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Effects of increasing dietary lysine in phase ii diets (15- to 25-lb) on nursery pig growth performance

Abstract

A total of 1,260 weanling pigs (initially 18.6 lb) was used in a 19 d growth assay (d 10 to 29 after weaning) to determine the effects of increasing lysine in Phase II diets on nursery pig growth performance. All pigs were weaned and fed 1.2 lb per pig of a SEW diet, then switched to a transition diet until day 10 after weaning. Pigs were then weighed and switched to experimental diets containing true digestible lysine levels of 1.22, 1.32, 1.42, 1.52, and 1.62%, corresponding to approximately 1.36, 1.47, 1.56, 1.65, and 1.75% total lysine. All diets were formulated to contain 30% soybean meal, with increasing amounts of synthetic amino acids to achieve desired amino acid concentrations in the diets. From d 10 to 17 after weaning, increasing lysine increased ADG (quadratic, $P < 0.04$) and improved feed efficiency (quadratic, $P < 0.01$), with both appearing to be maximized at 1.52% true ileal digestible lysine. From d 17 to 24 and 24 to 29, ADFI and F/G improved (linear, $P < 0.05$) with increasing true ileal digestible lysine. For the overall study, (d 10 to 29 after weaning), increasing true ileal digestible lysine increased ADG (quadratic, $P < 0.07$) and improved feed efficiency (quadratic, $P < 0.001$). In conclusion, 1.52% true ileal digestible lysine maximized both ADG and F/G early in the study, but the lysine requirement appeared to decrease to 1.42% from d 17 to 24. Results of two recent studies conducted at the University of Missouri with similar lysine levels fed to 15- to 25-lb pigs suggest a requirement estimate between 1.32 and 1.42% true ileal digestible lysine, slightly lower than the requirements observed in the present study.; Swine Day, 2003, Kansas State University, Manhattan, KS, 2003

Keywords

Swine day, 2003; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 920; Kansas Agricultural Experiment Station contribution; no. 04-120-S; Nursery pig; Phase II; Lysine requirement; Growth; Swine

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EFFECTS OF INCREASING DIETARY LYSINE IN PHASE II DIETS (15- TO 25-LB) ON NURSERY PIG GROWTH PERFORMANCE

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Summary

A total of 1,260 weanling pigs (initially 18.6 lb) was used in a 19 d growth assay (d 10 to 29 after weaning) to determine the effects of increasing lysine in Phase II diets on nursery pig growth performance. All pigs were weaned and fed 1.2 lb per pig of a SEW diet, then switched to a transition diet until day 10 after weaning. Pigs were then weighed and switched to experimental diets containing true digestible lysine levels of 1.22, 1.32, 1.42, 1.52, and 1.62%, corresponding to approximately 1.36, 1.47, 1.56, 1.65, and 1.75% total lysine. All diets were formulated to contain 30% soybean meal, with increasing amounts of synthetic amino acids to achieve desired amino acid concentrations in the diets. From d 10 to 17 after weaning, increasing lysine increased ADG (quadratic, $P < 0.04$) and improved feed efficiency (quadratic, $P < 0.01$), with both appearing to be maximized at 1.52% true ileal digestible lysine. From d 17 to 24 and 24 to 29, ADFI and F/G improved (linear, $P < 0.05$) with increasing true ileal digestible lysine. For the overall study, (d 10 to 29 after weaning), increasing true ileal digestible lysine increased ADG (quadratic, $P < 0.07$) and improved feed efficiency (quadratic, $P < 0.001$). In conclusion, 1.52% true ileal digestible lysine maximized both ADG and F/G early in the study, but the lysine requirement

appeared to decrease to 1.42% from d 17 to 24. Results of two recent studies conducted at the University of Missouri with similar lysine levels fed to 15- to 25-lb pigs suggest a requirement estimate between 1.32 and 1.42% true ileal digestible lysine, slightly lower than the requirements observed in the present study.

(Key Words: Nursery Pig, Phase II, Lysine Requirement, Growth)

Introduction

In a previous lysine titration study for 25- to 45-lb pigs, we found that dietary lysine requirements appear to be much higher than previously estimated. In fact, the requirements for 25- to 45-lb pigs are greater than levels currently fed to pigs from 15 to 25 lb. In addition to better growth performance, feeding additional dietary lysine resulted in improved margin over feed costs and lowered feed cost per lb of gain. As pigs grow, their feed intake increases, and the lysine requirement expressed as a percentage of the diet decreases. Therefore, from these previous studies, we suspect that lysine levels currently fed to 15- to 25-lb pigs may be too low. Therefore, our objective was to determine the optimum lysine level for pigs fed from 15 to 25 lb.

¹Food Animal Health and Management Center.

Procedures

A total of 1,260 weanling pigs (initially 18.6 lb) was used in a 19 d growth assay (d 10 to 29 after weaning) to determine the effects of increasing lysine in Phase II diets on nursery pig growth performance. Pigs were housed in a commercial nursery in southern Minnesota. At weaning, pigs were randomly sorted into one of 60 pens (30 pens of barrows and 30 pens of gilts) with 21 pigs per pen. All pigs were weaned and fed 1.2 lb per pig of a SEW diet, and then switched to a transition diet until day 10 after weaning. Pigs were then weighed and switched to experimental diets containing true digestible lysine levels of 1.22, 1.32, 1.42, 1.52, and 1.62%, corresponding to approximately 1.36, 1.47, 1.56, 1.65, and 1.75% total lysine. All diets were formulated to contain 30% soybean meal, with increasing amounts of synthetic amino acids to achieve desired amino acid concentrations in the diets. Experimental diets met or exceeded the nutrient requirements of the NRC (1998). As the dietary lysine level increased, the levels of synthetic methionine, threonine, tryptophan, isoleucine, and valine also increased as needed to maintain minimum ratios relative to lysine (Table 1).

The common SEW diet was formulated to contain 1.70% lysine, and contained 6.7% animal plasma, 5.8% fishmeal, and 1.65% blood meal. The transition diet was formulated to contain 1.55% lysine and contained 2.5% animal plasma and 6% fishmeal. Pigs were weighed and feed disappearance determined at the start of the study on d 10, and on d 17, 24, and 29 for calculation of ADG, ADFI, and F/G.

Data were analyzed using the PROC MIXED procedures of SAS as a randomized complete block design, with two pens consuming feed from a single feeder as the ex-

perimental unit. Linear and quadratic effects of increasing dietary lysine were determined.

Results and Discussion

From d 10 to 17, increasing true ileal digestible lysine improved (quadratic, $P < 0.04$) ADG and F/G. It appeared that 1.52% true ileal digestible lysine maximized both ADG and F/G for this period corresponding to 18 to 23 lb. Average daily feed intake tended to increase (linear, $P < 0.07$) with increasing true ileal digestible lysine.

From d 17 to 24, increasing true ileal digestible lysine increased (linear $P < 0.01$) ADG and improved (quadratic $P < 0.06$) F/G. During this period, it appeared that 1.42% true ileal digestible lysine was sufficient for both ADG and F/G.

From d 24 to 29, both ADG and F/G increased (linear $P < 0.01$) with increasing true ileal digestible lysine.

For the overall experimental period (d 10 to 29 after weaning), increasing true ileal digestible lysine improved ADG (quadratic, $P < 0.07$) and F/G (quadratic, $P < 0.01$). Average daily feed intake was unaffected ($P > 0.41$) by increasing true ileal digestible lysine. Average pig weight taken on each weigh day during the study increased (linear, $P < 0.01$) with increasing true ileal digestible lysine. It appeared that 1.52% true ileal digestible lysine maximized both ADG and F/G early in the study, but then the lysine requirement appeared to decrease to 1.42% from d 17 to 24. Results of two recent studies conducted at the University of Missouri with similar lysine levels fed to 15- to 25-lb pigs suggest a requirement estimate between 1.32 and 1.42% true ileal digestible lysine, just slightly lower than the requirements observed in the present study. Current lysine recommendations for pigs of this weight are much lower than ob-

served in both our study and those conducted by the University of Missouri. Calculating the expected value of the added weight gain from increasing dietary lysine (\$0.40/lb) and current ingredient prices, feeding diets containing

1.42% true ileal digestible lysine (approximately 1.56% total lysine) will decrease feed cost per pig by \$0.05 to \$0.10 per pig and increase margin over feed cost (profit) by \$0.20 to \$0.30 per head.

Table 1. Experimental Phase II Diets (As-fed Basis)^a

Ingredient,%	True ileal digestible lysine, %				
	1.22	1.32	1.42	1.52	1.62
Corn	50.39	50.13	49.87	49.53	49.13
Soy bean meal 48% CP	30.00	30.00	30.00	30.00	30.00
Lactose	7.00	7.00	7.00	7.00	7.00
Select menhaden fishmeal	6.67	6.67	6.67	6.67	6.67
Choice white grease	3.00	3.00	3.00	3.00	3.00
Dicalcium phosphate (18.5% P)	0.88	0.88	0.89	0.88	0.88
Limestone	0.33	0.33	0.33	0.33	0.33
Salt	0.40	0.40	0.40	0.40	0.40
DL-Methionine	0.05	0.12	0.18	0.24	0.30
L-Lysine HCl	---	0.13	0.26	0.38	0.51
L-Threonine	0.04	0.10	0.17	0.24	0.30
L-Tryptophan	---	---	---	0.02	0.04
L-Isoleucine	---	---	---	---	0.06
L-Valine	---	---	---	0.07	0.14
Zinc oxide	0.25	0.25	0.25	0.25	0.25
Vitamin & trace mineral premix	0.30	0.30	0.30	0.30	0.30
Medication	0.70	0.70	0.70	0.70	0.70
Total	100.00	100.00	100.00	100.00	100.00
<u>Calculated analysis</u>					
Total lysine, %	1.36	1.47	1.56	1.65	1.75
ME, kcal/lb	1,562	1,564	1,565	1,566	1,568
Crude protein %	22.63	22.81	23.00	23.25	23.53
Ca, %	0.80	0.80	0.80	0.80	0.80
Available P, %	0.40	0.40	0.40	0.40	0.40
<u>True ileal digestible amino acid ratios</u>					
Lysine, g/ Mcal ME	3.54	3.83	4.11	4.40	4.68
Methionine:Lysine, %	35	37	38	40	41
Met+Cys:Lysine, %	60	60	60	60	60
Threonine:Lysine, %	65	65	65	65	65
Tryptophan:Lysine, %	20	18	17	17	17
Isoleucine:Lysine, %	70	65	60	56	56
Valine:Lysine, %	78	72	67	67	67

^aAll pigs were fed 1.2 lb of common SEW diet (1.7% lysine) followed by the transition diet (1.65% lysine) to day 10. The experimental diets were fed from d 10 to 19 after weaning.

Table 2. Effects of Increasing Lysine in Phase II Diets on Nursery Pig Growth Performance^a

Item	True ileal Digestible Lysine, %					SEM	P<	
	1.22	1.32	1.42	1.52	1.62		Linear	Quadratic
Day 10 to 17								
ADG, lb	0.54	0.62	0.64	0.69	0.68	0.02	0.01	0.04
ADFI, lb	0.86	0.89	0.88	0.92	0.90	0.02	0.07	0.58
F/G	1.62	1.44	1.37	1.33	1.33	0.04	0.01	0.01
Day 17 to 24								
ADG, lb	1.00	1.08	1.11	1.11	1.13	0.03	0.01	0.13
ADFI, lb	1.42	1.42	1.45	1.44	1.43	0.02	0.47	0.53
F/G	1.42	1.31	1.30	1.29	1.27	0.02	0.01	0.06
Day 24 to 29								
ADG, lb	1.27	1.35	1.28	1.34	1.36	0.03	0.04	0.98
ADFI, lb	1.94	1.90	1.89	1.96	1.91	0.03	0.97	0.65
F/G	1.53	1.42	1.48	1.46	1.41	0.02	0.02	0.58
Day 10 to 29								
ADG, lb	0.94	1.02	1.01	1.05	1.06	0.02	0.01	0.07
ADFI, lb	1.41	1.41	1.41	1.44	1.42	0.02	0.41	0.86
F/G	1.53	1.39	1.39	1.36	1.34	0.01	0.01	0.01
Pig weight, lb								
Day 10	18.7	18.6	18.6	18.6	18.7	0.3	--	--
Day 17	22.4	23.0	23.1	23.4	23.4	0.3	0.01	0.41
Day 24	29.4	30.6	30.9	31.2	31.4	0.4	0.01	0.27
Day 29	35.9	37.3	37.3	37.9	38.2	0.4	0.01	0.38

^aA total of 1,260 pigs (5 observations/treatment with 2 pens of 21 pigs and a single fenceline feeder per observation) were used in the experiment.