116 **The effects of increasing digestible lysine from 18 to 34 kg on growth performance of segregated early weaned pigs** K.Q. Owen, R.D. Goodband, J.L. Nelssen, M.D. Tokach, J.R. Bergstrom, K.G. Friesen*, J.W. Smith, and B.T. Richert, Kansas State University, Manhattan.

One hundred forty-four high-health, high-lean growth barrows (Newsham) were used to determine the dietary lysine requirement to maximize growth performance from 18 to 34 kg. The experiment was designed as a randomized complete block, with blocks established on initial BW. Pigs were segregated early-weaned at 7 d of age and fed high nutrient dense diets from weaning to 11 kg. At 11 kg, pigs were switched to a 1.4% lysine diet for 14 d. After the 14 d acclimation period, pigs were allotted to each of six dietary treatments. Dietary treatments were fed for a 21 d period. Pigs were approximately 45 d of age and weighed 18 ± 3 kg at the initiation of the experimental period. Digestible lysine levels were .75, .85, .95, 1.05, 1.15, and 1.25%, with corresponding total lysine levels of .90, 1.02, 1.14, 1.25, 1.37, and 1.49%. All diets were corn-soybean meal-based, and formulated on a digestible amino acid basis with all amino acids other than lysine formulated to meet or exceed current recommended estimates. L-lysine HCl was fixed at .15% of the diet and soybean meal was adjusted to increase dietary lysine concentrations. Pigs were housed in pens of four with six replicate pens per treatment. Pig weights and feed disappearance were collected on d 7, 14, and 21 of the experiment to calculate ADG, ADFI, and feed efficiency (G/F). Pigs were bled on d 7 to evaluate urea N (PUN) concentrations. From d 0 to 7, ADG and G/F improved (linear, $P < .01$) with increasing digestible lysine (See Table). Pigs fed the 1.25% digestible lysine level had 20% higher ADG and G/F than pigs fed the lowest level of digestible lysine (which is close to the current NRC, 1988 estimates). Increasing digestible lysine improved ADG and G/F (quadratic, $P < .01$) from d 0 to 14 and for the overall trial (d 0 to 21) with a maximum observed for both response criteria at approximately 1.25 to 1.37% total lysine (1.05 to 1.15% digestible lysine). However, ADFI was not influenced ($P > .10$) by dietary lysine at any point during the experiment. Increasing digestible lysine decreased then increased (quadratic, $P < .01$) PUN concentrations on d 7. Based on the feed intake observed in this study, high-lean growth barrows that have been segregated early weaned to improve health status, require at least 13 to 14 g/d digestible lysine (16 to 17 g/d of total lysine) from 18 to 34 kg, to maximize ADG and G/F.

		Digestible Lysine, %						
Item		.75	.85	.95	1.05	1.15	1.25	CV
d 0 to 7	ADG, kg[a]	.60	.62	.69	.72	.73	.75	8.7
	G/F[a]	.57	.61	.65	.70	.69	.71	8.8
d 0 to 14	ADG, kg[a,b]	.67	.69	.74	.79	.80	.78	4.6
	G/F[a,b]	.55	.57	.61	.64	.65	.63	3.8
d 0 to 21	ADG, kg[a,b]	.69	.73	.74	.78	.79	.77	4.4
	G/F[a,b]	.53	.53	.56	.58	.59	.56	3.8
d 7	PUN, mg/dL[a,b]	19.3	17.4	17.7	23.4	29.3	29.1	7.9

[a]Linear effect of dietary lysine ($P < .01$).
[b]Quadratic effect of dietary lysine($P < .01$).

Key Words: Lysine, Pigs, Growth performance.

117 **Impact of immune system activation on lysine and sulphur amino acid needs of 6 to 16 kg pigs.** N.H. Williams* and T.S. Stahly, Iowa State University, Ames

Pigs from a single genotype and source of origin were reared via a medicated-early-weaning or conventional-weaning scheme to evaluate the impact of a low and high level of immune system (IS) activation, respectively, on dietary lysine (L) and sulphur amino acid (SAA) needs of pigs. At 26 d of age (6.1 ± 1.1 kg), pigs were placed on a corn-soy isolate - blood meal based diet fortified with crystalline amino acids (essential and nonessential) to provide a minimum of 100 % of the ideal ratios of digestible amino acids relative to L. Within each IS group, five littermate barrows in each of 12 litters were randomly allotted to the basal diet limiting in digestible L (.60, .80, 1.0, 1.2, 1.4%) or SAA (.33, .45, .57, .69, .82 %). The dietary L and SAA levels were achieved by substituting crystalline L-lysine or D,L-methionine for corn starch in the basal diet (1.4 % digestible L, .82 % digestible SAA). Pigs were penned individually in facilities maintained at 27° C and were offered ad-libitum access to both feed and water. Data were analyzed as a split-split-plot design with IS level representing the whole plot, limiting amino acid representing the subplot, and level of limiting amino acid level representing the sub-subplot. Low IS pigs consumed more feed (DF) and gained weight faster (DG) and more efficiently (G:F) than high IS pigs ($P < .10$). A higher dietary level of L was required ($P < .02$) to optimize DG and G:F in the low versus high IS groups; however, the level of SAA relative to L needed to optimize DG and G:F was lower in the low (.57/1.2 = .48) versus the high IS group (.57/1.0 = .57). Based on these data, minimizing the pigs level of IS activation enhances body growth rate, increases dietary L needs and alters the 'ideal' ratio of SAA relative to lysine.

	IS	Digestible Lysine, %					Digestible SAA, %				
Item	Level	.60	.80	1.0	1.2	1.4	.33	.45	.57	.69	.82
DF, g/d	Low	645	662	707	717	710	704	728	715	716	706
	High	562	614	656	640	610	605	634	630	620	618
DG, g/d	Low	292	334	425	475	435	358	399	432	442	431
	High	235	316	355	324	309	308	339	357	323	305
G:F	Low	.477	.503	.602	.662	.612	.508	.548	.607	.617	.610
	High	.415	.518	.541	.506	.506	.509	.534	.566	.521	.493

Key Words: Pigs, Immune system, Amino acids

118 **Influence of dietary β-glucan on growth performance, nonspecific immunity, and resistance to *Streptococcus suis* infection in weanling pigs.** S.S. Dritz, J. Shi, T.L. Kielian, R.D. Goodband, J.L. Nelssen, M.D. Tokach, M.M. Chengappa, J.E. Smith, and F. Blecha. Kansas State University, Manhattan.

Three experiments, using 344 weaned pigs, were conducted to evaluate the influence of β-glucan on growth performance, neutrophil and macrophage function, haptoglobin production, and resistance to *Streptococcus suis* challenge in weanling pigs. In Exp. 1, 144 pigs were used to evaluate the influence of .1% dietary β-glucan in a soybean meal or milk-protein based diet on growth performance and neutrophil function. Exp. 2 was a 28 d growth assay on a commercial operation and pigs were fed a high nutrient dense diet with or without 1% β-glucan containing 7.5% spray-dried plasma protein and 25% dried whey from d 0 to 14 postweaning. Pigs were then fed corn-soybean meal-based diets containing 2.5% spray-dried blood meal and 10% dried whey. Exp. 3 was a 35 d assay to evaluate growth performance, neutrophil and macrophage function, and plasma haptoglobin concentration. Pigs were challenged on d 28 postweaning with intravenous *S. suis*. In Exp. 3, pigs were fed the similar high nutrient dense diets as fed to pigs in Exp 2 which contained 0, .025 or .05% β-glucan. Dietary β-glucan at inclusion rates of .05 and .1% did not influence neutrophil or macrophage functions and did not increase overall growth performance. Similarly, .025% β-glucan did not alter neutrophil or macrophage bactericidal activity or production of superoxide anion. However, pigs fed diets containing .025% β-glucan had increased ($P < .05$) ADG and ADFI and were heavier ($P < .05$) on d 28 postweaning. No differences in feed efficiency (G/F) were detected between treatments. Pigs fed β-glucan had decreased ($P < .10$) plasma haptoglobin on d 14, 21, and 28 postweaning. However, Fischers exact test revealed pigs fed a diet containing .025% β-glucan were more likely ($P < .04$) to die by d 12 after challenge with *S. suis*. In conclusion, these data suggest the existence of a complex interaction involving growth performance and resistance to *S. suis* in pigs fed .025% β-glucan.

Exp. 3	Control	.025%	.05%	CV
d 0 to 28 postweaning				
ADG, g	413[a]	495[b]	445[a]	1.9
ADFI, g	431[a]	531[b]	481[a]	3.2
G/F	.94	.93	.93	5.9
d 28 to 35 postweaning				
ADG, g	141	36	9	389
Pig weight, kg				
d 28 postweaning	16.5[a]	18.6[b]	17.3[a]	6.4
Plasma haptoglobin, mg/dL				
d 14 postweaning	29.9[a]	8.4[b]	14.6[b]	150
d 21 postweaning	29.3[a]	12.3[b]	17.1[b]	150
d 28 postweaning	25.4[a]	12.2[b]	11.5[b]	150
Survival after challenge	10/10	5/10	8/10	–

[a,b] Means within row with the same letter are not significantly different ($P < .10$).

Key words: pigs, β-glucan, growth

119 Protective effect of fructooligosaccharide(FOS) in prevention of mortality and morbidity from infectious *E. Coli* K:88 challenge. T.J. Bunce*, M.D. Howard, M.S. Kerley, G.L. Allee, and L.W. Pace. University of Missouri, Columbia.

Weaning places sufficient stress on the pig to predispose it to disease caused by colonization of pathogenic bacteria in the large intestine. FOS has been found to stimulate growth of indigenous microflora to prevent enteric colonization by pathogenic microorganisms. An experiment was conducted to evaluate the effectiveness of FOS for protection of neonatal pigs from infectious challenge with *Escherichia Coli*. K:88 (*E. Coli*) . Sixteen pigs(7d;3.9Kg b.w.) were removed from sows not vaccinated against *E. Coli* and adapted to a non-medicated milk replacer diet(approximately 75ml per feeding/3 feedings/day) for 6 days. Eight pigs received milk replacer only and 8 received milk replacer plus 1g FOS per feeding. On day 7 pigs were challenged with oral administration of *E. Coli* ($5ml \times 10^{8}$). Pigs were monitored for visible symptoms and fecal samples analyzed for *E. Coli, Clostridium, Bifidobacteria* and total anaerobic flora. Within 36 hours 6 of 8 pigs in the control group developed symptoms of anorexia, pyrexia, dehydration, and diarrhea. One FOS pig developed diarrhea for 12 hours with remaining FOS pigs showing no visible symptoms. Three pigs with severe symptoms in the control group were euthanized resulting in a survival rate of 62.5%, compared to a survival rate of 100% in FOS pigs. Bacterial counts were analyzed on day 0, 2, 4, and 10 with results indicating a shift in microbial population . *E. Coli* were decreased($P < .3$) in FOS pigs at 9.4×10^{8} compared to control pigs having a count of 6.4×10^{9}. *Bifidobacteria* were increased($P < .09$) in FOS pigs at 1.8×10^{10} compared to 2.9×10^{9} in control pigs. *Clostridial* population changes were not different between groups. These results demonstrate that FOS can increase *Bifidobacteria* populations in the large intestine of the pig which provides protection from infectious *E. Coli*..

Key Words: *E. Coli*, pig fructooligosaccharide.