no effect of duodenal infusion of pancreatin or phytase supplementation ( $P > 0.10$ ) on the AID of essential AA. Also, there was no interaction ( $P > 0.10$ ) between phytase supplementation and pancreatin infusion. The AID of essential AA was 3.2 percentage units higher than non-essential AA. These results indicate that the duodenal infusion of pancreatin does not improve the AID of AA of growing pigs fed sorghum-SBM diets supplemented with phytase.

**Key Words:** Pigs, Amino Acid Digestibility, Pancreatin

**T220 Effect of dietary antibiotics and mannan oligosaccharides on growth performance, carcass characteristics and health of growing/finishing pigs.** H. Bernal-Barragán\*<sup>1</sup>, E. A. Ruiz-Chávez<sup>1</sup>, E. Gutiérrez-Ornelas<sup>1</sup>, R. Ávalos-Ramírez<sup>2</sup>, M. Cervantes-Ramírez<sup>3</sup>, and F. Sánchez-Dávila<sup>1</sup>, <sup>1</sup>Facultad de Agronomía, Universidad Autónoma de Nuevo León, Marín, Nuevo León, México, <sup>2</sup>Fac. de Medicina Veterinaria y Zootecnia UANL, Unidad Mederos, Monterrey N.L. México, <sup>3</sup>Instituto de Ciencias Agrícolas UABC, Ejido Nuevo León, Valle de Mexicali, B.C. México.

This study was conducted to evaluate the effects of a mannan oligosaccharide product (MOS) and antibiotic (BMD) on growth performance, carcass characteristics and health of growing/finishing pigs. Forty-eight (14 barrows and 32 gilts) crossbred (Landrace ×

Yorkshire × Duroc) pigs (43.5 ± 3.8 kg) allotted by sex and weight, were randomly allocated to one of four dietary treatments in a 2 × 2 factorial, with the factors being MOS (0 or 0.05%) and BMD (0 or 33 ppm). A Basal sorghum-SBM diet was formulated to meet the NRC 1998 standards for swine, and had no addition of pharmacological levels of cooper sulfate. The trial was conducted for 63 days during the summer (av. temperature 29.7°C, and relative humidity 62%). Results were analyzed with the General Linear Model of SPSS, and means were compared using the Duncan test. Average daily gain (0.775 kg/d), ADFI (2.414 kg/d) and F:G (3.12:1) were not affected (P>0.05) by the level of MOS or BMD. Pigs fed the diet added with both MOS and BMD, had higher ADG (P<0.05) than those fed the other three diets (0.855 vs 0.749 kg/d). By adding none or both of the additives, pigs had higher (P<0.05) carcass length at slaughter (75.1 vs 73.2 cm), than animals fed diets containing either MOS or BMD (Interaction MOS × BMD P<0.05). Pigs receiving BMD had higher (P<0.05) average fat depth than pigs with no BMD in their diet (30.3 vs 26.8 mm). Diets containing MOS alone had no effect on growth performance or carcass characteristics of growing/finishing pigs. Health condition of pigs was not affected by treatments. In conclusion, withdrawing BMD from the diet of growing/finishing pigs had no effect on performance or carcass characteristics. Adding MOS had a positive effect on ADG only if BMD was also provided in the diet.

**Key Words:** Pigs, Antibiotics, Mannan Oligosaccharides

**T221 Effect of a dry organic acid blend on lactating sow feed intake and performance.** J. Zhao<sup>\*1</sup>, R. J. Harrell<sup>1</sup>, L. L. Greiner<sup>2</sup>, X. Wang<sup>3</sup>, G. L. Allee<sup>3</sup>, F. Navarro<sup>1</sup>, and C. D. Knight<sup>1</sup>, <sup>1</sup>Novus International Inc, St. Louis, MO, <sup>2</sup>Innovative Sow Solutions, Carthage, IL, <sup>3</sup>University of Missouri, Columbia.

A total of 112 mixed parity (1, 2, or 3) lactating sows (PIC C22) were used to investigate the impact of a dry organic acid blend (DOAB) (ACTIVATE<sup>®</sup> Starter DA, registered trademark of Novus International, Inc., St. Louis, MO), containing 2-hydroxy-4-(methylthio) butanoic acid calcium, benzoic acid, and fumaric acid, on sow feed intake, wean to estrus interval, and litter growth performance. Sows were blocked by parity and randomly assigned to either a non-medicated basal corn-soybean diet, or the basal diet supplemented with 0.2 or 0.4% DOAB upon entry into the farrowing house. Sows were fed via a HOWEMA automatic feeding system 1.8, 2.7, and 3.6 kg for the day of farrowing, d 1 and d 2 post-farrowing, respectively, and ad libitum until weaning at 17±1 days of lactation. Daily feed intake was higher from 3 to 5 d post-farrowing with 0.4% DOAB supplementation (P < 0.05) compared to 0.2% or controls. Sows consumed 6.3, 6.3, and 7.2±0.3 kg/d feed from 3 to 5 d post-farrowing for the control, 0.2, and 0.4% DOAB, respectively. Feed intake was not affected by DOAB supplementation for the remainder of the study (P = 0.83). The wean to estrus interval was linearly reduced with DOAB supplementation (P < 0.05), with 9.2, 7.7, and 5.5±1.2 days for the control, 0.2, and 0.4% DOAB, respectively. Sow fecal E. Coli and C. perfringens counts (10 sows/treatment) on d 3 and 10 post farrowing was not different among treatments (P > 0.26). No differences were observed between treatments on litter weights, number weaned, or number of fall behinds (P > 0.31). In summary, DOAB supplementation improved feed intake during 3-5 days postfarrowing and shortened the return to estrus interval.

**Key Words:** Organic Acid, Sow, Reproduction

## Nonruminant Nutrition: Poultry Nutrition II

**T222 Broiler performance and yield observed with enzyme supplementation and a corn matrix adjustment for energy.** X. Sun<sup>\*1</sup>, C. Troche<sup>1</sup>, A. McElroy<sup>1</sup>, J. Remus<sup>2</sup>, E. Wong<sup>1</sup>, and C. Novak<sup>1</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, <sup>2</sup>Danisco Animal Nutrition, Carol Stream, IL.

Two studies were conducted to investigate the effect of a corn matrix adjustment and enzyme supplementation on broiler growth and performance from 0 to 49 days of age. A 2 × 2 factorial treatment design was used testing two corn matrix (CME) values for energy (actual ME vs. corn A with matrix increase of 138 kcal ME/ kg – trial 1; corn B with matrix increase of 125 kcal ME/ kg – trial 2) with or without enzyme supplementation (0.5 % Avizyme 1502 – AZ). For each trial, 1,440 Ross 708 male chicks were randomly assigned to one of four dietary trts (9 reps/trt and 40 chicks/ rep) on d 1. Body weight (BW) and feed intake (FI) were recorded at feed changes (d 14, 28, 37) and d 7 and 49. At d 28, subsets of birds were transferred to Petersime batteries to determine feed passage rate. At d 50 and 51, 54 birds per trt were processed to evaluate meat yield. Using corn B, an interaction was observed evaluating BWG with improvements noted when supplementing AZ with no matrix adjustment while reduced with a matrix adjustment to 35 d. The opposite was true using corn A. BWG was similar across trts from d 35 to 49 using either corn. FI followed BWG data using corn B. Using corn A, feeding matrix adjusted diets increased FI as compared to non adjusted diets from 37

to 49 days of age. Additionally, FI of broilers fed the AZ supplemented/ non adjusted diet ate less as compared to broilers fed the adjusted/ with AZ or non adjusted diet from 28 to 37 days of age. Overall, FCR in birds consuming non adjusted diets (corn A and B) was better (P ≤ 0.05) as compared to birds fed CME adjusted diets. Feeding corn A, percent tender was increased (P ≤ 0.05) with enzyme supplementation (4.80 vs. 4.62%). Additionally, percent fat pad was reduced (P ≤ 0.05) with a matrix adjustment for energy using corn A. In conclusion, decisions regarding matrix adjustments to utilize additional energy released with enzyme supplementation are dependant on corn source.

**Key Words:** Broiler, Enzyme, Matrix Energy Corn Source

**T223 The effect of chitosan and natural mineral complex supplementation on egg production and egg characteristic in laying hens.** J. S. Yoo<sup>\*1</sup>, Y. J. Chen<sup>1</sup>, J. H. Cho<sup>1</sup>, J. H. Lee<sup>2</sup>, B. C. Park<sup>2</sup>, and I. H. Kim<sup>1</sup>, <sup>1</sup>Dankook University, Cheonan, Choognam, Korea, <sup>2</sup>CJ Feed Inc, Incheon, Gyeonggi, Korea.

This study was conducted to investigate the effects of dietary natural mineral liquid complex(NMLC) on egg production and egg characteristic in laying hens. NMLC is made of *Aretmisia princeps*