TH131 Determination of the order of limiting amino acids in milk-based liquid diets for pigs from 1.5 to 5.5 kg. A. I. Broome[1], R. J. Harrell[2], J. Odle[1], K. E. Sullivan[1], and J. H. Eisemann*[1], [1]*North Carolina State University*, *Raleigh*, [2]*Novus International Incorporated*, *St. Louis, MO*.

This experiment was designed to determine the order of limiting amino acids (AA) beyond lysine (LYS) in a whey–skim milk–caseinate diet to be fed to low birth weight pigs. Initial pig weight was 1.71±0.30 kg (Rep. 1) and 1.62±0.11 kg (Rep. 2). The order was determined using a deletion assay. This was done using a positive control (PC) diet with AA concentrations and ratios to LYS at or above NRC recommendations, a negative control (NC) diet that reduced AA concentrations and ratios to LYS to 60% of the PC diet ratios, a supplemented negative control (Supp. NC) diet with AA supplemented to provide concentrations and ratios to LYS similar to the PC diet, and deletion diets which removed threonine (THR), tryptophan (TRP), sulfur amino acids (SAA), or phenylalanine (PHE) from the Supp. NC diet to levels in the NC diet. All diets contained 4.2 Mcal GE and 20.6 g LYS/kg DM. Diets were fed ad libitum (n=8/diet). Gain, intake, G:F, and PUN concentration were analyzed for effects of diet, replicate, and interaction. The SEM values were 7.33 g/d, 7.72 g DM/d, 0.02, and 0.33 mM, respectively, for diet main effect. Gain for animals fed PC (346 g/d), NC (269 g/d), and Supp NC (315 g/d) diets differed (P<0.05). Gain of pigs on all deletion diets was similar. The SAA deletion diet produced less gain (291 g/d, P<0.05) than Supp. NC diet. Intake was similar in pigs fed PC (306 g DM/d) and NC diets (310 g DM/d) and greater (P<0.05) than for pigs on all other diets. Feed efficiency decreased for pigs fed NC diet (0.87, P<0.05) compared to all other diets. Pigs fed SAA deletion diet had the greatest (P<0.05) PUN concentration (6.96 mM). Pigs fed THR deletion diet (5.70 mM) and PC diet (5.55 mM) had similar concentrations. Based on increased PUN concentration and decreased gain in pigs fed the SAA deletion diet relative to the Supp. NC diet, it is likely that SAA were next limiting. Threonine would likely be next limiting after SAA, also based on increased PUN concentrations.

Key Words: Limiting Amino Acids, Liquid Diets, Pigs

TH132 Use of distillers dried grains with solubles and soybean hulls in nursery pig diets. F.F Barbosa*, S.S Dritz, M.D. Tokach, J.M. DeRouchey, R.D Goodband, and J.L Nelssen, *Kansas State University*, *Manhattan, Kansas, United States*.

Two 21-d experiments with 1,584 pigs in each experiment were conducted to evaluate growth performance of nursery pigs fed different levels of distillers dried grains with soluble (DDGS) or soybean hulls. In each experiment, pigs (10.9 kg in Exp. 1 and 12.4 kg in Exp. 2) were allotted to 72 pens (36 pens of barrows and 36 pens of gilts) with 22 pigs per pen on day 21 after weaning. A pen of barrows and gilts shared a common feeder and, thus, feeder was the experimental unit. In Exp. 1, treatments were a corn-soybean meal based control diet or the same diet with 7.5%, 15%, or 22.5% added DDGS. Increasing DDGS from 0 to 22.5% did not influence ADG (P>0.26; 506, 512, 516, or 515 g/d) or ADFI (P>0.21; 758, 754, 737, or 743 g/d); but linearly (P<0.004) increased G:F (0.67, 0.68, 0.70, and 0.69). The survival rate (99.0 to 99.5%) was not affected (P>0.60) by diet. In Exp. 2, treatments were arranged as a 2 x 2 factorial with either 0 or 15% DDGS and 0 or 4% soybean hulls. Adding DDGS, soybean hulls or the combination of DDGS and soybean hulls to the control diet did not influence (P>0.17) ADG (557, 555, and 542 vs. 555 g/d). There was an interaction (P<0.01) between DDGS and soybean hulls for ADFI and a trend for an interaction (P<0.09) for G:F. Adding DDGS reduced ADFI and increased (P<0.04) G:F to a greater extent when added to the control diet (786 vs 822 g/d; 0.71 vs 0.68) than when added to the diet containing soybean hulls (789 vs 804 g/d; 0.69 vs 0.69). Adding soybean hulls to the control diet did not affect (P>0.17) pig performance. The survival rate (99.5 to 100%) was not affected (P>0.31) by treatments. In summary, 15 to 22.5% DDGS and up to 4% soybean hulls were added to diets for 12 to 24 kg pigs without influencing ADG while increasing levels of DDGS (up to 22.5%) improved feed efficiency in these experiments.

Key Words: Distillers Dried Grains with Solubles, Soybean Hulls, Nursery Pigs

TH133 Amino acid supplementation of hydrolyzed feather meal diets for finisher pigs: I. Growth performance and serum metabolite profile. K. C. Divakala*[1], L. I. Chiba[1], R. B. Kamalakar[1], S. P. Rodning[1], E. G. Welles[1], K. A. Cummins[1], J. Swann[2], F. Cespedes[2], and R. L. Payne[3], [1]*Auburn University*, *Auburn, AL*, [2]*American Proteins, Inc.*, *Hanceville, AL*, [3]*Evonik-Degussa Corp.*, *Kennesaw, GA*.

The objective of this study was to determine the possibility of replacing soybean meal (SBM) in pig diets completely with feather meal (FM). Corn-SBM, finisher (F) 1 and 2 positive control diets (PC) were formulated to contain 6.1 and 4.7 g apparent ileal digestible (AID) Lys/kg, respectively, and corn-FM, negative control diets (NC) were formulated to be iso-N to the PC. The NC were supplemented with AA to satisfy all the AID indispensable (Ind) AA requirements based on the 1998 NRC AID AA (NRC; NC + Lys and Trp) and the assumption that the apparent ileal digestibility of all Ind AA in FM is 40% (40-2AA = NC + Lys, Trp, and Thr, but no His and Ile, and 40All = NC + Lys, Trp, Thr, His, and Ile). Forty-five gilts and 45 barrows (57.8 ± 0.8 kg; 3 gilts or 3 barrows/pen) were randomly assigned to 5 F-1 diets. At 81.0 ± 1.4 kg, pigs were offered F-2 diets. Pigs had ad libitum access to feed and water, and blood samples were collected at the end of the study (112.1 ± 1.8 kg). As expected, overall ADFI, AID Lys (representing Ind AA) intake (LysI), ADG, and G:F were greater and G:LysI was lower in pigs fed the PC than those fed the NC ($P < 0.001$). Overall G:LysI tended to be lower in pigs fed the NRC than those fed the PC ($P = 0.083$) or 40-2AA and 40All ($P = 0.094$), and pigs fed the 40All had numerically higher G:F ($P = 0.119$) and G:LysI ($P = 0.160$) than those fed the 40-2AA. Pigs fed the PC had more serum albumin and total protein (TP; $P < 0.001$) but less glucose ($P = 0.031$) and cholesterol ($P < 0.001$) than those fed the NC, and TP was higher ($P = 0.031$) in pigs fed the 40All than those fed the 40-2AA. Diets had no effect on urea N or triglycerides. The results seemed to indicate that pigs fed the FM diet supplemented with the necessary AA can utilize AA for weight gain as efficiently as those fed the corn-SBM diet.

Key Words: Finisher Pigs, Feather Meal, Growth Performance

TH134 Amino acid supplementation of hydrolyzed feather meal diets for finisher pigs: II. Carcass traits, meat quality, and internal organs. K. C. Divakala*[1], L. I. Chiba[1], R. B. Kamalakar[1], S. P. Rodning[1], E. G. Welles[1], K. A. Cummins[1], J. Swann[2], F. Cespedes[2], and R. L. Payne[3], [1]*Auburn University*, *Auburn, AL*, [2]*American Proteins, Inc.*, *Hanceville, AL*, [3]*Evonik-Degussa Corp.*, *Kennesaw, GA*.

Forty-five gilts and 45 barrows were used to determine the possibility of replacing soybean meal (SBM) in pig diets completely with feather meal (FM). Pigs (57.8 ± 0.8 kg; 3 gilts or 3 barrows/pen) were randomly assigned to 5 finisher (F) 1 diets. At 81.0 ± 1.4 kg, pigs were offered F-2 diets. Corn-SBM, F-1 and F-2 positive control diets (PC) were formulated to contain 6.1 and 4.7 g apparent ileal digestible (AID) Lys/kg, respectively, and corn-FM, negative control diets (NC) were formulated to be iso-N to the PC. The NC were supplemented with AA to satisfy all the AID indispensable (Ind) AA needs based on the 1998 NRC AID AA (NRC; NC + Lys and Trp) and the assumption that apparent ileal digestibility of all Ind AA in FM is 40% (40-2AA = NC + Lys, Trp, and Thr, but no His and Ile, and 40All = NC + Lys, Trp, Thr, His, and Ile). Pigs had ad libitum access to feed and water, and all pigs were slaughtered at 112.1 ± 1.8 kg. Pigs fed the PC had less average backfat than those fed the NC ($P = 0.016$) or the NRC ($P = 0.020$). The LM was greater ($P < 0.001$) in pigs fed the PC or the 40All than those fed the NC or the 40-2AA, respectively. Pigs fed the PC had greater ($P < 0.01$) % lean, lean gain (LG), and LG:F than those fed the NC, but their LG:F or LG:Lys (representing Ind AA) intake (LysI) was similar to those fed the NRC. The LG:F ($P = 0.030$) and LG:LysI ($P = 0.028$) were lower in pigs fed the NRC than those fed the 40-2AA and the 40All, and LG:LysI tended to be higher ($P = 0.068$) in pigs fed the 40All than those fed the 40-2AA. Pigs fed the 40All had greater ($P < 0.001$) meat color, firmness, and marbling scores than those fed the 40-2AA. Diets had no clear effect on organ weights. The results seemed to indicate that pigs fed the FM diet supplemented with the necessary AA can utilize AA and feed for LG as efficiently as those fed the corn-SBM diet.

Key Words: Finisher Pigs, Feather Meal, Carcass Traits

TH135 Effects of dietary crude protein level on concentrations of fecal volatile fatty acids, and fecal and urinary ammonia and volatile organic compounds in growing pigs. S. B. Cho*, D. W. Kim, O. H. Hwang, C. W. Choi, W. T. Chung, J. H. Lee, I. B. Chung, and B. S. Lee, *National Institute of Animal Science, RDA*, *Suwon, Republic of Korea*.

Present study aimed to investigate effects of dietary crude protein (CP) level on concentrations of fecal volatile fatty acids (VFA), and fecal and urinary ammonia and volatile organic compounds (VOC) in growing pigs. Twenty boars were allotted to one of four dietary treatments in randomized complete block design with five replicates. Dietary treatments consisted of four corn-soybean based meals containing 10, 12, 14, or 16% CP. Synthetic amino acids of lysine, methionine and threonine were added into the diet to provide similar contents of limiting amino acids among treatments. Pigs were housed individually in metabolic cages to allow collection of feces and urine. Fresh feces and urine samples were collected to analyze concentrations of VFA, ammonia, and VOC. Total VFA concentration from fresh feces for CP 10% diet (12.3g/kg) was higher (P<0.05) than that from the other diets (mean 7.7g/kg). Fecal ammonia concentration for CP 14% diet (6.0g/kg) was lower (P<0.05) than that from the other diets (mean 7.6g/kg). Phenol (10.0mg/kg), p-cresol (408.4mg/kg) and ammonia (2.1g/kg) concentration in urine under 12% diets decreased (P<0.05) compared with those over CP 14% diets(22.2mg/kg, 883.2mg/kg and 5.4g/kg, respectivly). Present results indicate that dietary CP level may regulate odor-producing substances in growing pigs.

Key Words: Crude Protein, Pig, Volatile Organic Compounds

TH136 Feed preferences in nursery pigs fed diets containing varying fractions and qualities of dried distillers' grains with solubles (DDGS). B. S. Seabolt[1], E. van Heugten*[1], K. D. Ange-van Heugten[1], and E. Roura[2], [1]*North Carolina State University*, *Raleigh*, [2]*Lucta SA*, *Barcelona, Spain*.

Three experiments were conducted to evaluate nursery pig preference of diets containing DDGS of different quality and levels of inclusion. Pigs were adjusted to a commercial diet (without DDGS) at weaning for at least 10 d and subsequently housed individually. Each pen contained two identical feeders positioned side by side and preference was measured for two days. In Exp. 1, 60 pigs (11.63 ± 0.27 kg BW) were given a choice between a control diet (0% DDGS) and a diet containing either 0, 10, 20 or 30% DDGS. In Exp. 2, 80 pigs (10.25 ± 0.20 kg BW) were given a choice between a control diet (0% DDGS) and a diet containing either 0% DDGS, 30% good quality DDGS or 30% poor quality DDGS. Quality was determined by odor and color of the DDGS. In Exp. 3, 80 pigs (11.15 ± 0.18 kg BW) were given a choice between a control diet without DDGS and a diet containing either 10% or 20% good quality, or 10% or 20% poor quality DDGS. Feed disappearance was measured for two days in each experiment and preference was calculated as intake of the test diet as a percentage of total feed intake. In Exp. 1, a linear decrease ($P < 0.001$) in preference for DDGS containing diets was observed, where preferences were 58.2%, 34.8%, 26.4%, and 17.2% for the 0%, 10%, 20% and 30% DDGS inclusion, respectively. In Exp. 2, no significant differences in preference were detected between good and poor quality DDGS when fed at 30% of the diet. In Exp. 3, no significant differences in preference between the control diet and 10% good or poor quality DDGS were evident. However, mean intake was greater ($P < 0.05$) for the control diet (439 g/d) compared to the 20% good quality DDGS (144 g/d). Mean intake was also greater ($P = 0.09$) for the control diet (407 g/d) compared to the 20% poor quality DDGS (242 g/d). Nursery pigs prefer a diet without DDGS over a diet containing DDGS even at low inclusion levels. Quality of DDGS as defined in this study had no effect on preference.

Key Words: Dried Distillers Grains with Solubles, Pigs, Preference

TH137 Effect of dietary protein level on serum haptoglobin and pro-inflammatory cytokine concentrations in piglets challenged with *Escherichia coli* K88. F. O. Opapeju*[1], R. L. Payne[2], and C. M. Nyachoti[1], [1]*University of Manitoba*, *Winnipeg, MB, Canada*, [2]*Evonik-Degussa Corporation*, *Kennesaw, GA*.

A 14-d study was conducted to investigate the effect of dietary CP level on serum haptoglobin and pro-inflammatory cytokine concentrations in piglets challenged with enterotoxigenic *Escherichia coli* K88. Forty piglets (average BW = 5.32 ± 0.24 kg), housed in groups of 4 pigs per pen, were randomly allotted to 2 diets (5 pens/diet) immediately after weaning. Diet 1 contained 22.5% CP (high CP diet) and diet 2 contained

17.6% CP (low CP diet) supplemented with amino acids. The two dietary CP levels were achieved by using different combinations of corn, wheat and casein. The diets contained the same amount of ME and standardized ileal digestible Lys, Met + Cys, Thr, Trp, Ile, and Val based on the ideal protein ratio. Pigs were orally challenged with 6 mL of *E. coli* suspension (10^{10} cfu/mL) on d 8 after weaning. Blood samples were collected from 1 pig per pen on 7 d and 24 h before challenge and 8 h, 24 h, 72 h and 7 d post-challenge for determination of serum haptoglobin, TNF-α, IL-8 and IL-1β concentrations in the serum. Pigs fed the low CP diet had lower ($P < 0.05$) levels of haptoglobin (9 vs. 25 mg/dL), TNF-α (106 vs. 138pg/mL), IL-8 (52 vs. 119 pg/mL) and IL-1β (72 vs. 116 pg/mL) at 8 h post-challenge compared with those fed the high CP diet. There were no effects of diet on any of the measured parameters at the other periods of blood collection. The results indicate that a low protein diet supplemented with amino acids fed to pigs immediately after weaning reduced inflammation resulting from an enterotoxigenic *Escherichia coli* challenge.

Key Words: Dietary Protein, Piglets, Pro-Inflammatory Cytokines

TH138 Influence of micronization (fine grinding) of soy bean meal and fullfat soy bean on nutrient digestibility and digestive traits in young pigs. D. G. Valencia, M. P. Serrano, R. Lázaro, M. A. Latorre, and G. G. Mateos*, *Universidad Politécnica de Madrid*, *Spain*.

A trial was conducted to test the effect of micronization (very fine grinding) of soybean meal (SBM) and fullfat soy bean (FFSB) on coefficient of ileal apparent digestibility (CIAD) of dietary components and digestive traits of piglets. The experimental design was completely randomized with 4 treatments arranged factorially (SBM and FFSB, micronized and ground) and six replicates each (one piglet). Four isonutritive diets (2,490 kcal NE/kg and 1.28% available Lys) were fed from 23 to 45 d of age. The main difference among them was the mean particle size of the soy bean product used (47 and 881 μm for the SBM and 41 and 778 μm for the FFSB, micronized and ground, respectively). In all cases the source tested supplied 5.5% of the dietary protein (CP). The CIAD of dietary components, the pH of the gastrointestinal tract (GIT) and the weight of digestive organs and spleen were measured at 45 days of age. Particle size did not affect any trait studied (P≥0.10). Type of soy bean product had no effect on CIAD of CP or amino acids (P≥0.10). However, piglets fed the SBM diets had higher CIAD of organic matter (0.765 vs. 0.705) and gross energy (0.761 vs. 0.711) than piglets fed the FFSB diets (P≤0.001). The pH of the different segments of the GIT was not affected by the soybean product used (P≥0.10). Pigs fed SBM had heavier pancreas (2.3 vs. 1.9 g/kg body weight; P≤0.05) and livers (35.9 vs. 32.7 g/kg body weight; P≤0.01) than pigs fed FFSB. The poor nutrient digestibility of pigs fed FFSB as compared to pigs fed SBM might be related to the conditions applied during processing of the bean. It is concluded that pigs fed soy bean meal had better digestibility of organic matter and gross energy than pigs fed FFSB and that fine grinding of the two soy protein sources does not affect nutrient digestibility.

Key Words: Particle Size, Soy Bean Products, Digestibility in Piglets

TH139 Effects of including field peas in diets fed to weanling pigs. H. H. stein*[1] and D. N. Peters[2], [1]*University of Illinois*, *Urbana*, [2]*South Dakota State University*, *Brookings*.

Two experiments were conducted to measure effects of including field peas in diets fed to weanling pigs. Pigs that were weaned at 20 d and fed a common starter diet for 2 wk post-weaning were used in both experiments. In Exp. 1, 120 pigs were randomly allotted to 5 treatments with 3 or 4 pigs per pen and 7 replicate pens per treatment. The control diet was based on corn (56.8%), soybean meal (16.0%), and extruded full fat soybeans (21.0%). Two additional diets were formulated by including 24.5 or 49.0% raw field peas in the control diet at the expense of corn and soybean meal. The last 2 diets were similar to these diets with the exception that 24.5 or 49.0% extruded field peas were used rather than raw field peas. All diets were provided on an ad libitum basis during 25 d. There were no differences among pigs fed the 5 treatment diets in ADG (574, 559, 548, 598, and 549 g/d), ADFI (1,013, 1,024, 962, 1,003, and 914 g/d) or G:F (0.57, 0.55, 0.58, 0.60, and 0.61 g/g). Experiment 2 used 168 pigs that were randomly allotted to 6 treatments with 4 pigs per pen and 7 replicate pens per treatment. A control diet containing corn (57.1%), soybean meal (27.0%), and dried whey (10.0%) was formulated. Five additional diets were formulated by including, 12, 24, 36, 48, or 60% field peas in this diet at the expense of corn and soybean meal. Pigs were fed experimental diets on an ad libitum basis during 4 wk and results showed that there were no differences in ADG, ADFI, or G:F among treatment groups (Table 1). It is concluded from these experiments that up to 60% raw field peas may be included in diets fed to pigs from 2 weeks post-weaning. Use of extruded field peas does not improve pig performance compared with raw field peas.

Table 1. Increasing concentrations of field peas in diets fed to weanling pigs (Exp. 2)

Peas,%:	0	12	24	36	48	60	SEM	P-value, Linear	P-value, Quadratic
Initial BW, kg	8.94	8.92	8.92	8.92	8.95	8.94	0.729	0.99	0.98
ADFI, g	930	933	944	913	884	915	58	0.61	0.97
ADG, g	551	574	530	548	494	532	34	0.28	0.92
G:F, g/g	0.59	0.61	0.56	0.61	0.56	0.59	17	0.28	0.86
Final BW, kg	24.36	24.99	23.78	24.27	22.80	23.85	1.618	0.53	0.94

Key Words: Field Peas, Nursery Diets, Pigs

TH140 Effects of dietary pine cone meal on egg production, egg quality, serum cholesterol and cholesterol content and fatty acid composition of egg yolk in laying hens. S. O. Shin*[1], J. H. Cho[1], Y. J. Chen[1], J. D. Kim[2], J. H. Lee[3], K. W. Park[3], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Chungnam, Korea*, [2]*CJ CheilJedang*, *Seoul, Korea*, [3]*Korea National Arboretum*, *Pocheon, Gyeonggi, Korea*.

This study was conducted to evaluate the effects of dietary pine cone meal on egg production, egg quality, serum cholesterol, cholesterol content and fatty acid composition of egg yolk in laying hens. The total of 252 (51-wks) Hy-line brown commercial hens were used for 5 weeks. Dietary treatments included 1) T1 (basal diet + 1% cottonwood sawdust), 2) T2 (basal diet + 0.5% cottonwood sawdust + 0.5% pine cone meal) and 3) T3 (basal diet + 1% pine cone meal). During the overall period, there were no differences in egg production, egg weight and egg quality among treatments. Lipids profile (total, HDL, LDL cholesterol and Triglyceride) in serum was not affected by treatments. Egg yolk cholesterol was not different among the treatments. In fatty acid contents of yolk, C18:3 was higher (P<0.05) in T1 treatment (0.33%) than T3 treatment

(0.27%). Total SFA, PUFA, MUFA and UFA/SFA were no differences in experimental period. In conclusion, results of the experiment was affected by dietary supplementation of pine cone meal on C18:3 fatty acid contents of yolk in laying hens, without adversely production.

Key Words: Pine Cone Meal, Serum Cholesterol, Laying Hens

TH141 Effects of dietary pine cone meal on growth performance, serum cholesterol, carcass quality and fatty acid composition and cholesterol content of meat in broiler chickens. S. O. Shin*[1], J. H. Cho[1], J. D. Kim[2], J. H. Lee[3], K. W. Park[3], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Chungnam, Korea*, [2]*CJ CheilJedang*, *Seoul, Korea*, [3]*Korea National Arboretum*, *Pocheon, Gyeonggi, Korea*.

This study was conducted to evaluate effects of dietary pine cone meal on growth performance, serum cholesterol, carcass quality and fatty acid composition and cholesterol content of meat in broiler chickens. Three treatments were assigned to 480 (2 days) Arbor Acre broiler chicks with eight replications, allocating 20 broiler chicks in each replication. Dietary treatments included 1) CS (1% cottonwood sawdust), 2) PCM0.5 (0.5% cottonwood sawdust + 0.5% pine cone meal) and 3) PCM1.0 (1% pine cone meal). During the overall period there was no difference of growth performance among treatments. Also, cholesterol profile (total, HDL, LDL cholesterol and triglyceride) in serum and carcass characteristic were not affected by treatments. TBARS of leg and breast meat was significantly decreased (P<0.05) in PCM1.0 treatment (0.014 and 0.021 mgMA/kg, respectively) compared to CS treatment (0.025 and 0.030 mgMA/kg, respectively). In fatty acid contents of leg meat, C20:0 was significantly higher (P<0.05) in PCM0.5 treatment (0.32%) than PCM1.0 treatment (0.25%). Also, C18:3n3 was significantly lower(P<0.05) in PCM1.0 treatment (0.02%) than other treatments (0.04% and 0.04%). Cholesterol contents of leg, breast meat and abdomen fat were not affect by treatment. In conclusion, results of the experiment were affected by dietary supplementation of pine cone meal on TBARS of leg and breast meat.

Key Words: Pine Cone Meal, Growth Performance, Broiler

TH142 Effects of dietary level of brewer's grain on growth performance and digestibility in growing pigs. J. S. Yoo*[1], J. D. Kim[2], K. Y. Whang[3], H. J. Jung[4], S. B. Cho[4], H. B. Seok[1], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Choognam, Korea*, [2]*CJ CheilJedang*, *Seoul, Korea*, [3]*Korea University*, *Seoul, Korea*, [4]*National Institute of Animal Science*, *Korea*.

This study was conducted to investigate the effects of dietary brewer's grain supplementation on growth performance and digestibility in growing pigs. A total of forty-eight pigs (18.1kg, average initial body weight) were used during 42 days. Dietary treatments included: 1) CON (basal diet), 2) BG5 (basal diet + 5% brewer's grain) and 3) BG10 (basal diet + 10% brewer's grain). Each treatment had 8 replicates of 2 pigs per pen in a randomized complete block design. Growth performance was not affected(P>0.05) by treatments. However, in nutrient digestibility, DM digestibility was higher(P<0.05) in BG5(79.67%) treatment than CON(77.39%) and BG10(78.43%) treatments. Nitrogen digestibility was the highest(P<0.05) in BG10(84.35%) treatment and among another(72.67%, 82.63%) treatments, also, BG5(82.63%) treatment was higher(P<0.05) than CON treatment. Energy digestibility was higher(P<0.05) in BG5(80.88%) treatment than CON(78.41%) treatment. In conclusion, dietary brewer′s grain supplementation had no influence on growth performance whereas improved nutrient digestibility in growing pigs.

Key Words: Brewer's Grain, Growth Performance, Pigs

TH143 Effect of bedding types and different crude protein levels on growth performance, visceral organ weight and blood characteristics in broiler chickens. Y. Huang*[1], J. S. Yoo[1], Y. J. Chen[1], J. H. Cho[1], J. D. Kim[2], J. D. Hancock[3], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Chungnam, Korea*, [2]*CJ CheilJedang*, *Seoul, Korea*, [3]*Kansas State University*, *Manhattan*.

The object of this study was to assess whether bedding types could influence the growth performance of broiler chickens fed on high and low crude protein (CP) diets. The broilers were bedded with clean hulls or shavings. For hundred and eighty broiler chickens (Ross) were divided into six treatment groups including: 1) high CP diet with rice hulls, 2) high CP diet with wood shavings, 3) high CP diet with coconut hulls, 4) low CP diet with rice hulls, 5) low CP diet with wood shavings, and 6) low CP diet with coconut hulls. Each treatment included four replicate pens with twenty broilers per pen. Weight gain, feed intake, feed/gain ratio, visceral organ relative weight, RBC, WBC, and lymphocyte levels were evaluated. The Bursa of Fabricius, liver and abdominal fat relative weight, WBC, and lymphocyte levels were not altered consistently by any of the treatments. For the overall period, weight gain and feed intake was higher in the coconut hulls treatment groups as compared with wood shavings treatments (P<0.05). Feed intake was also higher in low CP diet than in the high CP diet treatment groups (P<0.05). The concentration of RBC in blood was reduced significantly by bedding wood shavings while these levels were increased in rice hulls treatments (P<0.05). In conclusion, our results indicate that coconut hulls are suggested as a replacement of rice hulls and wood shavings as a resource for broiler bedding, and reduced CP level increases feed intake, especially in the finisher period.

Key Words: Bedding, Broiler

TH144 Comparative efficacy of import fish meals and fermented (*L. acidophilus* GB-LC2) fish meal on growth performance, protein cells concentrations in serum, nutrient digestibility in weanling pigs. J. H. Cho*[1], Y. J. Chen[1], J. S. Yoo[1], I. B. Chung[2], J. H. Ahn[2], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Chungnam, Korea*, [2]*National Institute of Animal Science, RDA*, *Korea*.

The current study was conducted in an effort to evaluate and compare the effects of feeding imported fish meals and fermented fish meal on growth performance, protein cells concentrations in serum, nutrient digestibility, backfat thickness and lean percent in weaning pigs. One hundred twenty pigs [(Landrace × Yorkshire) × Duroc] barrows (6.70±0.20kg) were used in a 35 - d feeding trial. Dietary treatments included: E1 (5 and 2.5% LT fish meal in phase 1 & 2, respectively), E2 (5 and 2.5% Bio-CP fish meal), LF (5 and 2.5% domestic fish meal) and FLF (5 and 2.5% fermented domestic fish meal). During 35 days after weaning, there were no difference in average daily feed intake and

gain/feed ratio (n=24) among the treatments (P>0.05). However, pigs fed the E2 diet had greater (P<0.05) average daily gain (n=24) than pigs fed LF diets during entire feeding period. Weekly backfat thickness and lean percent (n=48) were not affected (P>0.05) by the experimental diets during the entire 5-wk study period. No differences (P>0.05) were observed for concentrations of albumin, creatinine, blood urea nitrogen and total protein in serum (n=48) on 0, 14 and 35 days. On 7 days, creatinine concentrations was highest (P<0.05) for pigs fed the LF diet compare to pigs fed the E2 and FLF diets (P<0.05). During 35 days after weaning, pigs fed the E2 and FLF diets had a greater nitrogen digestibility (n=48) than pigs fed the LF diet (P<0.05). In conclusion, the results of this study indicate that fermented fish meal had similar effects on growth performance and nitrogen digestibility as compared to imported fish meal.

Key Words: Fish Meal, Nitrogen Digestibilities, Weaning Pigs

TH145 Effect of deoiled corn dried distillers grains with solubles, solvent extracted on nursery pig growth performance. J. Y. Jacela*[1], L. Brandts[2], J. M. DeRouchey[1], S. S. Dritz[1], M. D. Tokach[1], R. D. Goodband[1], J. L. Nelssen[1], R. C. Thaler[2], D. Peters[2], and D. E. Little[3], [1]*Kansas State University*, *Manhattan*, [2]*South Dakota State University*, *Brookings*, [3]*DairyNet Inc.*, *Brookings, SD*.

Deoiled corn dried distillers grains with solubles, solvent extracted (dDGS) is a co–product of ethanol production which is traditional dried distillers grains with solubles with a majority of oil removed. A total of 210 pigs (initial BW 9.9 kg) were used in a 28–day study to evaluate the effect of dDGS on nursery pig performance. From weaning to just prior to start of the trial, all pigs were placed on a common diet until they reached an average of 10 kg BW. Pigs were then blocked based on pen weights and each pen was randomly assigned to 1 of 5 dietary treatments. There were 7 pens per treatment with 6 pigs per pen. The treatments provided 0, 5, 10, 20, and 30% dDGS formulated to contain equivalent dietary ME and standardized ileal digestible (SID) lysine based from a previous study at Kansas State University. Pen weights were obtained on d 0, 14, and 28 and feed intake was recorded on a pen basis. Growth rate ($P > 0.52$), feed intake ($P > 0.95$), and feed efficiency ($P > 0.55$) were similar between treatments regardless of the level of dDGS in the diet. Results from this experiment suggest that dDGS can be included in nursery pig diets of up to inclusion levels of 30% without affecting growth performance.

Table 1.

	dDGS, %					
Item	0	5	10	20	30	SE
Final wt, kg	22.7	22.8	22.2	22.4	22.3	0.6
ADG, g	455	459	452	445	442	19.7
ADFI, g	749	771	760	751	761	8.9
G:F	0.61	0.60	0.59	0.59	0.58	0.03

Key Words: Nursery Pig, Deoiled Corn Dried Distillers Grains, Growth

TH146 Evaluation of distillers dried grains with solubles (DDGS) and Allzyme® SSF in grow-finish pigs. J. Pierce* and J. Bannerman, *Alltech, Inc.*, *Nicholasville, KY*.

An experiment was conducted to evaluate the effects of Allzyme®SSF on the growth performance and carcass quality of pigs fed diets containing graded levels of DDGS in grow-finish pigs. A total of 420 pigs (42 pens of 10 pigs/pen) were randomly allotted by weight and sex to six dietary treatments. Diets were corn-soybean meal based with DDGS substituting for corn and soybean meal. The diets were formulated to meet or exceed the NRC 1998 nutrient requirements for each of three growth phases. The six dietary treatments were arranged in a 3×2 factorial structure with 10, 20, or 30% DDGS without or with 200g/tonne of Allzyme® SSF, respectively. All pigs were weighed at the onset of the experiment and then 30, 73 and 111 days later. Each pig was tattooed and sent to a commercial slaughter facility in the Midwest. Backfat samples were taken from five randomly chosen carcasses from each pen and analyzed for iodine values (IV) as an indicator of the degree of fat saturation. Means for ADG and F:G for the entire 111 day experiment were 856, 855, 823, 855, 855, 853 g/d and 2.83, 2.83, 2.83, 2.76, 2.89, 2.83 for the six treatments, respectively. As the level of dietary DDGS was increased, ADG was decreased (P<0.05), however the addition of Allzyme® SSF maintained ADG which resulted in a DDGS×Allzyme® SSF interaction (P<0.09). Last rib back fat and ham pH were unchanged by treatment, however, loin depth decreased linearly as DDGS was increased in the diet (P<0.05). Iodine values increased linearly as DDGS was increased (P<0.05) indicating less saturated fat. The increased iodine values that result from feeding 30% DDGS to finishing pigs until slaughter may not currently be an acceptable practice because of reduced pork quality. However, there is a possibility of oil removal for biodiesel and other purposes growing in the future. The addition of Allzyme® SSF to diets containing DDGS can reduce cost of gain in growing-finishing swine while maintaining growth performance.

Key Words: Pigs, Distillers Grains, Enzyme

TH147 Comparison of finishing pigs performance when diets containing DL- methionine and cull chickpeas in substitution of soybean meal and corn. J. M. Uriarte*, J. F. Obregón, H. R. Guemez, F. G. Rios, and O. S. Acuña, *Universidad Autónoma de Sinaloa*, *Culiacán, Sinaloa, México*.

To determinate the effect of substitution of soybean meal and corn for cull chickpeas on growth performance, 48 pigs (BW = 53.63 ±1.70 kg; Large white × Landrace × Large white × Pietrain) in groups of four were placed in 12 concrete floor pens (2.5 × 2.5 m). In a complete randomized experimental design, pens were fed one of three diets: 1) Diet with 15.2 % CP and 3.35 Mcal ME/kg, containing corn 76.5 %, soybean meal 15.5 %, and premix 4 % (CONT); 2) Diet with 17.1 % CP and 3.35 Mcal ME/kg with corn 42.5 %, cull chickpeas 50 %, soybean meal 3.5 %, and premix 4 % (CHP50) and 3) Diet similar to CHP50 with 0.2 % of methionine added (CHP50M). Pigs were weighed at days 0 and 48 of experiment and feed intake was recorded daily. The average daily gain (ADG) and feed intake/gain ratio were calculated from these data. Body weight at day 48 (95.17, 95.65 and 96.17 kg) was not affected (P=0.91) by CONT, CHP50 and CHP50M, respectively. ADG (0.82, 0.92 and 0.90 kg) was not similar (P=0.04) between dietary treatments.

Feed intake (2.47, 2.57 and 2.60 kg) was not modified (P=0.66) by treatments. Feed/gain ratio (3.04, 2.82, and 2.90) was similar (P=0.30) between treatments It is concluded, that cull chickpeas with 0.2 % added DL-methionine can be used up 50 % in diets for finishing pigs without affecting growth performance.

Key Words: Chickpeas, Growth Performance, Methionine

TH148 Carcass traits of pigs fed with cull chickpeas with added DL-methionine. J. M. Uriarte*, J. F. Obregón, H. R. Guemez, F. G. Rios, O. S. Acuña, and A. R. Cortina, *Universidad Autónoma de Sinaloa*, *Culiacán, Sinaloa, México*.

To determine the effect of substitution of soybean meal and corn for cull chickpeas on carcass traits of the finishing pigs, 48 pigs (BW = 53.63 ± 1.70 kg; LW × Land × LW × Piet) in groups of four were placed in 12 concrete floor pens (2.5 x 2.5 m). In a complete randomized experimental design, pens were fed one of three diets: 1) Diet with 15.2 % CP and 3.35 Mcal ME/kg, containing corn 76.5 %, soybean meal 15.5 %, and premix 4 % (CONT); 2) Diet with 17.1 % CP and 3.35 Mcal ME/kg with corn 42.5 %, cull chickpeas 50 %, soybean meal 3.5 %, and premix 4 % (CHP50) and 3) Diet similar to CHP50 with 0.2 % of methionine to added (CHP50M). Pigs were weighed at days 0 and 48 of experiment. After 48 days nine pigs by treatment were slaughtered and carcass traits measured. Body weight at day 48 (95.17, 95.65 and 96.17 kg) was not affected (P=0.91) by CONT, CHP50 and CHP50M, respectively. Hot carcass weight (78.83, 76.13 and 77.45 kg) was similar between treatments (P=0.66), and carcass yield (78.43, 75.87 and 77.82 %) was not affected by treatments (P=0.15). Backfat (1.87, 1.90 and 1.78 cm) was no affected, rib eye area (35.80, 37.25 and 35.70 cm^2) was similar between treatments. It is concluded, that cull chickpeas with 0.2 % added DL-methionine can be used at up 50 % of diets for pigs without affecting carcass traits.

Key Words: Chickpeas, Carcass Traits, Methionine

TH149 Comparison of chromic oxide and acid insoluble ash as digestiblity markers in the determination of apparent total tract digestibility in finishing pigs. V. D. Naranjo*, S. Powell, T. D. Bidner, and L. L. Southern, *LSU Agricultural Center*, *Baton Rouge*.

Two experiments were conducted to compare Cr_2O_3 and acid insoluble ash (AIA) as digestiblity markers for determining apparent total tract digestibility of DM (DMD), CP (CPD), and GE (GED) in early and late finishing pigs fed ad libitum. In both experiments, growth performance was determined at the end of the 14-d studies. Fecal samples were collected from each pig by rectal palpation on d 12, 13, and 14 and combined within day, pig, and pen (1 sample per pen) at the end of the collection period. Feed and fecal samples were analyzed for CP, GE, Cr, and AIA concentration. Finishing pigs (Exp. 1, n = 18 barrows, initial BW = 50 ± 2.90 kg; Exp. 2, n = 18 barrows and 18 gilts, initial BW = 85 ± 5.90 kg) were used. In Exp. 1, pigs were randomly assigned to 6 pens and fed a diet containing 1% added AIA (diatomaceous earth, Perma-Guard, Inc.) and 0.5% Cr_2O_3 (3,352 ppm Cr). In Exp. 2, pigs were assigned to 6 pens per diet (3 pens of 3 barrows and 3 pens of 3 gilts) on the basis of BW and sex to 2 diets (Diet 1 = 0.5% Cr_2O_3; Diet 2 = 1% added AIA). The diets were nutritionally adequate and based on corn and soybean meal. In Exp. 1, the diet analyzed to contain 1.48% AIA and 3,171 ppm Cr. The 1.48% AIA is because both the diatomaceous earth and the Cr_2O_3 contribute to the total AIA in the diet. Pigs had an ADG of 827 g, ADFI of 2,382 g, and G:F of 0.35. No significant differences ($P > 0.10$) were observed in CPD (70.63 vs. 67.72 %), but DMD (85.40 vs. 83.95 %) and GED (82.05 vs. 80.26 %) were greater ($P < 0.10$) with the Cr_2O_3 marker. In Exp. 2, Diet 1 analyzed to contain 3,484 ppm Cr and Diet 2 analyzed to contain 1.0% AIA. Growth performance was not affected by diet ($P > 0.10$). Pigs had an ADG of 611 g, ADFI of 2,820 g, and G:F of 0.22. As in Exp. 1, no significant differences were observed in CPD (52.42 vs. 54.45%), but in contrast to Exp. 1, DMD (72.78 vs. 75.95%) and GED (66.34 vs. 71.19%) were greater ($P < 0.05$) with the AIA marker. These data suggest that Cr_2O_3 and AIA result in similar digestibility values and that CP digestibility is not as susceptible to the specific marker as DM and GE.

Key Words: Pig, Digestibility, Marker

TH150 Effects of dried distillers grains and Gromega365™ on sow bratwurst quality. H. White*[1], K. Hesselbrock[1], N. Augspurger[2], J. Spencer[2], A. Schinckel[1], and M. Latour[1], [1]*Purdue University*, *West Lafayette, IN*, [2]*JBS United*, *Sheridan, IN*.

Feeding corn dried distillers grains with solubles (DDGS) to sows may impact the fatty acid profile and quality of final products such as bratwurst. The purpose of this study was to determine differences in bratwurst quality made from sows fed one of four dietary treatments: control [CON], control plus DDGS [CDDGS], control plus Gromega 365™ [CG], or DDGS plus Gromega 365™ [DDGSG] based on freshness quality scoring. DDGS was fed at 30% dietary inclusion during gestation and 15% during lactation. Freshness quality of bratwurst was based on a 1-4 scale (1=lowest and 4=highest). DDGSG brautwurst had a significantly ($P < 0.02$) higher overall quality score. Bratwurst fatty acid profiles also differed between treatments. The level of linoleic acid was significantly ($P < 0.0001$) higher in the DDGSG followed by the CDDGS group with both non DDGS treatments being lowest. The highest ($P < 0.0001$) calculated iodine value was observed in the CDDGS (65.6), followed by DDGSG (59.7) and the lowest being the two non DDGS diets (53.1 [CON] and 55.9 [CG]). In summary, there were noted differences in overall bratwurst quality which favored the DDGSG group. Similarly, when comparing the DDGS fed groups (DDGSG vs. CDDGS), the overall iodine value was lower in the DDGSG bratwurst.

Key Words: DDGS, Sows, Bratwurst

TH151 The effects of extrusion and inclusion of dried distillers grains on nitrogen retention in swine. A Dietz*[1], R.L. Atkinson[1], P Walker[2], and G Apgar[1], [1]*Southern Illinois University*, *Carbondale*, [2]*Illinois State University*, *Normal*.

Eight steered ileal cannulated pigs (PIC L337×C22; 51.2 + 3.8 kg) were used in a 4 × 4 repeated Latin square design to determine the effect of extrusion and protein source on N retention. Each period consisted of 5 d adjustment, 3 d total fecal and urine collection, followed by 2 d ileal collection, with 1 d rehydration between ileal collections. Semi-purified diets were formulated to supply 0.9% lysine from the following protein sources: 1) 100% non-extruded dried distillers grains +

solubles (DDG;ND); 2) 100% extruded DDG (ED); 3) 70:30% soybean meal:DDG mix non-extruded (NM); 4) 70:30% soybean meal:DDG mix extruded (EM). Protein sources were extruded using a single screw dry extruder. Treatments were balanced to meet AA requirements and fed at 9% metabolic body weight offered twice daily (0700 and 1700 h). Feed, feces and urine were analyzed for DM and N content. Data were analyzed using the MIXED procedures of SAS to compare effects of extrusion and inclusion of DDG. The inclusion of DDG decreased ($P <$ 0. 01) N intake and extrusion decreased N intake ($P < 0.0001$). As DDG increased in the diet, fecal N increased ($P = 0.01$). Although extrusion had no effect on N in the urine, increasing DDG in the diet decreased N in the urine ($P = 0.03$). However, neither extrusion nor protein source altered total N output ($P > 0.25$) or BV ($P > 0.12$). N digested (g/d) decreased with both extrusion ($P = 0.003$) and inclusion of DDG ($P <$ 0.0001). Furthermore, N digestibility, as a % of N intake, decreased ($P = 0.003$) with DDG inclusion, however; digestibility was not effected ($P = 0.31$) by extrusion. N retention was reduced by both extrusion ($P = 0.01$) and inclusion of DDG ($P = 0.09$). Extrusion tended ($P = 0.07$) to decrease net protein utilization, however; protein source had no effect ($P = 0.99$) on utilization. These data suggest that protein source does not effect N utilization; however, extrusion of the diets containing DDG may decrease N retention.

Key Words: Dried Distillers Grains, Nitrogen, Swine

TH152 L-Tryptophan dietary supplementation stimulated an earlier feed intake and reduced the physical activity of early weaned piglets. M. Anguita[1], R. G. Hermes*[1], J. Gasa[1], D. Melchior[2], and J. F. Pérez[1], [1]*Universitat Autònoma de Barcelona*, *Bellaterra, Barcelona, Spain*, [2]*Ajinomoto Eurolysine S.A.S.*, *Paris, France*.

L-Tryptophan (Trp) has been related with different metabolic functions that regulate feed intake, stress recovery and immune response. In the present study we evaluated if L-Tryptophan supplementation above the daily requirements proposed by different feeding systems (18% of the daily lysine-Lys- requirement) may improve the adaptation of piglets after weaning. A total of 30 piglets were selected from ten different sows (three piglets /sow, 6.80 kg ± 0.372) and allocated into fifteen pens (two piglets/pen). Three dietary treatments were designed based on the Trp to Lys ratio and the feeding manner, and distributed to the different pens (one pig per sow was present in each treatment). Two treatments were administered *ad libitum*, Trp18 (Trp:Lys = 0.18) and Trp22 (Trp:Lys = 0.22), and a third treatment, rTrp22, were restrictively fed to the same intake shown by Trp18 from day four after weaning. Feed intake was daily registered and the posture of the animals (laying or standing) controlled ten times within a day on days 4 to 6 and 9 to 10. No differences ($p = 0.372$) were observed on the accumulated feed intake per animal on day 4 after weaning (314, 437 and 449 g for Trp18, Trp22 and rTrp22, respectively). However, differences were observed on the motivation of piglets to eat early after weaning. Three out of five pens (3/5) on Trp18 showed a feed intake below 50 g/animal 72 h after weaning, while 4 out of 5 on Trp22 showed a higher feed intake, above 90 g/animal 48 h after weaning ($p = 0.046$). Differences ($p \leq 0.001$) were also observed on the behavior of the animals on days 6, 9 and 10, with pigs fed on Trp22 showing a lower number of records (44%) standing up than Trp18 (62%) and rTrp22 (84%). Therefore L-Tryptophan supplementation may improve the adaptation of piglets after weaning by enhancing feed intake.

Key Words: Piglets, L-Tryptophan, Feed Intake

TH153 Lysine restriction and realimentation affected growth, blood metabolites, and myostatin and leptin expressions in weaned pigs. Y. X. Yang[1], J. Guo[2], Z. Jin[1], S. Y. Yoon[1], J. Y. Choi[1], M. H. Wang[2], X. S. Piao[3], S. J. Ohh[1], B. W. Kim[1], and B. J. Chae*[1], [1]*College of Animal Life Sciences*, *Chuncheon, Kangwon-Do, Republic of Korea*, [2]*School of Biotechnology*, *Chuncheon, Kangwon-Do, Republic of Korea*, [3]*National Key Lab of Animal Nutrition*, *China Agricultural University, Beijing, P. R. China*.

A total of 128 weaned pigs (Landrace × Yorkshire × Duroc) were used in a 6-wk study to investigate the effects of lysine restriction and realimentation on performance, digestibility, blood profiles, and gene expressions of leptin and myostatin. Pigs were randomly allotted to four treatments on the basis of their body weights, each treatment comprised of four pens and each pen had 8 pigs. The starter diets fed to pigs during the first two weeks (P1) contained 1.350, 1.080, 0.945 or 0.810% lysine levels. Then common grower 1 and 2 diets were offered for two weeks (P2 and P3 containing 1.150 and 0.950% lysine, respectively) each. During P1, average daily gain (ADG, 391, 335, 306 and 295 g/d) decreased linearly ($P < 0.05$) with the increasing levels of lysine restriction. Final body weight did not differ ($P > 0.05$) among all the treatments. The apparent digestibilities of CP during P1 and P2, GE and CP during P3 were improved linearly ($P < 0.05$) with the decrease in dietary lysine levels. The apparent ileal digestibilities of Lys and Leu increased linearly ($P < 0.05$) with an increase in the degree of lysine restriction. Linear ($P < 0.05$) improvements in plasma triglyceride (29.8 to 40.0 mg/dl) and glucose (95.5 to 114.8 mg/dl) and decreased ($P < 0.05$) blood urea nitrogen (15.6 to 8.55 mg/dl), total protein (6.8 to 5.78 g/dl) and albumin (3.3 to 3.9 g/dl) during P1 were noticed with an increase in the degree of lysine restriction. During P2, pigs fed with lysine restricted starter diets had lower (linear, $P < 0.05$) blood urea nitrogen and total protein, however no differences in the plasma metabolites were noted during P3. The relative abundance of myostatin mRNA in skeletal muscle and leptin mRNA in subcutaneous adipose were lower ($P< 0.05$) in pigs fed lysine-restricted diets. These results indicated that pigs fed a lysine-restricted diet exhibited compensatory growth, while changes in myostatin and leptin mRNA abundance by lysine restriction suggested that lysine played a role in regulating protein and fat metabolism in young pigs.

Key Words: Lysine, Restriction, Pigs

TH154 Impaired translation initiation activation and reduced protein synthesis in weaned piglets fed a low-protein diet supplemented with essential amino acids. Y. Yin*[1], D. Deng[1], W. Chua[1], K. Yao[1], T. Li[1], R. Huang[1], Z. Liu[1], and G. Wu[2], [1]*The Chinese Academy of Sciences*, *Changsha, Hunan, P.R.China*, [2]*Texas A&M University*, *College Station*.

Weanling mammals (including infants) often experience intestinal dysfunction when fed a high-protein diet. Recent work with the piglet (an animal model for studying human infant nutrition) shows that reducing dietary protein intake can improve gut function during weaning but results in inadequate provision of essential amino acids (EAA) for muscle growth. The present study was conducted with weaned pigs to test the hypothesis that supplementing deficient EAA (Lys, Met, Thr, Trp, Leu, Ile, and Val) to a low-protein diet may maintain the activation of translation initiation factors and adequate protein synthesis in tissues. Pigs were weaned at 21 days of age and fed diets containing 20.7, 16.7, or 12.7% crude protein (CP), with the low-CP diets supplemented with

EAA to achieve the levels in the high-CP diet. On d 14 of the trial, tissue protein synthesis was determined by the phenylalanine flooding method. Reducing dietary CP levels decreased protein synthesis in pancreas, liver, kidney, and longissimus muscle. A low-CP diet reduced the phosphorylation of eukaryotic initiation factor (eIF) 4E-binding protein-1 (4E-BP1)) in skeletal muscle and liver and increased the formation of an inactive eIF4E 4E-BP1 complex in muscle, while decreasing the phosphorylation of mammalian target of rapamycin (mTOR) and the formation of an active eIF4E eIF4G complex in liver. These results demonstrate for the first time that chronic feeding of a low-CP diet suppresses protein synthesis in animals, in part, by inhibiting mTOR signaling. Additionally, our findings indicate that supplementing deficient EAA to low-protein diets is not effective in restoring protein synthesis or whole-body growth in weanling piglets. We suggest that conditionally essential amino acids (e.g. glutamine and arginine) may be required to maintain the activation of translation initiation factors and optimal protein synthesis in tissues of weanling pigs.

Key Words: mTOR Signaling, Protein Synthesis, Piglets

TH155 Effects of dietary protein level on intramuscular fat content and its fatty acid composition in lean and obese genotype finishing pigs. H.-J. Xu[1,2], Y.-L. Liu[3], W.-T. Gu[1], Y.-L. Yin*[1], X.-F. Kong[1], R.-L. Huang[1], W.-J. Tang[1], and Z.-Q. Liu[1], [1]*The Chinese Academy of Sciences*, *Changsha, Hunan, P.R. China*, [2]*West Anhui University*, *Luan, Anhui, China*, [3]*Wu Han Polytechnic University*, *Wuhan Hubei, China*.

Effects of dietary protein level on intramuscular fat (IMF) content and fatty acid composition in lean and obese genotype finishing pigs were studied. Twenty two Crossbred (Duroc×Landrace×Large White) barrows and eighteen Ningxiang barrows were equally randomly assigned to two groups and fed diets I (14% CP) and diet II (15% CP), respectively. Longissimus dorsi (LD) and semitendinosus muscle (ST) samples were collected to determine IMF content and fatty acid composition. Ratio of oleic acid (C18:1) and linoleic acid (C18:2) in LD of Crossbred was lower (36.6% vs 47.1%, $p<0.01$) and higher (19.0% vs 9.4%, $p<0.01$) than that of Ningxiang, respectively, when diet I was fed. When diet II was fed, the IMF amount of LD in Crossbred was lower (1.49% vs 3.39%, $p<0.01$) than that in Ningxiang and lower 1.49% vs 2.21%, $p<0.05$) than that of its own ST; ratio of stearic acid (C18:0), C18:1 and C18:2 in LD of Crossbred was higher (17.0% vs 13.4%, $p<0.01$), lower (33.4% vs 47.4%, $p<0.01$) and higher (20.6% vs 10.3%, $p<0.01$) than that of Ningxiang, respectively while ratio of palmitic acid (C16:0), C18:0, C18:1 and C18:2 in ST of Crossbred was lower (23.5% vs 27.3%, $p<0.01$), higher (15.3% vs 11.3%, $p<0.01$), lower (42.2% vs 50.6%, $p<0.01$) and higher (17.2% vs 9.6%, $p<0.01$) than that of Ningxiang; ratio of C18:1 in LD of Crossbred was lower (35.0% vs 43.8%, $p<0.01$) than that of its own ST while ratio of C18:0 and C18:1 in LD of Ningxiang was higher (13.4% vs 11.4%, $P<0.05$) and lower (47.4% vs 50.6%, $p<0.05$) than that of its own ST, respectively. These results indicate that different muscle types of different breeds responded differently in IMF content and fatty acid composition to the change in dietary protein level.

Key Words: Fatty Acids, Protein, Genotype

TH156 Dietary protein intakes affects expression of the cationic amino acid transporter-1 gene in the small intestine of finishing pigs. C. Y. Shi[1,2], W. Y. Chu[2], T. J. li[2], M. M. Geng[2], R. L. Huang[2], S.-Y. Bin[1], and Y.-L. Yin*[2], [1]*Guangxi Normal University*, *Guilin,Guangxi, China*, [2]*The Chinese Academy of Sciences*, *Changsha, Hunan, P. R.China*.

This study was conducted to determine the effect of dietary protein intakes on expression of the cationic amino acid transporter-1 (CAT1) gene in the small intestine of finishing pigs. Thirty-six castrated male pigs (Duroc × Landrace × Large White), with an average initial body weight of 55.6 ± 7.0 kg, were randomly allocated to one of the three dietary treatments. The pigs were housed individually in floor pens and fed diets containing three CP levels (13%, 16%, and 19%). After 45 days of feeding, 3 pigs in each treatment were randomly selected to be slaughtered. The duodenum, jejunum and ileum were obtained for the analysis of mRNA levels for CAT1 using real-time RT-PCR. The results indicate that CAT1 mRNA levels in the duodenum, jejunum and ileum fed the 16% CP diets were 1.01±0.14, 1.55±0.24 and 0.66±0.19, respectively , CAT1 mRNA levels in the duodenum, jejunum and ileum fed the 19% CP diets were 1.60±0.23, 1.91±0.38 and 1.11±0.57, respectively, CAT1 mRNA levels did not differ ($P > 0.05$) between the two groups of pigs fed the 16% and 19% CP diets. However, the CAT1 mRNA levels were 1.95±0.46 and 34.75±7.13, increased ($P < 0.05$) by 48% and 96%, respectively, in the duodenum and jejunum of pigs fed the 13% CP diet, when compared with pigs fed the 16% CP diet. In contrast, the CAT1 mRNA level in the ileum of pigs fed the 13% CP diet was 0.53±0.26 and was 25% lower ($P < 0.05$) than that in pigs fed the 16% CP diet. These results indicate that dietary protein intakes differentially influence expression of the CAT1 gene in the different segments of the pig small intestine to regulate the absorption of basic amino acids derived from dietary protein.

Key Words: Gene Expression, Finished Pig, Intestine

TH157 Molecular cloning, distribution and expression of the amino acid transporter y+LAT1 gene in tissues of young Tibet pigs. W. T. Gu[1], W. Y. Chu[1], W. C. Wang[1], M. M. Geng[1], T. J. li[1], Y. L. Yin*[1], and G. Y. Wu[1,2], [1]*The Chinese Academy of Sciences*, *Changsha, Hunan, P. R.China*, [2]*Texas A&M University*, *College Station*.

The Tibet pig (a Chinese swine breed) has a relatively small body size and provides a useful model for studying mechanisms that regulate animal growth and development. As an initial step of our investigation, we cloned the gene encoding the amino acid transporter y+LAT1 (HGMW-approved gene symbol SLC7A7) from the small intestine of the Tibet pig. This sodium-dependent cationic-amino-acid transporter functions to transport of arginine, lysine, ornithine, and histidine in cells. The Tibet porcine SLC7A7 gene encoded 487 deduced amino acid residues, which show a higher degree of sequence similarity to the human y+LAT1 gene (92%) than to the rat (89%) and opossum (88%) counterparts. The membrane topology analysis indicated that the porcine y+LAT1 protein had 12 putative transmembrane domains. Confocal microscopic examination of porcine y+LAT-GFP-expressing Vero cells revealed the localization of the protein on the plasma membrane. Using the RT-PCR technique, the y+LAT1 mRNA was detected in the brain, kidney, duodenum, jejunum, ileum, liver, and skeletal muscle of Tibet

pigs at both 7 and 21 d of age. Interestingly, the y+LAT1 mRNA was present in the spleen and backfat of Tibet pigs at 21 d of age but absent from these two tissues at 7 d of age. These results indicate age- and tissue-dependent expression of the y+LAT1 gene in Tibet pigs.

Key Words: Amino Acid Transporter, Tibet Pigs, Gene Expression

TH158 Molecular cloning, distribution and expression of the amino acid transporter b0,+ AT mRNAs in young Tibet pigs. W. Y. Chu[1], W. C. Wang[1], W. T. Gu[1], M. M. Gen[1], T. J. li[1], Y. L. Yin*[1], and G. Y. wu[1,2], [1]*The Chinese Academy of Sciences*, *Changsha, Hunan, P. R. China*, [2]*Texas A&M University*, *College Station*.

The amino acid transporter b0,+ AT functions to transport both neutral and basic amino acids by cells. This event is crucial for the absorption of dietary amino acids by the small intestine and the uptake of circulating amino acids by extraintestinal tissues. We used the Tibet pig (a Chinese swine breed), which has a relatively small body size, as a model to study mechanisms that regulate animal growth and development. Particularly, we succeeded in cloning the gene encoding the amino acid transporter b0,+ AT (HGMW-approved gene symbol SLC7A9) in the small intestine of Tibet pigs. The Tibet porcine SLC7A9 gene encoded 487 deduced amino acid residues, showing a higher degree of sequence similarity to the horse b0,+ AT gene (91.2%) than to the monkey (89.5%) and human (89%) counterparts. The membrane topology analysis indicated that the b0,+ AT protein had 12 putative transmembrane domains. Confocal microscopic examination of porcine b0,+ AT-GFP-expressing Vero cells revealed the localization of the protein on the plasma membrane. The RT-PCR analysis showed that the b0,+ AT mRNA was present in the brain, kidney, duodenum, jejunum, ileum, liver, and skeletal muscle of Tibet pigs at 7 and 21 d of age. The b0,+ AT mRNA was also in the spleen and backfat of Tibet pigs at 21 d of age but could not be detected in these two tissues at 7 d of age. These results indicate age- and tissue-dependent expression of the b0,+ AT gene in Tibet pigs.

Key Words: Amino Acid Transporter, Tibet Pigs, Amino Acid Transporter

TH159 Digestibility and metabolism of nitrogen and rnergy in ginishing Ningxiang pigs. W.-J. Tang, X.-F. Kong, Z.-Q. Liu, R.-L. Huang, T.-J. Li, and Y.-L. Yin*, *The Chinese Academy of Sciences*, *Changsha, Hunan, P. R. China*.

The experiment was conducted to determine the effects of dietary crude protein levels on nutrient digestibility and metabolism of nitrogen and energy. Nine finishing Ningxiang pigs (boar, castration) with an average BW of 65.0 kg ± 2.5 kg were randomly assigned to 3 treatment groups with 3 replications of 1 pig, fed diets with 10.41%, 12.91% or 15.43% CP, respectively. The experiment lasted 8 days, and all of the fecal and urinary samples were collected on the last three days. Results showed that pigs fed the diet with 12.91% CP level had the highest apparent digestibility of DM and energy, and the CP digestibility decreased with the increasing of dietary CP level ($P < 0.05$). Ingestive nitrogen, fecal nitrogen, urinary nitrogen, and total nitrogen in excretion, absorption and retention of nitrogen, and fecal and urinary energy increased with the increasing of dietary CP level ($P < 0.01$). Utilization and apparent digestibility of nitrogen, ME and ME/GE decreased with the increasing of dietary CP level ($P < 0.05$). These findings suggested that the dietary CP level had a significant effect on the digestibility of energy and crude protein, as well as the deposition and excretion of nitrogen.

Key Words: Protein, Utilization, Pigs

TH160 Ontogenetic development and nutritional regulation of Amino Acid Transporter EAAC1 in intestine of swine. X. Wu[1], C. Y. Xie[2], Y. L. yin*[1], L. Wang[3], W. Y. Chu[1], M. M. Geng[1], T. J. Li[1], R. L. Huang[1], and Y. Q Hou[3], [1]*The Chinese Academy of Sciences*, *Changsha, Hunan, P. R. China*, [2]*Huazhong Agricultural University*, *Wu Han, China*, [3]*Wuhan Polytechnic University*, *WuHan, Hubei, China*.

EAAC1 is responsible for the uptake of glutamate, a major metabolic fuel of the enterocyte through the Na+-dependent transport system X-AG. To evaluate the ontogenetic development and nutritional regulation of EAAC1 gene expression in small intestine, twenty Duroc×Landrace×Yorkshire crossbreed piglets (d 1, 7, 14, 21, and 28 d) were killed during lactation. Three intestinal segments (duodenum, jejunum, and ileum) were collected for total RNA and protein isolation. The abundance of mRNA and protein was evaluated using real time-PCR and western blotting using antibodies for EAAC1, respectively. Abundance of EAAC1 generally declined from d 1 to 14 and subsequently increased to d 21 in the jejunum. Intestinal of pigs 14 d were used for EAAC1 distribution in all segments. The results showed that abundance of EAAC1 mRNA and protein was greater in duodenum, and then jejunum and ileum (1.54:1.35:1.17 and 1.70:1.46:1, $P \leq 0.05$). Then intestinal segments from growing pigs (with average body weight of 55.6±7.0 kg) fed with four experimental diets with different dietary protein (DP) levels (13, 16, 19%, and 16% with 1% arginine) and DE levels (12.6, 14.6, 16.5 MJ/kg and 14.6 MJ/kg with 1% arginine) were studied. In general, both of the EAAC1 mRNA and protein abundance decreased from low to high DP (1.54:0.68:0.67 and 1.70:1.24:0.97), and 1% arginine enhanced EAAC1 expression in duodenum. On the contrary, EAAC1 protein had greater expression in high DE diet, and abundance in pigs with 14.6% DE added 1% arginine were lowest (1.10:1.69:2.13:1, P ï¼ž 0.05). In conclusion, gene expression of EAAC1 is not only differentially distributed among intestinal segments, but also differentially regulated by age, and was affected by diet, especially by arginine.

Key Words: Amino Acid Transporter, Intestine, Pigs