Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 926

2002

The optimal true ileal digestible threonine requirement for nursery pigs between 24 to 49 lb

B W. James

J L. Usry

Michael D. Tokach

See next page for additional authors

The optimal true ileal digestible threonine requirement for nursery pigs between 24 to 49 lb

Abstract

A 22-d growth assay was conducted to determine the appropriate true ileal digestible threonine requirement to maximize growth performance of pigs between 24 and 49 lb. The 10 experimental treatments consisted of two basal diets (1.1% and 1.2% true ileal digestible lysine; 16.1% and 17.4% CP) with increasing levels of threonine (50, 55, 60, 65, 70% threonine:lysine). Pigs fed 1.2% true ileal digestible lysine had improved ADG and F/G compared to pigs fed 1.1% lysine, this suggest that the requirement was greater than 1.1% true ileal digestible lysine. There was a threonine Ã— lysine interaction for feed efficiency. Pigs fed 1.1% true ileal digestible lysine had a greater response to increasing levels of threonine than pigs fed the diet containing 1.2% lysine. Increasing levels of threonine had no effect on ADG. Feed efficiency improved with increasing levels of true ileal digestible threonine:lysine and was maximized at 70% and 65% threonine:lysine for pigs fed 1.1% and 1.2% true ileal digestible lysine, respectively. However, the greatest improvements in feed efficiency were observed as the ratio increased to approximately 60%.; Swine Day, Manhattan, KS, November 14, 2002

Keywords

Swine day, 2002; Kansas Agricultural Experiment Station contribution; no. 03-120-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 897; Threonine; Growth Performance; Nursery Pigs; Swine

Authors

B W. James, J L. Usry, Michael D. Tokach, Robert D. Goodband, Jim L. Nelssen, and Steven S. Dritz

THE OPTIMAL TRUE ILEAL DIGESTIBLE THREONINE REQUIRMENT FOR NURSERY PIGS BETWEEN 24 to 49 lb[1]

B. W. James, M. D. Tokach, R. D. Goodband, S. S. Dritz[2], J. L. Nelssen, and J. L. Usry

Summary

A 22-d growth assay was conducted to determine the appropriate true ileal digestible threonine requirement to maximize growth performance of pigs between 24 and 49 lb. The 10 experimental treatments consisted of two basal diets (1.1% and 1.2% true ileal digestible lysine; 16.1% and 17.4% CP) with increasing levels of threonine (50, 55, 60, 65, 70% threonine:lysine). Pigs fed 1.2% true ileal digestible lysine had improved ADG and F/G compared to pigs fed 1.1% lysine, this suggest that the requirement was greater than 1.1% true ileal digestible lysine. There was a threonine × lysine interaction for feed efficiency. Pigs fed 1.1% true ileal digestible lysine had a greater response to increasing levels of threonine than pigs fed the diet containing 1.2% lysine. Increasing levels of threonine had no effect on ADG. Feed efficiency improved with increasing levels of true ileal digestible threonine:lysine and was maximized at 70% and 65% threonine:lysine for pigs fed 1.1% and 1.2% true ileal digestible lysine, respectively. However, the greatest improvements in feed efficiency were observed as the ratio increased to approximately 60%.

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

Introduction

Several studies have been conducted at Kansas State University to determine the optimal level of threonine for nursery pigs. However, results have been conflicting. As the cost of crystalline amino acids decreases, the use of crystalline threonine and less soybean meal becomes more economical. The objective of this experiment was to determine the appropriate true ileal digestible threonine requirement of nursery pigs between 24 and 49 lb.

Procedures

Three hundred eighty pigs were weaned at approximately 18 d of age. Before initiating the experiment, pigs were allowed a 20-d adjustment period following weaning. At approximately 25 lbs, pigs were randomly allotted to pens (5 pigs/pen and 7 pens/treatment) within blocks based on initial weight. Ten treatments were randomly allotted to pens within blocks. Pigs were housed for the 22-d growth assay in an environmentally controlled nursery. Each pen (4 × 4 ft) contained a stainless steel self-feeder and one nipple waterer to allow ad libitum consumption of feed and water.

Corn and soybean meal were analyzed for complete amino acid profiles. These levels were multiplied by the 1998 NRC true ileal

[1]Appreciation is expressed to Ajinomoto-Heartland Lysine, Chicago, IL, for partial support of this experiment.
[2]Food Animal Health and Management Center.

digestible coefficients and used in diet formulation. The 10 experimental treatments consisted of two basal diets (Table 1) containing 1.1% and 1.2% true ileal digestible lysine with 0.55% and 0.60% true ileal digestible threonine, respectively, and all other amino acids except threonine formulated to meet or exceed NRC requirements. Crystalline L-threonine was added to the basal diets to provide 55, 60, 65, and 70% true ileal digestible threonine:lysine. Experimental treatment diets were fed from 20 to 41 d post-weaning. Pigs were weighed and feed disappearance measured on d 8, 15, and 22 of the experiment.

The performance criteria (ADG, ADFI, F/G) were analyzed in a randomized complete block design using the general linear model (GLM) procedure of SAS with pen as the experimental unit. Linear and quadratic polynomial contrasts were performed to determine the effects of increasing levels of dietary threonine.

Results and Discussion

For the 22-d experiment there was a threonine × lysine interaction ($P<0.04$) for F/G. Pigs fed 1.1% lysine had optimal feed efficiency when fed 70% threonine:lysine with the greatest response occurring as the level of threonine increased from 50% to 55%, whereas pigs fed 1.2% true ileal digestible lysine had optimal feed efficiency when fed the diet containing 65% threonine:lysine. Pigs fed the diets containing 1.2% true ileal digestible lysine had better ADG ($P<0.01$) and feed efficiency than pigs fed 1.1% lysine. This would suggest that the lysine requirement of these pigs was greater than 1.1% true ileal digestible lysine.

Average daily gain was not affected ($P > 0.07$) by increasing levels of true ileal digestible threonine. However, F/G improved (quadratic, $P < 0.01$) with increasing levels of true ileal digestible threonine and was lowest for pigs fed diets containing 70% and 65% threonine:lysine for the 1.1% and 1.2% true ileal digestible lysine diets, respectively. However, feed efficiency started to stabilize as the level of threonine increased to approximately 60% threonine:lysine. These results would support data from our previous studies. In previous research, it was found that the true ileal digestible threonine requirement was approximately 62% of lysine, no improvements in ADG were found but an increase in feed efficiency with increasing levels of dietary threonine was noted.

Table 1. Basal Diet Composition (As-Fed Basis)[a]

Ingredient, %	1.1% TID Lysine Basal Diet	1.2% TID Lysine Basal Diet
Corn	68.94	65.20
Soybean meal (46.5% CP)	23.61	27.06
Soybean oil	3.00	3.00
Monocalcium phosphate (21% P)	1.70	1.70
Limestone	0.95	0.95
Antimicrobial[b]	0.50	0.50
L-Lysine·HCl	0.41	0.43
Salt[c]	0.35	0.35
Sand	0.25	0.25
Vitamin premix	0.25	0.25
Trace mineral premix	0.15	0.15
DL-Methionine	0.14	0.17
Calculated composition		
CP (N × 6.25), %	16.10	17.40
ME, kcal/lb	1,542	1,541
Cal, %	0.78	0.79
P, %	0.71	0.73
Lysine, %	1.21	1.32
Methionine, %	0.44	0.48
Threonine, %	0.64	0.70

[a]Basal diets contained 50% true digestible threonine:lysine.

[b]Provided 25 g/ton carbadox.

[c]L-Threonine replaced sand to provide either 55, 60, 65, or 70% true digestible threonine:lysine.

Table 2. Effect of Tue Digestible Threonine:Lysine Ratio on Growth Performance of the Nursery Pig[a,b]

	True digestible lysine, %															
	1.10					1.20										
	Threonine, % of lysine											Probability (*P*<)				
Item	50	55	60	65	70	50	55	60	65	70	SEM	Thr×Lys	Lys	Thr	Linear	Quad
Day 0 to 8																
ADG, lb	0.58	0.78	0.74	0.66	0.69	0.79	0.76	0.81	0.79	0.78	0.04	0.09	0.01	0.24	0.60	0.09
ADFI, lb	1.33	1.38	1.27	1.22	1.24	1.34	1.30	1.30	1.24	1.26	0.04	0.54	0.98	0.01	0.01	0.82
Feed/gain	2.33	1.79	1.77	1.89	1.82	1.71	1.74	1.64	1.60	1.66	0.07	0.01	0.01	0.01	0.01	0.01
Day 8 to 15																
ADG, lb	1.22	1.35	1.19	1.15	1.22	1.36	1.40	1.28	1.25	1.37	0.05	0.87	0.01	0.04	0.16	0.36
ADFI, lb	2.06	2.19	1.89	1.78	1.83	2.09	2.04	1.88	1.76	1.90	0.06	0.47	0.69	0.01	0.01	0.13
Feed/gain	1.71	1.63	1.59	1.56	1.51	1.55	1.47	1.48	1.41	1.39	0.04	0.95	0.01	0.01	0.01	0.53
Day 15 to 22																
ADG, lb	1.51	1.49	1.39	1.42	1.47	1.48	1.58	1.54	1.52	1.52	0.05	0.42	0.01	0.62	0.49	0.78
ADFI, lb	2.52	2.35	2.16	2.15	2.15	2.34	2.37	2.28	2.19	2.21	0.06	0.18	0.77	0.01	0.01	0.16
Feed/gain	1.67	1.58	1.55	1.51	1.47	1.58	1.49	1.48	1.44	1.46	0.04	0.80	0.01	0.01	0.01	0.16
Day 0 to 15																
ADG, lb	0.89	1.05	0.95	0.89	0.94	1.05	1.06	1.03	1.02	1.05	0.04	0.27	0.01	0.09	0.53	0.65
ADFI, lb	1.69	1.76	1.56	1.48	1.52	1.69	1.65	1.57	1.50	1.56	0.04	0.38	0.80	0.01	0.01	0.26
Feed/gain	1.92	1.68	1.65	1.68	1.63	1.60	1.56	1.53	1.48	1.48	0.03	0.04	0.01	0.01	0.01	0.01
Day 0 to 22																
ADG, lb	1.08	1.19	1.09	1.06	1.11	1.19	1.22	1.19	1.17	1.20	0.03	0.75	0.01	0.07	0.43	0.80
ADFI, lb	1.95	1.95	1.75	1.69	1.72	1.90	1.88	1.80	1.72	1.76	0.04	0.40	0.97	0.01	0.01	0.13
Feed/gain	1.80	1.64	1.61	1.60	1.55	1.59	1.53	1.51	1.46	1.47	0.02	0.04	0.01	0.01	0.01	0.01

[a]Initial BW, 24.1 lb.
[b]Values are means of seven replications (pens) and five pigs per pen in a 22-d experiment.