Effects of Conjugated Linoleic Acid Supplementation and Pig Genotype on Carcass and Meat Quality Attributes

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Summary and Implications

A study was conducted to examine the efficacy of feeding conjugated linoleic acid (CLA) to differing stress-genotype pigs in an effort to improve carcass and meat quality characteristics in finishing swine. Feeding CLA at 0.75% of the diet resulted in decreased (P<.05) 10th and last rib fat depth, regardless of stress-genotype. No differences were observed for percent cooler shrink, loin muscle area, or subjective color score of the loineye. However, subjective marbling (P<.03) and firmness (P<.06) scores of the loineye were increased with CLA supplementation. Increases in marbling were verified with proximate analysis where percent lipid was increased (P<.05) significantly with CLA supplementation.

Introduction

Improving the quality and healthfulness of pork products is key to the profitability of swine production in the United States. Several studies have shown the effectiveness of feeding CLA to pigs for improved growth, decreased carcass fat and enhanced meat quality attributes. Aside from improving animal performance and pork quality attributes, CLA has shown promise in decreasing cancer and atherogenesis of laboratory animals. Consequently, pork products from pigs fed CLA could be more healthful as well.

Materials and Methods

Sixty-four crossbred pigs weighing 36 kg were placed on a control (soybean oil) or CLA (0.75%) diet until harvest at 107 kg. Pigs were penned in pairs according to diet and genotype (normal, stress-gene carrier and stress-gene positive). Pigs were harvested by humane methods used at the ISU Meat Laboratory. Hot carcass weight (HCW) as recorded at 30 min postmortem. At 24 h postmortem, carcasses were ribbed between the 10th and 11th rib and 10th rib fat over the loineye, last rib fat depths and loin muscle area were measured. Chilled carcass weights (CCW) were recorded at 24 h postmortem and the percent differences between HCW and CCW were recorded. Additionally, at 24 h postmortem, subjective quality scores were taken based on the National Pork Producers Council 5-point descriptive scale for lean color, marbling and firmness of the loineye at the 10th and 11th rib interface. Carcasses were fabricated at 24 h postmortem and samples were removed from the 10th rib loin section for proximate analysis. These samples were frozen and subsequently analyzed by AOAC methods. Statistical analysis was performed with the MIXED procedure of SAS. The model included fixed effects of genotype and diet and a random effect of pen. Means were considered significantly different at a critical value of P<.05.

Results and Discussion

Data in Table 1 shows least squares means for percent cooler shrink at 24 h postmortem. No differences were observed between genotypes for diet. Tenth rib fat depth (p<.05) and last rib fat depth (P<.05) (Table 2) were decreased with CLA supplementation in each of the three stress genotypes. These results confirm our previous CLA pig studies at ISU in which fat depth was decreased and subjective marbling and firmness were significantly enhanced. Loin muscle area (LMA) (Table 3) was not effected by CLA

supplementation. However, stress-positive pigs produced larger (P<.05) LMA than stress-carrier pigs, which had larger (P<.05) LMA than normal stress-free pigs. Least squares means for subjective quality scores for lean color, marbling, and firmness of the loineye are shown in Table 4. No differences were observed for lean color due to the CLA diet. Significant differences (P<.05) were observed, however, between genotypes where loins from stress-negative pigs exhibited the highest scores and loins from stress-positive pigs exhibited the lowest scores for lean color. Stress-carrier loins were intermediate for color. Marbling scores were increased for pigs on CLA diets for all genotype groups. These subjective marbling scores were confirmed by proximate analysis (Table 5), where percent lipids increased in loin samples from CLA supplemented pigs. Firmness scores showed the same increases as marbling scores within each genotype group.

Conclusions

Improving carcass composition by decreasing fat and improving quality by increasing marbling and firmness have dramatic ramifications in the payment for market pigs. Many packers use fat thickness as a primary factor in their grid payment system. Consequently, feeding CLA to decrease fat depth could increase premiums for pork producers. Additionally, the improvements in marbling and firmness may play an increasingly more significant role in pork profitability as many packers are evaluating pork quality attributes as an additional method for payment of pork carcasses. Improving quality such as marbling and firmness attributes also should increase consumer appeal for pork products by increasing flavor and juiciness of fresh pork retail cuts.

Table 1. Least squares means for % cooler shrink of carcasses from three genotypes of pigs.

Genotype	Diet	Live wt (kg)	HCW (kg)[a]	CCW (kg)[b]	% Shrink
Normal	Control	105	79	77	2.5
Normal	CLA	105	77	75	2.5
Carrier	Control	108	80	78	2.5
Carrier	CLA	106	80	78	2.5
Positive	Control	107	82	80	2.4
Positive	CLA	105	80	78	2.5

[a] HCW = hot carcass weight.
[b] CCW = chilled carcass weight.

Table 2. Least squares means and standard errors for 10th rib and last rib fat depth (cm) of carcasses from three genotypes of pigs.

Genotype	Diet	Tenth rib[c]	SE	Last rib[c]	SE
Normal	Control	2.97a	.25	2.66a	.18
Normal	CLA	2.54b	.20	2.51b	.15
Carrier	Control	2.71a	.13	2.79a	.10
Carrier	CLA	2.18b	.13	2.38b	.10
Positive	Control	2.87a	.25	2.66a	.18
Positive	CLA	2.23b	.20	2.51b	.15

[c] Means within a column with different letters are significantly different at P<.05.

Table 3. Least squares means and standard errors for loin muscle area (cm^2) from carcasses of three genotypes of pigs.

Genotype	Diet	Loin Muscle Area[c]	Standard error
Normal	Control	35.57a	2.35
Normal	CLA	37.86a	2.03
Carrier	Control	39.80ab	1.35
Carrier	CLA	41.67ab	1.35
Positive	Control	44.11b	2.35
Positive	CLA	45.85b	2.03

[c] Means within a column with different letters are significantly different at P<.05.

Table 4. Least squares means and standard errors for subjective quality scores of loins at the 10th and 11th rib interface of carcasses from three genotypes of pigs.

Genotype	Diet	Color	SE	Marbling[c]	SE	Firmness[c]	SE
Normal	Control	3.16	.32	2.16a	.23	2.83a	.24
Normal	CLA	3.00	.28	2.50b	.20	3.00b	.20
Carrier	Control	2.44	.18	1.38a	.13	2.05a	.13
Carrier	CLA	2.38	.19	1.72b	.13	2.38b	.13
Positive	Control	1.40	.35	1.00a	.25	1.00a	.26
Positive	CLA	1.65	.28	1.37b	.20	1.50b	.20

[c] Means within a column with different letters are significantly different at P<.05.

Table 5. Least squares means for proximate analysis of loin samples from 10th and 11th rib interface (%) from three genotypes of pigs.

Genotype	Diet	Moisture	Lipid[c]
Normal	Control	73.13	2.86a
Normal	CLA	72.53	3.37b
Carrier	Control	73.10	2.55a
Carrier	CLA	72.50	3.04b
Positive	Control	72.77	2.41a
Positive	CLA	72.23	2.81b

[c] Means within a column with different letters are significantly different at P<.05.