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Influence of dietary supplementation of modified tall oil, chromium nicotinate, and L-carnitine on bacon characteristics

Abstract

Eighty crossbred (PIC) gilts were used to determine the influence of feeding modified tall oil (MTO, 0 or .5% of diet), chromium nicotinate (0 or 50 ppb), and L-carnitine (0 or 50 ppm) on bacon quality characteristics. Supplementation of MTO improved bacon slice firmness. Dietary additions of MTO, chromium nicotinate, and L-carnitine to diets for growing and finishing swine had minimal effects on other bacon characteristics. Therefore, producers probably can take advantage of any improvements in production or carcass cutability from these feed supplements without affecting bacon quality.; Swine Day, Manhattan, KS, November 18, 1999

Keywords

Swine day, 1999; Kansas Agricultural Experiment Station contribution; no. 00-103-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 841; Swine; Bacon; Modified tall oil; Chromium nicotinate; L-Carnitine

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INFLUENCE OF DIETARY SUPPLEMENTATION OF MODIFIED TALL OIL, CHROMIUM NICOTINATE, AND L-CARNITINE ON BACON CHARACTERISTICS[1]

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Summary

Eighty crossbred (PIC) gilts were used to determine the influence of feeding modified tall oil (MTO, 0 or .5% of diet), chromium nicotinate (0 or 50 ppb), and L-carnitine (0 or 50 ppm) on bacon quality characteristics. Supplementation of MTO improved bacon slice firmness. Dietary additions of MTO, chromium nicotinate, and L-carnitine to diets for growing and finishing swine had minimal effects on other bacon characteristics. Therefore, producers probably can take advantage of any improvements in production or carcass cutability from these feed supplements without affecting bacon quality.

(Key Words: Bacon, Modified Tall Oil, Chromium Nicotinate, L-Carnitine.)

Introduction

Modified tall oil is a by-product of the pulp and paper industry and has a high content of conjugated linoleic acid (67.4%). Supplementation of swine diets with MTO has decreased backfat, increased lean percentage, and increased belly firmness. Chromium (Cr) is an essential trace element involved in metabolism. Swine diet supplementation with Cr has decreased backfat and increased loin eye area in pork carcasses. Carnitine is a naturally occurring B-vitamin-like compound involved in normal metabolism. Feeding pigs carnitine has resulted in larger loin eye areas and a greater percentage of muscle on pork carcasses.

Investigations into the effects of chromium, carnitine, and MTO on bacon production and quality characteristics have not been conducted. Therefore, the objective of this study was to determine those effects.

Procedures

In a 2 × 2 × 2 factorial arrangement, 80 crossbred (PIC, Franklin, KY; L 326 or L 327 × C 22) gilts were blocked by initial BW (100 lb) and ancestry and randomly allotted to one of eight dietary treatments. Two pigs were fed in each pen with five replicate pens per treatment. The main effects were two levels of MTO (0 or .5% of the diet), two levels of chromium nicotinate (Cr; 0 or 50 ppb), and two levels of L-carnitine (0 or 50 ppm). The basal growing diet was fed from 100 lb to 160 lb BW and consisted of 66.5% corn and 27.7% soybean meal formulated to contain 1.0% lysine. The basal finishing diet was fed from 160 lb to 235 lb BW and consisted of 76.9% corn and 18.5% soybean meal formulated to contain .75% lysine.

Pigs were harvested humanely using standard industry procedures approved by the Kansas State University Animal Care Committee. At 28 h postmortem, the right side of each carcass was fabricated into the wholesale cuts of ham, loin, belly, spareribs, and shoulder. Bellies were weighed, vacuum packaged, and stored at -40°F until utilized for bacon manufacture, when they were thawed at 37°F for 72 h in their vacuum bags. The bellies were weighed and injected

[1]Appreciation is expressed to Lonza Inc., Fair Lawn, NJ for assistance in this research project.

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with pickle (10% of the weight) using a multineedle pump injector and reweighed. The pickle was a standard curing mixture (13.2 % salt, 7% sugar, 1.0% sodium nitrite, 2% maple sugar, and 76.8% water). Bellies were tumbled for 4 h, weighed, and hung on bacon combs before cooking in a smokehouse. After attaining an average internal temperature of 147°F (approximately 2 h), bellies were weighed, skin was peeled, and bellies were reweighed and rehung. The bellies were placed back in the smokehouse, smoked with 100% hickory wood sawdust, and processed to an internal temperature of 135°F. Bellies were removed from the smokehouse and placed in a 37°F cooler for 40 h and reweighed. Percentages of belly thawing loss, pumping uptake, tumbling loss, cooking loss, and final yield were calculated.

Cured bellies were cut into .16-in. bacon slices. Twelve slices at approximately one-third the length of the bacon slab from the cranial end were obtained for analysis. Slices were evaluated for firmness, number of holes, and thickness of belly. Firmness was evaluated on a scale of 1 = very soft oily to 8 = very brittle and crumbly. A score of 5 was optimal. Composite subjective evaluation of number and size of holes used a scale of 1 = very high number and 8 = none. The depth of the sixth bacon slice removed was measured to determine cured belly thickness. Eight slices were vacuum packaged, stored at 37°F for 4 d, and used for sensory evaluation.

Bacon slices were removed from their vacuum bag and cooked for 5 min on each side in a Blodgett dual-air-flow oven set at 350°F. Cooked bacon slices were cut into 1 in. × 1 in. subsamples (pieces). A trained 12-member qualitative descriptive analysis panel evaluated two subsamples. Eight samples (one from each treatment) per session were evaluated warm. Five sensory traits of brittleness, flavor intensity, saltiness, aftertaste, and off-flavor were evaluated on 8-point scales. Brittleness was evaluated on a scale from 1 = soft to 8 = extremely crispy. Flavor intensity was ranked on a scale from 1 = extremely bland to 8 = extremely intense. Saltiness was scored on a scale from 1 = extremely unsalty to 8 = extremely salty. Aftertaste was scored on a scale from 1 = none to 8 = extremely intense. Off-flavor intensity was ranked from 1 = extremely intense to 8 = none.

The experimental design was a 2 × 2 × 2 factorial experiment in a randomized complete block design using initial weight and ancestry to establish blocks. Statistical analyses for bacon measurements were performed with the GLM procedure of SAS using the pen mean as the experimental unit. All main effect and interaction means were separated ($P<.05$) using the Least Significant Difference procedure when the respective F-tests were significant ($P<.05$).

Results and Discussion

Bacon production, quality, and sensory traits are reported in Table 1. Bacon slices from pigs fed MTO were firmer ($P<.001$) than slices from pigs not fed MTO. The differences in slice firmness can be attributed partially to firmer bellies found in pigs fed MTO. All other bacon production and quality characteristics were similar ($P>.10$) among treatments.

Panelists' sensory evaluations of bacon for brittleness, flavor intensity, and saltiness were similar ($P>.05$) among all treatments. Pigs fed Cr produced bacon that had more ($P<.05$) aftertaste than pigs receiving no Cr. A Cr × L-carnitine interaction was observed ($P = .03$) for the off-flavor attribute. Bacon from pigs fed Cr and L-carnitine (7.73) had higher ($P<.05$) off-flavor scores (less total off-flavor) than bacon from pigs fed Cr but no L-carnitine (7.54). The no Cr with L-carnitine (7.59) and no Cr with no L-carnitine (7.69) treatment combinations were intermediate.

Previous research has indicated that MTO, Cr, and L-carnitine can improve feed efficiency and the proportion of lean to fat in swine. The additions of MTO, Cr, and L-carnitine to swine diets had minimal effects on bacon processing and sensory traits.

Therefore, producers probably can take advantage of any improvements in production or carcass cutability from these feed supplements without affecting bacon quality.

Table 1. Influence of Modified Tall Oil, Chromium Nicotinate, and L-Carnitine Supplementation on Production, Quality, and Sensory Traits of Bacon

	Modified Tall Oil, %		Chromium Nicotinate, ppb		L-Carnitine, ppm		
Item	0	.5	0	50	0	50	SE
Production Evaluations							
Thawing loss, %	1.18	1.21	1.25	1.14	1.20	1.19	.16
Pumping, %	8.65	8.26	8.39	8.52	8.54	8.37	.25
Pumping loss, %	.80	.58	.60	.78	.69	.69	.14
Cooking loss, %	27.54	27.91	27.88	27.58	27.98	27.48	.49
Final yield, %	77.99	77.41	77.46	77.95	77.54	77.87	.55
Quality Evaluations[a]							
Thickness, in	1.05	1.08	1.05	1.08	1.04	1.09	.03
Slice firmness	2.79[d]	3.91[e]	3.41	3.29	3.39	3.31	.15
Slice holes	5.64	5.68	5.71	5.60	5.73	5.59	.16
Sensory Analysis[b]							
Brittleness	4.73	4.70	4.70	4.72	4.73	4.70	.08
Flavor intensity	4.87	4.77	4.81	4.83	4.85	4.79	.05
Saltiness	4.46	4.42	4.44	4.44	4.46	4.43	.05
Aftertaste	4.18	4.14	4.10f	4.21g	4.17	4.15	.04
Off-flavor[c]	7.66	7.62	7.64	7.64	7.62	7.66	.05

[a]Thickness of cured belly at one-third the length of the bacon slab from the cranial end; scores of 1 to 8 for slice firmness and holes: 1 = very soft oily, 8 = very brittle and crumbly; and 1 = high number of holes, 8 = no holes, respectively.

[b]Scores of 1 to 8: brittleness (4 = slightly soft and 5 = slightly crisp); flavor intensity (4 = slightly bland and 5 = slightly intense); saltiness (4 = slightly unsalty and 5 = slightly salty); aftertaste (4 = slight and 5 = slightly intense); off flavor (7 = practically none and 8 = none).

[c]Chromium × L-carnitine interaction.

[d,e]Means within modified tall oil and the same row with a different superscript differ ($P<.05$).

[f,g]Means within chromium and the same row with a different superscript differ ($P<.05$).