INFLUENCE OF DIETARY NIACIN ON STARTER PIG PERFORMANCE [1]

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Summary

Two experiments were conducted using 415 weanling pigs (175 in Exp. 1, 240 in Exp. 2) to determine the influence of dietary niacin inclusion on starter pig performance. Pigs were fed a control diet with no added niacin or the control diet with 25, 50, 75 or 100 g/ton of added niacin. From d 0 to 8, increasing dietary niacin increased ADG and ADFI up to 50 g/ton of added niacin. Overall, pigs fed increasing levels of niacin tended to have improved ADG. These results suggest feeding 50 g/ton of added dietary niacin to complex nursery pig diets to improve growth performance.

(Key Words: Niacin, Starter, Performance.)

Introduction

Niacin has long been accepted as an essential vitamin for swine diets; however, the optimal level of inclusion receives considerable debate. According to a 1997 survey of vitamin inclusion rates, the average inclusion rate for niacin was 39 g/ton. The average of the 25% of the companies with the highest inclusion rate was 61 g/ton. The average of the lowest 25% of the companies was 23 g/ton. Vitamin requirements of pigs are influenced by many factors including the health status, previous nutrition, vitamin levels in other ingredients in the diet, and level of metabolic precursors in the diet. The most recent data published in the U.S. on niacin inclusion in starter diets found a linear increase in ADG through 90 g/ton. Due to the paucity of data concerning niacin requirements of nursery pigs and the wide range in supplementation rates in the commercial industry, we conducted this experiment to determine the influence of niacin level in nursery diets on starter pig performance.

Procedures

In Exp. 1, 175 weanling pigs (10.7 lb and 12 ± 2 days of age) were used in a 35d growth study. Pigs were housed in an environmentally regulated nursery in 4 × 4 ft pens at the Kansas State University Segregated Early Weaning facility. Pigs were provided ad libitum access to feed and water. Pigs were blocked by initial weight in a randomized complete block design. There were 7 replicate pens per treatment and each pen contained 5 pigs.

The trial was divided into four phases based on diet complexity (Table 1). The four phases were fed from d 0 to 4, d 4 to 8, d 8 to 22, and d 22 to 35. The first two diets were pelleted at the Kansas State University Grain Science Feed Mill using a 5/32 die and conditioned to 140°F. The last two diets were fed in meal form. Pigs were weighed and feed disappearance was determined to calculate ADG, ADFI, and F/G.

In Exp. 2, 240 pigs (initially 10.8 lb, 12 ± 2 d) were housed in a research facility on a commercial grower farm in NE Kansas.

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There were 8 pigs per pen (5 × 5 ft) with 6 pens per treatment, and pigs were allowed ad libitum consumption of feed and water. Pens of pigs were randomly assigned to dietary treatments, similar to that in Exp. 1. Pigs were also fed similar diets and similar data were collected as in Exp. 1.

Data from both trials were pooled and analyzed as a randomized complete block design with pen as the experimental unit using the GLM procedure of SAS. The model included linear and quadratic contrasts for increasing dietary niacin levels.

Results and Discussion

From d 0 to 8, pigs fed increasing levels of niacin had improved ADG (quadratic, $P<0.05$) and ADFI (quadratic, $P<0.02$) with pigs fed 50 g/ton additional niacin having the greatest improvement in ADG (Table 3). From d 8 to 22, increasing niacin tended to improve F/G (quadratic, $P<0.11$). Overall (d 0 to 38), pigs fed increasing levels of niacin tended to have improved ADG (quadratic, $P<0.12$). There were no differences ($P>0.21$) in overall ADFI or feed efficiency.

The niacin in corn is unavailable to the pig, while niacin from soybean meal, is highly available. Excess dietary tryptophan can also be converted to niacin by pigs. The diets fed in this experiment were formulated to exceed the pigs' requirement for tryptophan (Table 2). When calculating the available niacin from the basal diet including the potential niacin from tryptophan, the diets fed from d 0 to 22 were similar to the niacin requirement estimate (NRC, 1998). However, because feed intake was very low from d 0 to 8, increasing niacin improved growth performance. Therefore, these results suggest that nursery pigs require 25 to 50 g/ton of added niacin to improve growth performance.

Table 1. Composition of Basal Diets

Ingredient, %	D 0 to 4[a]	D 4 to 10[a]	D 10 to 24[b]	D 24 to 38[b]
Corn	33.06	39.70	48.66	56.46
Soybean meal (46.5%)	12.71	23.01	27.33	34.29
Spray-dried whey	25.00	20.00	10.00	-
Spray-dried animal plasma	6.70	2.50	-	-
Fish meal	6.00	2.50	5.00	-
Soybean oil	6.00	5.00	5.00	5.00
Lactose	5.00	-	-	-
Spray-dried blood meal	1.65	2.50	-	-
Medication[c]	1.00	1.00	1.00	0.50
Monocalcium phosphate (21% P)	0.75	1.30	1.00	1.50
Limestone	0.45	0.73	0.55	0.95
Corn starch[d]	0.40	0.40	0.40	0.40
Zinc oxide	0.38	0.38	0.25	-
Salt	0.20	0.30	0.25	0.35
Vitamin premix[e]	0.25	0.25	0.25	0.25
Lysine HCl	0.15	0.15	0.15	0.15
DL-methionine	0.15	0.13	0.01	-
Trace mineral premix[f]	0.15	0.15	0.15	0.15

[a]Fed in pelleted form. [b]Fed in meal form. [c]Provided 55 ppm carbadox from d 0 to 24 and 28 ppm from d 24 to 38. [d]Cornstarch was replaced by niacin (wt/wt) to provide supplemental niacin levels of 0, 25, 50, 75, 100 g/ton. [e]Vitamin premix provided 11,000 USP units vitamin A, 1,650 USP units vitamin D_3, 40 IU vitamin E, 4.4 mg vitamin K, 44 μg B_{12}, 10 mg riboflavin, and 33 mg pantothenic acid per kg of diet. [f]Trace mineral premix provided 165 mg zinc, 165 mg iron, 40 mg manganese, 17 mg copper, 0.30 mg iodine, and 0.30 mg selenium per kg of diet.

Table 2. Available Niacin Content of Basal Diets

Item, mg/kg	D 0 to 4	D 4 to 10	D 10 to 24	D 24 to 38
Total basal diet[a]	20.7	19.5	22.6	22.8
From corn[b]	(7.9)	(9.5)	(11.8)	(13.6)
Total available[c]	12.8	10.0	10.8	9.2
From excess tryptophan[d]	8.2	3.6	2.4	10.0
Total niacin	20.0	13.6	13.2	19.2
Requirement[e]	20.0	15.0	12.5	10.0

[a]Analyzed values.
[b]Calculated from NRC (1998).
[c]Available niacin in basal diet excluding corn.
[d]Potential niacin from excess tryptophan over requirement (NRC, 1998).
[e]NRC (1998).

Table 3. Effects of Increasing Niacin on Nursery Pig Growth Performance[a]

	Niacin, g/ton						Contrasts, (P<)		
Item	0	25	50	75	100	SEM	Trt[b]	Linear	Quadratic
D 0 to 8									
ADG, lb	0.28	0.27	0.32	0.30	0.28	0.021	0.36	0.80	0.05
ADFI, lb	0.33	0.33	0.36	0.36	0.33	0.017	0.13	0.61	0.02
F/G	1.21	1.29	1.15	1.26	1.27	0.061	0.54	0.33	0.39
D 8 to 22									
ADG, lb	0.62	0.66	0.66	0.61	0.63	0.021	0.46	0.22	0.22
ADFI, lb	0.89	0.90	0.91	0.84	0.88	0.025	0.75	0.88	0.56
F/G	1.44	1.38	1.40	1.38	1.43	0.032	0.34	0.11	0.26
D 22 to 35									
ADG, lb	1.15	1.13	1.15	1.17	1.17	0.035	0.58	0.92	0.20
ADFI, lb	1.56	1.58	1.55	1.55	1.54	0.059	0.54	0.90	0.22
F/G	1.36	1.40	1.35	1.33	1.32	0.024	0.93	0.97	0.69
D 0 to 35									
ADG, lb	0.75	0.75	0.77	0.75	0.75	0.022	0.48	0.72	0.12
ADFI, lb	1.02	1.04	1.02	1.00	1.00	0.034	0.56	0.95	0.21
F/G	1.37	1.37	1.34	1.34	1.34	0.016	0.74	0.37	0.68

[a]Values represent means of two trials (7 replicates with 5 pigs/pen in Exp. 1, and 6 replicates with 8 pigs/pen in Exp. 2) that have been pooled.
[b]No treatment × trial interactions (P>0.20).