THE INFLUENCE OF INCREASING DIETARY METHIONINE ON THE PERFORMANCE OF THE EARLY-WEANED PIG (10 ± 4 D OF AGE)[1]

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

Summary

Four hundred thirty-five pigs (initially 7.7 lb and 10.1 ± 4 d of age) were used to determine the influence of increasing dietary methionine on growth performance of the early-weaned pig (10 d of age). Pigs were blocked by weight in a randomized complete block design, resulting in six to 13 pigs per pen and a total of eight pens per treatment. Experimental diets were fed from d 0 to 21 postweaning. Dietary methionine levels were achieved by adding increasing liquid methionine (Alimet) to a common basal diet. The control diet was corn-based and contained 8.7% moist extruded soy protein concentrate, 10% spray-dried porcine plasma, 25% dried whey, 5% dried skim milk, 3% fish meal, and 1.75% spray-dried blood meal. All diets were formulated to contain 1.8% lysine. Liquid methionine replaced sucrose in the control diet to provide dietary methionine levels of .36, .40, .44, .48, .52, and .56%. Each diet contained .62% cystine and 704 g of added choline chloride (60%). During d 0 to 7 postweaning, average daily gain (ADG) and feed efficiency (F/G) were improved by increasing dietary methionine, with optimal performance observed between .48 and .52% dietary methionine. However, average daily feed intake (ADFI) was not affected by dietary methionine. For the entire period (d 0 to 21 postweaning), ADG and F/G were improved with increasing dietary methionine and optimized between .48 to .52% dietary methionine. On d 7 postweaning, plasma urea nitrogen was reduced as dietary methionine increased, with pigs fed the .52% methionine having the lowest plasma urea nitrogen concentrations. These data suggest that the early-weaned pig (10-d of age) needs approximately .48 to .52% dietary methionine when fed a diet containing 1.8% lysine to optimize growth performance.

(Key Words: Methionine, Starter Pigs, Growth.)

Introduction

Advances in high nutrient density diets has allowed the adoption of medicated and segregated early weaning as a common management technique. Segregated early weaning (SEW) involves weaning pigs at 5 to 10 days of age and moving the pigs to a site separate from the sow herd. This allows producers to break disease cycles from the sow to piglet, which substantially improves pig performance. Our limitation for the SEW diets is an understanding of the appropriate amino acid levels needed to optimize pig performance. Because high levels of spray-dried blood products (porcine plasma and blood meal) are utilized in this SEW diet, and blood products are deficient in methionine, this is often the first limiting amino acid. Previous research at Kansas State University has shown substantial improvements in performance of 21-d-old pigs

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when DL-methionine was added to Phase I diets containing high levels of blood products. Therefore, the objective of this study was to determine the methionine requirement of the early-weaned pig (10-d of age).

Procedures

Four hundred thirty-five pigs (initially 7.7 ± 2.1 lb and 10.1 ± 4 d of age) were allotted randomly by weight to one of six dietary methionine treatments. For the first 21 d postweaning, pigs were fed diets containing either .36, .40, .44, .48, .52, or .56% dietary methionine (Table 1). The control diet was formulated to contain 1.8% lysine, .36% methionine, 1.0% Ca, and .90% P. Cornstarch was replaced by liquid methionine (Alimet, an 88% aqueous solution of DL-2-hydroxy-4-(methylthio) butanoic acid, DL-HMB) to achieve the experimental methionine levels. Because cystine can meet half the total sulphur amino acid requirement, cystine content of all diets was .67%. This exceeds the amount needed to meet the highest level of methionine (based on a 50:50 mixture of methionine and cystine). To ensure that methionine was the first limiting amino acid, dietary isoleucine, threonine, and tryptophan were maintained relative to lysine according to the ratio proposed by researchers at the University of Illinois. The levels of corn, moist extruded soy protein concentrate (8.7%), dried whey (25%), spray-dried porcine plasma (10%), dried skim milk (3%), and spray-dried blood meal (1.75%) were identical in all experimental diets.

Six to 13 pigs per pen were used in each block with six pens per treatment. Pigs were housed in an environmentally controlled nursery in 5 × 7 ft pens. Pens contained a four-hole self-feeder and one nipple waterer to allow ad libitum consumption of feed and water. Pigs were weighed and feed disappearance was measured on d 7, 14, and 21 after weaning to determine ADG, ADFI, and F/G. Blood samples were taken on d 7 and 14 postweaning to determine blood urea N.

Data were analyzed as a randomized complete block design. General linear model procedures were used with initial weight serving as the blocking factor. Orthogonal polynomial contrasts were used to determine linear and quadratic effects.

Table 1. Control Diet Composition, %[a]

Ingredient	Control
Corn	37.32
Soy protein concentrate	8.65
Dried whey	25.00
Spray-dried porcine plasma	10.00
Dried skim milk	5.00
Select menhaden fish meal	3.00
Soy oil	5.00
Monocalcium phosphate	1.87
Spray-dried blood meal	1.75
Antibiotic[b]	1.00
Limestone	.42
Vitamin premix	.25
Mineral premix	.15
Lysine, 98%	.10
Copper sulfate	.08
Cystine	.11
Choline chloride	.10
Cornstarch[c]	.20
Total	100.00

[a]Control diet (SEW) was formulated to contain 1.8% lysine, .36% methionine, 1.0% Ca and .90% P.
[b]Provided 50 g/ton apramycin.
[c]Liquid methionine (Alimet) replaced corn starch on a lb/lb basis to achieve the .40,.44, .48, .52, .56% dietary methionine experimental diets.

Results and Discussion

During d 0 to 7 postweaning, ADG and F/G were improved (linear, P<.01) by increasing dietary methionine, with optimal performance observed between .48 and .52% dietary methionine. However, ADFI was not affected by dietary methionine. For the entire period (d 0 to 21 postweaning), ADG and F/G were improved (linear, P<.05) with increasing dietary methionine and optimized between .48 to .52% dietary methionine.

On d 7 postweaning, plasma urea nitrogen was reduced (quadratic, P<.10) as dietary methionine increased, with pigs fed the diet containing .52% methionine having the lowest plasma urea nitrogen concentrations. However, pigs fed .44% dietary methionine had the lowest blood urea nitrogen concentration on d 14 postweaning.

These data suggest that the early-weaned pig (d 10) needs approximately .48 to .52% dietary methionine when fed a diet containing 1.8% lysine to optimize growth performance. This implies that a methionine to lysine ratio of approximately 28% exists for the 10-d-old pig. This research adds to earlier results from our laboratory and the University of Illinois indicating that the optimal methionine to lysine ratio is approximately 28% for pigs from 7 to 40 lb. However, more work is needed to further address the requirements of other amino acids for the segregated early-weaned pig (d 10).

Table 2. Performance of Pigs Fed Increasing Levels of Dietary Methionine[a]

	Dietary methionine, %						
Item	.36	.40	.44	.48	.52	.56	CV
d 0 to 7							
ADG, lb[b]	.23	.26	.28	.30	.31	.31	22.6
ADFI, lb	.27	.27	.29	.28	.30	.30	13.8
F/G[b]	1.21	1.08	1.06	1.01	1.02	1.00	14.8
d 0 to 14							
ADG, lb[b]	.36	.40	.40	.44	.43	.43	14.1
ADFI, lb	.47	.48	.47	.49	.47	.48	9.2
F/G[b,d]	1.31	1.21	1.19	1.15	1.12	1.14	7.3
d 0 to 21							
ADG, lb[b]	.49	.53	.54	.55	.55	.57	7.6
ADFI, lb[c]	.62	.63	.65	.66	.64	.66	7.4
F/G[c]	1.29	1.20	1.22	1.23	1.20	1.18	7.2
Pig weight, lb							
d 0	7.78	7.80	7.75	7.83	7.77	7.75	1.1
d 7[b]	9.42	9.62	9.73	9.93	9.92	9.92	4.3
d 14[b]	12.83	13.42	13.32	13.95	13.81	13.81	5.8
d 21[b]	18.00	18.94	19.07	19.33	19.20	19.73	4.5

[a]Four hundred thirty-five weanling pigs (initially 7.6 lbs and 10.1 d of age) were used with 6 to 13 pigs/pen and 8 pens/treatment.
[b,c]Linear effect of dietary methionine (P<.01 and P<.10, respectively).
[d]Quadratic effect of dietary methionine (P<.10).