THE OPTIMAL TRUE ILEAL DIGESTIBLE LYSINE REQUIREMENT FOR NURSERY PIGS BETWEEN 27 to 44 lb[1]

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Summary

A 20-d growth assay was conducted to determine the appropriate true ileal digestible lysine requirement to maximize growth performance of pigs between 27 to 44 lb. The basal diet (1.0% true ileal digestible lysine; 20.1% CP) was corn-soybean meal-based and was formulated to contain 3% added fat. Sand was substituted with L-lysine·HCl to form the other treatment diets (1.1, 1.2, 1.3, and 1.4% true ileal digestible lysine). The positive control contained more soybean meal than the basal diet (44.2 vs. 32.2% of the diet) and no L-lysine·HCl to provide 1.3% true ileal digestible lysine. Growth performance improved (quadratic, $P<0.04$) with increasing true ileal digestible lysine and was maximized at 1.1% true ileal digestible lysine. Feed efficiency was better (quadratic, $P<0.01$) for pigs fed increasing true ileal digestible lysine and was best for pigs fed 1.3% true ileal digestible lysine. These results indicate that the true ileal digestible lysine requirement for the 27 to 44 lb pig is at least 1.1% for ADG and 1.3% for feed efficiency.

(Key Words: Lysine, Growth Performance, Nursery Pigs.)

Introduction

Lysine, the first limiting amino acid, has been researched extensively in all growth phases of swine. This is because the lysine requirement of pigs is one of the most critical factors affecting profit margin over feed cost. The primary dietary source of lysine and other amino acids is soybean meal, but when the cost of soybean meal increases or cost of crystalline amino acids decreases, the use of other amino acid sources becomes economical. Determining the actual lysine requirement is also an essential element in determining the optimal ratio of other amino acids to lysine. This is especially important as the use of crystalline threonine increases. Recent research conducted at the University of Missouri indicated that the optimal lysine level for 25 to 55 lb pigs may be close to 1.32% true ileal digestible lysine or 1.46% total lysine (PIC female × Dalland boar). However, the requirement may be different for pigs with a different growth capacity. Therefore the objective of this experiment was to determine the appropriate true ileal digestible lysine requirement of nursery pigs between 27 and 44 lb.

Procedures

A total of 180 pigs (PIC L42) were used in a 20-d growth assay. Pigs were weaned at approximately 18-d of age and fed typical nursery diets for 20 d following weaning. On d 20 post-weaning (27.0 lb BW), pigs were blocked by weight and allotted randomly to six dietary treatments in a randomized complete block design. Each treatment had six replications

[1]Appreciation is expressed to Ajinomoto-Heartland lysine, Chicago, IL, for partial support of this experiment.
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(pens) and five pigs per pen. Pigs were housed in an environmentally controlled nursery. Each pen (4 × 4 ft) contained a stainless steel self-feeder and one nipple waterer to allow ad libitum access to feed and water. Pigs were weighed and feed disappearance measured on d 7, 14, and 20 of the experiment to determine ADG, ADFI, and F/G.

The basal diet (Table 1) was corn-soybean meal-based and contained 3% added fat. In the basal diet (1.0% true ileal digestible lysine; 20.1% CP), sand was substituted with L-lysine·HCl to form the other experimental diets (1.1, 1.2, 1.3, and 1.4% true ileal digestible lysine). In addition, a positive control diet was formulated to contain more soybean meal than the basal diet (44.2 vs. 32.2% of the diet) and no L-lysine·HCl to provide 1.3% true ileal digestible lysine. Diets were formulated using NRC (1998) estimated amino acid concentrations and true digestibility values. Diets were fed in meal form.

Data were analyzed in randomized complete block design using the GLM procedures of SAS with pen as the experimental unit. Linear and quadratic polynomial contrasts were performed to determine the effects of increasing true ileal digestible lysine. Pigs fed the positive control diet (1.3% true ileal digestible lysine; no L-lysine·HCl) were contrasted with pigs fed the experimental treatment containing 1.3% true ileal digestible lysine to determine if there was a difference in growth performance based on lysine source. Pigs fed the positive control diet were also contrasted with the experimental treatment containing 1.0% true ileal digestible lysine to ensure that lysine was below the pigs' requirement in the basal diet.

Results and Discussion

Pigs fed the positive control diet (1.3% true ileal digestible lysine; no L-lysine·HCl) had similar ($P>0.20$) growth performance (Table 2) as those fed 1.3% true ileal digestible lysine (0.38% L-Lysine·HCl). This indicates that pigs respond similarly to lysine from L-Lysine·HCl or soybean meal. Pigs fed the positive control diet had better ($P<0.01$) ADG and F/G than pigs fed 1.0% true ileal digestible lysine which demonstrated that the basal diet was deficient in lysine.

Increasing true ileal digestible lysine improved (quadratic, $P<0.04$) ADG and F/G throughout the experiment. Average daily gain was maximized in pigs fed the diet containing 1.1% true ileal digestible lysine. However, feed efficiency improved as true ileal digestible lysine increased to 1.3%. It is not uncommon to observe that the level needed to maximize feed efficiency is slightly higher than that needed to maximize ADG.

These results suggest that the optimal true ileal digestible lysine requirement for the 27 to 44 lb pig is 1.1% and 1.3% for ADG and F/G, respectively. The requirement observed in this experiment is equal to 1.23% and 1.43% total dietary lysine. These estimates are slightly higher than suggested by the 1998 NRC estimate of 1.01% true ileal digestible lysine. Other recent experiments have shown improvements in growth performance with higher levels of lysine, including the threonine trial in this publication, which observed an improvement in gain as the true ileal digestible lysine level increased from 1.1% to 1.2%. Also, research from the University of Missouri has estimated the lysine requirement at 1.32% true ileal digestible lysine, similar to the requirement for F/G in this experiment.

Table1. Basal Diet Composition (As-Fed Basis)

Ingredient, %	1.0% True Ileal Digestible Lysine	Positive Control
Corn	59.85	47.95
Soybean meal (46.5% CP)	32.27	44.22
Soybean oil	3.00	3.00
Monocalcium phosphate (21% P)	1.65	1.60
Sand	1.00	0.94
Limestone	0.95	0.95
Antimicrobial[a]	0.50	0.50
Salt[b]	0.35	0.35
Vitamin premix	0.25	0.25
Trace mineral premix	0.15	0.15
DL-Methionine	0.04	0.10
Calculated composition		
CP (N × 6.25), %	20.10	24.60
ME, kcal/lb	1,538	1,536
Cal, %	0.79	0.82
P, %	0.74	0.78
Lysine, %	1.13	1.46
Methionine, %	0.36	0.48
Threonine, %	0.77	0.96

[a]Provided 25 g/ton carbadox.

[b]L-Lysine replaced sand to provide either 1.1, 1.2, 1.3, and 1.4% true ileal digestible lysine.

Table 2. Effect of True Ileal Digestible Lysine on Nursery Pig Growth Performance[a,b]

	True Ileal Digestible Lysine, %					Positive		Probability (*P*<)		
Item	1.0	1.1	1.2	1.3	1.4	Control[c,d]	SEM	Lysine	Linear	Quadratic
Day 0 to 7										
ADG, lb	0.79	0.88	0.88	0.82	0.91	0.88	0.05	0.64	0.33	0.74
ADFI, lb	1.34	1.34	1.32	1.20	1.26	1.23	0.06	0.41	0.12	0.87
Feed/gain[e]	1.72	1.52	1.51	1.49	1.40	1.40	0.05	0.01	0.01	0.32
Day 7 to 14										
ADG, lb[e]	1.48	1.56	1.62	1.64	1.54	1.69	0.05	0.04	0.16	0.03
ADFI, lb	2.28	2.23	2.23	2.15	2.04	2.17	0.05	0.06	0.01	0.38
Feed/gain[e]	1.54	1.43	1.37	1.31	1.32	1.29	0.03	0.01	0.01	0.03
Day 14 to 20										
ADG, lb	1.70	1.80	1.70	1.72	1.65	1.76	0.06	0.61	0.39	0.37
ADFI, lb	2.70	2.70	2.59	2.46	2.39	2.55	0.07	0.02	0.01	0.51
Feed/gain[e]	1.59	1.50	1.52	1.44	1.46	1.44	0.04	0.06	0.01	0.36
Day 0 to 20										
ADG, lb[e]	1.30	1.39	1.38	1.38	1.35	1.43	0.03	0.07	0.45	0.04
ADFI, lb	2.08	2.06	2.02	1.91	1.87	1.96	0.04	0.01	0.01	0.48
Feed/gain[e]	1.59	1.48	1.45	1.39	1.39	1.37	0.02	0.01	0.01	0.01

[a]Average initial BW, 27.0 lb.

[b]Values are means of six replicates (pens) and 5 pigs per pen.

[c]Positive control contained 1.3% true digestible lysine with no L-lysine·HCl.

[d]Contrast vs. 1.3% true ileal digestible lysine (*P*>0.20).

[e]Contrast 1.0% true ileal digestible lysine vs. positive control (*P*<0.01).