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EFFECT OF B-VITAMIN SUPPLEMENTATION ON NURSERY PIG GROWTH PERFORMANCE[1]

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Summary

A 35-d growth assay was conducted to determine the effect of added dietary B-vitamins on growth performance of nursery pigs (12.9 lb initial BW). The basal diet (Phase I, 1.5% lysine; Phase II, 1.3% lysine) was formulated to contain no added B-vitamins. The other treatment diets were formed by adding a B-vitamin premix (biotin, folacin, niacin, pantothenic acid, riboflavin, thiamin, B_6, and B_{12}) to the basal diet with the vitamins added at 1, 2, or 4 times NRC (1998) recommendations. In phase I (d 0 to 14) and for the overall trial, pigs fed increasing B-vitamins had increased (linear, $P<0.04$) ADFI and improved (quadratic, $P<0.04$) feed efficiency. Feed efficiency was best for pigs fed the diet with B-vitamins added at the NRC requirement. There was no effect of B-vitamin level ($P>0.09$) on growth performance in phase II (d 14 to 35). These results suggest that B-vitamin supplementation is necessary to maximize growth performance of early-weaned pigs; however, typical margins of safety for B-vitamins can be lowered without affecting growth performance.

(Key Words: B-vitamins, Growth Performance, Nursery Pigs)

Introduction

Frequently B-vitamins are added to nursery pig diets in excess of recommendations of the 1998 NRC. These high levels are provided as a “safety factor”; however, there is economic interest to lower the amount of vitamins added to these diets that are already relatively expensive. Research conducted at Iowa State University has suggested that the B-vitamin requirement of weanling pigs is higher than what is typically fed in the swine industry. However, that study estimated the requirement from pigs that were previously depleted in B-vitamins. Therefore, the objective of this experiment was to determine the appropriate level of B-vitamins to add to nursery pig diets.

Procedures

One hundred and sixty-eight pigs were weaned at approximately 21 d of age. At weaning, pigs were allotted by weight (12.9 lb BW), ancestry, and sex (equal barrows and gilts in each pen) to four dietary treatments within blocks based on initial weight (6 pigs/pen and 7 pens/treatment). Pigs were housed for the 35-day growth assay in an environmentally controlled nursery. Temperature was maintained at 90°F for the first week and reduced to 85°F the second

[1]Appreciation is expressed to the NCR-42 committee for supplying the vitamin test premix and A, D, E, and K premix. This study is a portion of a larger regional experiment evaluating the effects of increased B-vitamin supplementation.

[2]Food Animal Health and Management Center.

week. Each pen (4 ft^2 with slatted metal flooring) contained a stainless steel self-feeder and one nipple waterer to allow ad libitum consumption of feed and water. Pigs were weighed and feed disappearance measured at d 7, 14, 21, 28 and 35 of the experiment. Pigs subject to removal were weighed and feed consumption determined. Reason for removal or treatment was documented.

Pigs were fed a complex starter diet for phase I (1.5% lysine; 20.9% CP) from d 0 to 14 and a corn-soybean meal spray-dried whey-based diet for phase II (1.3% lysine; 19%CP) from d 14 to 35 (Table 1). The basal diet was formulated with no added B-vitamins. For the other treatment diets, a B-vitamin premix (Table 2) was added to the basal diet to provide B-vitamins at 1, 2, and 4 times the NRC (1998) recommendation. Therefore, those diets contained the added B-vitamins in addition to the concentrations in the base ingredients. The phase I diet was pelleted and phase II was fed in meal form.

Data were analyzed in a randomized complete block design using the 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 B-vitamins in weanling pig diets.

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

Ingredient, %	Phase I[b]	Phase II[b]
Corn[c]	35.41	48.54
Soybean meal (46.5% CP)	23.19	24.17
Spray dried whey	20.00	20.00
Lactose	10.00	-
Spray-dried animal plasma	6.00	-
Spray-dried blood cells	-	2.00
Monocalcium phosphate	1.45	1.52
Soybean oil	1.00	1.00
Medication[d]	1.00	1.00
Limestone	0.89	0.76
Salt	0.35	0.35
Zinc oxide	0.28	0.28
L-Lysine·HCL	0.15	0.12
Trace mineral premix[e]	0.13	0.13
DL-Methionine	0.11	0.09
Vitamin A, D, E, K premix	0.05	0.05
B-Vitamin premix[f]	-	-
Calculated composition		
CP (N × 6.25), %	20.9	19.6
ME, kcal/lb	1,494	1,478
Ca, %	0.85	0.82
P, %	0.81	0.77
Total lysine, %	1.50	1.30
Methionine, %	0.41	0.39
Threonine, %	0.96	0.79

[a]Diets were formulated to meet or exceed NRC (1998) requirements.

[b]Phase I was fed from days 0 to 14, phase II from days 14 to 35.

[c]B-vitamin premix replaced corn to provide 1, 2, or 4 lb/ton of premix.

[d]Provided 50 g/ton carbadox.

[e]Contributed per pound of complete diet: Zn (from zinc oxide), 75.97 mg; Fe (from ferrous sulfate), 75.97 mg; Mn (from manganese oxide), 18.0 mg; Cu (from copper sulfate), 7.48 mg; I (from calcium iodate), 0.14 mg; and Se (from sodium selenite), 0.15 mg.

[f]Contributed per lb of complete diet: biotin, 0.023 mg; folacin, 0.14 mg; niacin (available), 8.21 mg; pantothenic acid, 5.10 mg; riboflavin, 1.74 mg; thiamin, 0.45 mg; vitamin B_6, 0.83 mg; and vitamin B_{12}, 8.84 μg. One pound of premix provided the suggested B-vitamin requirement (NRC, 1998) for the 11 lb pig in the complete diet.

Results and Discussion

In phase I (d 0 to 14), there were no differences (P>0.12) in ADG (Table 2). However, pigs fed increasing additions of B-vitamins had increased (linear, P<0.02) ADFI. There were no improvements in F/G from d 0 to 7 or 7 to 14 because of the low variation in the response. Feed efficiency was improved (quadratic, P<0.04) from d 0 to 14 with increasing additions of B-vitamins and was best for pigs fed the B-vitamins added to the NRC requirement.

In phase II, from d 14 to 21, F/G improved (quadratic, P<0.03) with increasing additions of B-vitamins and was also best for pigs fed B-vitamins added at the NRC requirement. From d 28 to 35, ADFI increased (linear,

$P<0.01$) with increasing additions of B-vitamins. However, there were no differences ($P>0.09$) in growth performance for the overall phase II period.

For the overall experiment, increased additions of B-vitamins had no effect ($P>0.16$) on ADG. This is in contrast to the regional experiment, which this trial was a part of, that demonstrated a quadratic improvement in ADG with the best gain observed in pigs fed B-vitamins added at the NRC requirement. Average daily feed intake increased (linear, $P<0.04$) and F/G improved (quadratic, $P<0.04$) with increasing additions of B-vitamins. Feed efficiency was best for pigs fed the diet containing B-vitamins added at the NRC requirement. These results support those of the regional study in which no further improvements in feed efficiency was observed with increased added B-vitamins above the NRC requirement. These results differ from findings at Iowa State University. This is probably because pigs in our experiment and the regional study were not previously depleted of B-vitamins prior to initiation of the experiment.

These results suggest that B-vitamin supplementation is necessary to maximize growth performance of early-weaned pigs; however, typical margins of safety above the added NRC requirement for B-vitamins can be lowered without affecting growth performance.

Table 2. Levels of B-Vitamin Added per Ton of Complete Feed and Current KSU Starter Diet Recommendation

	Added B-Vitamin Concentration			
Ingredient, per ton	NRC	2×NRC	4×NRC	KSU
Biotin, mg	46	92	184	0
Folacin, mg	280	560	1,120	0
Niacin (available), g	16.42	32.84	65.68	45.00
Pantothenic acid, g	10.20	20.40	40.80	25.00
Riboflavin, g	3.48	6.96	13.92	7.50
Thiamin, g	0.90	1.80	3.60	0
B_6, g	1.66	3.32	6.64	[a]
B_{12}, mg	17.68	35.36	70.72	35.00

[a]KSU recommends adding 2 g of pyridoxine per ton of complete feed for pigs weighing less than 15 lb.

Table 3. Effect of B-Vitamin Supplementation on Nursery Pig Growth Performance[a,b,c]

	B-Vitamin					Probability (*P*<)		
Item	0	NRC	2×NRC	4×NRC	SEM	B-Vitamin	Linear	Quadratic
Day 0 to 7								
ADG, lb	0.65	0.66	0.69	0.65	0.03	0.82	0.84	0.47
ADFI, lb	0.55	0.56	0.59	0.58	0.02	0.61	0.30	0.68
F/G	0.87	0.85	0.86	0.89	0.02	0.49	0.36	0.22
Day 7 to 14								
ADG, lb	0.78	0.81	0.81	0.87	0.03	0.23	0.06	0.53
ADFI, lb	0.92	0.90	0.93	1.02	0.03	0.04	0.02	0.09
F/G	1.18	1.12	1.17	1.17	0.03	0.30	0.89	0.22
Day 14 to 21								
ADG, lb	1.05	1.14	1.11	1.11	0.04	0.52	0.48	0.32
ADFI, lb	1.45	1.50	1.48	1.57	0.04	0.24	0.08	0.60
F/G	1.39	1.31	1.34	1.43	0.03	0.11	0.39	0.03
Day 21 to 28								
ADG, lb	1.26	1.20	1.23	1.28	0.05	0.71	0.71	0.29
ADFI, lb	1.97	1.96	1.97	2.04	0.06	0.81	0.45	0.56
F/G	1.56	1.64	1.61	1.60	0.04	0.59	0.58	0.31
Day 28 to 35								
ADG, lb	1.68	1.70	1.71	1.74	0.04	0.74	0.28	0.95
ADFI, lb	2.53	2.49	2.62	2.62	0.04	0.10	0.05	0.64
F/G	1.51	1.46	1.54	1.51	0.02	0.17	0.53	0.63
Day 0 to 14								
ADG, lb	0.71	0.73	0.75	0.76	0.02	0.46	0.12	0.94
ADFI, lb	0.74	0.73	0.76	0.80	0.02	0.07	0.02	0.29
F/G	1.04	0.99	1.02	1.05	0.02	0.11	0.37	0.04
Day 14 to 35								
ADG, lb	1.32	1.35	1.35	1.38	0.03	0.73	0.30	0.96
ADFI, lb	1.98	1.98	2.02	2.08	0.04	0.33	0.09	0.58
F/G	1.49	1.47	1.50	1.51	0.01	0.23	0.19	0.28
Day 0 to 35								
ADG, lb	1.08	1.10	1.11	1.13	0.02	0.53	0.16	0.99
ADFI, lb	1.48	1.48	1.52	1.57	0.03	0.20	0.04	0.50
F/G	1.37	1.34	1.37	1.38	0.01	0.03	0.07	0.04

[a]Average initial BW, 12.9 lb.

[b]Values are means of seven (pens) and six pigs per pen.

[c]Dietary lysine was 1.5% in phase I (days 0 to 14) and 1.3% in phase II (days 14 to 35).