Kansas Agricultural Experiment Station Research Reports

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

Article 558

1994

Appropriate methionine:lysine ratio for the segregated early-weaned pig (1994)

K Q. Owen

B T. Richert

K G. Friesen

See next page for additional authors

Recommended Citation

Owen, K Q.; Richert, B T.; Friesen, K G.; Goodband, Robert D.; Nelssen, Jim L.; Tokach, Michael D.; and Dritz, Steven S. (1994) "Appropriate methionine:lysine ratio for the segregated early-weaned pig (1994)," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6398

APPROPRIATE METHIONINE:LYSINE RATIO FOR THE SEGREGATED EARLY-WEANED PIG[1]

K. Q. Owen, R. D. Goodband, J. L. Nelssen, M. D. Tokach, S. S. Dritz, B. T. Richert, and K. G. Friesen

Summary

A total of 350 crossbred pigs (9.0 ± 2 d old and 8.4 lb +/- 2.5 BW) was used to determine the appropriate methionine:lysine ratio in diets for the segregated early-weaned pig. Two lysine levels (1.8 and 1.4%) and five methionine levels within each lysine level were used in a 2 × 5 factorial arrangement. Methionine:lysine ratios ranged from 21.5 to 33.5%. From d 0 to 21 postweaning, all diets contained 25% dried whey, 12% lactose, 7.5% spray dried porcine plasma, 6.0% select menhaden fish meal, and 1.75% spray-dried blood meal. The basal diets containing 1.4 and 1.8% lysine were formulated to contain .301 and .387% dietary methionine, respectively. Cornstarch was replaced by Alimet(equivalent to 88% methionine) to provide the four additional experimental methionine concentrations for each lysine level. Cystine contents of all diets within each lysine level were identical at .52 and .66% for the 1.4 and 1.8% lysine diets, respectively. All other amino acids were formulated on a digestible basis to ensure that methionine was first limiting. No methionine × lysine interactions were observed throughout the 21-day experiment. Increasing dietary methionine increased average daily gain (ADG) during each week of the trial, with the maximum observed at approximately .50 and .39% methionine in the diets containing 1.8 and 1.4% dietary lysine, respectively (27.5% of lysine). Dietary methionine level had no effect on feed efficiency (F/G). Increasing dietary lysine improved ADG and F/G. In conclusion, with either dietary lysine level used, maintaining methionine at 27.5% of lysine was required to maximize growth from d 0 to 21 postweaning.

(Key Words: Pigs, Growth, Methionine, Sulfur Amino Acids, Lysine.)

Introduction

Segregated early weaning involves weaning pigs at 5 to 10 d of age and moving the pigs to a site separate from the sow herd. This breaks the vertical transmission of disease from the sow to piglets, which substantially improves pig growth performance. Advances in nutrition, environmental regulation, and management techniques have allowed the adoption of segregated early weaning as a common management technique. The major limitation in diets for this age of pig is an understanding of the appropriate amino acid levels needed to optimize pig performance. Lysine is generally thought of as the first limiting amino acid in swine diets. However, previous research at Kansas State University reports that methionine becomes the first limiting amino acid in high nutrient dense diets containing spray-dried blood coproducts (porcine plasma and blood meal) because of their low methionine concentrations.

[1]Appreciation is expressed to Novus International, Inc., St. Louis, MO, for financial support and for the Alimet used in this experiment. Appreciation is also expressed to Newsham Hybrids, Colorado Springs, CO, for providing partial support and the pigs used in this research.

Therefore, the objective of this experiment was to determine the appropriate methionine:lysine ratio needed to obtain optimal growth performance in the segregated early-weaned pig.

Procedures

Three hundred-fifty crossbred pigs (9.0 ± 2 d old and 8.4 lb) were allotted by weight, in a 2 × 5 factorial arrangement, to pens (4 ft × 4 ft) with tri-bar flooring. Blocks were based on initial weight, with five pigs per pen and seven replications (pens) per treatment. Pigs were housed in an environmentally regulated nursery in which the initial temperature (94°F) was reduced by 5°F each week. Pens contained a four-hole self-feeder and one nipple waterer to allow ad libitum consumption of feed and water.

Treatments were arranged in a 2 × 5 factorial arrangement with two lysine levels (1.4 and 1.8%) and five methionine:lysine ratios (21.5, 24.5, 27.5, 30.5, and 33.5%). A control diet was formulated for each lysine level (1.4 and 1.8%). Soybean meal content was increased to formulate the 1.8% lysine diet. The control diet with 1.4% lysine was formulated to contain .301% methionine (.25% digestible), .52% cystine, .90% Ca, and .80% P. The diet with 1.8% lysine contained .387% methionine (.33% digestible), .66% cystine, .90% Ca, and .80% P. Cornstarch was replaced by Alimet (an 88% aqueous solution of DL-2-hydroxy-4-(methylthio) butanoic acid, DL-HMB) to provide the four additional experimental methionine concentrations for each lysine level (.301, .343, .385, .427, and .469% at 1.4% lysine and .387, .441, .495, .549, and .603% at 1.8% lysine). Cystine contents of all diets within each lysine level were identical. Dietary isoleucine, threonine, and tryptophan were maintained relative to lysine according to a ratio proposed for the 20- to 40-lb pig. Additionally, choline chloride was supplemented to all diets at .10%. All diets contained 25% dried whey, 12% lactose, 7.5% spray dried porcine plasma, 6.0% select menhaden fish meal, and 1.75% spray-dried blood meal. Pigs and feeders were weighed on d 7, 14, and 21 to determine ADG, ADFI, and F/G.

Data were analyzed as a randomized complete block design in a 2 × 5 factorial arrangement. Data were analyzed for methionine × lysine interactions. Analysis of variance was performed using the GLM procedure of SAS, and linear and quadratic polynomials were evaluated.

Results and Discussion

No methionine × lysine interactions were observed for any of the response criteria during the 21-day experiment (Table 2). From d 0 to 7 postweaning, increasing dietary methionine increased (quadratic, $P<.01$) ADG and ADFI regardless of dietary lysine. Inflection point analysis projected maximum ADG at a methionine:lysine ratio of 27%. Increasing dietary lysine improved ($P<.01$) ADG and F/G from d 0 to 7 postweaning, with pigs fed 1.8% lysine having 10 and 7% greater ADG and F/G, respectively, than those fed 1.4% lysine.

From d 0 to 14 postweaning, increasing dietary methionine improved ADG (quadratic, $P<.01$), ADFI (quadratic, $P<.01$), and F/G (linear, $P = .11$). Inflection point analysis projected maximum ADG at a methionine to lysine ratio of 27 and 27.5% for pigs fed the 1.4 and 1.8% lysine treatments, respectively. Cumulative (d 0 to 21 postweaning) ADG (quadratic, $P<.01$), ADFI (quadratic, $P<.05$), and F/G (quadratic, $P<.05$) were improved by increasing dietary methionine. Inflection point analysis projected maximum ADG at a methionine to lysine ratio of 28% for pigs fed either 1.4 or 1.8% lysine and maximum F/G at a ratio of 28.2% for pigs on the 1.8% lysine treatment. Increasing dietary lysine improved ADG ($P<.01$) and F/G ($P<.01$) from d 0 to 14 and for the overall experiment.

These data agree with earlier research conducted at Kansas State University on the appropriate methionine requirement for the Phase I and Phase II diets (Swine Day, 1993). Additionally, the methionine:lysine ratio is similar to the ratio suggest by researchers at the University of Illinois. In conclusion, these data suggest that the early-weaned pig requires a methionine:lysine ratio of approximately 27.5 to 28% to optimize growth performance.

Table 1. Composition of Basal Diets[a]

	Dietary lysine, %	
Item, %	1.4	1.8
Corn	25.22	35.20
Soybean meal (48% CP)	13.5	3.74
Dried whey	25.00	25.00
Spray-dried porcine plasma	7.50	7.50
Select Menhaden fish meal	6.00	6.00
Lactose	12.00	12.00
Soybean oil	5.00	5.00
Monocalcium phosphate	1.26	1.43
Spray-dried blood meal	1.75	1.75
Limestone	.13	.17
Mineral premix	.15	.15
Vitamin premix	.25	.25
L-lysine•HCl	.27	.10
Antibiotic[b]	1.00	1.00
Copper sulfate	.08	.08
Corn starch[c]	.22	.17
Alimet	.04	-
L-Isoleucine	.10	.05
L-cystine	.22	.25
L-threonine	.15	.02
Choline chloride (60%)	.10	.10
L-Tryptophan	.06	.04
Total	100.00	100.00

[a]Diets were formulated to contain either .387 or .301% dietary methionine (1.4 and 1.8% lysine, respectively) and .9 Ca, and .8% P from d 0 to 21 postweaning.
[b]Provided 50 g/ton carbadox.
[c]Alimet replaced cornstarch on a lb/lb basis to provide .343, .385, .427 and .469% dietary methionine in the 1.4% lysine diet and .441, .495, .549, and .603% dietary methionine in the 1.8% lysine diet.

Table 2. **Performance of Pigs Fed Increasing Dietary Methionine at Two Lysine Levels[a]**

		1.8% Lysine					1.4% Lysine					
	Met., %	.387	.441	.495	.549	.603	.301	.343	.385	.427	.469	
Item	Met:lys, %	21.5	24.5	27.5	30.5	33.5	21.5	24.5	27.5	30.5	33.5	CV
d 0 to 7												
ADG,lb[bf]		.45	.50	.54	.46	.45	.42	.44	.45	.47	.40	17.2
ADFI,lb[b]		.42	.45	.48	.43	.42	.41	.45	.43	.46	.39	14.5
F/G[f]		.94	.92	.89	.94	.94	.98	1.04	.99	.98	.99	9.5
d 0 to 14												
ADG,lb[bf]		.63	.68	.73	.68	.66	.56	.60	.64	.65	.60	10.4
ADFI, lb[b]		.66	.69	.72	.67	.68	.65	.70	.71	.73	.67	9.7
F/G[ef]		1.07	1.01	.99	.98	1.03	1.17	1.17	1.12	1.13	1.12	5.6
d 0 to 21												
ADG, lb[bdf]		.77	.84	.88	.83	.82	.71	.76	.82	.82	.77	6.8
ADFI, lb[c]		.89	.90	.91	.87	.87	.86	.91	.94	.96	.88	7.7
F/G[cdf]		1.15	1.07	1.04	1.05	1.07	1.21	1.19	1.15	1.16	1.15	4.5

[a]Three hundred fifty weanling pigs (initially 8.4 lb and 9.0 ± 2 d old) were used with 5 pigs per pen and 7 pens per treatment.
[bc]Quadratic effect of dietary methionine ($P<.01$ and .05, respectively).
[de]Linear effect of dietary methionine ($P<.01$ and = .10).
[f]Lysine effect ($P<.01$).