Color, Marbling, and Firmness Characteristics of Fresh Hams from Barrows Supplemented with Conjugated Linoleic Acid

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Summary and Implications

This study is a part of a continuing research project investigating the feeding of conjugated linoleic acid (CLA) to market pigs to achieve improvements in carcass growth and pork-quality characteristics. The CLA was fed at a constant level (0.75%) from 40 kg to 115 kg of body weight. This resulted in an increase in subjective uniformity, color, marbling, and tended to increase objective L∗ values of hams from pigs supplemented with CLA compared with hams that were from pigs fed a control diet. No treatment differences were observed for pH, ham weight, firmness, and Hunter a∗ and b∗ values. This report will focus on the subjective and objective quality and compositional characteristics of fresh pork hams form CLA-supplemented pigs. Pigs supplemented CLA in finishing diets had as high ham quality as controls. Therefore, CLA would be beneficial in swine diets.

Introduction

Conjugated linoleic acid (CLA) has been shown to have potential effect to improve meat composition a quality. The CLA is a naturally occurring isomer of linoleic acid. Consequently, there is interest in feeding pigs CLA to improve lean production and quality in hams. Quality of ham has been of great concern because of a lack of uniform color and firmness and higher marbling. These findings prompted us to investigate the effect of CLA on subjective measures of ham composition and subjective quality.

Materials and Methods

This research project of 46 Yorkshire × Duroc × Hampshire × Landrace barrows were used and randomly put into litters of four treatments with five replications per treatment. The treatment groups were fed at a constant level of (0.75%) of CLA in the diet. There were three treatments of pigs supplemented with CLA and a control. Treatment 1 was the control (fed no CLA), treatment 2 was fed CLA beginning at 90 kg of body weight, treatment 3 was fed CLA beginning at 65 kg of body weight, and treatment 4 was fed CLA beginning at 40 kg of body weight. Pigs were slaughtered at Hormel in Austin, MN, in two slaughter groups (about 30 days apart) at an average of 115 kg of body weight. Whole bone-in hams were removed from the left side of the side of the carcass at 24-h postmortem. Hams were boxed and trucked under refrigerated conditions to he ISU Meat Laboratory. At 48-h postmortem, ham semimembranousis muscles were subjectively evaluated for lean color, uniformity, firmness, and marbling by using the 5-point scale of the National Pork Producers Council. Semimembranousis muscles also were objectively color scored by using a L∗, a∗, and b∗ Hunter scale values. Measures of pH in the semimembranousis were made with a Fisher Accumet 925. Finally, hams were manually separated into fat, lean, skin, and bone. Statistical analysis was performed using the GLM procedure of SAS. The model included fixed effects of treatment and replication for subjective quality score and objective ham composition. Means were considered different at a preset P-value of 0.05 or less.

Results and Discussion

Data in Table 1 show least squares means and standard errors for subjective measures of color, marbling, and firmness. No differences were observed (P=0.42) for subjective firmness at 48-h postmortem. Subjective uniformity (P=0.009), color (P=0.02), and marbling (P=0.03) scores showed a linear effect with increasing time on CLA. Hence, pigs fed with supplemented CLA had a higher degree of marbling and more uniform color.

Table 1. Least squares means and standard errors for subjective measures of color, marbling, firmness, and uniformity of fresh hams.

	Treatments			
	1	2	3	4
Color	2.50[a]	2.49[a]	2.69[a]	2.89[a]
SE	0.12	0.13	0.12	0.12
Marb	2.17[a]	2.51[a]	2.26[a]	2.57[a]
SE	0.10	0.10	0.10	0.10
Firm	2.89	2.83	2.94	2.99
SE	0.11	0.11	0.11	0.11
Uniform	2.88[a]	3.02[a]	3.15[a]	3.38[a]
SE	0.14	0.14	0.14	0.13

1=control (no CLA), 2=CLA beginning at 90 kg to 115kg, 3=CLA beginning at 65 kg to 115 kg, 4=CLA beginning at 40 kg to 115 kg.

Results in Table 2 shows least squares means and standard errors for Hunter L∗, a∗, and b∗ values taken at 48-h postmortem. No statistical differences were observed for any of the Hunter color values, although L∗ values tended towards significance (P=0.06).

Table 2. Least squares means and standard errors for Hunter L∗, a∗, and b∗ values taken at 48-h postmortem in the semimembranousis muscle.

	Treatment			
	1	2	3	4
L∗	50.01	50.74	48.84	49.01[a]
SE	0.60	0.61	0.60	0.57
a∗	17.25	17.00	16.64	17.06
SE	0.28	0.28	0.28	0.27
b∗	7.96	7.94	7.85	7.64
SE	0.23	0.23	0.23	0.22

1=control (no CLA), 2=CLA beginning at 90 kg to 115kg, 3=CLA beginning at 65 kg to 115 kg, 4=CLA beginning at 40 kg to 115 kg.

Least squares means and standard errors for ham composition of fat, lean, skin, and bone are shown in Table 3. No statistical differences was found for fat, lean, and bone but skin was highly significant for hams from CLA-supplemented pigs (P=0.0007). This is probably due to hard fat sticking to the skin and not being fully separated.

Table 3. Least squares means and standard errors for ham composition for separable fat, lean, skin, and bone of fresh hams.

	Treatment			
	1	2	3	4
Fat	1.79	1.76	1.78	1.89
SE	0.24	0.24	0.24	0.23
Lean	6.65	6.73	6.85	6.93
SE	0.31	0.32	0.32	0.31
Skin	0.82[a]	0.81[a]	0.67[a]	0.65[a]
SE	0.09	0.09	0.09	0.09
Bone	1.13	1.15	1.15	1.16
SE	0.07	0.07	0.07	0.06

1=control (no CLA), 2=CLA beginning at 90 kg to 115kg, 3=CLA beginning at 65 kg to 115 kg, 4=CLA beginning at 40 kg to 115 kg.

Conclusions

Results from this phase of our research indicates that some measures such as uniformity of color, intensity of lean color, marbling, and skin are increased when CLA is fed at 0.75% of the diet from 40 kg to 115 kg of body weight. Increase in marbling could improve flavor and juiciness of center ham slices. Additionally, improved color and uniformity could potentially result in a product with greater processor and higher consumer appeal.