

Nonruminant Nutrition: Feed Ingredients

505 Energy, phosphorus, and amino acid digestibility in Lemna protein concentrate, fish meal, and soybean meal fed to weanling pigs. O. J. Rojas* and H. H. Stein, *University of Illinois, Urbana*.

Lemna protein concentrate (LPC; 68% CP) may be used in diets fed to pigs, but no data on the nutritional value to pigs of LPC have been published. Three experiments were, therefore, conducted to determine the concentration of ME, the standardized total tract digestibility (STTD) of P, and the standardized ileal digestibility (SID) of AA in LPC and to compare these values to values for fish meal (FM) and soybean meal (SBM). Experiment 1 was conducted to determine the ME of LPC, FM, and SBM. Thirty-two barrows (initial BW: 16.8 ± 2.8 kg) were placed in metabolism cages and allotted to a randomized complete block design with 4 diets and 8 replicate pigs per diet. A corn-based diet and 3 diets that contained corn and LPC, FM, or SBM were formulated. Feces and urine were collected for 5 d after a 5-d adaptation period and all samples were analyzed for GE. Results indicated that the concentration of ME was not different among the 3 ingredients. In Exp. 2, 24 barrows (initial BW: 10.5 ± 2.5 kg) were allotted to a randomized complete block design with 3 diets and 8 replicate pigs per diet and used to determine the STTD of LPC, FM, and SBM. Three diets that each contained 1 of the 3 test ingredients as the sole source of P were formulated. Pigs were placed in metabolism cages and feces were collected for 5 d after a 5-d adaptation period. The STTD of P in LPC (72.8%), FM (65.6%), and SBM (62.8%) was not different among ingredients. The SID of AA in LPC, FM, and SBM was determined in Exp. 3. Eight barrows (initial BW: 21.4 ± 4.0 kg) were equipped with a T-cannula in the distal ileum and randomly allotted to a replicated 4 × 4 Latin square design. An N-free diet and 3 cornstarch-based diets in which SBM or SBM and LPC or SBM and FM were the only sources of AA were formulated. The SID of most indispensable AA was greater ($P \leq 0.01$) in SBM than in LPC and FM. In conclusion, the concentration of ME and the STTD of P is not different among LPC, FM, and SBM, but SID of most indispensable AA is greater in SBM than in FM and LPC.

Key Words: Lemna protein concentrate, nutrient digestibility, pigs

506 Amino acid digestibility in camelina seeds and camelina expellers fed to growing pigs. F. N. Almeida*¹, J. K. Htoo², J. Thomson³, and H. H. Stein¹, ¹*University of Illinois, Urbana*, ²*Evonik Industries AG, Hanau, Germany*, ³*Evonik Degussa Corporation, Kennesaw, GA*.

The nutritional value of camelina seeds (*Camelina sativa*) and camelina expellers fed to pigs has not been reported. Therefore, an experiment was conducted to determine the standardized ileal digestibility (SID) of CP and AA in camelina seeds and camelina expellers and to compare these values with SID values of CP and AA in canola meal fed to pigs. Two sources of camelina seeds (average of 27.9% CP, 39.4% acid hydrolyzed ether extract (AEE), and 27.6% NDF, as-fed basis), 3 sources of camelina expellers (average of 33.1% CP, 15.8% AEE, and 24.9% NDF, as-fed basis), and 1 source of canola meal (36.4% CP, 3.7% AEE, and 34.8% NDF, as-fed basis) were procured from companies located in the United States. Seven pigs (initial BW = 43.5 ± 3.5 kg) were allotted to a 7 × 7 Latin square design with 7 diets and 7 periods. Two diets contained camelina seeds (CS-1 and CS-2), 3 diets contained camelina expellers (CE-1, CE-2, and CE-3, respectively), and 1 diet contained canola meal as the sole source of CP and AA. Each test ingredient was included at 40% in the diets. An N-free diet was used to determine basal endogenous

losses of CP and AA. Data were analyzed by the Mixed Procedure with diet as the main effect, and pig and period as random effects. Results indicate that the SID of AA in camelina seeds is less ($P < 0.05$) than in camelina expellers and canola meal (Table 1), which limits the use of camelina seeds in swine diets, but the SID of AA in camelina expellers is mostly comparable to that of canola meal. Camelina expellers may, therefore, be used as an alternative feed ingredient in diets fed to pigs.

Table 1. Standardized ileal digestibility (%) of AA in camelina seeds (CS), camelina expellers (CE), and canola meal

| Item | | | | | | Canola | | SEM | P-value |
|------|-----------------|-----------------|-------------------|------------------|------------------|-----------------|---|-------|---------|
| | CS-1 | CS-2 | CE-1 | CE-2 | CE-3 | meal | | | |
| Ile | 42 ^c | 62 ^b | 73 ^a | 63 ^b | 78 ^a | 78 ^a | 3 | <0.01 | |
| Leu | 49 ^c | 66 ^b | 77 ^a | 67 ^b | 80 ^a | 81 ^a | 3 | <0.01 | |
| Lys | 48 ^c | 63 ^b | 72 ^{ab} | 68 ^{ab} | 69 ^{ab} | 75 ^a | 3 | <0.01 | |
| Met | 54 ^d | 72 ^c | 84 ^a | 76 ^{bc} | 82 ^{ab} | 85 ^a | 2 | <0.01 | |
| Phe | 46 ^d | 65 ^c | 76 ^{ab} | 68 ^{bc} | 79 ^a | 80 ^a | 3 | <0.01 | |
| Thr | 38 ^d | 56 ^c | 64 ^{abc} | 59 ^{bc} | 67 ^{ab} | 73 ^a | 3 | <0.01 | |
| Trp | 45 ^c | 57 ^b | 67 ^{ab} | 58 ^b | 71 ^a | 75 ^a | 3 | <0.01 | |
| Val | 44 ^c | 63 ^b | 74 ^a | 65 ^b | 76 ^a | 76 ^a | 3 | <0.01 | |

^{a-d}Values within a row lacking a common superscript letter are different ($P < 0.05$).

Key Words: amino acid digestibility, camelina, pigs

507 Withdrawal patterns of DDGS on performance, belly firmness, and fatty acids in pigs—A cooperative study. G. L. Cromwell,* M. J. Azain, O. Adeola, S. K. Baidoo, S. D. Carter, T. D. Crenshaw, G. M. Hill, P. S. Miller, J. F. Patience, M. C. Shannon, and H. H. Stein, *NCCC-42 Committee on Swine Nutrition, University of Kentucky, Lexington*.

An experiment involving 580 pigs (20 reps of 4 to 8 pigs/pen) was conducted at 10 stations to assess the effect of various DDGS withdrawal patterns to pigs from 29 to 123 kg BW. Corn-soybean meal diets with 0 to 33.5% DDGS were fed in 3 phases. A single source of DDGS containing 8.8% fat, 26.4% CP, and 1.07% Lys was used at each station. Diets were formulated to contain 0.91, 0.73, and 0.58% SID Lys during the 3 phases with changes at 58 and 91 kg BW. Levels of DDGS in the 3 phases were Trt 1, 0–0–0%; Trt 2, 33.5–33.5–33.5%; Trt 3, 33.5–33.5–0%; Trt 4, 33.5–20–11%; and Trt 5, 20–20–20%. Levels of DDGS in Trt 3, 4, and 5 were such that total DDGS consumed during the experiment was nearly identical (55.3, 55.2, and 55.1 kg/pig, respectively). At each station, 2 pigs from each pen in 2 reps were killed and a backfat sample was obtained for fatty acid (FA) analysis and iodine value (IV). In most cases, there were differences among stations ($P < 0.05$), but station × treatment interactions were few. The ADG and ADFI of the 5 groups did not differ (957, 925, 922, 938, 927 g/d; 2.67, 2.73, 2.79, 2.76, 2.68 kg/d), but pigs fed the control diet with 0% DDGS were more efficient (0.360, 0.341, 0.331, 0.341, 0.348 G:F; $P < 0.05$). Hot carcass yield tended to be less (76.1, 75.4, 75.8, 75.9, 75.5%; $P = 0.06$), and calculated fat-free lean was greater for Trt 2 (52.4, 53.7, 52.5, 52.3, 52.9%; $P < 0.05$). Bellies were softer ($P < 0.01$) in pigs fed DDGS based on lateral (16.0, 11.6, 14.4, 14.9, 14.9 cm) and vertical flex scores (22.6, 27.2, 24.9, 24.4, 24.0 cm). Feeding the high level of DDGS throughout resulted in less saturated and monounsaturated FA in the backfat (39.3, 34.9, 37.9, 38.6, 37.2%, and 46.6, 41.6, 43.7, 43.8, 43.3% of total FA; $P < 0.001$)

and more polyunsaturated FA (13.5, 22.8, 17.8, 17.1, 19.0%; $P < 0.001$). The IV for outer fat layers were 67.9, 79.4, 73.2, 72.0, 74.3, and for inner fat layers were 60.4, 72.8, 65.0, 63.8, 67.2 ($P < 0.001$). Gilts had higher IV than barrows in outer (74.8 vs. 72.2) and inner (67.5 vs. 64.6) fat ($P < 0.001$). Withdrawal of DDGS in phase 3 or feeding less DDGS produced FA and IV levels that reverted toward those of control pigs.

Key Words: pigs, DDGS, fatty acids

508 Wheat-DDGS pig finishing diet reduces feed cost but does not improve net profit of production. G. A. Mastromano,* M. R. Ashby, R. C. Roberson, J. M. Scheffler, and J. Escobar, *Virginia Tech University, Blacksburg.*

Corn prices are increasing due, in part, to ethanol production, resulting in increased feed costs for swine producers. The objective of this experiment was to determine if a wheat-dried distiller's grains with solubles (DDGS) based diet (WD) would reduce cost efficiency of gain compared with a corn-SBM (CS) based diet. Fifty pigs (24 gilts and 26 barrows) were segregated by sex and housed 2–3 pigs/pen with free access to feed and water over a 53-d study. One-half of pigs were fed CS diet (85.92% corn, 12.50%SBM, 1.58% others) and the remainder were fed WD diet (50.50% wheat, 40% corn DDGS, 7.00% SBM, 2.5% others). Feed disappearance was monitored daily and pigs were weighed every 14 d. At the end of the study, pigs were transported about 6 h to a commercial slaughter facility. Initial BW was not different ($P = 0.83$) between CS (68.5 ± 1.7 kg) and WD (68.0 ± 1.7 kg) treatments. Overall ADG, ADFI, and G:F was not different ($P = 0.48$ to 0.67) between CS (1.17 ± 0.03 kg/d, 3.80 ± 0.09 kg/d, 0.32 ± 0.01, respectively) and WD (1.14 ± 0.03 kg/d, 3.85 ± 0.08 kg/d, 0.31 ± 0.01, respectively). Final BW was not different ($P = 0.23$) between CS (131.3 ± 1.8 kg) and WD (128.2 ± 1.7 kg) treatments, but hot carcass weight (HCW) was reduced ($P = 0.009$) 5.6% in WD compared with CS pigs. Dietary treatment had no effect on ham weight ($P = 0.41$); however, pigs eating WD had lower picnic ($P = 0.008$), boneless loin ($P = 0.03$), belly ($P = 0.06$), and butt ($P = 0.10$) weights compared with controls. Ultrasound measurements of last rib backfat (BF) and longissimus dorsi eye area (LEA) were recorded before transportation. BF was reduced ($P < 0.001$) in WD (1.30 ± 0.03 cm) compared with CS (1.52 ± 0.03 cm) pigs; however, treatment had no effect on LEA (42.1 ± 0.4 cm for CS vs. 41.5 ± 0.4 cm for WD). Feed cost (¢ per kg) was 9.45% lower ($P < 0.001$) in WD (37.97 ± 0.33) compared with CS (41.94 ± 0.33). Even though feed cost was reduced using the WD treatment, there was no difference in profit due to lower HCW in WD pigs. Further investigation in lengthening the trial period may be necessary to increase profit when feeding the WD diet.

Key Words: DDGS, swine growth, wheat

509 The effects of corn- or sorghum-based diets with or without sorghum dried distillers grains and solubles on lactating sow and litter performance. K. M. Sotak,* R. D. Goodband, M. D. Tokach, J. M. DeRouchey, S. S. Dritz, and J. L. Nelssen, *Kansas State University, Manhattan.*

A total of 140 sows (PIC 1050) and their litters were used to determine the effects of corn- or sorghum-based diets with or without 20% sorghum dried distiller's grains with solubles (DDGS; 31.1% CP and 9.2% crude fat) on lactating sow and litter performance. Sows were allotted to 1 of 4 dietary treatments 3 d before farrowing in a RCBD. There were 2 and 1 sows removed from the study for the sorghum and sorghum-DDGS treatments because of initial feed refusal with all others removed due to illness. Weaning age was 21 d. Treatments were arranged in a 2 × 2 factorial with main effects of grain source (corn vs. sorghum) and sorghum

DDGS (0 vs. 20%). All diets were formulated to 0.97% standardized ileal digestible Lys but were not balanced for energy. Overall (d 0 to 21), ADFI increased in corn-based diets when DDGS were added, but decreased in sorghum-based diets resulting in a tendency ($P < 0.08$) for a DDGS × grain source interaction. Sows fed the sorghum-based diets had decreased ($P < 0.04$) lactation weight loss compared with those fed corn-based diets. Pig weights at weaning were lower ($P < 0.06$) for sows fed the diets containing DDGS compared with those fed the diets without DDGS. Overall, feeding sows corn- vs. sorghum-based (without DDGS) diets in lactation did not affect litter performance; however, the 4% decrease in litter weaning weight of sows fed sorghum with 20% sorghum DDGS needs to be taken into account in ingredient selection for lactating sows.

Table 1. Effects of corn- or sorghum-based diets with or without 20% sorghum dried distillers grains with solubles (DDGS)

| Item | Corn DDGS | | Sorghum DDGS | | SED | Probability, P < | | |
|---------------------|-----------|-------|--------------|------|------|-----------------------------|-----------------------|------------------|
| | 0% | 20% | 0% | 20% | | DDGS × Control Grain source | vs. DDGS ¹ | vs. Corn sorghum |
| Sows, n | 35 | 35 | 32 | 32 | | | | |
| ADFI, kg | 5.76 | 5.93 | 6.30 | 5.88 | 0.24 | 0.08 | 0.46 | 0.15 |
| Lact. wt change, kg | -14.3 | -13.9 | -11.0 | -9.7 | 2.65 | 0.86 | 0.65 | 0.04 |
| Lact. BF change, mm | -1.4 | -1.3 | -1.7 | -2.2 | 0.62 | 0.39 | 0.65 | 0.15 |
| Foster litter size | 12.6 | 13.0 | 12.6 | 12.7 | 0.24 | 0.69 | 0.28 | 0.75 |
| Wean litter size | 11.8 | 12.1 | 11.8 | 11.8 | 0.29 | 0.38 | 0.48 | 0.58 |
| Wean pig wt, kg | 13.8 | 13.3 | 13.8 | 13.1 | 0.43 | 0.74 | 0.06 | 0.72 |
| Wean litter wt, kg | 73.6 | 73.0 | 73.4 | 70.2 | 2.90 | 0.53 | 0.34 | 0.46 |

¹Basal diets vs. diets with 20% sorghum DDGS.

Key Words: sorghum, sorghum DDGS, sows

510 Amino acid digestibility in blood products fed to weanling pigs. F. N. Almeida*¹, J. K. Htoo², J. Thomson³, and H. H. Stein¹, ¹University of Illinois, Urbana, ²Evonik Industries AG, Hanau, Germany, ³Evonik Degussa Corp., Kennesaw, GA.

Blood products are commonly used in diets for nursery pigs, but different processing techniques may result in differences in AA digestibility among these ingredients. Thus, the objective of this experiment was to compare values for the standardized ileal digestibility (SID) of AA in spray-dried animal blood (SDAB; 89.4% CP), spray-dried blood cells (SDBC; 92.6% CP), spray-dried plasma protein (SDPP; 77.7% CP), roller dried avian blood meal (ABM, 88.4% CP), and roller dried porcine blood meal (PBM, 94.6% CP), when fed to weanling pigs. Seven weanling barrows (initial BW: 11.5 ± 1.1 kg) were equipped with a T-cannula in the distal ileum and allotted to a 7 × 7 Latin square design with 7 diets and 7 periods in each square. One of the diets was based on casein, and 5 diets were based on a mixture of casein and each source of blood product. A N-free diet that was used to measure basal endogenous losses of AA and protein was also formulated. The SID of AA in each blood product was calculated by the difference procedure. The Mixed procedure of SAS was used to analyze the data. The model included diet as the main effect whereas pig and period were random effects. Results indicate that the SID of AA in SDAB, SDBC, and in SDPP is close to 100% and not different from casein. The SID of AA in ABM and PBM is less ($P < 0.05$) than those calculated for the 3 spray dried blood products, which indicates that the drying procedure used to prepare these products may have reduced the SID of AA.

Table 1. Standardized ileal digestibility (%) of AA

| Item | SDAB | SDBC | SDPP | ABM | PBM | Casein | SEM | P-value |
|------|------------------|------------------|------------------|-------------------|-----------------|-------------------|-----|---------|
| Ile | 110 ^a | 64 ^{cd} | 99 ^{ab} | 67 ^{bcd} | 34 ^d | 97 ^{abc} | 13 | <0.01 |
| Leu | 100 ^a | 98 ^a | 98 ^a | 67 ^c | 76 ^b | 99 ^a | 3 | <0.01 |
| Lys | 100 ^a | 98 ^a | 98 ^a | 74 ^b | 79 ^b | 97 ^a | 2 | <0.01 |
| Met | 102 ^a | 98 ^a | 98 ^a | b | 70 ^b | 98 ^a | 3 | <0.01 |
| Phe | 100 ^a | 98 ^a | 98 ^a | 67 ^c | 76 ^b | 99 ^a | 3 | <0.01 |
| Thr | 104 ^a | 96 ^a | 98 ^a | 72 ^b | 69 ^b | 94 ^a | 4 | <0.01 |
| Trp | 99 ^a | 94 ^a | 97 ^a | 69 ^b | 77 ^b | 96 ^a | 3 | <0.01 |
| Val | 100 ^a | 98 ^a | 98 ^a | 67 ^c | 76 ^b | 97 ^a | 3 | <0.01 |

^{a-c}Values within a row lacking a common superscript letter are different ($P < 0.05$).

Key Words: amino acid digestibility, blood products, pigs

511 Amino acid digestibility in hydrolyzed feather meal fed to pigs. F. N. Almeida¹, L. I. Chiba², S. D. Brotzge², R. L. Payne³, and H. H. Stein¹, ¹University of Illinois, Urbana, ²Auburn University, Auburn, AL, ³Evonik-Degussa Corp., Kennesaw, GA.

An experiment was conducted to determine the standardized ileal digestibility (SID) of AA in hydrolyzed feather meal (FM) products without or with blood addition when fed to pigs. Eight FM products were obtained from 4 sources with each source providing FM without and with added blood. Ten pigs (initial BW: 23.8 ± 1.3 kg) were allotted to a 10 × 10 Latin square design with 10 diets and 10 periods. One diet contained 36% soybean meal, and the 8 FM diets contained 12% soybean meal and 25% of 1 of the 8 FM products. Soybean meal and FM were the only ingredients contributing AA in these 9 diets. The 10th diet was a N-free diet that was used to determine the basal endogenous losses of AA. Pigs were fed experimental diets for 7 d with ileal digesta being collected during the last 2 d. Values for the SID of AA were calculated for each diet using the direct procedure, and the difference procedure was used to calculate the SID of AA in each FM product. Data were analyzed as a 2 × 4 factorial, with blood addition, FM source, and the interaction between blood addition and FM source as main effects. Differences ($P < 0.01$) in the SID of all indispensable AA were observed among the 4 sources of FM (Table 1). There were also effects ($P < 0.01$) of blood addition on the SID of Ile, Leu, Lys, Phe, and Val, but there was an interaction ($P < 0.05$) between FM source and blood addition, indicating that addition of blood did not have a consistent effect on the SID of AA in the 4 sources of FM. In conclusion, the SID of AA in FM varies among sources, and addition of blood to FM may affect the SID of AA.

Table 1. Standardized ileal digestibility (%) of AA in feather meal

| Item | FM-1 | FM-1 | FM-2 | FM-2 | FM-3 | FM-3 | FM-4 | FM-4 | SEM |
|----------------------|------|------|------|------|------|------|------|------|-----|
| Blood addition: No | Yes | No | Yes | No | Yes | No | Yes | - | |
| Ile ^{1,2,3} | 76 | 66 | 86 | 96 | 82 | 83 | 80 | 72 | 2 |
| Leu ^{1,2,3} | 71 | 59 | 81 | 81 | 77 | 77 | 75 | 67 | 2 |
| Lys ^{1,2,3} | 48 | 56 | 59 | 79 | 59 | 71 | 59 | 55 | 3 |
| Met ^{1,3} | 65 | 58 | 72 | 77 | 63 | 72 | 70 | 63 | 2 |
| Phe ^{1,2,3} | 74 | 62 | 83 | 84 | 80 | 80 | 77 | 70 | 2 |
| Thr ¹ | 65 | 56 | 72 | 76 | 70 | 70 | 66 | 60 | 2 |
| Trp ¹ | 67 | 74 | 85 | 85 | 86 | 82 | 84 | 80 | 3 |
| Val ^{1,2,3} | 72 | 60 | 83 | 83 | 77 | 80 | 78 | 69 | 2 |

¹Effect of FM source ($P < 0.01$).

²Effect of blood addition ($P < 0.01$).

³Interaction between FM source and blood addition ($P < 0.01$).

Key Words: amino acids, hydrolyzed feather meal, pigs

512 Nutritive value and relationship between nutrient content and protein quality of soybean meals according to origin. G. G. Mateos¹, M. P. Serrano¹, M. González², S. Sueiro², M. Hermida², R. Lázaro¹, and P. G. Rebollar¹, ¹Universidad Politécnica de Madrid, Madrid, Spain, ²Laboratorio de Mouriscade, Pontevedra, Spain.

Soybean meal (SBM) is the main protein source in pig and poultry feeds. United States (USA), Brazil (BRA), and Argentine (ARG) are the major SBM exporter countries. According to agronomic and processing conditions of the beans, the nutritive value of SBM varies among countries. This research studied the chemical composition and correlations between chemical analyses and protein quality of SBM by origin (USA, BRA, and ARG). Samples (n = 412) were collected during a 5-yr period and analyzed for major chemical components including amino acids (AA) and protein quality. On DM bases, USA meals (n = 164) had more CP (53.8 vs. 53.0 vs. 51.6%; $P < 0.001$) and sucrose (8.2 vs. 7.6 vs. 6.5%; $P < 0.001$) but less NDF (8.9 vs. 10.6 vs. 12.0%; $P < 0.001$) than ARG (n = 131) and BRA meals (n = 117). Stachyose content was higher and raffinose lower for USA than for ARG and BRA meals (6.47 vs. 5.56 vs. 5.29%; and 1.11 vs. 1.33 vs. 1.59%, respectively; $P < 0.001$). The USA meals had more P (0.79 vs. 0.69 vs. 0.75%; $P < 0.001$) than the BRA with ARG meals being intermediate. The CP content was negatively related with sucrose (-0.70, $P < 0.001$) for USA and with NDF (-0.64 and -0.46, $P < 0.001$) for ARG and BRA meals. The trypsin inhibitor activity (TIA) was higher (3.86 vs. 2.97 vs. 2.97 mg/g; $P < 0.001$) for USA meals than for ARG or BRA SBM. Protein dispersibility index and KOH were higher for USA than for ARG and BRA meals (19.7 vs. 16.8 vs. 15.3 and 86.8 vs. 82.1 vs. 83.3, $P < 0.001$), and were positively related with TIA of the meals (+0.70 and 0.73, $P < 0.001$ for USA; +0.62 and +0.65, $P < 0.001$ for ARG; +0.27 and +0.44, $P < 0.05$ for BRA, respectively). On CP bases, Lysine was higher (6.16 vs. 6.09 vs. 6.05, $P < 0.001$) for USA than for ARG and BRA meals. The Lysine content was negatively related with CP content (-0.48, $P < 0.001$) for USA, but positively (+0.34, $P < 0.001$) for BRA SBM. Heat Damage Index (Amino-nitrogen) was (-0.90, -0.87 and -0.90, $P < 0.001$) related with percentage of Lysine (%CP) for all origins. Nutrient values and the relationship between chemical composition and protein quality of the meal varied widely among origins. Thus, SBM origin should be considered in the evaluation of the nutritive value of the meal.

Key Words: chemical composition, origin, soybean meal

513 Influence of soybean meal source and micronization (fine grinding) of soybean meal on productive performance and digestive traits of Iberian pigs from 30 to 51 days of age. J. D. Berrocoso,* M. P. Serrano, L. Camara, P. G. Rebollar, A. Lopez, R. Abad, and G. G. Mateos, Universidad Politecnica de Madrid, Madrid, Spain.

In total, 216 Iberian piglets weaned at 30 d were used in a 21 d experiment to evaluate the effects of the inclusion of different sources of SBM on growth performance, nutrient digestibility (TTAD and AID), and morphological characteristics of the ileum. There was a positive control diet that included 10% soy protein concentrate (65% CP; SPC), a negative control diet with 14.8% regular SBM (44% CP; R-SBM), and 4 extra diets arranged factorially that included 13.3% of high protein SBM (USA vs. Argentina origin) with 49% CP (HP-SBM) at 2 different particle size (ground, 990 μm vs. micronized, 60 μm). Each of the 6 treatments was replicated 6 times (6 pigs per pen). The experiment design was completely randomized. The following orthogonal contrasts conducted: 1) SPC vs. all SBM diets, 2) micronized HP-SBM vs. ground HP-SBM, 3) HP-SBM of ARG origin vs. HP-SBM of USA origin, and 4) R-SBM vs. HP-SBM diets. Type of soy product had no effect on growth performance but the incidence of diarrhea (DI) was higher (P

≤ 0.01) for pigs fed R-SBM than for pigs fed HP-SBM. At 15 d of the experiment, the TTAD and AID of nutrients were higher ($P < 0.05$) for the HP-SBM than for the R-SBM diets. The inclusion of SPC in the diet had no effect on TTAD of nutrients except for CP that tended ($P = 0.06$) to be higher. The TTAD of DM ($P = 0.07$) and GE ($P = 0.05$) tended to be higher with micronized than with ground HP-SBM. Source of HP-SBM did not affect TTAD, except for GE that tended ($P = 0.05$) to be higher for the USA meal than for the Argentinean meal. At 15 d of experiment, pigs fed HP-SBM showed higher villi height: crypt depth ratio ($P < 0.05$) than pigs fed R-SBM. It is concluded that the inclusion of SPC in the diet improved TTAD of CP and reduced the DI but did not affect growth performance of the pigs. The inclusion in the diet of HP-SBM in substitution of R-SBM increased TTAD and AID of all nutrients, reduced the DI, and improved the morphological characteristics of the ileum but did not affect growth performance of the pigs.

Key Words: iberian pig, nutrient digestibility, soybean meal

514 Net portal absorption of amino acids in Iberian pigs fed with acorn. J. M. Rodriguez-Lopez, M. Lachica, L. Gonzalez-Valero, and I. Fernandez-Figares,* *CSIC (Spanish National Research Council), Granada, Spain.*

Iberian pigs are reared indoors fed concentrate feeds until the final fattening period at the *dehesa* (Mediterranean woodland) where they are fed acorns and grass. The acorn is rich in carbohydrates and lipids but it has low protein content with unbalanced AA profile. This is a very abrupt nutritional challenge. There are no studies of how this nutritional challenge affect AA metabolism in the portal-drained viscera and consequently AA supply to peripheral tissues. For that reason, 6 pure Iberian pigs (26 kg BW) were fitted with chronic catheters, in carotid artery, portal vein and mesenteric vein and trained to consume 25 and 75% of their daily ration at 9.00 and 15.00, respectively. An equilibrated diet (140 g/kg CP and 14–14.5 MJ ME/kg DM) based on barley and soybean meal, at 85% ad libitum was consumed until surgery recovery (32 kg BW) in metabolic cages. The day before sampling, pigs were offered 2.4 kg of acorns (85% ad libitum: 1.405 kg DMI, 23.27 MJ MEI, 71.0 g CP intake) following the same feeding schedule. The first set of blood samples was taken the following day, after pigs were fed 600 g of acorns, every 30 min for 4 h and then hourly until 6 h after feeding. Pigs were then fed acorns for 7 d and a second set of blood samples was taken following the same protocol as in the first set. Net portal AA absorption was calculated by multiplying porto-arterial plasma AA concentration difference by portal vein plasma flow rate, estimated by infusing p-aminohippuric acid into the mesenteric vein. Repeated measures analyses were carried out using the mixed procedure of SAS. Overall, net portal AAs absorption of sum of all AAs, sum of

NEAA, Tyr, Ala, Asn, Pro, Hypo and His was greater when the pigs were adapted to acorn consumption. Furthermore, Phe, Leu and Gly also tended to increase. The peak of portal absorption of AAs in pigs fed acorns appeared at 0.5 h postprandial. In conclusion, after one week adaptation to acorns feeding, net portal absorption of AAs increased in Iberian pigs. Changes in microflora may be responsible of the improved utilization of AAs from acorn.

Key Words: pig, amino acids, portal drained viscera

515 Gas production, in vitro organic matter disappearance, volatile fatty acid concentrations and physicochemical characteristics of fibrous sources for pigs. M. Chimonyo* and S. P. Ndou, *Animal and Poultry Science, Pietermaritzburg, South Africa.*

Although dietary fiber enhances gut health, satiety and improves welfare of pigs, knowledge of physical and fermentation characteristics of bulky feeds is essential to understand the effects of dietary fiber on feed intake, digestibility and growth performance of pigs. The objective of the study was to characterize physicochemical properties and fermentation characteristics of common fibrous feed ingredients with a huge potential use formulating pig diets in Southern Africa. Crude fiber, neutral detergent fiber (NDF), acid detergent fiber (ADF), bulk density, water holding capacity (WHC), gas production parameters, in vitro organic matter disappearance (IVOMD) and volatile fatty acid (VFA) concentrations were assayed in groundnut haulms (GH), lucerne hay (LC), maize cobs (MC), maize stover (MS), rice bran (RB), saw dust (SD), sunflower husks (SH) and veld grass (VG). Fermentation was conducted over 24 h, using pig fecal inocula collected by rectal palpation from pigs (85.0 ± 5.49 BW) that had received a diet containing 12.6 MJ DE, 160 g CP/kg DM and 80 g CF/kg DM. Rice bran and maize cobs had the highest total VFA concentrations (6.5 ± 0.18 and 4.7 ± 0.18 μ M, respectively). None of the fiber sources produced propionic acid, with acetic acid being the predominant acid. Surprisingly, maize cobs produced twice ($P < 0.01$) the amount of acetic acid (4.0 μ M) than either groundnut haulms (2.2 ± 0.16 μ M) or lucerne hay (2.0 ± 0.16 μ M). Total gas production was 432, 485, 461, 428, 614, 210, 382 and 266 (s.e. = 12.2) ml g⁻¹ OM for GH, LC, MC, MS, RB, SD, SH and VG, respectively. Total gas production and partitioning factor were reliable predictors of IVOMD and VFA concentrations ($P < 0.01$). Rice bran, maize cob, groundnut haulms were the most fermentable fibrous feed ingredients. The possibility of incorporating maize cob meal in pig diets, widely available in many countries where maize is a staple crop, should be explored. The influence of these physicochemical properties on voluntary feed intake is necessary to develop appropriate fiber-based feeding strategies for pigs.

Key Words: acetic acid, physical properties, rate of gas production