

**T29 The amino acid ideal pattern for Pekin ducks during early growing period.** Y. Wang\*, Z. Niu, and F. Liu, *Northwest Sci-Tech University of Agriculture & Forestry, Yangling, China.*

Five experiments were conducted to set up the ideal pattern of amino acid requirement of Pekin ducks. In experiment 1, the digestibility of some amino acids in the basal diet were determined, including lysine (Lys), methionine (Met), tryptophan (Trp), threonine (Thr), and isoleucine (Ile). In experiment 2, the growth performance was investigated to effect of different levels of Lys, Met, and Trp, and their interaction under a 3×3 factorial arrangement. The experiment 3 was conducted to evaluate the influence of different levels of Trp, Thr, and Ile, and their interaction. The experiment 4 was carried out to investigate the efficacy of different levels of Trp, Thr, and Ile in a lower protein-diet. In experiment 5, based on the results above, six amino acid models were used to test in order to select a ideal model. The results showed that Lys, Met, Trp, Thr, and Ile requirement of Pekin ducks during 0-2 week was 1.10%, 0.46%, 0.24%, 0.42%, and 0.53% resp., and the digestive amino acid requirement was 1.02%, 0.44%, 0.21%, 0.38%, and 0.47% resp. The total amino acid ideal pattern for duckling was: Lys:Met:Trp:Thr:Ile=100:41:21:38:48, and the digestive amino acid ideal pattern was: Lys:Met:Trp:Thr:Ile=100:43:21:37:46.

**Key Words:** Pekin Duck, Amino Acid, Ideal Pattern

### Nonruminant Nutrition: Grow/Finish - Energy & Protein

**T31 Advantages of formulating diets based on net energy on pig performance, carcass characteristics and production economics.** M. Rademacher\*<sup>1</sup> and L. Hagemann<sup>2</sup>, <sup>1</sup>Degussa AG, Hanau, Germany, <sup>2</sup>State Office for Consumer Protection and Agriculture of Brandenburg, Teltow, Germany.

The objective of this study was to determine the effect of dietary energy formulation system on performance, carcass quality and production cost. A total of 126 pigs were used in a three phase-feeding program (phase I: 32 to 50 kg, phase II: 50 to 80 kg, phase III: 80 to 112 kg) in the weight range 32 to 112 kg. Pigs were housed in groups of 14 on a partially slatted floor. Feed was offered ad libitum via a FIRE system (Feed Intake Recording Equipment). Water was provided from low pressure nipple drinkers. Wheat-barley-rye and soybean meal based diets were formulated. Within each growth phase (Phase I, II and III), three diets (A, B, C) were formulated to provide similar digestible amino acid contents. Diets A within each phase were formulated on ME basis and standard dietary CP levels. Diets B were reduced CP diets formulated on ME basis. Diets C were formulated to the same CP contents as Diets B but taking into account the net energy (NE) values of the ingredients. During the overall growing-finishing period, feed intake and feed efficiency were not affected ( $P>0.05$ ) comparing the 3 experimental groups. Growth rate was significantly affected ( $P<0.05$ ) with group B having a lower ADG compared with group C (836 vs 868 g/d) and group A (854 g/d) being intermediate. Lean gain of groups A, B and C was 422, 411 and 432 g/d ( $P>0.05$ ), respectively. The economic impact of comparing group A with group C resulted in a reduction in feed cost per pig by 0.63 EUR (30.62 vs 29.99 EUR), carcass value was improved by 1.10 EUR (109.63 vs 110.73 EUR) and carcass value minus feed cost was improved by 1.73 EUR per pig. Dietary CP can be reduced in growing-finishing diets without affecting growth rate, feed intake, feed efficiency and carcass quality as long as diets are formulated based on the NE concept in combination with digestible amino acids and limiting amino acids supplemented according to the ideal protein concept. This will further result in higher profit due to improved pig performance, better carcass quality and savings in feed costs.

**Key Words:** Pigs, Energy Systems, Performance

**T32 The effects of dietary oil inclusion and oil source on apparent digestibility, fecal volatile fatty acid concentration and manure ammonia emission.** A. G. B. Leek<sup>1</sup>, V. E. Beattie<sup>2</sup>, and J. V. O' Doherty\*<sup>1</sup>, <sup>1</sup>Department of Animal Science and Production, University College Dublin, Dublin, Ireland, <sup>2</sup>Devenish Nutrition Ltd., Belfast, North Ireland.

An investigation was conducted to test the hypothesis that dietary oil inclusion increases ammonia nitrogen (NH<sub>3</sub>-N) emission from the ma-

**T30 Transgenic chickens expressing beta-galactosidase hydrolyze lactose in the intestine.** S. Pophal\*<sup>1,2</sup>, P. Mozdziak<sup>1</sup>, S. Borwornpinyo<sup>1</sup>, and J. Petite<sup>1</sup>, <sup>1</sup>North Carolina State University, Raleigh, <sup>2</sup>Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil.

Chickens do not possess the necessary enzymes to efficiently hydrolyze lactose into glucose and galactose. The bacterial enzyme beta-galactosidase can convert lactose into glucose and galactose. Transgenic chickens that carry the E. coli lacZ gene and express beta-galactosidase could potentially employ lactose as an energy source. The objective of this study was to determine the ability of the small intestinal mucosa from transgenic chickens to hydrolyze lactose into glucose and galactose. Lactase activity was examined in the intestinal mucosa from wild-type chickens and two lines of chickens that carry the lacZ gene and express beta-galactosidase. Lactase activity was significantly ( $P < 0.05$ ) higher in both transgenic lines compared to wild-type birds. The presence of the beta-galactosidase enzyme was revealed via X-gal staining in the intestine of transgenic chickens, while it was not present in the wild-type chickens. Overall, it appears that inserting the lacZ gene, which encodes beta-galactosidase has resulted in a chicken that can utilize lactose as an energy source. This study demonstrates that transgenic technology can be used to modify nutrient utilization in domestic poultry.

**Key Words:** LacZ, Lactase, Transgenic

nure, due to a negative effect of either unsaturated or saturated oil on microbial activity in the intestine. Dietary oil was included at 45 g/kg, as either crude palm oil (PO), soya oil (SO) or a 50:50 PO:SO blend (OB), to a basal barley-soya-wheat diet (control) at the expense of dextrose and maize starch. Diets were formulated to contain 13.2 MJ DE/kg and 11.0 g/kg lysine. Four boars were assigned to each dietary treatment, and were transferred to metabolism crates (mean live weight, 74.0 kg ± 2.89) following 14 days dietary acclimation. Urine and feces were collected separately over a 5-day digestibility/nitrogen (N) balance period and a 2-day manure collection period. Inclusion of dietary oil increased apparent digestibility of oil ( $P < 0.01$ ) and decreased the apparent digestibility of dry matter ( $P < 0.01$ ) and gross energy ( $P < 0.05$ ). Dietary oil did not affect the apparent nitrogen, acid detergent fibre, neutral detergent fibre or hemicellulose digestibility. Apparent digestibility of oil was lower when oil was included as PO compared to SO and OB ( $P < 0.001$ ). The concentration of faecal volatile fatty acid (VFA) was similar in all treatments, although the acetic:propionic acid was lower when oil was included as PO and OB compared to SO ( $P < 0.05$ ). N balance, manure N concentration and NH<sub>3</sub>-N emission was not affected by oil inclusion or oil source. In conclusion, dietary oil inclusion reduced apparent dry matter and energy digestibilities, although no effect on fermentation was indicated by digestibility of fibre or faecal VFA content. Consequently, ammonia emission was not affected by dietary oil included at 45 g/kg.

**Key Words:** Pigs, Oil, Ammonia

**T33 Influence of lipid source in diets on the performance, meat quality and lipid profile for finishing pigs.** R. V. de Sousa<sup>1</sup>, E. T. Fialho\*<sup>1</sup>, J. A. F. Lima<sup>1</sup>, P. V. R. Logato<sup>1</sup>, and J. I. A. Leite<sup>2</sup>, <sup>1</sup>University Federal of Lavras - UFLA- Brazil, <sup>2</sup>University Federal of Minas Gerais-UFGM-Brazil.

Two experiments were conducted to evaluate lipid sources for finishing pigs. Exp. 1 utilized a total of 44 barrows and 44 gilts (LD × LW; 68.5 ± 1.45 kg BW) while Exp. 2 used a total of 66 hybrid barrows (33 with 73.65 ± 1.56 kg initial BW and 33 with 88.50 ± 1.11 kg initial BW). The experiments were conducted to evaluate different sources of lipids at 2% (soybean oil, canola oil, linseed oil and commercial PUFA oil) in Exp. 1 and different levels (2.0, 2.5, 3.0 and 3.5%) of canola oil in Exp. 2 upon lipid metabolism, growth, carcass characteristics and meat quality. Experimental diets were isocaloric, isoprotein and isolysinic, and formulated with corn and soybean meal as base ingredients. There were no effects of sources and levels of canola oil tested on the performance. However, lean meat percentage and longissimus muscle area was improved ( $P<0.01$ ) by the addition of 2% linseed oil in the diet. The pigs fed diets with linseed and canola oil had higher content of protein and ash in longissimus muscle in comparison with those fed diets with

soybean oil. The biceps muscle of animals fed diets with linseed oil had higher content of protein in the same tissue of animals fed soybean oil. The different levels (2.0, 2.5, 3.0, and 3.5%) of canola oil decreased linearly ( $P < 0.01$ ) the level of ash in longissimus muscle. The fatty acid composition of intramuscular fatty of longissimus muscle reflected the dietary fatty acid composition. Blood lipids (total cholesterol, triglycerides and total cholesterol fractions [HDL, LDL and VLDL]) did not differ ( $P > 0.10$ ) for the sources and levels of lipids added to the diets. In conclusion, the linseed oil at 2.0% in the finishing pig diet improved lean tissue accretion at the expense of lipogenesis. In addition fatty acid deposition follows the dietary fatty acids profile.

**Key Words:** Lipids, Oils, Cholesterol

**T34 Utilization of pearl millet in substitution for corn in diets for growing pigs - metabolism assay and performance.** E. T. Fialho\*, M. da S. M. Pinheiro, J. A. F. Lima, P. B. Rodrigues, and R. T. F. de Freitas, *University Federal of Lavras - UFLA, Brazil.*

To evaluate the technical viability of substitution of corn by pearl millet in an isometric way for growing pig diets, two metabolism assays and one performance trial were conducted. The metabolism assays utilized 12 crossbred (LD x LW) barrows ( $31.8 \pm 2.2$  kg BW) for the feedstuffs (corn ground, whole pearl millet and ground pearl millet) and 10 barrows ( $42.1 \pm 2.10$  kg/BW) for diets with 0, 25, 50, 75 and 100% substitution of corn by ground pearl millet. A 7 d period for adaptation and 5 d period for total collection of feces and urine with ferric oxide (2%) as the indigestible marker was used for both metabolism assays. A total of 120 crossbred (LD x LW) barrows and gilts ( $30.7 \pm 1.2$  kg BW) were utilized in the performance trial. Pigs were allotted by weight and gender with five treatments (the same as used in the metabolism assay) and 12 replicates. The experimental unit was represented by the pen (1 barrow and 1 gilt/pen). The metabolism data from both whole and ground pearl millet revealed no differences ( $P > 0.05$ ) for apparent digestibilities of nutrients or energy values; on average the DDM, ADCP, DP, DE and ME of pearl millet were 87.14%, 86.25%, 11.49%, 3166 kcal/kg and 3040 kcal/kg, respectively. The substitution of pearl millet at 100% for corn did not affect ( $P > 0.05$ ) the digestibility coefficients of CP or nitrogen retention. But the digestibility coefficients of DM, as well as the dietary DE and ME values decreased linearly ( $P < 0.01$ ) as corn was substituted by pearl millet. The performance data did not show any effects ( $P > 0.05$ ) by totally replacing corn with pearl millet in the diet (ADG, kg - 100% corn 0.872 vs 100% pearl millet 0.889; ADFI, kg - 100% corn 2.30 vs 100% pearl millet 2.38; Feed/gain - 100% corn 2.67 vs 100% pearl millet 2.69). In conclusion, it is technically feasible to substitute up to 100% of corn with pearl millet in an isometric way for growing pigs from 30 to 60 kg.

**Key Words:** Swine, Pearl Millet, Corn

**T35 Energy, protein, and amino acid digestibility in different sources of rice bran for growing pigs.** C. Kaufmann<sup>1</sup>, W. Sauer<sup>1</sup>, M. Cervantes<sup>2</sup>, M. Rademacher<sup>3</sup>, and J. He<sup>1</sup>, <sup>1</sup>University of Alberta, Edmonton, AB, Canada, <sup>2</sup>Universidad Autónoma de Baja California, Mexicali, Mexico, <sup>3</sup>Degussa-Huls AG, Hanau-Wolfgang, Germany.

A study was conducted to determine the fecal GE digestibility and apparent ileal digestibilities (AID) of AA in five samples of rice bran (RB). Six barrows (36.5 kg average initial BW) fitted with a simple T-cannula at the distal ileum were used according to a 6 x 6 Latin square design. Five different sources of RB were evaluated: RB 1: Canadian source; RB 2: Riceland Foods Inc., Stuttgart, AR, US; RB 3: Italy; RB 4: Phillipines; and RB 5: Agribbrands/Tradico, Greenville, MS, US. Six diets were formulated to contain 18% CP. Diets A, B, C, D and E contained 53.8% corn, 19.9% soybean meal (SBM) and 23.1% of each RB source. Diet F (reference diet) contained 71.03% corn and 26.3% SBM. The fecal energy digestibility of RB 4 (86.9%), which was the lowest in NDF content, was higher ( $P < 0.05$ ) than those of RB 1, 2, 3, and 5 (60.5, 64.1, 62.6, 65.8%, respectively). The AID of CP and AA in RB 1, 2, 3, 4, and 5 were: CP, 61.3, 38.3, 48.3, 65.3, 67.3; Arg, 85.1, 75.7, 79.7, 83.1, 83.3; His, 81.7, 66.0, 75.8, 79.8, 76.7; Ile, 73.2, 53.9, 67.7, 73.4, 72.0; Leu, 72.0, 50.9, 63.7, 73.5, 67.2; Lys, 82.2, 62.6, 72.7, 70.5, 73.1; Met, 76.0, 61.4, 66.9, 72.2, 74.0; Phe, 71.9, 52.5, 65.2, 76.8, 70.6; Thr, 82.8, 58.4, 73.9, 86.1, 75.9; Val, 76.2, 60.2, 71.1, 76.9, 75.3; Trp, 82.6, 58.8, 69.7, 70.0, 73.3, respectively. There was considerable variation in

the amino acid digestibilities among the RB samples. The ileal CP and amino acid digestibilities were lowest in RB 2, a defatted source of RB. The values for amino acid digestibility were highest in RB 4 (which has the lowest NDF content), in RB 5 (an extruded source of RB), and RB 1. There were significant relationships ( $P < 0.05$ ) between the content of fat (positive), or CP (negative) and the AID of Lys and Trp. No significant correlations were observed between the NDF or ash contents and the AID of AA. This study shows that there is considerable variation in fecal GE, and CP and AA apparent ileal digestibility values in RB, and that it is rather difficult to specify an overriding factor responsible for the variation.

**Key Words:** Rice Bran, Pigs, Digestibility

**T36 Comparison of growing swine performance when fed diets containing cull chickpeas in substitution of soybean meal and corn.** J.F. Obregon, J.M. Uriarte\*, R. Barajas, and H.R. Guemez, *FMVZ-Universidad Autonoma de Sinaloa, Culiacan-Mazatlan, Mexico.*

To determine the effect of substitution of soybean meal and corn for cull chickpeas on growth performance and carcass traits in finishing pigs, 72 pigs (BW =  $27.48 \pm 0.97$  kg; Large White x Landrace x Large White x Pietrain) in groups of six were placed in 12 concrete floor pens (1.5 x 6 m). Pens were fed one of three diets: 1) Diet with 17.2% CP and 3.36 Mcal ME/kg, containing corn 73%, soybean meal 23%, and premix 4% (CONT); 2) Diet with 17.1% CP and 3.35 Mcal ME/kg with corn 60.5%, cull chickpeas 20%, soybean meal 15.5%, and premix 4% (CHP20), and 3) Diet with 17.1% CP and 3.33 Mcal ME/kg with corn 47.2%, cull chickpeas 40%, soybean meal 8.8%, and premix 4% (CHP40). Pig were weighed at days 0 and 45 of the experiments and feed intake was recorded daily; ADG and feed intake/gain ratio were calculated from these data. Body weight at day 45 (59.41, 61.62 and 58.51 kg) were not affected ( $P = 0.16$ ) by CONT, CHP20 and CHP40, respectively. ADG (0.71, 0.75 and 0.69 kg) was similar ( $P = 0.15$ ) between dietary treatments. Feed intake (1.83, 1.90 and 1.89 kg) was not modified ( $P = 0.13$ ) by treatments. Feed/gain ratio (2.58, 2.53 and 2.67) was similar ( $P = 0.33$ ) between treatments. It is concluded, that cull chickpeas can be used up to 40% in diets for growing pigs without affecting growth performance.

**Key Words:** Chickpeas, Growth Performance, Pigs

**T37 Effect of the substitution of soybean meal and corn for cull chickpeas in the diet on growth performance and carcass traits of finishing pigs.** J. F. Obregon, H. R. Guemez\*, F. G. Ríos, R. Barajas, and J. M. Uriarte, *FMVZ-Universidad Autonoma de Sinaloa, Culiacan-Masatlan, Mexico.*

To determine the effect of substitution of soybean meal and corn for cull chickpeas in the diet growth performance and carcass traits of finishing pigs, 72 pigs (BW =  $62.81 \pm 2.63$  kg; Large white x Landrace x Large white x Pietrain) in groups of six were placed in 12 concrete floor pens (1.5 x 6 m). Pens were fed one of three diets that consisted of the treatments: 1) Diet with 13% CP and 3.88 Mcal ME/kg, containing corn 81.7%, soybean meal 14.3% and premix 4% (CONT); 2) Diet with 13.1% CP and 3.34 Mcal ME/kg with corn 61.7%, cull chickpeas 30%, soybean meal 4.3% and premix 4% (CHP30), and 3) Diet with 15.1% CP and 3.30 Mcal ME/kg with corn 36%, cull chickpeas 60% and premix 4% (CHP60). Pigs were weighed at days 0 and 42 of the experiment and feed intake was recorded daily; ADG and feed/gain ratio were calculated from these data. After 42 days eight pigs from each treatment were killed in a slaughterhouse and carcass traits measured. Body weight at day 42 (92.33, 92.45 and 91.49 kg) was not affected ( $P = 0.80$ ) by CONT, CHP30 and CHP60, respectively. ADG (0.721, 0.723 and 0.698 kg) were similar ( $P = 0.84$ ) between dietary treatments. Feed intake (2.67, 2.69 and 2.56 kg) was not modified ( $P = 0.35$ ) by treatments. Feed/gain ratio were similar ( $P = 0.42$ ) between treatments. Hot carcass weight (81.37, 79.37 and 77.56 kg) was similar ( $P = 0.26$ ) and carcass yield was not affected ( $P = 0.35$ ) by the treatments. Back fat (1.64, 1.46 and 1.60 cm) were not affected ( $P = 0.42$ ), rib eye area, weights of loin and leg was similar ( $P = 0.39$ ). It is concluded, that cull chickpeas can be used up to 60% in diets for finishing pigs without affecting performance and carcass traits.

**Key Words:** Chickpeas, Carcass Traits, Pigs

**T38 Effect of diets formulated based on ileal lysine digestibility and alternative feeds for finishing pigs - metabolism and performance assay.** M. L. F. Silva, E. T. Fialho\*, J. A. F. Lima, R. V. de Sousa, and L. D. S. Murgas, *University Federal of Lavras - UFRA-Brazil*.

Two experiments were conducted to evaluate the digestibility of dietary nutrients, performance and carcass characteristics of pigs fed finishing diets based on corn, soybean meal and alternative ingredients with the same total dietary content of true digestible lysine (NRC, 1998). The treatments in both experiments were: T1 diet formulated with corn and soybean meal; T2 corn, soybean meal, peanut meal solv. and cottonseed meal solv. 41% CP; T3 - corn, soybean meal, meat and bone meal 45% CP, and fish meal 60% CP; T4 sorghum, defatted rice bran and soybean meal. The metabolism assay used 24 barrows (62 kg BW). A 7 d period for adaptation and 5 d period for total collection of feces and urine with ferric oxide (2%) as the indigestible marker was used. In the performance assay, 64 commercial hybrid barrows (61.9 ± 3.10 kg BW) were used. The pigs were housed in pairs in pens with pen as the experimental unit. For the two assays, a total of 6 and 8 replications were used, respectively. The apparent fecal digestibility of DM, nitrogen retention, as well as DE and ME of the diets did not differ (P>0.05) among the treatments tested. However, the digestibility of CP was better (P<0.05) for T2 (86.65%) and T3 (87.24%) than T1 (85.78%) and T4 (85.82%). The performance of finishing pigs as well as the carcass characteristics did not differ (P>0.05) for the diets tested. In conclusion diets for finishing pigs formulated with alternative feeds and based on the same amount of true digestible lysine have been shown to be technically viable.

**Key Words:** Performance, Digestible Lysine, Metabolism Assay

**T39 Energy and protein values of some Brazilian feedstuffs for pigs as determined by metabolism assay.** E. T. Fialho\*, Z. A. S. Santos, J. A. F. Lima, R. T. D. Freitas, and A. G. Bertechini, *University of Lavras-UFLA, Brazil*.

Assays were conducted to determine the chemical composition and digestibility of protein and energy of 16 Brazilian feedstuffs in growing pigs. Five metabolism trials were conducted with a total of 60 LDxLW barrows (40.4 ± 2.2 kg). During each trial, pigs were penned individually in stainless steel metabolism cages with a 7 d period for adaptation and 5 d period for total collection of feces and urine. Ferric oxide (2%) was utilized as the indigestible marker. The basal diet was an 18% CP corn-soybean meal diet in each metabolism assay. The experimental diets consisted of 70% basal diet plus 30% of the test feedstuff, except for the oils and lards which were added at 15% for evaluation. In each metabolism trial three feeds plus the basal diet were tested. Digestible protein and digestible and metabolizable energy values were calculated by using the Matterson et al., 1968 (Agric. Exp. Station Research Report, Univ. Connecticut) equation. These data indicate that there are differences in digestibility protein and energy among Brazilian feedstuffs in relation to those referenced by the foreign feed composition tables (NRC, 1998 and Feedstuffs, 2003). We conclude that reliable estimates of digestibility values can significantly improve the precision of pigs diets formulation.

Chemical composition and digestibility of protein and energy of some Brazilian feedstuffs determined by metabolism assays<sup>1</sup>

FEED-STUFFS	DM, %	CP, %	NDF, %	ADF, %	CP Digest, %	DE, kcal/kg	ME, kcal/kg
Cottonseed Meal	89.10	32.1	28.4	17.4	66.2 (2.3)	2480 (60)	2190 (77)
Bakery Residue Meal	89.3	8.4	10.4	9.3	84.4 (2.5)	3220 (76)	3185 (69)
Coconut, Lard	99.4	-	-	-	-	8110 (86)	7960 (78)
Soybean Meal, 46%	88.6	46.3	13.4	9.6	86.5 (2.1)	3430 (56)	3360 (79)
Soybean Meal, Micronized	89.3	37.1	10.6	9.1	86.8 (2.3)	4580 (73)	4350 (56)
Yellow Corn Ground	87.6	8.0	9.8	3.0	85.3 (1.2)	3480 (65)	3320 (59)
Pearl Millet Ground	87.0	11.6	20.7	11.7	86.2 (1.6)	3213 (62)	3048 (72)
Swine, Lard	99.3	-	-	-	-	8540 (84)	8280 (86)
Citrus Pulp	91.1	6.3	40.8	13.2	60.8 (3.3)	2367 (89)	2096 (87)
Milk dried skim	90.2	31.2	-	-	90.4 (2.7)	4560 (67)	4450 (78)
Peanut Meal	92.2	49.6	11.54	9.72	81.2 (3.4)	3292 (84)	3146 (90)
Sunflower Meal	92.7	2.5	43.6	32.9	77.7 (1.7)	2365 (54)	2289 (54)
Wheat Meal	87.7	15.1	40.2	12.5	74.9 (2.7)	2515 (67)	2358(72)
Cassava Meal	87.8	2.2	8.7	5.2	78.3 (3.0)	3225 (100)	3097 (87)

<sup>1</sup>Data on as fed basis.

**Key Words:** Digestibility, Swine, Metabolism Assay

**T40 Comparison of a diet containing food waste with a corn/soybean diet fed to swine.** J. Jones, M. L. Westendorf\*, and J. E. Wohlt, *Rutgers, The State University of New Jersey, New Brunswick*.

Recycled food waste can provide an acceptable and nutritious feed for swine. Although pigs will readily consume wet food waste, the high moisture content contributes to spoilage and feeding management problems. The use of a dry, processed food waste product was compared to a traditional corn/soy diet using growing swine in two performance trials and one digestibility trial. The food waste diet contained 30-35% processed food waste on a dry matter basis. In Trial 1, 24 gilts (76.4 kg) were fed in a six-week trial. Intake, gain, feed efficiency, and carcass characteristics were compared. Feed intake and gain averaged 3.4 and 3.6 kg of DM/d and .87 and .85 kg/d for gilts fed traditional and food waste diets, respectively. There were no differences in these or any other measurements (P#88050.05). In Trial 2, 12 barrows (84.3 kg) were fed in a six-week trial. Intake, gain, feed efficiency, and carcass characteristics were compared. Feed intake and gain averaged 3.1 and 3.3 kg of DM/d and .62 and .71 kg/d for barrows fed traditional and food waste diets, respectively (P#88050.05). There were no differences in carcass characteristics (P#88050.05) except in Trial 2 when belly weight in food waste-fed pigs was greater (P#88040.05) than control pigs (10.7 vs 9.6 kg). In Trial 3, four growing gilts (68.2 kg) were used to compare digestibility in a crossover design. There were no differences (P#88050.05) for DM, CP, ADF, or NDF digestibility when feed intake averaged 1.9 kg of DM/d for both food waste and corn/soy diets. The use of up to 35% processed food waste may be suitable in commercial swine diets.

**Key Words:** Food Waste, Wheat Middlings, Growing Pigs

**T41 Evaluation of protein dispersibility index as an indicator for soybean meal protein quality in growing pigs: II. Feeding trial.** H. S. Lee\*<sup>1</sup>, J. G. Kim<sup>2</sup>, Y. W. Shin<sup>2</sup>, Y. H. Park<sup>2</sup>, and K. Y. Whang<sup>2</sup>, <sup>1</sup>*American Soybean Association, Seoul, Korea*, <sup>2</sup>*Korea University, Seoul, Korea*.

A 42-d feeding trial was conducted to verify the plausibility of using the protein dispersibility index (PDI) as an indicator of soybean meal protein quality. Soy flake treatments (Trt) used in this experiment were: 1) raw; 2) steamed for 5 min at 95°C; 3) 5 min at 110°C; 4) 15 min at 110°C; and 5) 60 min at 110°C. A total of 120 pigs (Y×L×D) weighing 12.2 ± 0.8 kg were assigned to five dietary treatments with 6 replicates. Experimental diets containing various heat-treated soy flakes included 3390 kcal/kg ME, 19.1% CP, and 1.05% lysine. The ADG of Trt 4 was

higher ( $P < .05$ ) than those of Trt 1, 2, and 5. Feed efficiency (G/F) and feed intake of pigs in Trt 1 were lower ( $P < .05$ ) than those in other treatments. Although pepsin digestibility and urease activity index were not correlated with growth performance, the KOH protein solubility and PDI measurements were highly correlated with ADG ( $r^2 = 0.659$ ,  $P < .001$  and  $r^2 = 0.649$ ,  $P < .001$ , respectively) and G/F ( $r^2 = 0.719$ ,  $P < .001$  and  $r^2 = 0.739$ ,  $P < .001$ , respectively). These results suggest that PDI is as effective as KOH protein solubility as an indicator of soybean meal protein quality in growth performance of growing pigs.

Treatments	ADG, g	ADFI, g	G/F
1	323.75 <sup>c</sup>	847.63 <sup>c</sup>	0.38 <sup>b</sup>
2	554.81 <sup>b</sup>	1038.99 <sup>b</sup>	0.54 <sup>a</sup>
3	583.34 <sup>b</sup>	1040.91 <sup>b</sup>	0.56 <sup>a</sup>
4	625.13 <sup>a</sup>	1127.73 <sup>a</sup>	0.55 <sup>a</sup>
5	550.44 <sup>b</sup>	1062.71 <sup>ab</sup>	0.52 <sup>a</sup>
SEM	15.64	30.33	0.02
P-value	0.001	0.001	0.001

**Key Words:** Pigs, Protein Dispersibility Index, Growth Performance

**T42 Evaluation of protein dispersibility index as an indicator for soybean meal protein quality in growing pigs: I. Metabolic study.** H. S. Lee<sup>\*1</sup>, Y. W. Shin<sup>2</sup>, J. G. Kim<sup>2</sup>, Y. H. Park<sup>2</sup>, and K. Y. Whang<sup>2</sup>, <sup>1</sup>American Soybean Association, Seoul, Korea, <sup>2</sup>Korea University, Seoul, Korea.

Five differently heat-treated soy flake treatments (Trt), 1) raw; 2) steamed for 5 min at 95°C; 3) 5 min at 110°C; 4) 15 min at 110°C; and 5) 60 min at 110°C, were prepared and used as a major dietary protein source to verify the plausibility of using protein dispersibility index (PDI) as an indicator of soybean meal protein quality in a nitrogen balance trial with growing pigs. Twenty castrated pigs (Y×L×D) weighing 14.1 ± 0.9 kg were randomly assigned to dietary treatments and fed experimental diets containing various heat-treated soy flakes. Pigs were adjusted for three days prior to fecal and urinary sample collection for four days. Pigs fed the diet containing soy flake heat-treated for 15 min at 110°C (Trt 4) had the highest nitrogen retention among pigs in this experiment. Nitrogen retention was increased as the heat-treatment was applied from Trts 1 to 4, and then decreased in Trt 5. Both KOH protein solubility ( $y = -0.0153x^2 + 1.9191x + 13.957$ ,  $r^2 = 0.893$ ,  $P = 0.001$ ) and PDI measurements ( $y = -0.0067x^2 + 0.3033x + 66.2127$ ,  $r^2 = 0.841$ ,  $P < 0.001$ ) were correlated with the nitrogen retention of the pigs. It is found however that urease activity index and pepsin digestibility were not correlated with nitrogen retention in this experiment. This result suggests that PDI is as effective as KOH protein solubility as an indicator of soybean meal quality in nitrogen retention of growing pigs.

Treatments:	1	2	3	4	5	SEM	P-value
Urease activity	1.95 <sup>a</sup>	0.10 <sup>b</sup>	0.02 <sup>c</sup>	0.03 <sup>c</sup>	0.01 <sup>c</sup>	0.01	0.001
Pepsin dig., %	95.25	95.07	94.72	94.54	93.29	0.62	NS
KOH prot. sol., %	96.12 <sup>a</sup>	84.78 <sup>b</sup>	79.06 <sup>c</sup>	76.99 <sup>d</sup>	41.70 <sup>e</sup>	0.54	0.001
PDI, %	65.37 <sup>a</sup>	33.75 <sup>b</sup>	22.59 <sup>c</sup>	21.10 <sup>c</sup>	8.64 <sup>d</sup>	0.45	0.001
N retention, %	57.49 <sup>c</sup>	67.21 <sup>b</sup>	69.86 <sup>ab</sup>	71.64 <sup>a</sup>	67.46 <sup>b</sup>	0.95	0.001

**Key Words:** Pigs, Protein Dispersibility Index, Nitrogen Retention

**T43 Effects of altering bed depth in the desolventizer/toaster used in soybean meal preparation on nutrient digestibility by ileally cannulated pigs and cecectomized roosters.** L. Pope<sup>\*</sup>, K. Bruce, L. Karr-Lilienthal, C. Grieshop, N. Merchen, C. Parsons, and G. Fahey, *University of Illinois, Urbana.*

Soybean meal (SBM) has been a major contributor of dietary amino acids for the poultry, swine, and aquaculture industries for many years, and it is widely known that processing conditions used to prepare SBM have an impact on its nutrient composition. In an attempt to determine

the optimal processing conditions for preparation of SBM that maximize amino acid digestibilities, six lots of high protein SBM were produced under different toasting conditions. Specifically, the bed depth in the desolventizer-toaster was varied (4.0, 4.5, 5.5, 6.0, 7.0, and 8.0 in.). All soybeans were acquired from the same producer, and the preparation and extraction conditions were held constant for all lots. The SBMs then were incorporated into semipurified diets and fed to ileally cannulated pigs in a 7 × 7 Latin Square design to determine ileal and total tract nutrient digestibility. A low-protein casein diet also was fed to estimate endogenous losses of amino acids, and to allow for an accurate determination of true amino acid digestibilities. Each experimental period was seven days, with a five-day adaptation period and a two-day ileal collection. The SBMs were also fed to cecectomized roosters in order to determine true amino acid digestibilities by poultry. When fed to pigs, there were no differences ( $P > 0.05$ ) among treatments in apparent or true ileal lysine digestibilities, with values ranging from 87.3 to 90.2% and 90.7 to 93.5%, respectively. Additionally, there were no differences ( $P > 0.05$ ) in ileal apparent or true total amino acid digestibilities, but the dietary amino acids were highly available (true average total amino acid digestibility = 92.2%). For cecectomized roosters, no differences ( $P > 0.05$ ) were observed in true lysine digestibility with values ranging from 83.2 to 87.0%. Alteration of the bed depth in the desolventizer-toaster had little effect on nutrient digestibilities of SBM by swine and poultry.

**Key Words:** Swine, Soybean Meal, Poultry

**T44 Utilization of sunflower meal in diets of finishing pigs - performance and digestibility.** D. de C. Carellos, J. A. F. Lima, E. T. Fialho<sup>\*</sup>, R. T. F. Freitas, and E. P. Filgueiras, *University Federal of Lavras, UFLA, Brazil.*

The objective of this study was to evaluate the influence of increasing levels of solvent extracted sunflower meal (SFM - DM 92.71%, CP 27.50%, NDF 43.57%, ADF 32.96%, CF 25.91%, EE 3.08%, GE 4,390kcal/kg) on the digestibility, performance and carcass characteristics of finishing pigs. A total of two experiments were conducted. The metabolism trial was conducted to evaluate the digestibility of Dry Matter (DDM), crude Protein (DCP), gross Energy (DGE) and fiber detergent neutral (DFDN) of SFM nutrients in diets containing 0, 4, 8, 12 and 16% SFM by utilizing 15 crossbred barrows (LD × LW; 55.1 ± 4.8 kg). The experimental unit was represented by the metabolism cage. A 7 d period for adaptation and 5 d period for total collection of feces and urine with ferric oxide (2%) as the indigestible marker was used. The digestibility values for SFM (as fed basis) were 54.40% DM, 77.73% CP, and 53.80% GE resulting in a digestible nutrient content of 50.43% DDM, 21.38% DCP, 2,365 kcal/kg DE and 2,289 kcal/kg ME. A linear effect ( $P < 0.01$ ) was found for DDM and DFDN, a quadratic effect ( $P < 0.01$ ) for DGE (higher value with 13.5% of SFM), DCP (higher value 11.55% of SFM) and NR (higher value 17.45% of SFM). In the performance trial, 80 crossbred pigs (LD × LW; 62.0 ± 4.2 kg BW) were utilized. Pigs were allotted by weight and gender to treatment and replicate. The experimental unit was represented by the pen (1 barrow and 1 gilt/pen). The five dietary treatments were increasing levels of SFM (0, 4, 8, 12 and 16%). At the end of the performance trial (99.80 ± 6.91 kg), the pigs were slaughtered for carcass evaluation. The increasing levels of SFM resulted in a linear decrease ( $P < 0.05$ ) for feed intake. In carcass evaluation, the increasing levels of SFM inclusion did not affect ( $P > 0.05$ ) any variable evaluated. However, it was found that the barrows had higher P2 values, carcass weight and percentage carcass lean, and the gilts had greater ham weight. It was concluded that inclusion levels of SFM up to 16% in a isonutritive diet should be technically feasible for finishing pigs from 65 to 98 kg BW.

**Key Words:** Sunflower Meal, Pigs, Byproduct

**T45 Effect of dry skim milk on fecal bacterial populations and Salmonella shedding in growing-finishing swine.** J. E. Wells<sup>\*</sup>, J. T. Yen, and D. N. Miller, *USDA-ARS; U.S. Meat Animal Research Center, Clay Center, NE.*

Dry skim milk (DSM) contains approximately 55% lactose and lactose has been suggested to have prebiotic effects in the mammalian digestive system. Barrows were fed growing, growing-finishing, and finishing diets from age 10-14 wk, 14-18 wk and 18-22 wk, respectively. For each feeding phase, diets were formulated to contain 0 or 10% DSM (balanced with ME and apparent ileal digestible AA). Animals were weighed every

two wk. DSM did not alter animal gain, feed intake, or feed conversion ( $P>0.05$ ). Fecal samples were collected from 40 animals (20 with DSM and 20 without DSM) at wk 10 (d 0 on diets), 14, 18, and 22, and were analyzed for *Lactobacillus* sp. (LAB), Enterobacteriaceae (EB), coliforms (CF), generic *Escherichia coli* (EC), and *Salmonella* sp. At week 10, fecal bacterial counts ( $\log_{10}$  CFU/g feces) were 9.55, 7.26, 7.01, and 6.93 for LAB, EB, CF, and EC populations, respectively. The EB, CF, and EC populations decreased through wk 14 and 18 ( $P<0.05$ ), but were still higher with the DSM diet ( $P<0.05$ ). The LAB population decreased over time in the absence of DSM in the diet, whereas DSM sustained higher LAB counts ( $P<0.05$ ). At wk 22, populations of EB, CF, and EC were higher ( $P<0.05$ ) than wk 18 for the diet without DSM, but no change was observed with DSM. As a result, no differences between the diets were observed at week 22. *Salmonella* were detected in 70% of the animals at wk 10 and 14, but only 20% at wk 18 and 22. DSM did not affect *Salmonella* shedding, but pooled analysis indicated that fewer recurring incidences of *Salmonella* shedding occurred in animals with higher LAB bacteria. Nonetheless, weight gain for individual animals was not affected by *Salmonella* shedding in this study. It is concluded that 10% DSM affects fecal bacterial populations, but not *Salmonella* shedding in growing-finishing pigs.

**Key Words:** Gut and Microbes, Dry Skim Milk, Swine

## Nonruminant Nutrition: Grow/Finish - Minerals & Additives

**T47 Response of pigs to dietary phytase and calcium-to-phosphorus ratio.** J. A. Jendza<sup>\*1</sup>, R. N. Dilger<sup>1</sup>, M. R. Bedford<sup>2</sup>, and O. Adeola<sup>1</sup>, <sup>1</sup>*Animal Sciences, Purdue University, West Lafayette, IN*, <sup>2</sup>*Zymetrics, Golden Valley, MN*.

Pigs were fed corn-soybean meal-based basal diets containing 0.71% Ca and 0.40% P to determine response to phytase and Ca-to-total P ratio (Ca:tP) in two 4-wk experiments. Pigs were blocked by weight and gender such that the average weight across treatments was similar with 1 barrow and 1 gilt receiving each treatment within each block, housed in individual pens, and allowed ad libitum access to diets and water. In Exp. 1, 48 10-kg crossbred pigs were used to evaluate the efficacy of an experimental microbial phytase. Diets consisted of the basal, basal plus 3.4 or 6.7 g/kg monosodium phosphate (MSP), basal plus 500 or 1,000 phytase units (FTU)/kg of the experimental or control phytase, and a positive control with adequate Ca and P. Supplemental MSP resulted in linear increases in wk 1 ADFI ( $P < 0.05$ ), ADG in all periods ( $P < 0.05$ ), final weight and ASH ( $P < 0.0001$ ). Experimental phytase increased percent bone ash (ASH), apparent P digestibility ( $P < 0.0001$ ), final weight, overall ADG, wk 4 ADG and wk 4 ADFI ( $P < 0.05$ ). Bone ash (51.1%) in the 1,000 FTU experimental phytase/kg diet was similar to the 6.7 g/kg MSP diet (51.5%). Control phytase improved ASH and apparent P digestibility ( $P < 0.01$ ). In Exp. 2, 48 11-kg crossbred pigs, were randomly assigned to treatments in a 3 x 2 factorial arrangement. The respective factors were Ca:tP (1.8, 1.5, or 1.2) and supplemental experimental phytase (0 or 1,000 FTU/kg). Phytase increased ( $P < 0.01$ ) average BW at 2, 3 and 4 wk; ADG at 2, 3, 4 wk and overall; ADFI at 4 wk and feed efficiency (G:F). Lowered Ca:tP improved ( $P < 0.05$ ) BW and ADG in all periods; ADFI at 3, 4 wk and overall; and G:F at 2, 3, 4 wk and overall. Interaction was significant for ADFI at 3, 4 wk and overall ( $P < 0.05$ ). Results indicate that the experimental phytase is effective at liberating phytate P for uptake and utilization, while decreasing Ca:tP from 1.8 to 1.2 improves ADG, ADFI and G:F.

**Key Words:** Phosphorus, Phytase, Pig

**T48 Growth performance and meat quality changes from trace mineral manipulation of finishing pig diets.** B. V. Lawrence<sup>\*</sup>, D. Overend, S. A. Hansen, J. D. Hahn, and J. Hedges, *Hubbard Feeds Inc., Mankato, MN*.

A total of 257 terminal Duroc cross gilts (Compart Boar Store Line 442 X D100;  $32.5 \pm 1.9$  kg) were compared between 2 treatments: a corn-soybean meal control diet (CTRL), or the CTRL diet for 63-d followed by the CTRL diet supplemented with Yield Pak (a blend of vitamins and trace minerals, YPC) from day 63 - 91. Pens ( $n = 6$ ) were weighed on d-0, 63 and 91. Gain and gain:feed during the 91-d was not different between treatments despite the YPC pigs having higher ( $P<0.05$ )

**T46 Metabolizable energy value of meat and bone meal for pigs.** S. A. Adedokun<sup>\*</sup> and O. Adeola, *Purdue University, West Lafayette, IN*.

The metabolizable energy (ME) values of six samples of meat and bone meal (MBM) were determined in barrows. Twenty four pigs with an average weight of 34 kg were used for each of the MBM samples. The gross energy (GE), crude protein (CP), fat, and ash contents of the MBM samples ranged between 3.49 to 4.75 kcal/g, 44.81 to 61.38%, 8.44 to 13.27%, and 18.87 to 35.37%, respectively. The CP and GE of diets ranged from 17.6 to 19.2% and 4.26 to 4.44 kcal/g, respectively. Each diet was randomly assigned to each block of three crates giving a total of eight blocks for each sample of MBM. Diets were formulated by replacing the same ratio of corn and soybean meal in the basal diet with MBM at 0, 5, or 10%. The digestibility assay employed a 5-d acclimation followed by a 5-d period of total but separate collection of feces and urine. The ME of each of the MBM sample was calculated by regressing the MBM contribution to ME intake against amount MBM intake. The slope of the regression gave the ME content of the MBM sample. The ME of the MBM ranged from between 2.43 and 3.28 kcal/g. Meat and bone meal ME increased as both the GE and fat contents of the different MBM samples increased while MBM ME decreased with an increase in MBM ash content.

**Key Words:** Metabolizable Energy, Meat and Bone Meal, Pigs

intakes from day 63 - 91. At day 91, 80 gilts per treatment ( $116.2 \pm 6.6$  kg) were scanned using real-time ultrasound for 10th rib backfat and loin eye area as well as last rib fat. There was no effect ( $P>0.10$ ) of YPC inclusion on carcass composition. A total of 40 gilts per treatment were individually tagged, tattooed, and weighed prior to shipment ( $123.0 \pm 4.5$  kg). After 8-h of transit to a commercial abattoir, live weights ( $119.7 \pm 4.1$  kg) and hot carcass weights (HCW) were obtained ( $91.9 \pm 3.2$  kg). Weight prior to shipment, abattoir live weight, and HCW were not different ( $P>0.10$ ) between treatments. Fat and muscle depth and lean percentage were similar between treatments ( $P>0.10$ ). Loin pH was measured at 1 and 22-h post-mortem and was not different at 1-h post-harvest, however, 22-h pH (5.62 vs. 5.70) was higher ( $P<0.05$ ), and 22-h pH drop loss (0.49 vs. 0.60 units) lower ( $P<0.05$ ) for the YPC pigs. At 22-h a 40 - 50 g loin core was taken between the 7th and 8th ribs and held for 7-d for determination of drip loss. The reduction in 22-h pH drop was associated with a tendency ( $P<0.15$ ) toward a reduction in 7-d drip loss (3.93 vs. 4.86%). NPPC measures of loin color, firmness, and marbling, as well as ColorTec L\*, A\*, and B\* values were not different ( $P>0.10$ ) between the CTRL and the YPC pigs. The results of this experiment suggest that short term supplementation of the diet with an appropriate blend of vitamins and trace minerals may improve pig growth via stimulation of feed intake and may reduce drip loss via a reduction in the rate of post-mortem pH decline.

**Key Words:** Minerals, Pigs, Meat Quality

**T49 Performance of pigs fed grain sorghum-based diets supplemented with phytase.** J. Yáñez<sup>1</sup>, M. Cervantes<sup>\*1</sup>, M. A. Barrera<sup>1</sup>, W. Sauer<sup>2</sup>, and N. Torrentera<sup>1</sup>, <sup>1</sup>*Universidad Autónoma de Baja California, Mexicali, Mexico*, <sup>2</sup>*University of Alberta, Edmonton, AB, Canada*.

An experiment was conducted to evaluate the effect of phytase supplementation to sorghum-soybean meal diets on the performance of growing pigs. Twenty-eight pigs (average initial BW 22.9 kg) were randomly distributed in 4 dietary treatments (7 replicates/treatment), according to a RB design. Treatments were: T1) sorghum-soybean meal, basal diet, 0.67% apparent ileal digestible lysine; T2) basal diet plus 350 units of phytase activity (FTU)/kg diet; T3) basal plus 700 FTU/kg diet; T4) basal diet plus 1 050 FTU/kg diet. All were formulated to contain 90% (0.77%) of the requirement of apparent ileal digestible lysine, and 100% the requirement of available phosphorus for pigs ranging in BW from 20 to 50 kg. All diets were supplemented with vitamins and minerals to meet or exceed the requirements for the 20 to 50 kg pigs. Daily weight gain (ADG), feed intake, lysine intake, threonine intake, and feed conversion for treatments 1 to 4 were: 0.67, 0.60, 0.61, 0.66 kg/d; 1.39, 1.29, 1.33, 1.47 kg/d; 12.4, 11.5, 11.9, 13.1 g/d; 9.3, 8.6, 8.9, 9.8 g/d; 2.09, 2.18, 2.17, 2.17. There was no effect of phytase supplementation on the