Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 708

1996

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Recommended Citation

Smith, J W. II; Richert, B T.; Owen, K Q.; Bergstrom, J R.; Nessmith, W B. Jr; Blum, S A.; Nelssen, Jim L.; Goodband, Robert D.; and Tokach, Michael D. (1996) "The effects of supplementing growing-finishing pig diets with carnitine and(or) chromium on growth and carcass characteristics," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6548

The effects of supplementing growing-finishing pig diets with carnitine and(or) chromium on growth and carcass characteristics

Abstract

Eighty crossbred gilts (initially 83 lb) were used to examine the effects of 50 ppm carnitine and(or) 200 ppb chromium from chromium nicotinate on growth performance and carcass characteristics. In this trial, adding carnitine and(or) chromiunm to the diets of high-lean growth finishing gilts did not increase carcass leanness. However, the combination of carnitine and chromium improved the color characteristics of the longissimus muscle.; Swine Day, Manhattan, KS, November 21, 1996

Keywords

Swine day, 1996; Kansas Agricultural Experiment Station contribution; no. 97-142-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 772; Swine; Feed efficiency; Carnitine; Chromium

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THE EFFECTS OF SUPPLEMENTING GROWING-FINISHING PIG DIETS WITH CARNITINE AND(OR) CHROMIUM ON GROWTH AND CARCASS CHARACTERISTICS[1]

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Summary

Eighty crossbred gilts (initially 83 lb) were used to examine the effects of 50 ppm carnitine and(or) 200 ppb chromium from chromium nicotinate on growth performance and carcass characteristics. In this trial, adding carnitine and(or) chromium to the diets of high-lean growth finishing gilts did not increase carcass leanness. However, the combination of carnitine and chromium improved the color characteristics of the longissimus muscle.

(Key Words: Feed Efficiency, Carnitine, Chromium.)

Introduction

Research at Kansas State University has tested several carcass modifiers to examine their effects on growing-finishing pig performance and carcass characteristics. In the past, both carnitine and chromium were tested with medium-lean growth potential pigs. The results of these studies indicated that adding both carnitine and chromium to growing-finishing pig diets decreased backfat thicknesses and increased carcass leanness. Researchers at Louisiana State University showed dramatic improvements in leanness with the addition of chromium, from chromium nicolinate, to growing-finishing pig diets. Therefore, our objective was to examine the possible interactive effects of carnitine and chromium, from chromium nicotinate, on growth performance and carcass characteristics of growing-finishing pigs.

Procedures

Eighty crossbred gilts (PIC L326 × C15; initially 83 lb) were used in a growth assay. Carnitine (0 or 50 ppm) and chromium (0 or 200 ppb), from chromium nicotinate, were used in a 2 × 2 factorial arrangement. Pigs were blocked by weight and ancestry in 10 randomized complete blocks. The corn-soybean meal-based experimental diets (Table 1) were fed in two phases: growing (83 to 145 lb) and finishing (145 to 240 lb). The growing diets were formulated to contain 1.0% lysine, .75% Ca, and .65% P. The finishing diets were formulated to contain .80% lysine, .65% Ca, and .55% P. All diets contained .1% L-lysine HCl.

The study was conducted in an environmentally controlled finishing barn with two pigs in each 4 ft × 4 ft totally slatted pen. The pens contained a single hole self-feeder and a nipple waterer to allow pigs ad libitum access to feed and water. Drip coolers were activated when temperatures exceeded 80°F, cycling on for 3 out of every 15 min. Pigs and feeders were weighed every 14 days to calculate ADG, ADFI, and F/G. When mean weight in a pen reached 240 lb, pigs were slaughtered to collect standard carcass measurements. Visual analysis of the longissimus muscle was conducted with procedures developed by the National Pork Producers Council for color, marbling, moisture, and

[1]The authors acknowledge Lonza, Inc., Fair Lawn, NJ, for partial financial support of this trial.

[2]Lonza, Inc., Fair Lawn, NJ.

firmness. In addition, color was analyzed objectively with Minolta colorspectrometry to determine Hunter L*, a*, and b* values.

Data from this trial were analyzed with the GLM procedure of SAS. The statistical model included the main and interactive effects of carnitine and chromium.

Results and Discussion

In this study, carnitine and(or) chromium did not affect growth performance of high-lean growth potential gilts (Table 2).

When pigs were slaughtered at 240 lb, no differences were detected for tenth rib backfat depth; last rib fat thickness; or average backfat thickness (average of first rib, last rib, and last lumbar vertebra backfat thicknesses; Table 3). Longissimus muscle area, percentage lean, and percentage muscle in high-lean growth gilts were not affected by the addition of carnitine and(or) chromium to the diet.

An interaction occurred between carnitine and chromium for color ($P<.05$) and firmness ($P<.10$). Adding carnitine or chromium separately did not affect the color or firmness of pork compared with pigs fed the control diet. However, pork from pigs fed the combination of carnitine and chromium was darker and firmer. This indicates that feeding the combination of carnitine and chromium may improve the color and firmness of pork longissimus muscle.

Instrumental analysis of the longissimus muscle also revealed a carnitine × chromium interaction for Hunter L* (measure of light to dark color) and a* values (measure of redness) and saturation index (measure of vividness or intensity, $P<.10$). This means that adding both carnitine and chromium produced longissimus muscle that was darker, redder, and more intensely colored than adding either carnitine or chromium alone. When chromium and carnitine were added separately, color and firmness scores were not different than those for muscle from pigs fed the control diet.

In conclusion, feeding carnitine and(or) chromium did not influence growth, leanness, or muscling of the high-lean growth gilts used in this trial. However, adding carnitine and chromium in combination improved the color characteristics of longissimus muscle. The improvement in color may not justify the addition of these compounds without an improvement in leanness. Although our previous research with both carnitine and chromium showed improvement in leanness of pigs with lower lean growth potentials, further evaluation is needed to understand why a similar response was not observed in this study.

Table 1. Diet Composition[a]

Ingredient, %	Grower (80 to 145 lb)	Finisher (145 to 240 lb)
Corn	79.08	71.70
Soybean meal, 46.5%	15.53	22.53
Soybean oil	2.50	2.50
Monocalcium phosphate	1.09	1.46
Limestone	.90	.91
Salt	.35	.35
Vitamin premix	.20	.20
Trace mineral premix	.15	.15
L-lysine HCl	.15	.15
Antibiotic[b]	.05	.05
Premix[c]	---	---
Total	100.00	100.00

[a]Grower diets were formulated to 1.0% lysine, .75% Ca, and .65% P; Finisher diets were formulated to .80% lysine, .65% Ca, and .55% P.
[b]Provided 40 g/ton tylosin.
[c]Premix contained either .1 lb L-carnitine and(or) 1.36 g of chromium nicotinate to achieve experimental levels of carnitine or chromium.

Table 2. The Effects of Carnitine and(or) Growth Performance of Growing-Finishing Pigs[ab]

Item	Control	Carnitine	Chromium	Carnitine + Chromium	CV
Grower, 80 to 145 lb					
ADG, lb	2.19	2.18	2.16	2.16	6.7
ADFI, lb	4.98	5.19	4.98	5.01	8.1
F/G	2.28	2.37	2.31	2.33	7.0
Finisher, 145 to 240 lb					
ADG, lb	2.04	2.08	2.02	2.02	8.9
ADFI, lb	6.29	6.48	6.06	6.32	9.5
F/G	3.11	3.11	3.00	3.13	9.2
Overall, 80 to 240 lb					
ADG, lb	2.09	2.13	2.08	2.07	7.2
ADFI, lb	5.77	5.81	5.62	5.77	5.9
F/G	2.77	2.72	2.71	2.79	4.8

[a]Means derived from 79 gilts (initially 83 lb) housed at two per pen with ten replicate pens per treatment. Carnitine was fed at 50 ppm, and chromium from chromium nicotinate was fed at 200 ppb.
[b]No significant difference ($P > .10$).

Table 3. The Effects of Carnitine and(or) Chromium on Carcass Characteristics[a]

Item	Control	Carnitine	Chromium	Carnitine + Chromium	CV
Backfat					
First rib, in	1.42	1.37	1.41	1.43	
Tenth rib, in	.80	.76	.78	.82	25.7
Last rib, in	.78	.79	.82	.79	13.9
Last lumbar, in	.70	.68	.72	.73	19.6
Average, in[b]	.97	.96	1.00	.97	12.0
LMA, in^2	6.86	7.07	6.96	6.82	10.6
Lean, %[c]	54.13	54.47	55.03	54.16	3.4
Muscle, %[d]	56.83	56.99	57.46	56.84	6.0
Dressing percent	73.78	74.24	74.15	73.81	2.6
Visual color[eh]	2.39	2.29	2.22	2.66	20.6
Firmness[ei]	2.44	2.26	2.35	2.62	21.8
Marbling[eh]	2.09	1.81	1.93	2.32	29.6
Hunter L*[fi]	54.00	54.43	54.76	52.07	7.4
Hunter a*[fi]	10.84	10.80	9.66	11.31	17.9
Hunter b*[f]	7.96	7.67	7.15	7.78	2.4
Hue angle[fij]	53.93	50.00	54.90	48.27	20.2
Saturation index[fh]	13.48	13.29	12.06	13.76	18.7
A:B ratio[fj]	1.39	1.47	1.40	1.49	13.6

[a]Means derived from 79 pigs slaughtered at 240 lb with 15 or 16 pigs per treatment. Hot carcass weight was used covarate in the statistical analysis.
[b]AVGBF calculated as the average of first rib, last rib, and last lumbar fat depths.
[c]Lean percent was derived from NPPC equations for carcasses with 5% fat.
[d]Muscle percent was derived from NPPC equations for carcasses with 10% fat.
[e]Scores of 1 to 5: 2 = grayish pink, traces to slight, or soft and watery; 3 = reddish pink, small to modest, or slightly firm and moist; and 4 = purplish red, moderate to slightly abundant, or firm and moderately dry.
[f]Means derived from three readings per loin. Measure of dark to light (Hunter L*), redness (Hunter a*), yellowness (Hunter b*), vividness or intensity (saturation index), or red to orange (Hue angle).
[gh]Carnitine × chromium effect ($P < .05$, and .10, respectively).
[i]Chromium effect ($P < .05$).
[j]Carnitine effect ($P < .07$).