

EFFECT OF CARNICHROME® ON GROWTH PERFORMANCE OF WEANLING PIGS IN A COMMERCIAL ENVIRONMENT¹

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Summary

A 43-day growth study with a total of 384 weanling pigs (14 ± 2 d of age) was conducted to evaluate the effects of Carnichrome®, a combination of L-carnitine and chromium picolinate, on growth performance of weanling pigs. Secondary objectives were to compare pigs fed diets with or without a feed-grade medication, evaluate any interactive effects between Carnichrome and medication, and identify any carryover effect once medication was withdrawn from the diet. Experimental diets were arranged in a 2×3 factorial to compare the main effects of medication (none or Denagard/CTC, 35/400 g/ton) and Carnichrome (none, 25, and 100, or 50 and 100 ppm, respectively, of L-carnitine and chromium picolinate). No interactions between Carnichrome and Denagard/CTC were detected ($P > 0.17$). Pigs fed Denagard/CTC had improved ADG ($P < 0.01$), and F/G ($P < 0.02$) from d 0 to 10, 10 to 29, 0 to 29, and overall (d 0 to 43) compared with those of pigs fed diets without Denagard/CTC. In addition, pigs fed diets containing Denagard/CTC tended to have increased ADFI ($P < 0.08$) from d 0 to 10, and significantly increased ADFI ($P < 0.01$) from d 10 to 29, 0 to 29, and overall (d 0 to 43). No differences in ADG, ADFI, and

F/G were seen for pigs fed diets containing either rate of Carnichrome, compared with those of pigs fed the negative control diet. For the period d 29 to 43, when pigs were fed a common phase 3 diet, there were no differences in ADG, ADFI, or F/G between treatments ($P > 0.14$), and no carry-over effect of medication resulted. Pigs fed nursery diets containing Carnichrome did not have enhanced growth performance, but pigs fed diets containing Denagard/CTC had improved ADG, ADFI, and F/G compared with those of pigs fed diets without Denagard/CTC.

(Key Words: Antibiotics, L-carnitine, Chromium, Pigs, Weanling Pigs.)

Introduction

L-carnitine is a vitamin-like compound that aids in the movement of fatty acids across the mitochondrial membrane to be broken down for energy, and may be required to aid in the utilization of fat sources, along with having other functions. Chromium, a trace mineral that is a component of glucose-tolerance factor, is important in carbohydrate, fat, and protein metabolism through its potentiating action on insulin, and may reduce backfat by limiting the response to insulin from a meal.

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Research involving L-carnitine and chromium has suggested reduction in body weight loss in sows and reduced backfat in finishing pigs. Previous research from Kansas State University and Oklahoma State University has shown that supplementing nursery pig diets with L-carnitine can improve ADG and feed efficiency. But the combination of L-carnitine and chromium has not been evaluated in nursery pigs. Carnichrome® is a combination product of L-carnitine and chromium picolinate. Therefore, the objectives were to determine whether a combination of L-carnitine and chromium picolinate, as Carnichrome, can influence weanling pig performance and to determine if interactive effects of Carnichrome and medication exist.

Procedures

A total of 384 weaned pigs (initially 12.1 lb and 14 ± 2 d of age) were blocked by weight in a 43-day growth study. They were randomly allotted to one of six dietary treatments in a randomized complete-block design. Each pen contained eight pigs per pen, with eight replicates (pens) per treatment. Pigs were housed at a commercial farm in northeastern Kansas in an environmentally controlled nursery. All pens (4 × 6 ft) contained one stainless steel self-feeder and two nipple waterers to allow ad libitum access to feed and water.

Pigs were fed one of six experimental diets arranged in a 2 × 3 factorial consisting of antibiotic (with or without) and two concentrations of Carnichrome. Diets were: no antibiotic or Carnichrome (negative control); Carnichrome (25 ppm L-carnitine and 100 ppb chromium picolinate); Carnichrome (50 ppm L-carnitine and 200 ppb chromium picolinate); Denagard/CTC (35 g/ton Denagard™, 400 g/ton Chlortetracycline) (positive control); Denagard/CTC plus Carnichrome (25 ppm L-carnitine and 100 ppb chromium picoli-

nate); or Denagard/CTC plus Carnichrome (50 ppm L-carnitine and 200 ppb chromium picolinate).

Experimental diets were based on corn-soybean meal and were fed in meal form for 29 days after weaning; a common diet was fed from d 29 to 43. The SEW diets (1.7% lysine) were fed on a feed budget of one pound per pig, transition diets (1.6% lysine) were fed after the SEW diet until d 10, and phase 2 diets (1.51% lysine) were fed from d 10 to 29 after weaning (Table 1). Diets contained growth-promoting amounts of zinc oxide. A common phase 3 diet was fed from d 29 to 43 to evaluate potential carryover effects. Pigs were weighed, and feed disappearance was measured, on d 0, 10, 17, 24, 29, and 43 to determine ADG, ADFI, and F/G. Data were analyzed as a randomized complete-block design, with pen as the experimental unit, by using the Mixed procedure of SAS.

Results and Discussion

No Denagard/CTC by Carnichrome interactions were detected for ADG, ADFI, or F/G ($P > 0.17$); therefore, the treatment main effects are presented in Table 2. The individual treatment means are also shown in Table 3.

From d 0 to 10, pigs fed diets containing Denagard/CTC had improved ADG and F/G ($P < 0.01$), compared with those of pigs fed diets without Denagard/CTC. In addition, pigs fed diets containing Denagard/CTC tended to have increased ADFI ($P < 0.08$), compared with that of pigs fed diets without Denagard/CTC. Pigs fed diets with either rate of Carnichrome had ADG, ADFI, and F/G ($P > 0.47$) similar to those of pigs fed diets without Carnichrome.

From d 10 to 29, pigs fed diets containing Denagard/CTC had improved

ADG, ADFI, and F/G ($P < 0.01$), compared with those of pigs fed diets without Denagard/CTC. Adding Carnichrome to the diet had no effect on ADG, ADFI, and F/G ($P > 0.41$).

For the overall treatment period (d 0 to 29), pigs fed diets containing Denagard/CTC had greater ADG, ADFI, and improved F/G ($P < 0.01$), compared with those of pigs fed diets without Denagard/CTC. Pigs fed diets containing either rate of Carnichrome had ADG, ADFI, and F/G ($P > 0.36$) similar to those of pigs fed diets without Carnichrome.

From d 29 to 43, when pigs were fed a common diet, ADG, ADFI, and F/G were similar for all treatment groups ($P > 0.14$).

For the overall trial period (d 0 to 43), pigs fed diets containing Denagard/CTC had greater ADG ($P < 0.01$), ADFI ($P < 0.01$), and F/G ($P < 0.02$), compared with those of pigs fed diets without Denagard/CTC. Pigs fed diets containing either rate of Carnichrome had ADG, ADFI, and F/G ($P > 0.31$) similar to those of pigs fed diets without Carnichrome.

In agreement with many previous trials, results showed that feeding diets containing an antibiotic such as Denagard/CTC to nursery pigs improved growth performance, but supplementation with either rate of Carnichrome did not improve ADG, ADFI, or F/G in this study. There also were no interactive effects of combining Carnichrome with Denagard/CTC.

Table 1. Diet Composition (As-fed Basis)^a

Ingredient, %	SEW ^b	Transition ^b	Phase 2 ^c	Phase 3 ^d
Corn	40.25	41.20	50.75	-
Milo	-	-	-	58.40
Spray dried whey	25.00	25.00	10.00	-
Soybean meal, 46.5% CP	12.10	21.55	27.70	34.95
Spray-dried plasma	6.70	2.50	-	-
Select menhaden fish meal	6.00	6.00	4.50	-
Spray-dried blood meal	1.65	-	-	-
Lactose	5.00	-	-	-
Choice white grease	-	-	3.00	3.00
Test ingredient or starch ^e	1.00	1.00	1.00	-
Monocalcium phosphate, 21% P	0.50	0.75	1.00	1.00
Limestone	0.40	0.50	0.55	0.95
Zinc oxide	0.38	0.38	0.25	-
Salt	0.25	0.30	0.30	0.35
Vitamin premix	0.25	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15	0.15
Lysine HCl	0.15	0.20	0.30	0.30
DL-Methionine	0.15	0.13	0.15	0.10
L-Threonine	0.08	0.08	0.10	0.07
TOTAL	100.00	100.00	100.00	100.00
Calculated Values				
Lysine, %	1.70	1.60	1.51	1.42
Isoleucine:lysine ratio, %	51	60	61	68
Methionine:lysine ratio, %	30	32	34	30
Met & Cys:lysine ratio, %	56	57	58	56
Threonine:lysine ratio, %	66	66	64	63
Tryptophan:lysine ratio, %	18	18	17	20
Valine:lysine ratio, %	73	69	68	75
ME, kcal/lb	1,489	1,476	1,545	1,538
CP, %	22.6	22.3	21.2	21.6
Ca, %	0.81	0.92	0.81	0.68
P, %	0.78	0.83	0.75	0.62
Lysine:calorie ratio, g/mcal	5.18	4.92	4.43	4.19

^aAll diets fed in meal form.

^bPigs were fed one pound of SEW diet and then transition diet until d 10 postweaning.

^cFed from d 10 to 29 after weaning.

^dFed from d 29 to 43 after weaning.

^eDenagard/CTC (Denagard™ 35 g/ton; Chlortetracycline 400 g/ton), Carnichrome (25 ppm L-carnitine, 100 ppb chromium picolinate), or Carnichrome (50 ppm L-carnitine, 200 ppb chromium picolinate) replaced corn starch to provide additional dietary treatments.

Table 2. Main Effects of Carnichrome and Denagard/CTC on Growth Performance of Nursery Pigs^a

Item	Denagard/CTC ^b		Carnichrome ^c			SE	Carnichrome		Carnichrome	P-value	
	0	35g, 400g/ton	0	0.025%	0.05%		Linear	Quadratic		Denagard/ CTC	Denagard/CTC *Carnichrome
Replicates	24	24	16	16	16						
Day 0 to 10											
ADG, lb	0.40	0.47	0.45	0.42	0.43	0.034	0.50	0.31	0.47	0.01	0.20
ADFI, lb	0.48	0.51	0.50	0.48	0.50	0.035	0.89	0.34	0.62	0.08	0.48
F/G	1.19	1.10	1.14	1.15	1.16	0.037	0.48	0.97	0.77	0.01	0.20
Day 10 to 29											
ADG, lb	1.06	1.14	1.12	1.09	1.10	0.031	0.50	0.26	0.41	0.01	0.23
ADFI, lb	1.47	1.56	1.52	1.50	1.52	0.043	0.94	0.34	0.63	0.01	0.24
F/G	1.41	1.38	1.38	1.40	1.40	0.021	0.37	0.65	0.60	0.01	0.31
Day 0 to 29											
ADG, lb	0.83	0.91	0.89	0.86	0.87	0.028	0.47	0.22	0.36	0.01	0.20
ADFI, lb	1.13	1.20	1.17	1.15	1.17	0.037	0.95	0.31	0.59	0.01	0.23
F/G	1.38	1.35	1.35	1.37	1.37	0.019	0.25	0.59	0.43	0.01	0.54
Day 29 to 43											
ADG, lb	1.32	1.33	1.33	1.31	1.34	0.046	0.93	0.44	0.74	0.74	0.92
ADFI, lb	2.09	2.14	2.12	2.09	2.14	0.065	0.76	0.26	0.51	0.15	0.19
F/G	1.58	1.61	1.60	1.60	1.60	0.036	0.99	0.92	0.99	0.14	0.18
Day 0 to 43											
ADG, lb	0.99	1.05	1.03	1.00	1.02	0.023	0.67	0.15	0.31	0.01	0.42
ADFI, lb	1.44	1.50	1.48	1.45	1.49	0.036	0.71	0.20	0.40	0.01	0.32
F/G	1.43	1.41	1.41	1.43	1.43	0.017	0.25	0.71	0.47	0.02	0.17

^aA total of 384 pigs approximately 12.1 lbs and 14 ± 2 d of age on a commercial farm in northeastern Kansas.

^bInclusion rate of Denagard (35 g/ton) CTC (400 g/ton).

^cContains L-carnitine (25, 50 ppm) and Chromium picolinate (100, 200 ppb), respectively.

Table 3. Effects of Carnichrome and Denagard/CTC on Growth Performance of Weanling Pigs in a Commercial Environment^a

Item	Control	Carnichrome ^b (25, 100)	Carnichrome ^b (50, 200)	Dena/ CTC ^c	Dena/CTC* Carnichrome (25, 100)	Dena/CTC* Carnichrome (50, 200)	SED	P-value	
								Treatment	Med vs. non-Med
Day 0 to 10									
ADG, lb	0.40 ^d	0.41 ^d	0.41 ^d	0.51 ^e	0.43 ^d	0.46 ^{de}	0.029	0.02	0.01
ADFI, lb	0.47	0.48	0.48	0.54	0.49	0.52	0.030	0.35	0.08
F/G	1.20 ^d	1.17 ^{def}	1.19 ^{de}	1.07 ^g	1.13 ^{efg}	1.12 ^{fg}	0.027	0.01	0.01
Day 10 to 29									
ADG, lb	1.07 ^{de}	1.06 ^{de}	1.04 ^d	1.16 ^f	1.11 ^{ef}	1.16 ^f	0.046	0.01	0.01
ADFI, lb	1.46 ^d	1.48 ^d	1.47 ^d	1.59 ^e	1.51 ^{de}	1.58 ^e	0.067	0.01	0.01
F/G	1.39 ^{de}	1.41 ^{de}	1.42 ^d	1.38 ^e	1.38 ^e	1.37 ^e	0.015	0.12	0.02
Day 0 to 29									
ADG, lb	0.83 ^d	0.84 ^d	0.82 ^d	0.94 ^f	0.88 ^{de}	0.92 ^{ef}	0.038	0.01	0.01
ADFI, lb	1.11 ^d	1.14 ^d	1.13 ^d	1.22 ^e	1.16 ^{de}	1.22 ^e	0.052	0.02	0.01
F/G	1.37 ^{def}	1.38 ^{de}	1.40 ^d	1.34 ^f	1.35 ^{def}	1.34 ^f	0.013	0.02	0.01
Day 29 to 43									
ADG, lb	1.32	1.30	1.34	1.34	1.32	1.33	0.040	0.97	0.74
ADFI, lb	2.06 ^{de}	2.05 ^d	2.15 ^{de}	2.18 ^e	2.12 ^{de}	2.12 ^{de}	0.069	0.24	0.15
F/G	1.56 ^e	1.58 ^{de}	1.61 ^{de}	1.64 ^d	1.61 ^{de}	1.59 ^{de}	0.039	0.34	0.14
Day 0 to 43									
ADG, lb	0.99 ^d	0.99 ^d	0.99 ^d	1.07 ^e	1.02 ^{de}	1.05 ^e	0.031	0.01	0.01
ADFI, lb	1.42 ^d	1.43 ^d	1.46 ^{de}	1.53 ^e	1.47 ^{de}	1.51 ^e	0.054	0.02	0.01
F/G	1.42 ^e	1.43 ^{de}	1.45 ^d	1.41 ^e	1.42 ^e	1.40 ^e	0.015	0.07	0.02

^aA total of 384 pigs approximately 12.1 lbs and 14 ± 2 d of age in a commercial unit in Northeast Kansas.

^bContains L-carnitine (50 ppm) and Chromium (200 ppb).

^cInclusion rate of Denagard (35 g/ton) CTC (400 g/ton).

^{d,e,f,g}Values with different superscripts differ (P < 0.05).