384 Effects of creep feeding and supplemental glutamine or glutamine plus glutamate (AminoGut) on pre- and post-weaning growth performance and intestinal health of piglets. R. Cabrera*[1], J. Usry[2], E. Nogueira[3], M. Kutschenko[3], A. Moeser[1], and J. Odle[1], *[1]North Carolina State University, Raleigh, [2]Ajinomoto Heartland LLC, Chicago, IL, [3]Ajinomoto Brazil, Brazil.*

We determined the impact of creep feeding and adding either L-glutamine (GLN) or AminoGut (AG) to pre- and post-weaning diets on pig performance and intestinal health. Litters (n = 120) were randomly allotted based on litter size and sow parity to 4 treatments: 1) Non-creep fed (NC, n = 45); 2) creep fed control diet (CFCD, n = 45); 3) creep fed 1% GLN (CFGLN, n = 15); 4) creep fed 0.88% AG (CFAG, n = 15). No effects of creep feed on intake, weaning weight or mortality were detected ($P > 0.25$). After weaning, the NC and CFCD groups were divided into 3 groups (n = 15 each), receiving either a control nursery diet (NC-CD, CFCD-CD) or a diet supplemented with GLN (NC-GLN, CFCD-GLN) or AG (NC-AG, CFCD-AG). The litters creep fed diets containing GLN or AG also were supplemented with those AA in the nursery diets (CFGLN-GLN, CFAG-AG). GLN was added at 1% in all 3 phases and AG was added at 0.88% in phase 1 and 2 and at 0.66% in phase 3. Pigs receiving GLN in pre- and post-weaning diets (CFGLN-GLN) had the best G:F for the first 3-wk period ($P < 0.056$), exceeding controls (CFCD-CD) by 35%. The NC-AG group had ($P = 0.02$) the greatest feed intake in the last 3 wk of the study, exceeding controls (CFCD-CD) by 12%. Pigs creep fed a control diet with or without glutamine and fed with a post-weaning diet supplemented with glutamine (CFGLN-GLN, CFCD-GLN respectively) had the greatest ($P < 0.05$) villi height exceeding those which were creep fed with a control diet and later supplemented with AminoGut (CFCD-AG) by 18% and 20% respectively. Although this treatment (CFCD-AG) had the shortest villi among all treatments, they had the widest ($P = 0.1$) villi. We found that pigs creep fed with a diet supplemented with AminoGut and fed with a post-weaning diet supplemented with AminoGut (CFAG-AG) had the deepest ($P < 0.01$) crypts of all the treatments. In conclusion, supplementation of nursery diets with GLN in the first 3-wk improved feed conversion and with AG improved feed intake in the last 3-wk implicating possible improvement in intestinal health.

Key words: creep feed, glutamine, Amino-Gut

385 Metabolomic analysis of the response to weaning and dietary L-glutamine supplementation in piglets using gas chromatography/mass spectrometry. Y. Xiao*[1], T. Wu[1], B. Dai[2], S. Luo[1], J. Feng[2], and A. Chen[1], *[1]Zhejiang University, Hangzhou, Zhejiang, China, [2]Zhejiang Gomore Group, Hangzhou, Zhejiang, China.*

A novel metabolomic method based on gas chromatography/mass spectrometry (GC/MS) was applied to determine serum metabolites involved in responses to weaning and dietary glutamine supplementation in piglets. Thirty-six 21-d-old piglets were randomly assigned into 3 groups. One group continued to suckle from the sows, whereas the other 2 groups were weaned and their diets were supplemented with 1% L-glutamine (wt:wt) or isonitrogenous L-alanine, representing glutamine-supplemented group and weaned group. Serum samples were collected to characterize metabolites at 28-d-old. The GC/MS data was analyzed following the 2 sample *t*-test ($P < 0.05$)to explore the potential maker metabolites, and principal component analysis (PCA) was used to classify the different groups. Results showed that 17 metabolites were downregulated by both weaning and glutamine treatment compared with suckling piglets. These were mostly carbohydrates ($P < 0.05$) and lipids ($P < 0.05$), except for 2-hydroxybutanoic acid ($P = 0.031$), 4-hydroxypentenoic acid ($P = 0.048$), and phosphoric acid ($P = 0.0011$). Another 3 metabolites, creatinine ($P = 0.0208$), D-xylopyranose ($P = 0.0439$), and glyceryl monostearate ($P = 0.0414$), were reduced in weaned group . The level of 2-hydroxybutanoic acid ($P = 0.0077$), creatinine ($P = 0.0003$), D-xylopyranose ($P = 0.0006$), palmitelaidic acid ($P = 0.0016$) and α -L-galactofuranose ($P = 0.0495$) were greater in the glutamine-supplemented piglets than in the weaned ones. Based on the data, correlation network for weaned and suckling piglets revealed that weaning disturbed the lipid, carbohydrate and amino acid metabolism, whereas the metabolic state was partially improved by glutamine supplementation. Principal component analysis demonstrated that suckling piglets were metabolically distinct from their weaned and glutamine-supplemented counterparts, and yielded a separate clustering of profiles between glutamine group and weaned group. These novel findings provide fresh insight into the complex metabolic mechanisms of weaning and show the influence of dietary glutamine supplementation in piglets.

Key words: glutamine, metabolomics, weaning

386 Feed efficiency of 7- to 16-kg pigs is maximized when additional lysine is supplied by L-Lys instead of intact protein, but is not affected when diets are supplemented with differing sources of non-essential amino acid nitrogen. C. K. Jones*[1], J. A. Acosta[2], M. D. Tokach[3], J. L. Usry[4], C. R. Neill[5], and J. F. Patience[1], *[1]Iowa State University, Ames, [2]Universidad Nacional de Colombia, Bogotá, Columbia, [3]Kansas State University, Manhattan, [4]Ajinomoto Heartland LLC, Chicago, IL, [5]Pig Improvement Company, Hendersonville, TN.*

Little is known about how the pig′s response to Lys changes due to differences in protein source. A total of 540 (Exp. 1, 6.7 kg, 6 pigs/pen) or 450 (Exp. 2, 6.6 kg, 5 pigs/pen) PIC pigs were used in 2 14-d experiments to evaluate if the source of non-essential AA nitrogen (NEAA; Exp. 1) or source of additional Lys (Exp. 2) affects the Lys requirement of pigs. In both experiments, there were 9 replicates/treatment. The NEAA were supplied by L-Glu and L-Gly or L-Gly, L-Ala, L-Pro, and L-His, while additional Lys was supplied by L-Lys HCl or SBM. Pigs were fed 1 of 10 dietary treatments that included 1 of 5 levels of standardized ileal digestible Lys (1.2, 1.3, 1.4, 1.5, and 1.6%). There were no ($P > 0.24$) protein source × Lys level interactions. In Exp. 1, ADG increased linearly ($P < 0.0001$) and quadratically ($P = 0.02$) with increasing Lys level, while G:F increased in a linear ($P < 0.0001$) manner. Linear 1-slope broken-line analyses of all treatments revealed optimum ($P = 0.0004$) ADG was obtained at 1.36% Lys. The source of NEAA did not affect ADG ($P = 0.82$) or G:F ($P = 0.90$). In Exp. 2, both ADG and G:F increased linearly ($P < 0.0001$) with increasing Lys level. Broken-line analyses showed optimum ($P = 0.0001$) ADG was obtained at 1.47% Lys. While the source of Lys did not affect ($P = 0.48$) ADG, supplying Lys from L-Lys rather than SBM resulted in improved ($P = 0.01$) G:F, particularly at the level closest to the breakpoint (pairwise comparison of additional Lys sources at 1.5% Lys: $P = 0.01$). In summary, feed efficiency of nursery pigs is affected by Lys source, but not by source of non-essential AA nitrogen.

Table 1.

Source of non-essential AA	Exp. 1 Lys level	ADG, g/d	G:F	Source of additional Lys	Exp. 2 Lys level	ADG, g/d	G:F
L-Glu and L-Gly	1.2	330	0.73	L-Lys	1.2	312	0.74
	1.3	362	0.76		1.3	338	0.80
	1.4	401	0.80		1.4	368	0.81
	1.5	375	0.80		1.5	381	0.85
	1.6	395	0.85		1.6	367	0.85
L-Gly, L-Ala, L-Pro, and L-His	1.2	320	0.71	SBM	1.2	316	0.72
	1.3	374	0.77		1.3	334	0.78
	1.4	387	0.81		1.4	347	0.78
	1.5	385	0.80		1.5	365	0.79
	1.6	409	0.86		1.6	379	0.86
SEM		17.1	0.018	SEM		16.9	0.015
P =	Lys level	<0.0001	<0.0001	*P* =	Lys level	<0.0001	<0.0001
P =	NEAA source	0.82	0.90	*P* =	Additional Lys source	0.48	0.01

Key words: lysine, nutrient requirement, pig

387 Effect of increasing levels of lysine in the diet on growth performance and carcass and meat quality of growing-finishing pigs. L. Cámara[1], M. P. Serrano[1], J. I. Morales[1], E. Alcázar[2], J. L. Sánchez[2], and G. G. Mateos*[1], *[1]Departamento de Producción Animal, UPM, Ciudad Universitaria, s/n. [28040], Madrid, [2]S.A.T. Vallehermoso, Ctra. La Solana a Infantes, km [9]. [13248], Alhambra, Ciudad Real.*

A trial was conducted to study the effect of level of Lys in the diet on productive performance and carcass and meat quality of pigs from 26 to 124 kg BW. A total of 480 crossbreds pigs (Large White × Landrace females crossed with Duroc male and PIC 410 sires) were used. Half of the animals were gilts and half males castrated at 4 d. The feeding program consisted of 5 periods with 5 dietary Lys levels each. Diets within each period were formulated to have the same NE (2,425 kcal/kg) but differed in digestible Lys content (1) Control (C); 2) C - 6%; 3) C - 12%; 4) C + 6%; and 5) C + 12%). The digestible Lys content of the control diets was 1.02, 0.86, 0.75, 0.70, and 0.58% for each of the 5 periods. In all cases, the other indispensable AA were formulated on an ideal protein basis. Each treatment was replicated 8 times. The experimental unit was the pen for all traits (12 pigs each for productive traits and 4 carcasses chosen at random for carcass and meat quality traits). From 26 to 44 kg BW, pigs fed diets with +12% and +6% Lys had better G:F than those fed the −6% and −12% Lys diets ($P = 0.024$) with pigs fed the control diet being intermediate. From 63 to 80 kg BW pigs fed diets with +12% and +6% Lys had better G:F than fed the control or the −6 and −12% Lys diets ($P = 0.042$). Cumulatively, pigs fed +12% and +6% Lys diets and control diet had better G:F ($P = 0.007$) than pigs fed −6% and −12% Lys diets. An increase in Lys content of the diet increased linearly carcass lean ($P = 0.011$) and quadratically the percentage of protein of the meat ($P = 0.020$), but no differences were detected for carcass fat or percentage of primal cuts. Under the conditions of the experiment, the use of 1.08%, 0.91%, 0.80%, 0.70%, and 0.58% digestible Lys for each of the periods considered in diets containing 2,425 kcal NE/kg, is recommended.

Key words: carcass and meat quality, dietary lysine, pig growth

388 Apparent prececal digestibility of amino acids and performance of broiler chickens fed soybean meal-based diets. A. F. Agboola*[1] and E. A. Iyayi[1], *[1]Department of Animal Science, University of Ibadan, Ibadan, Oyo, Nigeria, [2]University of Ibadan, Ibadan, Oyo, Nigeria.*

The apparent prececal amino acid digestibility of soybean meal (SBM) at varying levels of inclusion (0, 10, 20, and 30%) was determined for broiler chicks in a 7-d experiment. The feed ingredient SBM used served as the sole source of amino acids, as other feed ingredients were fixed. The birds received a commercial broiler starter diet during the first 14 d posthatch. On d 14, birds were sorted by body weight and randomly distributed into 4 dietary treatments in a completely randomized design. Each diet was comprised of 4 replicates of 5 birds per replicate from d 14 to 21 posthatch. On d 21 posthatch, birds were asphyxiated with CO2 and digesta samples from the terminal ileum were collected. Titanium dioxide was included as the indigestible dietary marker. In general, the concentration of essential amino acids (AAs) was highest in the 30% SBM diet as compared with other diets with the least in the control diet. The digestibility of all the essential AAs shows significant ($P < 0.05$) increases with inclusion of SBM in the diets. Arginine digestibility in birds fed 20% SBM was highest (94.92%) as compared with other essential amino acids, whereas threonine had the lowest digestibility value across the treatments. Lysine and methionine digestibilites in birds improved significantly ($P < 0.05$) at 20% SBM inclusion level. Increasing amounts of soybean meal had no significant effect on the weights of the birds but birds on the SBM diets had significantly ($P < 0.05$) higher weights and weight gain than those on the control diet. Feed intake was significantly increased ($P < 0.05$) in birds with increasing SBM levels while the feed conversion ratio was significantly ($P < 0.05$) improved. In conclusion, the data from the present study show that there are considerable differences in varying levels of SBM in the digestibility of their amino acids and growth performance for broiler starters. Therefore, it is imperative to consider lower levels of SBM inclusion, as levels above 20% resulted in decreased digestibility of amino acids.

Key words: prececal digestibility/amino acids, performance/soybean meal, broiler chickens

389 Amino acid digestibility and energy content in Dried Fermentation Biomass, Peptone 50, and P.E.P. Two Plus fed to weanling pigs. R. C. Sulabo*[1], J. K. Mathai[1], J. L. Usry[2], B. W. Ratliff[3], D. M. McKilligan[3], and H. H. Stein[1], *[1]University of Illinois, Urbana, [2]Ajinomoto Heartland LLC, Chicago, IL, [3]TechMix LLC, Stewart, MN.*

Two experiments were conducted to determine the standardized (SID) ileal digestibility of AA (Exp. 1) and the DE and ME content (Exp. 2) in Dried Fermentation Biomass (DFB), Peptone 50 (PEP50), and P.E.P. Two Plus (PEP2+) fed to weanling pigs and to compare these values to those in fish meal. DFB (Ajinomoto Heartland LLC) is a co-product from AA production and PEP50 and PEP2+ (TechMix LLC) are produced from hydrolyzed pig intestines. In Exp. 1, 12 barrows (BW: 11.5 ± 1.1 kg) were allotted to a replicated 6 × 6 Latin square design with 6 diets and 6 periods. One diet was based on SBM as the sole source of AA and 4 additional diets were formulated based on a combination of SBM and DFB, PEP50, PEP2+, or fish meal. A N-free diet was used to calculate endogenous losses of AA. The SID of Lys in DFB were greater (93.8 vs. 87.2%; $P < 0.01$) than in fish meal, but were similar for all other indispensable AA. The SID of Lys was less ($P < 0.01$) in PEP2+ (84.1%) than in DFB, but was similar to those in PEP50 (87.5%) and fish meal. Except for the SID of Thr, PEP50

had similar SID for all indispensable AA compared with fish meal. The SID of all indispensable AA except for Trp was less ($P < 0.05$) in PEP2+ than in any of the other ingredients. In Exp. 2, 40 barrows (BW: 12.8 ± 1.4 kg) were used with 5 diets and 8 replicate pigs per diet. A basal diet consisting of 96.4% corn and 4 diets with corn and DFB, PEP50, PEP2+, or fish meal were formulated. The DE (5,781 kcal/kg DM) and ME (5,560 kcal/kg DM) in DFB were similar to those in PEP2+ (5,300 and 4,959 kcal/kg DM), but were greater ($P < 0.01$) than in PEP50 (5,003 and 4,744 kcal/kg DM) and fish meal (4,586 and 4,180 kcal/kg DM). The DE and ME in PEP2+ were also greater ($P < 0.01$) than in fish meal, but were similar to those in PEP50. The ME in PEP50 was not different from the ME in fish meal. In summary, DFB, PEP50, and PEP2+ had similar AA digestibility, but greater energy value than fish meal.

Key words: alternative feedstuffs, amino acids, pigs

390 Digestibility of amino acids in corn, corn co-products, and bakery meal fed to growing pigs. F. N. Almeida*, G. I. Petersen, and H. H. Stein, *University of Illinois, Urbana.*

The objectives of this experiment were to measure the apparent ileal digestibility (AID) and the standardized ileal digestibility (SID) of CP and AA in bakery meal, corn gluten meal, corn gluten feed, corn germ meal, and hominy feed and to compare these values to the AID and SID of CP and AA in corn and distillers dried grains with solubles (DDGS). Eight growing barrows (initial BW: 82.5 ± 5.5 kg) were randomly allotted to an 8 × 8 Latin square design with 8 diets and 8 periods. Diets contained corn, DDGS, bakery meal, corn gluten meal, corn gluten feed, corn germ meal, or hominy feed as the sole source of protein and AA. An N-free diet was used to measure basal endogenous losses of AA and protein. Pigs were fed the experimental diets during 8 7 d periods with ileal digesta being collected on d 6 and 7 of each period. Results indicated that the SID of Lys in corn gluten meal (78.7%) was greater ($P < 0.01$) than in DDGS, bakery meal, corn germ meal, and hominy feed (46.0, 48.4, 68.4, and 58.8%, respectively). The SID of all indispensable AA except Arg, Leu, and Met in bakery meal were not different from DDGS. For corn gluten feed, the SID of all indispensable AA were not different from corn, except Arg, His, Leu, and Met, which had SID values that were less ($P < 0.01$) than in corn, but for most indispensable AA, the SID in corn gluten feed was not different from the SID in DDGS. The SID of all indispensable AA in corn germ meal except Arg, His, Leu, and Met were not different from corn. Likewise, the SID of all indispensable AA in corn germ meal except Arg and Leu were not different from DDGS. For most of the indispensable AA in hominy feed, the SID was not different from corn. All indispensable AA in hominy feed had SID values that were not different from the SID of AA in DDGS, except for Arg and Lys, which had greater ($P < 0.01$) SID than in DDGS. In conclusion, bakery meal is a poor source of digestible AA when compared with other corn co-products. Corn gluten meal has SID values for most AA that are greater than in DDGS, bakery meal and other corn co-products.

Key words: AA digestibility, corn co-prodcuts, pigs

391 Effect of L-Trp supplementation on growth performance pigs transitioning from nursery to finisher pens in a commercial farm. Y. B. Shen*[1], G. Voilqué[1], D. Kendall[2], D. Sykes[2], and S. W. Kim[1], *[1]North Carolina State University, Raleigh, [2]Murphy-Brown LLC, Rose Hill, NC.*

Transition period from nursery to finisher pens can be a stressful time for pigs physically and socially. Tryptophan serves as the precursor for the synthesis of serotonin which is a cerebral neurotransmitter with a key role in stress adaption. The aim of this study was to evaluate the effect of L-Trp supplementation on growth performance of nursery pigs transitioning from nursery to finisher pens. Six-hundred 74 pigs in 40 pens were used in a randomized complete block design study. Pigs were allotted to 2 treatments representing supplementation of 0% and 0.8% L-Trp. Both diets were isonitrogenous using L-Ala as a non-specific N source. Two neighboring pens shared a common feeder, and thus 2 neighboring pens were the experimental unit (n = 10 per treatment). Experimental period was composed of 5 d in nursery and 7 d in finisher. After 12 d feeding of experimental diets, pigs were provided a common diet for additional 7 d. Pigs in 2 neighboring pens were mixed on d 5 (when pigs were moved from nursery to finisher) and again on d 8. Body weight and feed intake were measured on d 5, 8, 12, and 19. During the first 5 d in nursery pens, growth performance was not affected by L-Trp supplementation. During d 5 to 8 in finisher pens, supplementation of 0.8% L-Trp improved ADG (549 vs. 669 g; $P = 0.017$) and G:F (0.558 vs. 0.690; $P = 0.001$) whereas ADFI was not affected by L-Trp supplementation. During d 8 to 12, supplementation of 0.8% L-Trp did not affect ADG, ADFI, and G:F. During the entire 12-d L-Trp supplementation period, pigs fed diet with 0.8% L-Trp tended to grow faster (511 vs. 556 g; $P = 0.092$) and more efficiently (G:F; 0.559 vs. 0.611; $P = 0.043$) compared with pig fed diet with 0% L-Trp. During the entire 19-d, pigs fed diet with 0.8% L-Trp had greater ADG (654 vs. 696 g; $P = 0.016$) and G:F (0.603 vs. 0.646; $P = 0.001$) compared with pig fed diet with 0% L-Trp but without affecting ADFI. Collectively, dietary L-Trp supplementation improved growth performance of pigs transitioning from nursery to finisher pens with new physical and social environment.

Key words: pig, transition period, tryptophan

392 Effect of L-Trp supplementation on growth and stress responses of nursery pigs fed diets varying large neutral amino acid concentrations. Y. B. Shen*, G. Voilqué, and S. W. Kim, *North Carolina State University, Raleigh.*

Tryptophan competes with large neutral amino acids (LNAA) for LNAA transporter to cross the blood-brain barrier. Availability of Trp in the brain is a limiting factor of serotonin synthesis. Thus, the ratio between Trp and LNAA in diets would affect serotonin synthesis in the brain, which plays a critical role in mediating stress. This study evaluated the effect of L-Trp supplementation on nursery pigs fed diets varying LNAA concentrations. Forty-eight barrows at 6 wk of age were housed individually and randomly allotted to 4 dietary treatments based on a 2x2 factorial arrangement (n = 12). First factor was L-Trp supplementation (0 or 0.6%) and the second factor was LNAA concentrations (4.5 or 3.8%). Pigs were fed the diets for 7 d. Body weight was measured on d 4 and 7. Saliva and blood were collected on d 4 and 7. During the first 4 d, pigs fed diets with 0.6% L-Trp increased ADG (341 vs. 264, g; $P = 0.022$) and G:F (0.453 vs. 0.321; $P = 0.001$) compared with pigs fed diets with 0% L-Trp and the effects of L-Trp on ADG and G:F were enhanced by 74% ($P = 0.079$) and 59% ($P = 0.040$), respectively, when dietary LNAA concentration was reduced from 4.5 to 3.8%. During the entire 7 d, L-Trp supplementation improved ($P = 0.004$) G:F of pigs (0.423 vs. 0.345) and lowering LNAA further enhanced ($P = 0.025$) the effects of L-Trp by 79%. Supplementation of 0.6% L-Trp reduced malonedialdehyde in plasma (19.16 vs. 25.14, μM; $P = 0.027$) and hypothalamus (24.92 vs. 34.47, μmol; $P = 0.024$) indicating reduced lipid peroxidation. Sali-

vary cortisol concentration was not affected by L-Trp supplementation but reduced (1.90 vs. 2.46, ng/mL; $P = 0.017$) when dietary LNAA concentration was reduced from 4.5 to 3.8%. Plasma urea nitrogen was reduced (5.18 vs. 4.29, μg/mL; $P = 0.018$) by L-Trp supplementation. Collectively, supplementation of 0.6% L-Trp improved G:F, and reduced systemic and hypothalamic lipid peroxidation. These effects were further enhanced by reducing dietary LNAA concentration.

Key words: pigs, stress, tryptophan

393 Feeding modality affects muscle protein deposition by influencing protein synthesis but not degradation in muscle of neonatal pigs. S. W. El-Kadi*[1], A. Suryawan[1], M. C. Gazzaneo[1], R. A. Orellana[1], N. Srivastava[1], H. V. Nguyen[1], R. Murgas-Torrazza[1], G. E. Lobley[2], and T. A. Davis[1], *[1]USDA/ARS Children's Nutrition Research Center, Dept. Pediatrics, Baylor College of Medicine, Houston, TX, [2]Division of Obesity and Metabolic Health, Rowett Institute of Nutrition and Health, University of Aberdeen, Aberdeen, UK.*

Neonatal pigs can serve as dual-use models for nutrition research in animal agriculture and biomedical fields. To determine how feeding modality by either intermittent bolus or continuous schedule affects protein anabolism and catabolism, neonatal pigs (n = 6/group, 9-d-old) were overnight fasted (FAS) or fed continuously (CON) or intermittently (INT; 7 × 4 h meals) for 28h. During the last 8 h, pigs were infused with [$^2H_5$]phenylalanine and [$^2H_2$]tyrosine and amino acid (AA) net balances were measured across the hindquarters for the last 4h. Glucose, insulin, branched-chain AA (BCAA), phenylalanine (Phe) and tyrosine (Tyr) arterial levels, and whole body Phe and Tyr rates of appearance were greater ($P < 0.05$) in INT after the meal but not in the CON or FAS groups. Whole body Phe hydroxylation was greatest for INT ($P < 0.05$). Across the hindquarters, BCAA, Phe, and Tyr were net removed (different from zero, $P < 0.05$) for INT and CON but not for FAS pigs. Hindquarters net protein deposition was stimulated following the meal for INT as compared with CON and FAS groups ($P < 0.001$). This was because protein synthesis increased following feeding for INT ($P < 0.001$) but remained unchanged for CON and FAS pigs, while no temporal changes in protein degradation occurred in any of the diet treatments. These results suggest that muscle protein accretion is enhanced with intermittent to a greater extent than continuous feeding, mainly by increasing protein synthesis. (Supported by NIHAR444474 and USDA/ARS 6250–51000–055)

Key words: amino acid, protein turnover, pig

394 Arginine deficiency is responsible for high rates of mortality in low-birth-weight piglets. G. Wu*, X. L. Li, R. Rezaei, and D. A. Knabe, *Texas A&M University, College Station.*

Pigs exhibit the most severe naturally occurring intrauterine growth retardation (IUGR) among livestock species. Under current feeding conditions, approximately 25% of live-born piglets have a birth weight of less than 1.1 kg, and they represent 76% of preweaning deaths. In the present study, we conducted 2 series of experiments to test the hypothesis that arginine deficiency may contribute to high rates of mortality in IUGR piglets. In Experiment 1, normal-birth-weight (NBW) and IUGR piglets, which were 1.43 ± 0.03 and 0.90 ± 0.04 kg ($P < 0.01$) at birth, respectively, were used for blood sampling at birth and thereafter. In Experiment 2, beginning at birth, IUGR piglets received oral administration of either L-arginine-HCl (0.1 g/kg BW) or an isonitrogenous amount of L-alanine twice daily. In each experiment, there were 40 piglets per group at birth. Data, expressed as means ± SEM, were analyzed by ANOVA and X2 analysis. Results of Experiment 1 indicated that concentrations of arginine in plasma of NBW and IUGR piglets at birth were 145 ± 4 and 81 ± 2 μM ($P < 0.01$), respectively. Concentrations of ammonia in plasma of NBW and IUGR piglets at birth were 72 ± 3 and 128 ± 5 μM ($P < 0.01$), respectively. During the first 3 wk of life, 7.8% and 46% of NBW and IUGR piglets died ($P < 0.01$), respectively. Analysis of blood samples obtained from IUGR piglets immediately after death revealed low concentrations of arginine (48 ± 4 vs. 130 ± 6 μM; $P < 0.01$) but high concentrations of ammonia (279 ± 13 vs. 145 ± 10 μM; $P < 0.01$), when compared with surviving IUGR piglets. Findings from Experiment 2 showed that arginine administration increased ($P < 0.01$) concentrations of arginine in plasma by 58%, while reducing ($P < 0.01$) concentrations of ammonia in plasma by 47% and preweaning mortality by 83%. Interestingly, arginine administration only modestly enhanced ($P < 0.01$) the daily weight gain of IUGR piglets by 21%. Thus, arginine deficiency is primarily responsible for high rates of mortality in IUGR piglets, but their maximal growth is limited by yet an unidentified factor. (Supported by AFRI-USDA grants.)

Key words: arginine, IUGR, mortality