13.6 cm^2). Fat-free lean gain increased ($P < 0.001$) as dietary lysine concentration increased, regardless of lysine source. Gilts had a greater ($P < 0.001$) fat-free lean gain than barrows (264.4 vs 245.2 g/d). The results suggest that lysine from SBM-bound and crystalline sources was utilized similarly for growth.

Key Words: Pigs, Lysine, Growth

187 Influence of crystalline or protein-bound lysine on body protein deposition in growing pigs.

J. J. Colina*, P. S. Miller, A. J. Lewis, and R. L. Fischer, *University of Nebraska, Lincoln*.

Two 4-wk experiments were conducted to determine lysine utilization for protein deposition (PD) in barrows and gilts. Thirty-two growing pigs (16 barrows and 16 gilts; average initial BW of 18.3 kg) were used in each experiment. Pigs were randomly allotted to one of seven dietary treatments. Four pigs (two barrows and two gilts) were killed at the start and the remaining pigs were killed at the end of the experiments to determine body composition. There were two replications per treatment in each experiment for a total of four replications. Dietary treatments consisted of a basal diet (0.55% lysine) and diets containing 0.65, 0.75, and 0.85% lysine that were achieved by adding lysine to the basal diet from either soybean meal (SBM) or L-lysine·HCl (crystalline). Blood samples were taken from all pigs weekly to determine plasma urea concentration (PUC). Body protein concentration was greater ($P < 0.01$) in pigs fed the 0.75% crystalline-supplemented diet than pigs fed SBM at the same concentration (152.9 vs 160.4 g/kg). Body PD was affected by dietary lysine concentration ($P < 0.01$), but was not different between the two sources of lysine (SBM vs crystalline, respectively) at the same concentration (0.65% lysine: 77.9 vs 68.3; 0.75% lysine: 88.3 vs 96.2; 0.85% lysine: 97.3 vs 90.5 g/d). Barrows tended to have greater PD ($P = 0.08$) than gilts (88.2 vs 78.8 g/d) regardless of lysine source. Body fat concentration decreased ($P < 0.001$) as the dietary lysine concentration increased for both lysine sources at the same concentration; however, fat deposition was not affected by diet. Water deposition increased with dietary lysine concentration ($P = 0.05$). Ash variables were similar for both sources of lysine. There was a diet × week effect ($P < 0.05$) for PUC. The PUC decreased for pigs consuming crystalline-supplemented diets and increased for pigs consuming SBM-supplemented diets during the 4-week experimental period. The results suggest that PD of growing pigs fed lysine from SBM is similar to that of pigs fed crystalline lysine.

Key Words: Growing Pigs, Lysine, Protein Deposition

188 The performance of grower-finisher pigs fed diets formulated to meet amino acid requirements but with declining crude protein content.

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A changing price structure for synthetic amino acids (AA) combined with a mounting desire to reduce nitrogen excretion is increasing interest in lower CP diets. This study examined the performance and carcass composition of grower-finisher pigs fed conventional diets or those formulated to a lower CP content. The study was divided into Phase 1 (35 to 60 kg BW), phase 2 (60 to 90 kg BW) and phase 3 (90 to 115 kg BW). Diets were pelleted and based on barley, wheat and SBM. The high CP treatment (HiCP) contained less than 0.1% L-lysine·HCl while a low CP treatment (LoCP) was formulated to meet AA requirements using maximal amounts of synthetic L-lysine·HCl, L-threonine, and DL-methionine without using L-tryptophan or other synthetic AA. A third series of diets (MedCP) was formulated to be intermediate between the HiCP and LoCP diets. Diets were formulated to contain 2.32 Mcal NE/kg (NRC, 1998). The experiment was analyzed as a factorial with 2 genders and 3 treatments using 5 pens/(trt·gender) and 22 pigs/pen (0.64 m^2/pig). Treatment did not affect ADG, ADFI, feed efficiency (gain:feed) or days to reach market weight ($P > 0.05$). Gilts gained less than barrows (0.945 vs 0.973 kg/d, $P < 0.03$), consumed less feed (2.57 vs 2.78 kg/d, $P < 0.001$) and had an improved feed efficiency ($P < 0.001$). A gender × treatment interaction for neither ADG nor ADFI was observed ($P > 0.05$). Feeding a LoCP AA supplemented diet resulted in 2 mm greater loin thickness ($P < 0.004$) relative to the HiCP diet. Treatment did not affect lean yield, fat thickness, premiums or final carcass value ($P > 0.05$). Growth performance and carcass value can be maintained while feeding low CP, AA-supplemented diets formulated on the basis of net energy.

	CP, % DM (analyzed)		**g dLys/Mcal NE** (calculated)	
	HiCP	LoCP	HiCP	LoCP
Phase 1	25.4	23.1	3.8	3.8
Phase 2				
Barrows	19.6	18.2	3.2	3.2
Gilts	21.7	19.0	3.4	3.4
Phase 3				
Barrows	17.8	15.5	2.9	2.9
Gilts	19.3	16.6	3.0	3.0

Key Words: Swine, Crude Protein, Synthetic Amino Acids

189 Influence of crystalline or protein-bound lysine on body protein deposition and lysine utilization in nursery pigs.

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A 4-wk experiment was conducted to determine the efficiency of utilization for protein deposition (PD) in nursery pigs of crystalline lysine relative to the lysine in soybean meal (SBM). Pigs were 23 or 24-d-old and had an initial BW of 6 kg. Pigs were blocked by sex and weight and randomly allotted to one of five dietary treatments. Pigs were individually penned in two nursery facilities and each treatment was replicated six times. Six pigs were killed at the start and the remaining were killed at the end of the experiment to determine body composition. The dietary treatments consisted of a basal diet (1.05% lysine) and diets containing 1.15 and 1.25% lysine that were achieved by adding lysine to the basal diet from either SBM or L-lysine·HCl (crystalline). Body protein concentration was greater ($P < 0.01$) in pigs consuming the diet with 0.10% added (1.15% total lysine) crystalline lysine, than in pigs supplemented with 0.10% added lysine from SBM (159.2 vs 147.3 g/kg). However, PD was similar for both supplemented-diets with values between 80.4 and 88.8 g/d. Body fat concentration and body fat deposition were affected ($P \leq 0.07$) by diet, but were similar between the two sources of dietary lysine at the same concentration. No differences were observed among treatments for body lysine concentration or lysine deposition rate. Ash concentration was greatest ($P < 0.05$) in pigs fed 0.10% added crystalline lysine vs SBM at the same concentration (26.5 vs 24.0 g/kg). No differences were observed for body water variables among diets. The efficiency of lysine utilization for PD was greatest ($P = 0.08$) in pigs fed the basal diet and the 0.10% added crystalline lysine (50.2 and 48.5%, respectively). However, at the concentration of 1.25% lysine, the efficiency was similar between sources (44.3 vs 44.5%). The results suggest that there are no differences in the efficiency of utilization between SBM-bound lysine and lysine from L-lysine·HCl for PD in nursery pigs.

Key Words: Nursery Pigs, Lysine, Protein Deposition

190 Determining an optimum lysine:calorie ratio for 40 to 120 kg barrows in a commercial finishing facility.

R. G. Main*, S. S. Dritz, M. D. Tokach, R. D. Goodband, and J. L. Nelssen, *Kansas State University, Manhattan*.

Our objective was to determine the optimum lysine:calorie ratio (g total dietary lysine/Mcal ME) for 40 to 120 kg barrows (PIC L337 × C22) in a commercial finishing environment. Three trials were conducted using randomized complete block designs (42 pens/trial, 3,281 pigs). Six treatments of increasing lysine:calorie ratio were used in each study. Diets were corn-soybean meal-based with 6% choice white grease. Lysine:calorie ratios were attained by adjusting the amount of corn and soybean meal. No crystalline lysine was used. In trial 1 (43 to 70 kg), increasing lysine:calorie ratio (2.21, 2.55, 2.89, 3.23, 3.57, and 3.91) increased (quadratic, $P < 0.01$) ADG (913, 970, 992, 966, 963, 943 ± 22 g/day), feed efficiency (0.44, 0.46, 0.47, 0.47, 0.47, 0.47 ± 0.006), income over marginal feed costs (IOMFC; \$15.00, 16.11, 16.33, 15.73, 15.28, 14.83 ± 0.43/pig), feed cost per kg of gain (\$0.30, 0.29, 0.29, 0.30, 0.32, 0.32 ± 0.004), and decreased (linear, $P < 0.01$) 10th rib backfat as measured by ultrasound. In trial 2 (69 to 93 kg), increasing lysine:calorie ratio (1.53, 1.78, 2.03, 2.28, 2.53, and 2.78) improved (linear, $P < 0.01$) ADG (818, 828, 893, 902, 916, 946 ± 18 g/day), feed efficiency (0.36, 0.36, 0.39, 0.38, 0.40, 0.40 ± 0.005), IOMFC (\$12.06, 12.03, 13.35, 13.21, 13.63, 13.92 ± 0.35/pig), and decreased (quadratic, $P < 0.01$) backfat. In trial 3 (102 to 120 kg), increasing lysine:calorie ratio (1.40, 1.60, 1.80, 2.00, 2.20, and 2.40) improved (linear, $P < 0.03$) ADG (808, 818, 857, 864, 868, 877 ± 23 g/day), feed efficiency (0.31, 0.31, 0.32, 0.32, 0.33, 0.34 ± 0.005), and (quadratic, $P < 0.01$) lean percentage (53.9, 53.9, 53.6, 53.6, 54.2, 54.2 ± 0.15 %). Numeric improvements (linear, $P = 0.12$) in IOMFC ($106.64, 106.66, 106.98, 107.09, 107.60, 107.81 ± 1.40/pig) were observed as lysine increased. The equation (lysine:calorie ratio = -0.0133 × BW, kg + 3.6944) describes the lysine:calorie ratio that optimized performance and IOMFC from 40 to 120 kg.

Key Words: Lysine, Pigs, Economics

191 Determining an optimum lysine:calorie ratio for 35 to 120 kg gilts in a commercial finishing facility. R.G. Main, S.S. Dritz, M.D. Tokach, R.D. Goodband, and J.L. Nelssen, *Kansas State University, Manhattan*.

Our objective was to determine the optimum lysine:calorie ratio (g total dietary lysine/Mcal ME) for 35 to 120 kg gilts (PIC L337 × C22) in a commercial finishing environment. Four trials were conducted using randomized complete block designs (42 pens/trial, 4,520 pigs). Six treatments of increasing lysine:calorie ratio were used in each study. Diets were corn-soybean meal-based with 6% choice white grease. Lysine:calorie ratios were attained by adjusting the amount of corn and soybean meal. No crystalline lysine was used. As in trial 1 (35 to 60 kg, reported in 2002), increasing lysine:calorie ratio (1.96, 2.24, 2.52, 2.80, 3.08, and 3.36) in trial 2 (60 to 85 kg) increased (quadratic, $P< 0.02$) ADG (916, 935, 960, 973, 951, 936 ± 12 g/d), feed efficiency (0.40, 0.41, 0.41, 0.43, 0.40, 0.41 ± .005), income over marginal feed costs (IOMFC; $14.42, 14.68, 14.90, 15.14, 14.13, 13.80 ± .27/hd), feed cost per kg of gain ($0.32, 0.32, 0.32, 0.33, 0.35, 0.36 ± .004), and reduced (linear, $P< 0.01$) backfat. In trial 3 (78 to 103 kg), increasing lysine:calorie ratio (1.53, 1.78, 2.03, 2.28, 2.53, and 2.78) improved (quadratic, $P< 0.02$) ADG (807, 813, 900, 917, 912, 897 ± 18 g/d), feed efficiency (0.32, 0.32, 0.35, 0.36, 0.36, 0.36 ± 0.005), IOMFC ($11.32, 11.24, 13.18, 13.41, 13.20, 12.56 ± .36), feed cost per kg of gain($.381, .388, .359, .361, .365, .382 ± .006), and reduced (linear, $P< 0.01$) backfat. In trial 4 (100 to 120 kg), increasing lysine:calorie ratio (1.40, 1.60, 1.80, 2.00, 2.20, and 2.40) improved (linear, $P< 0.02$) ADG (722, 725, 767, 837, 880, 879 ± 19 g/d), feed efficiency (0.30, 0.30, 0.33, 0.35, 0.36, 0.36 ± 0.007), IOMFC ($105.66, 106.19, 107.46, 108.87, 109.64, 109.64 ± 1.57), feed cost per kg of gain ($0.40, 0.40, 0.38, 0.36, 0.36, 0.37 ± .008), and (quadratic, $P< 0.04$) lean percentage (54.7, 55.1, 54.6, 55.1, 55.3, 55.5 ± .15%). The equation (lysine:calorie ratio = -0.0164 × BW, kg + 4.004) describes the lysine:calorie ratio that met biological requirements and optimized IOMFC from 35 to 120 kg.

Key Words: Lysine, Pigs, Economics

192 Evaluation of the lysine requirements for barrows fed ractopamine HCl (Paylean®) under conditions of heat stress. D. C. Kendall*, J. W. Frank, A. M. Gaines, G. F. Yi, and G. L. Allee, *University of Missouri, Columbia*.

Two experiments were conducted to evaluate the lysine requirement of barrows fed ractopamine HCl (Paylean®, RAC) under heat-stress conditions. Exp. 1 was conducted in the Brody environmental chambers at the University of Missouri. Seventy-two barrows (TR-4 x PIC C-22) were subjected to a controlled cycling heat stress (cycling from 27 C at 2400 h to 35 C maintained from 1100 to 1900 h; HS) and fed corn-soy meal diets containing 10 ppm RAC and 3.51 Mcal ME/kg. Pigs were fed one of three dietary Lys levels (0.70, 0.95, or 1.20% total Lys) for 20 days to 6 replicate pens of 3 pigs/pen. An additional treatment consisted of pigs housed at thermoneutral conditions (21 C; TN) and fed a diet containing 10 ppm RAC and 1.20% total Lys. There was a linear improvement in ADG ($P < 0.05$) and feed efficiency ($P < 0.05$) with increasing Lys level (593, 633, and 782 g/d, respectively; 0.178, 0.218, and 0.255, respectively). Pigs fed the 1.20% total Lys diet in the TN environment had higher ADG ($P < 0.01$), ADFI ($P < 0.01$) and tended to be more efficient (0.371 vs 0.340, $P < 0.07$) than pigs fed 1.20% total Lys in HS. In Exp. 2, 210 barrows (TR-4 x PIC C-22) were housed in a cycling heat stress environment (28 to 34 C) and fed corn-soy meal diets containing 10 ppm RAC and 3.47 Mcal ME/kg. Pigs were fed one of four dietary Lys levels (0.90, 1.10, 1.30, or 1.50% total Lys) for 25 d to 6 replicate pens of 7 pigs/pen. A fifth treatment consisted of the 0.90% total Lys diet without RAC. There were no differences in ADG or loin eye area accretion among the RAC fed treatments; however, ADFI ($P < 0.01$) and tenth rib backfat accretion ($P < 0.05$) decreased linearly with increasing Lys level. Therefore, feed efficiency linearly ($P < 0.01$) and quadratically ($P < 0.05$) improved with increasing Lys level (0.399, 0.414, 0.441, and 0.421, respectively). Pigs fed diets with 10 ppm RAC and 0.90% total Lys had greater ADG ($P < 0.02$), feed efficiency ($P < 0.001$), and loin eye area accretion ($P < 0.03$) than non-RAC fed pigs. These experiments demonstrate that feeding Paylean® improves the growth performance of heat-stressed pigs and that the lysine requirement of barrows fed Paylean® may be as high as 1.30% total lysine under heat-stress conditions.

Key Words: Pigs, Ractopamine, Lysine

193 The effects of environmental housing conditions on two ractopamine use programs in finishing pigs. S. A. Trapp*, B. E. Hill, S. L. Hankins, A. P. Schinckel, and B. T. Richert, *Purdue University, West Lafayette, IN*.

Littermate barrows (93) and gilts (96) were used in a 6-wk study evaluating the effect of environmental housing conditions on two ractopamine use programs for late finishing pigs. All pigs were weaned into an SEW nursery. Following the nursery period, they were sorted into two environments: an all-in-all-out grow/finish facility with high bio-security measures in place (AIAO) or into a continuous flow system for the grow/finish phase (CF). At an average initial BW = 72.1 kg, pigs were allotted by weight, sex and ancestry to one of three ractopamine (RAC) treatments (trt): 1) control, no RAC; 2) 5 ppm RAC wks 0-3, 10 ppm RAC wks 4-6; 3) 10 ppm RAC wks 0-6. Barrows were fed a 1.05% Lys diet wks 0-3 and a 1.00% Lys diet wks 4-6; gilts were fed a 1.15% Lys diet wks 0-3 and a 1.10% Lys diet wks 4-6. Pigs fed RAC had increased ADG (1022 vs 867 g/d; $P < 0.05$) and increased G:F (0.416 vs 0.359; $P < 0.05$) compared to the control trt during wk 0-3. Overall, pigs fed RAC had increased ADG (958 vs 872 g/d, $P < 0.05$) and increased G:F (0.378 vs 0.338, $P < 0.05$) compared to the control trt. Additionally, pigs fed trt 2 had greater ADG (990 vs 926 g/d, $P < 0.05$) than trt 3 during wk 0-6. Pigs fed trt 2 also had increased final BW (109.0, 114.0, 110.8 kg; trt 1-3 respectively, $P < 0.05$) than the control trt. Real-time ultrasound data indicate that pigs fed RAC had increased loin eye area (LEA) (42.8, 45.8, 46.0 cm^2; trt 1-3 respectively, $P < 0.05$) and decreased 10^{th} rib backfat (20.4, 18.5, 18.4 mm; trt 1-3 respectively, $P < 0.05$). No significant differences between housing systems or interactions between grow/finish environments and treatments were found for overall ADG, ADFI, G:F, or carcass characteristics ($P > 0.05$). However, pigs in the CF environment were 11 d older at the start of the experimental BW. Both RAC use programs had increased pig growth rate and feed efficiency with nearly identical LEA and backfat depths over the control. Additionally, the step-up RAC trt had greater final BW and ADG than the constant RAC trt, while utilizing less RAC in the late finishing period.

Key Words: Ractopamine, Pigs, Environment

194 Interactive effects between dietary L-carnitine and ractopamine HCl (Paylean®) on finishing pig growth performance. B. W. James*[1], M. D. Tokach[1], R. D. Goodband[1], J. L. Nelssen[1], S. S. Dritz[1], K. Q. Owen[2], and J. C. Woodworth[2], [1]*Kansas State University, Manhattan*, [2]*Lonza, Inc., Fair Lawn, NJ*.

A total of 2,152 pigs were used in four experiments to determine the interactive effects of dietary carnitine and ractopamine HCl (Paylean®, RAC). All trials were arranged as factorials with main effects of carnitine (0, 25, or 50 ppm in Exp. 1 and 2 and 0 or 50 ppm in Exp. 3 and 4) and RAC (0, 5, or 10 ppm in Exp. 1 and 0 or 10 ppm in Exp. 2, 3, and 4). Dietary carnitine was fed from 38 kg to market (Exp. 1 and 3) or for the last 3 or 4 wk before market (Exp. 4 and 2, respectively). Ractopamine was fed prior to market for 4 wk in Exp. 1, 2, and 3, and 3 wk in Exp. 4. Experiments 1 and 2 were conducted in university research facilities and Exp. 3 and 4 in commercial research barns. All diets were formulated to 1.0% Lys during the last phase of each experiment. In all experiments, pigs fed RAC had increased ($P < 0.05$) ADG and feed efficiency (G:F) compared to pigs not fed RAC. Feeding carnitine prior to the RAC feeding period did not affect ($P > 0.25$) pig performance. In Exp. 1 and 2, carnitine did not affect ($P > 0.46$) ADG during the 4 wk prior to market; however, G:F tended (quadratic; $P < 0.07$) to improve with increasing carnitine in Exp. 2. In Exp. 3, a carnitine × RAC interaction was observed ($P < 0.04$) for ADG and G:F. Both carnitine and RAC improved performance, but not additively. In Exp. 4, pigs fed carnitine had increased ($P < 0.04$) ADG (0.88 vs 0.84 kg) and G:F