

313 Utilization of blood-derived products in pig nutrition. P. Medel^{*1}, D. Torrallardona², L. Llaurodo², and G. G. Mateos¹, ¹Universidad Politécnica de Madrid, Spain, ²IRTA-Mas Bova, Tarragona, Spain.

Two trials were conducted to study the effect of inclusion, and the ileal amino acid digestibility of two blood-derived meal sources in pig diets. In trial one (T1), one hundred twenty male piglets weaned at 20 d of age and weighing an average 5.7 kg were blocked by litter and body weight and used in a 28 d performance trial. From 0 to 14 d the piglets were divided in 3 groups (eight replicates of five piglets each). The only difference among treatments in this phase was the source of blood-derived meal used: 5% of spray dried animal plasma (SDP), 5% of a high quality spray-dried blood meal (HQBm, Blosol A92, DAKA a.m.b.a.), or a 50% mixture of both. From 14 to 28 d of trial each of the 3 pre-starter treatments were divided into two groups that received a diet with 5% of fish meal dried at low temperature (FMLT, 999, Esbjerg Fiskeindustri), or 5% of a regular blood meal (BM, DAKA a.m.b.a.), respectively. In trial two (T2), six males (46.3 kg) were surgically modified with an end to end ileo-rectal anastomosis and ileal digestibility of amino acids was measured for the QBm and BM samples. The experimental products were mixed with a basal protein-free diet to obtain feeds with 18.7 and 19.5% crude protein for the QBm and BM diets, respectively. Each diet was tested in all the animals using a 2 d quantitative collection period preceded by a 5 d adaptation period. In T1, no differences among treatments were detected from 0 to 14 d for any of the traits studied. From 14 to 28 d, diets containing BM allowed the same growth rate (495 vs 485 g/d, $P > .10$), but poorer feed conversion (1.29 vs 1.35, $P = .10$) than FMLT diets. The ileal digestibilities of all the amino acids except for isoleucine were greater for QBm than for BM ($P < .05$). The digestibility coefficients for lysine, threonine, methionine, cystine, and tryptophan were 99.4, 99.2, 99.3, 98.7, 95.7 for QBm, and 98.3, 97.8, 98.5, 96.0, 91.9 for BM, respectively. It is concluded that both QBm and BM can be used successfully in pig feeds, although feed conversion tended to be impaired when BM was used in substitution of FMLT.

Key Words: Blood meal, Pigs

314 Perfect Pro[®] as a source of protein for weanling pigs. A. C. Guzik^{*}, L. L. Southern, and T. D. Bidner, .

Three experiments were conducted to evaluate the use of Perfect Pro[®] (PP) as a source of protein. In each experiment, treatments were replicated with four (Exp. 1 and 2) or seven (Exp. 3) pens of three to five pigs each. Each experiment lasted from three to four weeks for the combined Phase I (1.5% Lys in Exp. 1 and 2, 1.6% Lys in Exp. 3) and Phase II (1.3% Lys) periods. In Exp. 1 (6.7 kg and 23 d of age) and 2 (6.1 kg and 22 d of age), pigs were fed one of three Phase I diets: 1) basal (B) diet containing corn, SBM, whey, fish meal, and blood cells (AP-301 G), 2) B + 4% spray dried porcine plasma (SDPP), or 3) B + 2% SDPP+2% PP. In Phase II, the dietary groups from Phase I were divided into two subsequent groups. One group received a diet containing corn, SBM, whey, fish meal, and 2% blood cells, and the second group received this same diet with 2% PP, resulting in six treatments for the Phase II and overall periods. In Exp. 1, ADG and ADFI were increased ($P < .10$) during Phase I in pigs fed 4% SDPP or 2% SDPP+2% PP. Gain:feed (GF) was not affected ($P > .10$) during Phase I. In Phase II, the 2% PP addition did not affect ADG, ADFI, or GF. Also, Phase I diets did not affect ($P > .10$) growth performance during Phase II. Overall, ADG ($P < .10$) and ADFI ($P < .04$) were increased in pigs fed 2% SDPP+2% PP during Phase I. In Exp. 2, ADG and GF were increased in pigs fed 2% SDPP+2% PP during Phase I. During Phase II, ADFI was increased in pigs fed 2% SDPP+2% PP relative to those fed the basal diet ($P < .005$) or the diet containing 4% SDPP ($P < .01$) in Phase I. Also in Phase II, GF was increased in pigs fed 2% SDPP+2% PP ($P < .03$) relative to those fed 4% SDPP. Overall, ADG and GF were not affected ($P > .10$) by diet, but ADFI was increased in pigs fed 2% SDPP+2% PP ($P < .03$) relative to the basal diet. In Exp. 3, all pigs (5.7 kg and 17 d of age) were fed a Phase I diet containing 2% SDPP+2% PP. In Phase II, ADG, ADFI, and GF were not affected ($P > .10$) by the addition of 2% PP relative to 2% blood cells. Overall, pigs fed 2% SDPP+2% PP have equal performance to those fed 4% SDPP.

Key Words: Pigs, Protein Sources, Growth

315 Effects of water soluble globulin on the performance of weanling pigs. B. S. Borg^{*}, J. M. Campbell, L. E. Russell, D. U. Thomson, and E. M. Weaver, American Protein Corporation, Ames, IA.

Three-hundred weanling pigs (5.0 kg initial weight, 14-21 d of age) were used in a 28 d experiment to evaluate the effects of a water soluble globulin protein (WSGP). Pigs were blocked by sex and initial weight and randomly allotted to two experimental treatments with 25 pigs/pen and 6 replications/treatment. Experimental treatments included a typical pelleted 3-phase nursery program with and without WSGP. Total lysine content of diets offered was 1.65, 1.30 and 1.20% for phases one, two and three, respectively. Spray-dried animal plasma was included at a level of 4% in the phase one diet. Pigs were fed the various diets for 7, 14 and 7 days for phase one, two and three, respectively. WSGP was supplied through the water source for 14 d using a commercially available proportional dispenser. Compared to d 0-7, the concentration delivered was reduced by 50% during d 7-14. During the initial 7 d, pigs receiving WSGP had improved ($P < .001$) average daily gain (ADG), average daily feed intake (ADFI) and gain/feed (G/F) compared to the controls. Relative improvements in each measure were 65, 33 and 27% for ADG (0.130 vs 0.215 kg), ADFI (0.137 vs 0.182 kg) and G/F (0.94 vs 1.19). From d 7-14, ADG (0.227 vs 0.318 kg), ADFI (0.304 vs 0.373) and G/F (0.74 vs 0.86) was improved ($P < .02$) for pigs receiving WSGP compared to controls. Overall (d 0-28) WSGP improved performance ($P < .01$), ADG, ADFI and G/F was 0.300 kg, 0.398 kg, 0.76; and 0.350 kg, 0.438 kg, 0.80 for control and WSGP pigs, respectively. These results suggest the WSGP improves performance from d 0-14 and the enhancement in performance is maintained through 28 d postweaning.

Key Words: Globulin protein, weanling pigs, liquid-feeding

316 Use of spray dried plasma in combination with different types of milk proteins in diets for piglets. P. Medel¹, F. Baucells², J. C. de Blas¹, and G. G. Mateos^{*1}, ¹Universidad Politécnica de Madrid, Spain, ²Pinsos Baucells, Barcelona, Spain.

A trial was conducted to evaluate the influence of milk protein source (casein vs serum proteins) and spray dried animal plasma (SDP) supplementation (0% inclusion vs 4% of either APC-920 or Proglobulin) on performance of piglets weaned at 21-d. A total of 180 male piglets (21-d and 5.4 kg of average body weight) were used in a 2 x 3 factorial experiment with 6 replicates of five piglets per treatment. The experimental diets were formulated to be isonutritive (2500 kcal/kg NE, 21.6% crude protein, 1.54% total lysine, and 10.3% lactose) and were offered ad libitum for 20-d. Afterwards, all the replicates were fed a common starter diet containing 2435 kcal/kg NE, 21% crude protein and 1.28% total lysine. Spray dried animal plasma supplementation improved growth at 10 (187 vs 154 g/d; $P = .01$) and at 20-d of trial (346 vs 312 g/d; $P < .01$). The effect was mostly due to an increase in feed consumption (191 vs 162 g/d, $P = .02$, and 379 vs 346 g/d, $P = .09$, from 0 to 10, and from 0 to 20-d, respectively). Feed conversion was not modified by SDP addition. Diets that included casein as the main milk protein source showed better feed conversion than diets based on serum protein at 10 (1.01 vs 1.11 g/g; $P = .10$) and at 20-d (1.08 vs 1.13 g/g; $P = .14$) of trial. A significant interaction between milk protein source and SDP supplementation was observed for average daily gain, but not for feed conversion; the addition of SDP improved growth more in piglets fed milk serum proteins than in piglets fed casein ($P = .03$). No differences were detected between SDP sources for any of the parameters studied. It is concluded that SDP addition improves growth of piglets mostly due to an increase of feed consumption and that casein diets tended to decrease feed conversion with respect to serum milk protein diets during the first 20-d after weaning. The addition of SDP resulted in better performance when serum vs casein protein was used.

Key Words: Milk protein, Spray dried plasma, Piglets

317 Effects of increasing pellet conditioning temperature of diets containing spray-dried animal plasma on weanling pig performance. M. U. Steidinger^{*1}, R. D. Goodband¹, M. D. Tokach¹, J. L. Nelssen¹, L. J. McKinney¹, J. C. Woodworth¹, B. S. Borg², and J. M. Campbell², ¹Kansas State University, ²American Protein Corp. Ames, IA.

Two hundred fifty-two weanling pigs (6.0 ± 1.3 kg and 21 ± 3 d of age; PIC) were used in a 14 d growth assay to determine the effects of

increasing pellet conditioning temperature on pig growth performance. Experimental treatments consisted of a corn-soybean meal control diet (1.4% lysine and 15% dried whey) with no spray-dried animal plasma (SDAP) and fed in a meal form, or the control diet with 5% SDAP replacing soybean meal on a equal lysine basis also fed in a meal form. Additional treatments were the 5% SDAP diet pelleted (3.97 mm diameter) at conditioning temperatures of 60, 66, 71, or 77°C. Corresponding pellet exit temperatures were 68, 74, 77, and 80°C. The pelleted diets were conditioned with a ten second retention time and then pelleted using a Master Model HD 1000 series California Pellet Mill equipped with a 31.8 mm effective thickness die. Pigs were blocked by initial weight and allotted randomly to each of six dietary treatments with six pigs/pen and seven replications/treatment. From d 0 to 14 after weaning, pigs fed diets containing SDAP had greater ($P<.001$) ADG, G/F, and ($P<.08$) ADFI than pigs fed the control diet. No differences in performance were observed among pigs fed the meal diet containing SDAP and the mean of pigs fed the pelleted diets. Increasing pellet conditioning temperature up to 77°C did not adversely affect performance. These results suggest that conditioning temperatures up to 77°C do not adversely affect growth performance of pigs fed diets containing 5% SDAP from d 0 to 14 after weaning.

Key Words: Weanling Pigs, Spray-dried Animal Plasma, Pellet Conditioning Temperature

318 Effects of weaning diet on pig performance and intestinal morphology. K. J. Touchette^{*1}, R. L. Matteri², C. J. Dyer², J. A. Carroll², and G. L. Allee¹, ¹*University of Missouri-Columbia*, ²*Animal Physiology Research Unit, ARS, USDA*.

We evaluated the effect of feeding liquid versus dry diets after weaning on pig performance and intestinal morphology. At 14 d of age, 32 pigs (4.67±.06 kg) were assigned to 1 of 4 treatments in a RCBD: 1) cross-fostered to another sow (SOW); 2) weaned to a dry diet with 7% spray-dried plasma (SDP); 3) weaned to a dry diet with no SDP; 4) weaned to a liquid milk replacer (MR) diet. The 0 and 7% SDP diets contained 30% lactose and exceeded NRC (1998) recommendations for other nutrients. All pigs were killed after 4 d, and intestinal samples collected at 3 equidistant sites from the proximal jejunum to the distal ileum to measure villus heights, crypt depths and villus:crypt ratio (VCR). The stomach, heart, kidney, and liver were weighed. The final weight of pigs fed milk replacer were similar to the pigs cross-fostered to another sow (6.03 vs 5.83 kg). There was no difference between the pigs fed either 0 or 7% SDP (4.61 vs 4.59 kg), with both groups weighing less than either group on a liquid diet ($P \leq .001$). The villi for pigs fed either liquid diet were taller ($P \leq .001$) than pigs fed either dry diet. The crypt depth of the most distal section for the pigs that remained on the sow was reduced compared to all other crypt depth measurements ($P \leq .001$). The pigs fed either dry diet had a lower VCR than the pigs on a liquid diet ($P \leq .001$), and the most distal section for the pigs that remained on the sow had a higher VCR than all other VCR measurements ($P \leq .01$). Organ weights are shown below. This study shows that pigs weaned to a liquid milk replacer perform similar to pigs kept on a sow, while pigs weaned to a dry diet have reduced performance. There were also differences in intestinal morphology which may be related to pig performance.

Organ	SOW	0% SDP	7% SDP	MR	SEM
Heart ¹	9.87 ^a	9.40 ^{ab}	8.82 ^b	10.06 ^a	.035
Kidney ¹	10.85 ^a	9.68 ^a	9.90 ^a	13.47 ^b	.655
Stomach ¹	8.15 ^{ab}	8.64 ^a	7.98 ^{ab}	7.77 ^b	.238
Liver ¹	44.98 ^a	41.94 ^a	42.48 ^a	57.29 ^b	1.48

¹g/kg^{.75}BW, ^{a,b} $P < .05$

Key Words: Weaned pigs, Liquid diet, Intestinal morphology

319 Effect of source and level of dietary lysine on growth performance of 11 to 22 kg pigs. E. L. Hansen*, M. D. Tokach, S. S. Dritz, R. D. Goodband, J. L. Nelssen, J. C. Woodworth, P. R. O'Quinn, M. De La Lata, and M. U. Steidinger, *Kansas State University*.

Three hundred-twenty PIC (C22 X 355 barrow and gilt) nursery pigs (10.89 kg) were used to compare the effects of increasing dietary lysine from L-Lysine HCl (L-LYS) or Peptide PlusTM (PP). Peptide Plus is a hydrolyzed bovine muscle protein source. L-LYS was added at .1595,

.3185 and .4775% or PP at 2.39, 4.78, and 7.16% to a basal corn-soybean meal diet (0.90% lysine; negative control, NEG) to achieve diets with 1.025, 1.15 and 1.275% total LYS, respectively. A positive control (POS) diet was formulated to 1.275% LYS with corn and soybean meal. Ideal ratios of other amino acids were maintained in all diets with synthetic amino acid additions. All diets were formulated to maintain similar dietary Ca, P, Na, Cl and ME. There were eight replications of the eight treatments with five pigs/pen. Data were analyzed as a randomized complete block design with seven single df contrast comparisons; POS vs NEG, POS vs other 1.275% LYS, L-LYS linear, L-LYS quadratic, PP linear, PP quadratic and L-LYS vs PP. For the 19-d study period, ADG increased linearly ($P < .001$) with increasing dietary LYS. Feed intake tended to decrease linearly ($P = .12$) and G/F increased ($P < .01$) with increasing PP. Increasing dietary LYS with L-LYS resulted in linear ($P < .001$) and quadratic ($P = .011$) improvements in G/F. Pigs fed diets containing L-LYS vs PP had increased ADG ($P < .05$) and G/F ($P<.001$). Pigs fed the POS diet had decreased ($P < .05$) ADFI and increased ($P < .001$) G/F compared to pigs fed the other 1.275% LYS diets. These data suggest that PP is less bio-available than L-LYS and that high levels of synthetic amino acids or PP do not promote the same degree of feed utilization as soybean meal.

	NEG	L-LYSINE HCl			PEPTIDE PLUS			POS	
Lysine,%	.90	1.025	1.15	1.275	1.025	1.15	1.275	1.275	SEM
ADG,g/d	538	563	599	613	566	558	592	611	10.08
G/F	.557	.590	.652	.644	.591	.597	.631	.683	.008

Key Words: Lysine, Peptide Plus, Pigs

320 Effects of free fatty acids in choice white grease on growth performance of nursery pigs. J. M. DeRouchey*, J. D. Hancock, C. A. Maloney, H. Cao, D. J. Lee, J. S. Park, D. W. Dean, and R. H. Hines, *Kansas State University, Manhattan, KS*.

A total of 120 crossbred barrows and gilts (average initial BW of 6.2 kg) were used to determine the effects of free fatty acids (FFA) in choice white grease (CWG) on growth performances of nursery pigs. The pigs were blocked by weight and allotted to pens based on sex and ancestry for the 33-d growth assay. The pigs (five per pen) were housed in an environmentally controlled room and fed diets formulated to 1.7% lysine for d 0 to 5, 1.55% lysine for d 5 to 19, and 1.40% lysine for d 19 to 33. Treatments were a corn-soybean meal-based control with no added fat, 6% CWG, and 6% CWG that had been heated at 35 °C and treated with 1872, 1,1752 and 2,248 lipase units/g of fat. The FFA concentrations in the CWG were increased from 1.8% to 18.3, 35.4 and 53.3% with increasing lipase concentrations. As for pig growth, those fed the control diet (no added fat) had the same ADG ($P < .30$) but lower gain/feed ($P < .04$) than pigs fed diets with added fat. There were no effects of FFA concentration on ADG or gain/feed ($P < .36$) and ADFI increased as FFA concentration was increased (linear effect, $P < .04$). In conclusion, our data suggest that concentrations of FFAs up to 53.3% in CWG do not adversely affect growth performance of nursery pigs.

Item	Control	Free Fatty Acids, %				SE
		1.8	18.3	35.4	53.3	
ADG, g	473	489	487	475	494	11
ADFI, g	737	687	712	718	716	9
G/F, g/kg	642	712	684	662	690	18

Key Words: Pigs, Free fatty acids, Fat quality

321 Influence of different vegetable oils on the exocrine pancreatic secretion in piglets. S. Jakob^{*1}, R. Zabielski², S. G. Pierzynowski^{3,5}, M. Sorhede Winzell⁴, C. Rippe⁴, L. Evilevitch³, M. Kuria³, and R. Mosenthin¹, ¹*Inst. Anim. Nutr., Hohenheim Univ., Germany*, ²*Dept. Anim. Physiol., Warsaw Agricultural Univ., Poland*, ³*Dept. Anim. Physiol., Lund Univ., Sweden*, ⁴*Dept. Cell and Molecular Biol., Lund University, Sweden*, ⁵*R&D Gramineer Int. AB, Lund, Sweden*.

The influence of intraduodenal (id) application of vegetable oils on the spontaneous reaction of the exocrine pancreas of piglets has not yet been studied. Six growing pigs (BW 13.3 kg) were prepared with a pancreatic duct catheter and a duodenal re-entrant T-cannula. The animals were fed twice daily (10.00 and 16.00 h), a commercial weaner diet at a level of 2% of BW. Beginning with the morning feeding, olive oil, coconut oil