DIET ACIDIFICATION EFFECTS ON PERFORMANCE OF EARLY-WEANED PIGS

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Story in Brief

A six-week growth trial involving 72 weanling pigs was conducted to determine the effects of dietary acidifiers on pig performance in a three-phase nursery feeding regime. Each feeding phase consisted of a two-week period. During Phase 1 pigs were fed one of the following diets: 1) a basal control diet devoid of acidifiers, 2) the basal diet with .35% Syneracid (a complex of organic and inorganic acids), or 3) the basal diet with 2% fumaric acid. Syneracid level was decreased to .225% and .1% in Phase 2 and 3, respectively. During wk 1, pigs fed Synearcid and fumaric acid had improved gains of 15% and 55%, respectively when compared with those fed the control diet. Similarly, pigs fed either acid consumed 19% more feed than those fed the control diet. Feed efficiency was also improved by the addition of acidifiers. During wk 2, pigs fed Syneracid and fumaric acid had 34% and 13% higher gains, respectively than pigs fed the control diet. During Phase 1, the magnitude of improvements in daily gains in pigs fed Syneracid or fumaric acid was 27% and 25%, respectively when compared with those fed the control diet. This improvement in gains was achieved with a similar feed intake among treatments. Therefore, pigs fed Syneracid and fumaric acid were 16% and 14% more efficient than those fed the control diet, respectively. During Phase 2 and 3, pig performance was similar among treatment groups. These results indicate that addition of acidifiers to the weanling pig diet improved performance, and that Syneracid at a lower inclusion level during Phase 1 (7 lb/ton) was more effective in improving performance than fumaric acid (40 lb/ton).

(Key Words: Syneracid, Fumaric Acid, Acidifier, Performance.)

Introduction

There has been a considerable amount of research regarding the use of organic acids to promote acidification of the intestinal tract in young pigs. Interest in acidifying early-weaned pig diets started with the discovery that young pigs have limited capacity to maintain proper gastric pH (Ravindran and Kornegay, 1993) and the observation that feed acidification improved nutrients digestibility (Kirchgessner and Roth, 1982) and reduced proliferation of coliform bacteria (Scipioni et al., 1978; Ravindran and Kornegay, 1993).

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These effects have been shown to improve performance. However, the benefits of adding acidifiers to the early-weaned pig diet should be weighed against their cost-effectiveness.

It has been suggested that a mixture of organic and inorganic acids would enhance the effectiveness of acidification due to their ability to dissociate over a broad range of pH values, thus providing an optimum pH balance throughout the gastrointestinal tract (Ravindran and Kornegay, 1993). In addition, acidification can be achieved with a lower dietary inclusion level. Therefore, this study was conducted to determine the effect of dietary acidifiers on nursery pig performance, and to compare the efficacy of a complex of organic and inorganic acids (Syneracid™) at a lower inclusion level with fumaric acid.

Materials and Methods

Seventy-two pigs (Hampshire and Yorkshire) were group weaned (from one farrowing room) when the oldest pigs were 26 d old, and the youngest pigs were 20 d old to evaluate the use of acidifiers in a three-phase nursery feeding program. Pigs were grouped by age (36 pigs in each of two groups) and stratified by litter, weight and sex to pens containing six pigs. Pens from each age group were randomly assigned to one of three treatments as described in Table 1. Syneracid and fumaric acid were substituted for an equal quantity of corn in the basal diets (Table 2).

Pigs were housed in an environmentally regulated nursery in pens (4'11" x 5') with woven wire flooring. The initial temperature was 86°F and was subsequently decreased 2°F per week. Pigs had ad libitum access to one nipple waterer and a five-hole feeder. Pig body weight and feed intake were determined weekly to evaluate average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (feed/gain).

The data for each response criteria were analyzed by least square analysis of variance. Pen was considered the experimental unit and the models for ADG, ADFI, feed/gain and pig weight included the effects of weaning age, treatment, and the interaction. The *t* test was used to evaluate differences among treatment means.

Results and Discussion

The effect of acidification on ADG, ADFI, and feed/gain are presented in Table 3. Data from the two age groups were combined since no age x treatment interaction was observed ($P>.1$). During wk 1, ADG was improved by 15% ($P<.1$) in pigs fed Syneracid and by 55% ($P<.05$) in pigs fed fumaric acid when compared with pigs fed the control diet devoid of acidifiers. During wk 2, gain was improved by 34% ($P<.1$) and by 13% in pigs fed Syneracid or fumaric acid,

respectively, when compared with pigs fed the control diet. For the two week Phase 1 period, the magnitude of improvement in pigs fed Syneracid or fumaric acid was 27% (P<.1) and 25%, respectively, when compared with pigs fed the control diet. Pigs fed Syneracid during wk 3, wk 4, and for the two week Phase 2 period continued to exhibit numerically higher gains than pigs fed the control diet (22%, 2%, and 9%, respectively). During Phase 2, inclusion of fumaric acid failed to improve gain when compared with pigs fed the control diet or those fed Syneracid. Average daily gain was not affected by either acidifier source during Phase 3 when pigs were fed a simpler corn-soybean meal diet.

Average daily feed intake was enhance by 19% (P<.1) during wk 1 by inclusion of either Syneracid or fumaric acid while, during the remainder of the trial, ADFI was similar among dietary treatments. Improvements in feed/gain for pigs fed both acidifiers was similar to the improvements observed in ADG although differences were significant only during wk 1, wk 3, and Phase 1. During Phase 1 feed efficiency was improved by 16% (P<.05) in pigs fed Syneracid and by 14% (P<.1) in pigs fed fumaric acid when compared with those fed the control diet. During Phase 2, the magnitude of improvement for feed/gain due to dietary acidification was reduced, and during Phase 3 feed/gain was similar among dietary treatments. Pig weight throughout the study was improved by the inclusion of Syneracid in the diet and pigs fed Syneracid weighed 2.12 lb more than pigs fed the control diet devoid of acidifiers and 2.39 lb more (P<.1) than pigs fed fumaric acid (Table 4). While pigs fed fumaric acid exhibited improved weight gain through wk 1 and 2, the improvement in weight did not continue throughout the study.

In summary, this study suggests that addition of acidifiers to the early-weaned pig diet improved performance, and that Syneracid at an inclusion level of 7 lb/ton in Phase 1 and 4.5 lb/ton in Phase 2 was more effective in improving performance than fumaric acid at an inclusion level of 40 lb/ton.

Literature Cited

Kirchgessner, M. and F. X. Roth. 1982. Pig News and Information. 3:259.
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Table 1. Arrangement of treatments.

	Treatment		
Phase	1	2	3
1 (wk 1 and wk 2 PW[a])	Phase 1 control	Control + .35% Syneracid[b]	Control + 2% fumaric acid
2 (wk 3 and wk 4 PW[a])	Phase 2 control	Control + .225% Syneracid[b]	Control + 2% fumaric acid
3 (wk 5 and wk 6 PW[a])	Phase 3 control	Control + .1% Syneracid[b]	Control + 2% fumaric acid

[a] PW = Postweaning.
[b] Agrimerica, Inc., Northbrook, IL.

Table 2. Composition of basal diets.

	Diet[a]		
	Phase 1	Phase 2	Phase 3
Ingredient, %	Week 1 and 2	Week 3 and 4	Week 5 and 6
AP-820[b]	5.00		
Whey, dehydrated	20.00	5.00	
Soybean oil	4.00		
AP-300[c]	1.50	2.00	
Soybean meal, 44%	7.25	18.50	31.75
Corn, ground	54.095	68.52	64.31
Ethoxiquin	.025		
Lysine HCl	.30	.30	.28
Fishmeal	5.00	2.50	
Flavor, berry	.10		
DL-Methionine	.05		
Mecadox[d]	.25	.25	.25
$CuSO_4$	.03	.03	.08
Calcium carbonate		.30	.55
Vit-Min premix[e]	.38	.38	.38
Special premix	.12		
Dicalcium phosphate	1.90	1.82	2.00
Salt		.40	.40

[a] As fed basis. Diets were formulated to contain 1.46% lysine, 1% Ca, and .85% P in Phase 1; 1.3% lysine, .85% Ca, and .75% P in Phase 2 and 3, and to exceed the NRC (1988) standards for all nutrients.

[b] Plasma protein source, American Protein Corp., Ames, IA.

[c] Blood meal source, American Protein Corp., Ames, IA.

[d] Contains 22 g Carbadox per kg.

[e] Vitamins and minerals met or exceed the NRC (1988) requirements.

Table 3. Effect of diet acidification on growth performance of weanling pigs [a].

Item	Treatment		
	1 Control	2 Syneracid	3 Fumaric Acid
No. of pigs	24	24	24
No. of pens	6	6	6
ADG, lb			
Week 1[f]	.27[b]	.31[bc]	.42[c]
Week 2	.53[d]	.71[e]	.60[de]
Phase 1 (week 1 and week 2)	.40[d]	.51[e]	.50[de]
Week 3	.68	.83	.73
Week 4	1.32	1.34	1.20
Phase 2 (week 3 and week 4)	.99	1.08	.96
Phase 3 (week 5 and week 6)	1.34	1.31	1.27
ADFI, lb			
Week 1	.36[d]	.43[e]	.43[e]
Week 2	.67	.74	.72
Phase 1 (week 1 and week 2)	.52	.58	.57
Week 3	1.31	1.29	1.22
Week 4	2.08[de]	2.23[d]	1.96[e]
Phase 2 (week 3 and week 4)	1.70	1.76	1.59
Phase 3 (week 5 and week 6)	2.51	2.51	2.36
Feed/gain			
Week 1	1.35[b]	1.18[bc]	1.05[c]
Week 2	1.28	1.09	1.22
Phase 1 (week 1 and week 2)[g]	1.32[b]	1.11[c]	1.14[bc]
Week 3	1.95[d]	1.57[e]	1.75[de]
Week 4	1.58	1.67	1.65
Phase 2 (week 3 and week 4)	1.77	1.62	1.70
Phase 3 (week 5 and week 6)	1.89	1.96	1.88

[a] Values are least squares means.
[b,c] Means in the same row with different superscripts differ (P<.05).
[d,e] Means in the same row with different superscripts differ (P<.1).
[f] Treatment 1 differs from treatment 2 (P<.1).
[g] Treatment 1 differs from Treatment 3 (P<.1).

Table 4. Effect of diet acidification on pig weight (lb)[a].

Item	Treatment		
	1 Control	2 Syneracid	3 Fumaric Acid
Initial pig weight	14.69	14.98	14.80
Week 1	16.59[d]	17.15[de]	17.71[e]
Week 2[f]	20.27[b]	22.13[c]	21.87[bc]
Week 3	25.48[d]	27.91[e]	26.99[de]
Week 4	34.71	37.30	35.37
Week 5	44.17[d]	47.39[e]	44.63[de]
Week 6	53.45[de]	55.57[d]	53.18[e]

[a] Values are least squares means.

[b,c] Means in the same row with different superscripts differ (P<.05).

[d,e] Means in the same row with different superscripts differ (P<.1).

[f] Treatment 1 differs from Treatment 3 (P<.1).