Effects of Conjugated Linoleic Acid (CLA) Supplementation on Pig Growth, Pork Quality and Carcass Composition in Two Genetic Populations of Gilts

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Introduction

The pork industry has selected to increase percent lean in response to consumer demand for lean pork products. Unfortunately, selection to increase leanness can result in poorer carcass quality, including lower color, firmness and marbling evaluations as well as decreased fat firmness. The pork industry must consider methods to produce lean pork without sacrificing pork quality.

One quality problem associated with high-percent lean pigs is soft, unsliceable bellies. Dietary supplementation with conjugated linoleic acid (CLA) has been shown to increase belly firmness of lean pigs. It has also been demonstrated that CLA can decrease subcutaneous fat and increase carcass lean percentage.

The objective of this trial was to evaluate the effects of CLA on pig growth, carcass composition, and pork quality characteristics of two genetic populations of gilts.

Materials and Methods

Terminal cross gilts of two genetic populations were assigned to a 2 x 5 factorial arrangement of slaughter weight (100, 150, 200, 250 and 300 lbs) and dietary level of supplement CLA oil (0 versus 1%). The first genetic population (G_1) was produced by mating Large White terminal sires to Large White-Landrace females. The second population (G_2) was produced by mating a synthetic terminal sire line to (Large White-Duroc x Large White-Landrace) crossbred females. The diets consisted of a conventional corn-soybean meal diet supplemented with either 1.0% CLA oil (containing 60% CLA isomers) or 1.0 % sunflower oil. The lysine levels of the diets were 1.15% (50-100 lbs), .86% (100-200 lbs) and .73% (200-300 lbs live weight).

Individual live weights and feed intake were obtained weekly for seven weeks. At their target weights, pigs were transported to the Purdue Meat Science Laboratory for slaughter, tissue collection and carcass evaluation. At 24 hours postmortem, standard carcass measurements such as backfat depths, loin eye area, and subjective loin eye quality (color, firmness/wetness and marbling) were taken.

Bellies were removed from the carcasses and subjectively graded for firmness. The portion of the belly anterior to the 10^{th} rib was removed from the carcass and evaluated by placing it on a 1 cm wide metal bar and determining the angle that it bent over the bar. A score of 3 was assigned to the firmest bellies which maintained a flop angle of greater than 120^{o}. A firmness score of 1 was designated for the softest bellies, which yielded a flop angle of less than 60^{o}. Any intermediate bellies were recorded as a firmness score of 2.

Results

The data for pigs with target weights of 200, 250 and 300 lbs are summarized in Tables 1 and 2. CLA supplementation had no significant effect on average daily gain, feed conversion, or daily feed intake. G_2 gilts had higher average daily gain (1.96 vs. 2.05 lbs/day; P=.04) and tended to have higher feed intakes (5.68 vs. 5.91 lbs/day; P=.12). G_1 gilts had less 10^{th} rib backfat, larger loin eye areas, and higher predicted percent lean than G_2 gilts. G_1 gilts also had lower color and marbling scores. Supplemental CLA reduced midline last rib backfat thickness (1.01 vs. 1.13 in; P<.01) and 10^{th} rib backfat depth (.64 vs. .73 in; P<.01). Supplemental dietary CLA improved color (2.28 vs. 2.02; P<.01), firmness (2.22 vs. 1.98; P<.01), and marbling scores (1.96 vs. 1.63; P<.01). Supplemental CLA substantially increased belly firmness scores (2.63 vs. 1.93; P=.02) and predicted fat-free lean (54.85 vs. 53.26; P=.02).

Discussion

This study demonstrated a large effect of CLA supplementation on increased belly firmness. Genetically lean gilts often have very soft fat. Lean pigs rely on dietary sources of fat for fat tissue growth rather than *de novo* fat synthesis. *De novo* fat synthesis yields more saturated fat, which is much firmer than unsaturated fat. Feeding a higher percentage of dietary fat usually decreases *de novo* synthesis, because the pig is acquiring adequate fatty acids from dietary sources. Under these conditions, the pig will deposit the same type of fat as consumed from its diet. CLA alters this process in some way. CLA is a polyunsaturated fatty acid and the pig deposits a greater percentage of saturated fatty acids when supplemented with dietary CLA.

CLA improved the pork quality of genetically lean pigs. The beneficial effects of CLA on pork quality and carcass composition measurements such as loin eye area, fat depth, subjective color and marbling tended to increase in magnitude as the duration of CLA supplementation increased.

Implications

As the pork industry continues to select for leanness, pork quality could decline. This trial demonstrated that dietary supplementation of CLA can improve fresh pork quality and belly firmness. This will enable the producer to more efficiently produce higher quality, lean pork products for the consumer. CLA has the potential to increase profitability for not only the producer, but the processor as well. The pork processing industry will benefit by the increased belly firmness, because it will increase the sliceability of lean bellies.

Table 1. Means for growth rate, feed conversion, and daily feed intake[a].

	Genetic Population		CLA Treatment		Significance	
Variable	G_1	G_2	0%	1%	Genetic Population	Diet
Average Daily Gain	1.96	2.05	2.01	1.98	.04	.54
Feed Conversion	3.04	3.03	3.05	3.02	.66	.56
Average Daily Feed Intake	5.68	5.91	5.80	5.80	.12	.79

[a] Adjusted to a trial weight of 250 lbs.

Table 2. Genetic population and diet means for carcass measurements.

	G_1		G_2			Significance		
	1% CLA	0% CLA	1% CLA	0% CLA	SE	Genetic Population	CLA	G x CLA
Last rib midline backfat thickness (in)	1.10	1.13	.92	1.13	.03	.04	.003	.04
10^{th} rib fat depth (in)	.58	.63	.71	.82	.02	.001	.008	.35
10^{th} rib loin eye (in^2)	7.57	7.20	7.09	6.90	.14	.05	.17	.64
L*	60.53	60.68	60.48	61.02	.45	.82	.59	.76
a*	9.77	9.67	9.51	9.00	.14	.34	.52	.67
b*	14.24	14.27	14.46	13.90	.05	.72	.20	.16
Color score	2.22	1.93	2.34	2.12	.05	.028	.001	.60
Firmness score	2.18	1.97	2.27	2.00	.05	.40	.001	.70
Marbling score	1.79	1.51	2.14	1.75	.07	.005	.001	.58
Belly firmness score	2.67	2.00	2.59	1.86	.07	.25	.001	.78
Predicted fat-free lean percent	55.98	54.46	53.71	52.05	.47	.001	.02	.92