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Effect of acidification on starter pig performance and nutrient digestibility

Authors

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EFFECT OF ACIDIFICATION ON STARTER PIG PERFORMANCE AND NUTRIENT DIGESTIBILITY

**T. L. Weeden, J. L. Nelssen, J. A. Hansen,
and K. L. Richardson**

Summary

One hundred ninety-six pigs (21 d of age and 12.3 lb initial wt) were used to evaluate the effect of adding an organic acid blend (OAB)¹ to starter diets on growth performance and nutrient digestibility. The four dietary treatments consisted of a control diet and the OAB replacing corn at 3, 4.5, and 6 lb/ton in both phases 1 and 2. In phase 1 (0 to 14 d) diets, contained 20% dried skim milk, 20% dried whey, and 5% soybean oil. Phase 2 diets (15 to 35 d) contained 10% dried whey and 5% soybean oil. There was no response in ADG, FI, or F/G to the addition of OAB to starter diets in either phase 1 or phase 2. Fecal samples were collected on d 12 (phase 1) of the experiment via rectal massage, and apparent digestibility of nitrogen and dry matter were calculated using chromic oxide (.25%) as an indigestible marker. Nitrogen and dry matter digestibility decreased linearly with increasing levels of OAB. This trial demonstrates that addition of OAB has no effect on performance when pigs consumed high milk-product diets.

(Key Words: Starter, Performance, Digestion, Acid.)

Introduction

The early-weaned pig has an immature digestive system and is somewhat limited in digestive capability; therefore, lowering the pH of the diet by feeding combinations of organic acids may improve digestibility and growth performance of early weaned pigs. Previous research has concentrated on addition of fumaric, hydrochloric, citric, or phosphoric acids to simple corn-soybean meal diets at levels of 1 to 4%, resulting in 5 to 10% improvements in feed efficiency only in the first 2 wk postweaning. The objective of this experiment was to determine the effect on pig performance and nutrient digestibility from addition of lower inclusion rates of an organic acid blend (OAB) to high nutrient density starter diets during phase 1 (0 to 14 d) and more simple diets during phase 2 (15 to 35 d).

Procedures

A 5-wk growth trial was conducted to evaluate the effects of various levels of OAB on pig performance and apparent nutrient digestibilities. Dietary treatments included OAB levels of .150, .225, and .300% of the diet. These levels were attained by replacing corn from the control diet with 3, 4.5, or 6 lb/ton of OAB, respectively. One hundred ninety-six

¹The authors express appreciation to SmithKline Animal Health Products, which donated the Stacidem® for testing.

crossbred pigs weaned at 21 ± 2 d, with an average weight of 12.3 lb were utilized. Pigs were housed in an environmentally controlled nursery with feed and water supplied ad libitum throughout the experiment. Pigs were allotted by litter and sex within weight blocks to the four dietary treatments. There were seven replications per treatment with seven pigs per pen. Feed intakes per pen and individual pig weights were recorded weekly. On d 12 postweaning (phase 1) fecal samples were collected via rectal massage and frozen for later analysis. Apparent digestibilities of dry matter and nitrogen were calculated using chromic oxide (.25%) as an indigestible marker.

Compositions of the control diets are shown in Table 1. A pelleted diet containing 40% milk products and 5% soybean oil was fed during phase 1 (0 - 14 d) containing 1.45% lysine, .90% Ca, and .80% P. In phase 2 (15 to 35 d), pigs were fed a meal diet containing 10% dried whey, 5% fish meal, and 5% soybean oil and formulated to contain 1.25% lysine, .90% Ca and .80% P.

Results and Discussion

The effect of OAB on growth performance is shown in Table 2. Pigs fed the OAB diets showed no improvement over the control diet for ADG, FI, or F/G in phase 1, phase 2, or the cumulative 5-wk experiment.

In phase 1, a linear ($P < .07$) decrease in the digestibilities of N and DM occurred as levels of OAB increased (Table 3).

These results indicate that the digestibility of high milk product diets (phase 1) do not benefit from addition of organic acids to the diet. These complex diets are highly digestible, thus the addition of acid did not improve protein digestibility, as often occurs with simple corn-soy diets. Although this decrease in digestibility is commonly found with organic acid addition to complex diets, the reason is unclear. One reason may be a slight problem with acidosis from organic acid addition to high milk diets, since research at Illinois has shown increased performance with acid-treated complex diets when sodium bicarbonate was added. Previous research with organic acid additions to starter diets has shown that most of the improved digestibility of simple corn-soybean meal was due to the lowered pH denaturing the protein. The low level additions of OAB ranging from .15 to .30% may not decrease pH enough to improve digestibility. By 6 to 8 wk of age, the digestive system of the pig has matured enough to digest most corn-soybean meal diets quite satisfactorily. This may explain why addition of organic acids to phase 2 diets did not improve pig performance, regardless of whether a complex or simple diet was fed. Based on the results of this experiment, the addition of low levels of OAB to complex starter-pig diets is not justified.

Table 1. Composition of Diets

Ingredient, %	Phase 1 ^a (control)	Phase 2 ^b (control)
Corn ^c	32.91	56.12
Soybean meal (44% CP)	18.20	—
Soybean meal (48% CP)	—	20.05
Fish meal	—	5.00
Dried skim milk	20.00	—
Dried whey	20.00	10.00
Soybean oil	5.00	5.00
Monocalcium phosphate	1.23	1.35
Limestone	.44	.48
Salt	.10	.25
L-lysine, HCL	.22	.20
D-L methionine	.10	—
Copper sulfate	.10	.10
Chromic oxide	.25	—
Selenium premix ^d	.05	.05
Trace mineral premix ^e	.15	.15
Vitamin premix ^f	.25	.25
Antibiotic ^g	1.00	1.00
Total	100.00	100.00

^aCalculated analysis for phase 1: 1.45% lysine, .9% Ca, .8% P.

^bCalculated analysis for phase 2: 1.25% lysine, .9% Ca, .8% P.

^cAn organic acid blend (Stacidem®) replaced corn at the rate of 3, 4.5, and 6 lb/ton in phase 1 and phase 2.

^dEach lb contains 272.4 mg Se.

^eContains 10% Mn, 10% Fe, 10% Zn, 4% Ca, 1% Cu, .4% K, .3% I, .2% Na, and .1% Co.

^fEach lb contains: vitamin A, 1,000,000 IU; vitamin D₃, 100,000 IU; vitamin E, 4,000 IU; menadione, 1.32 mg; riboflavin, 2 mg; niacin, 12 mg; d-pantothenic acid, 8 mg; vitamin B₁₂, 8 mg.

^gSupplied the following per lb of diet: 10 mg furazolidone, 50 mg oxytetracycline, 45 mg arsanilic acid.

Table 2. Effect of and Organic Acid Blend (OAB)^a on Starter Pig Performance^b

Item	Control	.15% OAB ^b	.225% OAB	.3% OAB	CV
0-2 wk					
ADG, lb	.73	.69	.66	.71	9.2
FI, lb/d	.76	.75	.70	.73	10.6
F/G	1.15	1.15	1.13	1.08	11.1
3-5 wk					
ADG, lb	1.27	1.28	1.26	1.28	6.8
FI, lb/d	2.34	2.31	2.23	2.35	7.5
F/G	1.95	1.83	1.86	1.92	8.0
0-5 wk					
ADG, lb	1.05	1.04	1.02	1.05	6.7
FI, lb/d	1.70	1.69	1.62	1.70	7.5
F/G	1.67	1.64	1.64	1.66	4.2

^aOAB was Stacidem®.

^bTotal of 196 weanling pigs, 7 pigs/pen with 7 pens/treatment; avg initial wt 12.3 lb, ave final wt 48.7 lb.

Table 3. Effect of an Organic Acid Blend (OAB)^a on Nutrient Digestibility

Item	Control	.15% OAB	.225% OAB	.30% OAB	CV
Apparent nitrogen					
digestibility, % ^b	88.20	87.49	84.54	86.57	2.3
Apparent dry matter					
digestibility, % ^c	88.95	87.53	87.14	87.68	1.7

^aOAB was Stacidem®.

^bStacidem® effect: linear decrease in digestibility (P<.02).

^cStacidem® effect: linear decrease in digestibility (P<.07).