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EFFECTS OF INCREASING PANTOTHENIC ACID ON GROWTH PERFORMANCE OF SEGREGATED EARLY-WEANED PIGS [1]

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Summary

We conducted a 28-d experiment to evaluate effects of increasing dietary pantothenic acid on growth performance of segregated early-weaned pigs. Pigs (initially 8.8 ± 2.2 lb and 11 ± 2 d of age) were fed a control diet (no added pantothenic acid) or the control diet with 30, 60, and 120 ppm of added pantothenic acid. Increasing pantothenic acid increased ADG and ADFI linearly from d 0 to 14 after weaning. However, from d 14 to 28 after weaning, pigs fed 60 mg/kg of added pantothenic acid tended to have the greatest ADG and ADFI. For the cumulative period (d 0 to 28 after weaning), ADG and ADFI increased linearly with increasing added pantothenic acid. The linear improvements in weanling pig growth performance observed with increasing pantothenic acid indicated that current NRC (1998) requirement estimates may be too low. Because of the wide range of pantothenic acid concentrations used in our study, additional research is warranted to define a more precise requirement estimate.

(Key Words: Starter Pigs, Pantothenic Acid, Performance.)

Introduction

Recent research has demonstrated that segregated early weaning (10 to 17 days of age) results in minimizing the transmission of disease from the sow to the pig. Pigs raised in these high-health environments have been shown to have increased growth rate compared to those conventionally weaned. Part of the improved growth performance has been linked to decreased immune system activation. Studies have found that these pigs may require increased dietary nutrient fortification to support the increased protein deposition. Recently, Iowa State University demonstrated that high-health pigs had a greater requirement for B-complex vitamins (approximately 4 times NRC, (1988) estimates) compared to pigs with chronic immune system activation. However, these pigs were fed a B-vitamin deficient diet for 1 week before experimental diets were fed, possibly confounding the response to vitamin supplementation. Therefore, the objective of this experiment was to evaluate the effects of increasing concentrations of one B-vitamin, pantothenic acid, on growth performance of pigs when fed from d 0 to 28 after weaning in an age-segregated production system.

Procedures

A total of 275 weanling pigs (initially 8.8 ± 2.2 lb and 11 ± 2 d of age) was used in a 28-d growth trial. Pigs were blocked by weight and allotted randomly to one of four dietary treatments. There were seven or eight

[1]The authors thank Daiichi Pharmaceutical Corp., Tokyo, Japan for providing the vitamin premix and pantothenic acid and partial financial support. We also thank Adam McNess and Eichman Brothers, St. George, KS for the use of facilities and animals.

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pigs per pen and nine replications per treatment. Pigs were fed a control diet (no added pantothenic acid) or diets containing 30, 60, or 120 ppm of added pantothenic acid replacing corn starch in the control diet. All pigs were fed a pelleted corn-soybean meal diet containing 25% dried whey, 6.7% spray-dried animal plasma, 6.0% select menhaden fish meal, and 5.0% lactose from d 0 to 14 after weaning (Table 1). This diet was formulated to contain 1.7% total lysine, .9% Ca, and .8% P. From d 14 to 28, all pigs were fed a corn-soybean meal diet containing 15% dried whey, 2.0% spray-dried blood meal, 2.0% select menhaden fish meal, and 1.0% spray-dried animal plasma. This diet was in a meal form and formulated to contain 1.4% lysine, .85% Ca, and .75% P. Pigs remained on their respective pantothenic acid levels throughout the 28-d experiment.

Pigs were housed in an environmentally controlled nursery in 5 × 5 ft pens. All pens contained one self-feeder and two nipple waterers to provide ab libitum access to feed and water. Average daily gain, ADFI, and feed:gain ratio (F/G) were determined by weighing pigs and measuring feed disappearances on d 7, 14, 21, and 28 after weaning.

Samples of each diet were collected and analyzed for pantothenic acid concentration. Given the wide range in permitted analytical variation in vitamin analysis, analyzed values were within acceptable expectations (Table 1).

Results and Discussion

From d 0 to 7 after weaning, increasing pantothenic acid had no effect on pig growth performance (Table 2). However, from d 7 to 14 after weaning, ADG and ADFI tended to increase (linear, $P = .09$ and .03 respectively) with increasing pantothenic acid, but feed efficiency was not affected. For the entire period (d 0 to 14 after weaning), ADG (linear, $P = .01$) and ADFI (linear, $P = .04$) increased with increasing pantothenic acid, but feed efficiency was not affected. Although the response to increasing pantothenic acid was linear, little or no improvement in ADG or ADFI occurred for pigs fed 30 or 60 ppm, but a large increase occurred for those fed 120 ppm.

From d 14 to 28 after weaning, ADG and ADFI tended to improve with increasing pantothenic acid (quadratic, $P<.10$ and linear, $P<.08$, respectively). Unlike the response from d 0 to 14 after weaning, pigs fed 60 ppm of added pantothenic acid had the greatest ADG and ADFI.

For the entire experimental period (d 0 to 28 after weaning), ADG and ADFI increased (linear, $P<.02$) with increasing pantothenic acid. Although a quadratic response was not observed, the greatest increases in ADG and ADFI were observed as pantothenic acid increased from 30 to 60 ppm. Feed efficiency was unaffected by increasing pantothenic acid.

The results of this experiment suggest that increasing pantothenic acid improved growth performance of pigs weaned at 11 d of age and averaging 8.8 lb. These data suggest that current NRC (1998) estimates (12 ppm) for pantothenic acid requirements are too low for maximum pig performance. The linear response to increasing pantothenic acid observed from d 0 to 14 followed by the quadratic response observed from d 14 to 28 suggests that the pantothenic acid requirement may decrease as the pig becomes older and feed intake increases. Because of the wide range of pantothenic acid concentrations used in our study, additional research is warranted to define a more precise requirement estimate.

Table 1. Compositions of Experimental Diets

Ingredients, %	Day 0 to 14[a]	Day 14 to 28[b]
Corn	34.55	49.77
Dried whey	25.00	15.00
Soybean meal	12.39	22.89
Spray-dried animal plasma	6.70	1.00
Select menhaden fish meal	6.00	2.00
Lactose	5.00	---
Soybean oil	6.00	3.00
Spray-dried blood meal	1.75	2.00
Antibiotic[c]	1.00	1.00
Monocalcium phosphate	0.76	1.30
Limestone	0.48	0.79
Zinc oxide	0.38	0.25
Vitamin premix[d]	0.25	0.25
Salt	0.20	0.20
L-Lysine HCl	0.15	0.15
Trace mineral premix	0.15	0.15
DL-methionine	0.15	0.10
Corn starch[e]	0.10	0.10
Total	100.00	100.00

[a]Diets were formulated to contain 1.7% lysine, .48% methionine, .9% Ca, and .8% P.
[b]Diets were formulated to contain 1.4% lysine, . 39% methionine, .85% Ca, and .75% P.
[c]Provided 50 g/ton carbodox.
[d]Premix provided the following vitamins per pound of complete feed: vitamin A, 5000 IU; vitamin D_3, 750 IU; vitamin E, 20 IU; vitamin K, 2 mg; vitamin B_{12}, .02 mg; riboflavin, 4.5 mg; niacin, 25 mg; biotin, .10 mg; pyridoxine, 1.5 mg; and pantothenic acid, 0 mg.
[e]Pantothenic acid premix (d-Cal Pan) replaced corn starch to provide the three additional experimental treatments within each phase. Analyzed pantothenic acid concentrations fed 21.4, 49.7, 87.1, and 146.0 from d 0 to 14 after weaning and 12.6, 48.4, 96.8, and 127.0 ppm from d 14 to 28 after weaning for the control, 30, 60, and 120 ppm of added pantothenic acid diets, respectively.

Table 2. Effects of Increasing Pantothenic Acid on Weaning Pig Growth Performance[a]

	Added Pantothenic Acid, ppm					P <		
Item	0	30	60	120	SEM	Linear	Quadratic	Cubic
Day 0 to 7								
ADG, lb	.25	.25	.26	.30	.022	.12	.58	.92
ADFI, lb	.33	.33	.33	.35	.016	.37	.56	.85
F/G	1.39	1.29	1.37	1.22	.092	.26	.79	.41
Day 7 to 14								
ADG, lb	.64	.61	.64	.68	.022	.09	.23	.39
ADFI, lb	.66	.63	.67	.72	.021	.03	.27	.31
F/G	1.04	1.05	1.07	1.06	.032	.55	.73	.87
Day 0 to 14								
ADG, lb	.44	.43	.45	.49	.014	.01	.16	.53
ADFI, lb	.50	.48	.50	.53	.015	.04	.27	.53
F/G	1.12	1.12	1.12	1.10	.024	.48	.84	.90
Day 14 to 21								
ADG, lb	.56	.60	.65	.62	.022	.05	.03	.54
ADFI, lb	.91	.91	.95	.94	.020	.16	.56	.37
F/G	1.68	1.53	1.47	1.54	.050	.10	.01	.92
Day 21 to 28								
ADG, lb	1.03	1.07	1.09	1.09	.030	.20	.40	.98
ADFI, lb	1.39	1.37	1.45	1.43	.025	.12	.58	.09
F/G	1.38	1.30	1.34	1.33	.027	.40	.24	.14
Day 14 to 28								
ADG, lb	.80	.84	.87	.85	.022	.07	.10	.75
ADFI, lb	1.15	1.14	1.20	1.19	.019	.08	.50	.11
F/G	1.48	1.38	1.39	1.41	.025	.16	.02	.29
Day 0 to 28								
ADG, lb	.62	.63	.66	.67	.015	.01	.56	.60
ADFI, lb	.82	.81	.85	.86	.014	.02	.86	.17
F/G	1.35	1.29	1.29	1.30	.020	.14	.11	.35

[a]A total of 275 weanling pigs (initially 8.8 lb ± 2.2 and 11 ± 2 d of age) with seven or eight pigs per pen and nine replications per treatment.