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Pyridoxine, but not thiamin, improves growth performance of weanling pigs

Abstract

Two trials were conducted to determine whether pyridoxine or thiamine needs to be added to the diet for weanling pigs. In the first trial, weanling pigs were fed either a control diet or diets containing added thiamin (2.5 or 5.0 g/ton) or pyridoxine (3.5 or 7.0 g/ton). From d 0 to 14 after weaning, pigs fed added pyridoxine had increased ADG and ADFI, with pigs fed 3.5 g/ton of added pyridoxine having the greatest response. Growth performance was not improved by added thiamin. In a second trial, weanling pigs were fed a control diet or diets containing 1, 2, 3, 4, or 5 g/ton added pyridoxine. From d 0 to 14 after weaning, increasing pyridoxine increased ADG and ADFI, with pigs fed 3 g/ton of added pyridoxine having the greatest ADG. Pyridoxine level had no influence on growth performance from d 14 to 35 after weaning. These results suggest that adding between 2 and 3 g/ton of pyridoxine to the diet maximizes ADG and ADFI from d 0 to 14 after weaning.; Swine Day, Manhattan, KS, November 20, 1997

Keywords

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PYRIDOXINE, BUT NOT THIAMIN, IMPROVES GROWTH PERFORMANCE OF WEANLING PIGS [1]

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Summary

Two trials were conducted to determine whether pyridoxine or thiamine needs to be added to the diet for weanling pigs. In the first trial, weanling pigs were fed either a control diet or diets containing added thiamin (2.5 or 5.0 g/ton) or pyridoxine (3.5 or 7.0 g/ton). From d 0 to 14 after weaning, pigs fed added pyridoxine had increased ADG and ADFI, with pigs fed 3.5 g/ton of added pyridoxine having the greatest response. Growth performance was not improved by added thiamin. In a second trial, weanling pigs were fed a control diet or diets containing 1, 2, 3, 4, or 5 g/ton added pyridoxine. From d 0 to 14 after weaning, increasing pyridoxine increased ADG and ADFI, with pigs fed 3 g/ton of added pyridoxine having the greatest ADG. Pyridoxine level had no influence on growth performance from d 14 to 35 after weaning. These results suggest that adding between 2 and 3 g/ton of pyridoxine to the diet maximizes ADG and ADFI from d 0 to 14 after weaning.

(Key Words: Weanling Pigs, Growth, Pyridoxine, Thiamin.)

Introduction

Thiamin and pyridoxine are two B-vitamins that are abundant in grain-soybean meal diets. For this reason, supplementation in starter pig diets has not been widely recommended. Recently, several breeding-stock companies and vitamin manufacturers have recommended the addition of thiamin (vitamin B_1) and pyridoxine (vitamin B_6) to diets to achieve maximum growth potential. Therefore, the objective of this experiment was to evaluate the effects of added thiamin or pyridoxine on weanling pig growth performance.

Procedures

Experiment 1. A total of 180 weanling pigs (initially 11.02 lb and 21 d of age) was used in a 35-d growth assay. Pigs (PIC Line C22 × 326) were blocked by initial weight, equalized for sex and ancestry, and allotted randomly to each of five dietary treatments in a randomized complete block design. Each treatment had six pigs per pen and six replications (pens) per treatment.

All experimental diets were fed in meal form. Diets fed from d 0 to 14 after weaning were formulated to contain 1.6% lysine, .44% methionine, .90% Ca, and .80% P (Table 1). Diets fed from d 14 to 35 were formulated to contain 1.35% lysine, .38% methionine, .85% Ca, and .75% P. The control diet contained a standard vitamin premix (Table 1) without added thiamin or pyridoxine. Experimental treatments were provided by adding either thiamin mononitrate (2.5 or 5.0 g/ton) or pyridoxine HCl (3.5 or 7.0 g/ton) to the control diet. Pigs were fed the same experimental vitamin concentrations throughout the 35-d study.

[1]The authors thank Daiichi Pharmaceutical Company LTD, Tokyo, Japan for partial financial support for these experiments and to Feed Specialties Co. Inc., Des Moines, IA for providing the pyridoxine HCL and thiamin mononitrate.

Pigs were weighed and feed disappearance was determined weekly after weaning to calculate ADG, ADFI, and G/F.

Experiment 2. A total of 216 weanling pigs (initially 13.6 lb and 21 d of age) was used in a 35 d growth assay to determine the optimum level of pyridoxine to maximize growth performance. Pigs (PIC Line C22 × 326) were blocked by initial weight, equalized for sex and ancestry, and allotted randomly to each of six dietary treatments. Each treatment had six pigs per pen and six replications (pens) per treatment.

The control diet was identical to that used in Exp. 1 (Table 1). The experimental treatments were formed by adding pyridoxine at 1, 2, 3, 4, or 5 g/ton. As in Exp. 1, pigs were weighed and feed disappearance was determined weekly after weaning to calculate ADG, ADFI, and G/F.

Feed samples from both experiments were collected and analyzed for concentrations of thiamin (Exp. 1) and pyridoxine (Exp. 1 & 2) (Tables 2 and 3). Analyzed concentrations generally increased with increasing supplementation. However, analyzed values showed considerable variation from calculated values. We believe that this difference was a result of analytical variation in vitamin analysis. The range in permitted analytical variation for some vitamins ranges from 25 to 45%.

Data were analyzed as a randomized complete block design with pen as the experimental unit. Pigs were blocked on the basis of initial weight and ANOVA was performed using the GLM procedure of SAS.

Results and Discussion

Experiment 1. From d 0 to 14 after weaning, ADG increased then decreased with increasing pyridoxine (quadratic, $P<.05$; Table 4). Pigs fed 3.5 g/ton of added pyridoxine had the greatest ADG. Surprisingly, for pigs fed thiamin, ADG decreased then increased (quadratic, $P<.05$). Average daily gain was decreased for pigs fed 2.5 g/ton of added thiamin but was identical between those fed the control diet and 5.0 g/ton of added thiamin. Average daily feed intake increased then decreased with increasing thiamin and pyridoxine (quadratic, $P<.10$ and .05, respectively). However, F/G decreased then increased (quadratic, $P<.05$) with increasing thiamin. This appeared to be a result of the high feed intake and poor growth of pigs fed 2.5 g/ton of added thiamin. Feed:gain ratio was unaffected by increasing pyridoxine.

From d 14 to 35 after weaning, added thiamin or pyridoxine had no effect on ADG or F/G; however, ADFI increased (linear, $P<.05$) with increasing pyridoxine.

Cumulative results (d 0 to 35) showed quadratic ($P<.05$) responses in ADG and F/G with increasing added thiamin. As for the period from d 0 to 14 after weaning, pigs fed 2.5 g/ton of added thiamin had decreased ADG, but pigs fed the 5.0 g/ton had similar ADG to those fed the control diet. Pigs fed increasing pyridoxine had increased ADFI (linear, $P<.05$) from d 0 to 35. Although ADG and F/G were not significantly improved, ADG was numerically highest for pigs fed the diet containing 3.5 g/ton added pyridoxine, reflecting the response from d 0 to 14.

Experiment 2. Based on the results of Exp. 1, we conducted a second study to determine the pyridoxine requirement of weanling pigs. From d 0 to 14 after weaning, increasing pyridoxine increased then decreased (quadratic, $P<.05$) ADG and ADFI (Table 5). Pigs fed 3 g/ton of added pyridoxine had the maximum ADG and ADFI. The increases in ADG appeared to be a result of increased feed intake, because increasing pyridoxine had no affect on F/G.

From d 14 to 35 or 0 to 35, increasing pyridoxine had no effect ($P>.05$) on pig growth performance; however, ADG and ADFI tended to numerically increase with increasing pyridoxine.

In conclusion, our results suggest that adding thiamin had no positive effect on growth performance of weanling pigs. However, adding pyridoxine improved ADG and ADFI of pigs from d 0 to 14 after weaning. The data suggest a requirement of 2 to 3 g/ton of added pyridoxine in diets fed from d 0 to 14 after weaning. For practical applications of this research, the SEW and transition diets should contain 3 g/ton of added pyridoxine.

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

Ingredients, %	d 0 to 14[b]	d 14 to 35[c]
Corn	41.84	50.72
Dried whey	20.00	10.00
Soybean meal (46.5% CP)	19.63	26.94
Spray-dried animal plasma	5.00	-
Soybean oil	5.00	5.00
Select menhaden fish meal	2.55	-
Spray-dried blood meal	1.75	2.50
Monocalcium phosphate	1.20	1.66
Medication[d]	1.00	1.00
Limestone	.80	.98
Zinc oxide	.38	.25
Vitamin premix[e]	.25	.25
Salt	.20	.25
L-Lysine HCl	.15	.15
Trace mineral premix[f]	.15	.15
DL-Methionine	.15	.15
Total	100.00	100.00

[a]In Exp. 1, diets contained added thiamin (2.5 or 5 g/ton) or pyridoxine (3.5 or 7.0 g/ton), and in Exp. 2, diets contained added pyridoxine (1, 2, 3, 4, and 5 g/ton).
[b]Diets were formulated to contain 1.60% lysine, .44% methionine, .90% Ca, and .80% P and were fed from d 0 to 14 after weaning.
[c]Diets were formulated to contain 1.35% lysine, .38% methionine, .85% Ca, and .75% P and were fed from d 14 to 35. Vitamin additions were identical to those from d 0 to 14.
[d]Provided 50 g/ton carbadox.
[e] Provided per ton of complete feed: 10,000,000 IU vitamin A; 1,500,000 IU vitamin D; 40,000 IU vitamin E; 4 g menadione; 9 g riboflavin; 30 g d-pantothenic acid; 50 g niacin; and 40 mg vitamin B_{12}.
[f] Provided per ton of complete feed: 36 g Mn; 150 g Fe; 150 g Zn; 15 g Cu; 270 mg I; and 270 mg Se.

Table 2. Analyzed Thiamin and Pyridoxine Concentrations, (Exp. 1)[a]

		Added Thiamin, g/ton		Added Pyridoxine, g/ton	
Item	Control	2.5	5.0	3.5	7.0
d 0 to 14					
Thiamin	1.8	4.0	7.1	2.2	2.0
Pyridoxine	2.2	2.9	2.2	9.8	7.3
d 14 to 35					
Thiamin	2.3	7.1	10.6	2.1	2.0
Pyridoxine	3.2	3.1	4.2	3.6	5.3

[a]Values (as-fed basis) represent analysis of one sample per diet for each time period.

Table 3. Analyzed Pyridoxine Concentrations, (Exp. 2)[a]

	Added Pyridoxine, g/ton					
Item	0	1	2	3	4	5
d 0 to 14						
Pyridoxine	3.6	4.6	6.7	6.9	7.4	10.1
d 14 to 35						
Pyridoxine	4.1	5.0	6.5	7.9	8.4	11.1

[a]Values (as-fed basis) represent analysis of one sample per diet for each time period.

Table 4. Effects of Added Thiamin and Pyridoxine on Starter Pig Performance (Exp. 1)[a]

		Added Thiamin, g/ton		Added Pyridoxine, g/ton		
Item	Control	2.5	5.0	3.5	7.0	CV
d 0 to 14						
ADG, lb[bc]	.81	.66	.81	.91	.86	7.9
ADFI, lb[bd]	.96	1.00	.96	1.05	1.00	5.4
F/G[c]	1.18	1.52	1.18	1.15	1.16	5.4
d 14 to 35						
ADG, lb	1.34	1.36	1.40	1.40	1.42	5.1
ADFI, lb[e]	2.15	2.13	2.19	2.22	2.27	4.2
F/G	1.61	1.56	1.56	1.59	1.59	4.9
d 0 to 35						
ADG, lb[c]	1.13	1.08	1.16	1.20	1.19	4.7
ADFI, lb[e]	1.67	1.68	1.70	1.75	1.76	3.5
F/G[c]	1.49	1.56	1.47	1.45	1.47	3.9

[a]A total of 180 weanling pigs (initially 11.02 lb and 21 d of age), six pigs per pen and six pens per treatment.
[b]Quadratic effect of pyridoxine ($P < .05$).
[c]Quadratic effect of thiamin ($P < .05$).
[d]Quadratic effect of thiamin ($P < .10$).
[e]Linear effect of pyridoxine ($P < .05$).

Table 5. Effects of Added Pyridoxine on Starter Pig Performance (Exp. 2)[a]

	Added Pyridoxine, g/ton							Probability (P<)	
Item	0	1	2	3	4	5	CV	Linear	Quadratic
d 0 to 14									
ADG, lb	.79	.80	.88	.93	.84	.85	9.8	.13	.05
ADFI, lb	.92	.94	1.00	1.01	.99	.93	8.8	.41	.03
F/G	1.16	1.18	1.14	1.09	1.19	1.10	6.3	.18	.99
d 14 to 35									
ADG, lb	1.32	1.26	1.35	1.33	1.33	1.33	6.6	.42	.87
ADFI, lb	2.17	2.10	2.23	2.19	2.22	2.23	5.2	.13	.97
F/G	1.64	1.67	1.67	1.67	1.67	1.67	5.5	.68	.93
d 0 to 35									
ADG, lb	1.10	1.08	1.16	1.17	1.13	1.14	5.6	.13	.21
ADFI, lb	1.66	1.63	1.74	1.72	1.73	1.71	4.9	.09	.30
F/G	1.52	1.52	1.49	1.47	1.52	1.49	4.1	.88	.69

[a]A total of 216 weanling pigs (initially 13.6 lb and 21 d of age), six pigs per pen and six pens per treatment.