

Effects of Corn and Conjugated Linoleic Acid (CLA) on the Storage and Shelf Life of Fresh Pork

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Introduction

Conjugated linoleic acid (CLA) has been demonstrated to have anticarcinogenic effects in a number of laboratory tests. Such effects have been attributed to the antioxidant properties of CLA. Because the quality of fresh pork is affected by oxidation, the purpose of this trial was to determine whether CLA, as a component of pork, would enhance the storage and shelf life of fresh pork.

Materials and Methods

Gilts (n=78) were fed one of four diets containing either Optimum® high oleic, high oil corn (HOHOC), conventional corn (CONV), high oil corn (HOC), or conventional corn supplemented with choice white grease (CWG) on an ad libitum basis beginning at 55 lb live weight. Additionally, diets were supplemented with either 1% CLA oil (60% CLA) or 1% sunflower oil (SFO) from 200 lb until slaughter at 258 lb.

At 24 hours postmortem, both the left and right side loins (6th-10th ribs) were removed and evaluated for color by three trained graduate students using established NPPC guidelines (1=pale, pinkish gray; 5=dark red, purple), as well as with the use of a Hunter Colorimeter (L*, a*, b*). The numbers given by the Hunter machine represent an average lightness vs. darkness of the loin for three distinct color spectrums (L*: 100=white, 0=black; a*: 100=red, -100=green; b*: 100=yellow, -100=blue). Loins were then weighed, vacuum packaged and placed in frozen storage for a duration of either 14 or 35 days. Upon completion of the frozen storage, each loin was removed and allowed to thaw at 35.5°F for 36 hours in the cooler. Loins were weighed and cut into five separate chops approximately .75 inch in thickness. The two external chops were discarded. The three internal chops were randomly assigned to a 1, 3 or 5 day shelf life duration, weighed, and reevaluated for color. Individual chops were presented on styrofoam, sealed with plastic wrap, and displayed under constant fluorescent light. Upon reaching the assigned shelf life duration, chops were again weighed and evaluated for color.

Results

At 24 hours postmortem, the subjective color evaluations of the loins were significantly affected by corn (HOHOC: 2.33; CONV: 2.51; HOC: 2.29; CWG: 2.28; P<.05). These effects, however, were not detected by the Hunter L*, a*, or b* values (Table 1). Color was subjectively evaluated to have improved during frozen storage for both HOC and CWG-fed pigs, but these results were not confirmed by objective measures with the Hunter Colorimeter. After being displayed for 5 days, corn had a significant effect on a* values (HOHOC: 10.69; CONV: 9.56; HOC: 10.12; CWG: 10.28, P<.05).

Chops from gilts fed CLA received higher subjective color evaluations than control gilts at 24 hours postmortem, and improved color after being displayed for three days based on the change from day 1 to day 3 (Table 2). However, these differences were minor and not confirmed by objective measures of color. At 24 hours postmortem, the L* values were slightly lower for CLA treated loins and a* values were higher (10.18 vs 9.56, $P < .19$). This shows evidence that the Hunter scores follow the same pattern, and give support to the visual scores, although they are not statistically significant. These differences may have occurred because score evaluators were focusing on the combination of overall redness and slightly increased darkness of the CLA treated loins. Following frozen storage, CLA had a negative effect on color scores, but a* values were significantly lower in the chops of CLA-fed pigs.

At day 5 of shelf life, the loin chops frozen for 14 days received significantly higher color evaluations (2.45 vs. 2.34, $P < .01$), lower L* values (59.8 vs. 61.2, $P < .01$), higher a* values (10.9 vs. 9.4, $P < .01$), and lower b* values (16.8 vs. 17.6, $P < .01$) than loins frozen for 35 days (Table 3).

Implications

Both corn type and CLA have minimal effects on the color characteristics of frozen and displayed loin chops. Thus, the feeding of CLA to enhance pig growth, carcass composition, and fresh pork quality (described elsewhere) does not raise any storage or shelf life concerns.

Table 1. Effect of corn type on storage and shelf life.

Trait	CWG	CONV	HOHOC	HOC	SE	Signif.
24 hours postmortem						
Color	2.28	2.51	2.33	2.29	.06	.0128
L*	59.10	57.43	59.73	57.83	.80	.1233
a*	9.66	9.99	9.99	9.85	.50	.9634
b*	13.81	13.49	13.23	13.37	.24	.4687
Effect of storage						
Purge	5.36	5.36	6.16	5.69	.30	.1957
Color	.12	-.002	.001	.16	.05	.0493
L*	.20	-.007	-.43	.92	.65	.4480
a*	1.59	.83	.29	.87	.48	.4002
b*	1.27	1.30	2.02	1.55	.31	.3240
Day 1 shelf						
Color	2.43	2.45	2.42	2.44	.05	.9758
L*	59.07	59.15	58.61	58.66	.41	.7072
a*	10.96	11.50	10.91	10.51	.56	.6487
b*	15.16	15.25	15.09	14.85	.16	.2966
Day 3 shelf						
Color	2.44	2.43	2.49	2.50	.05	.6466
L*	60.90	60.25	60.35	60.15	.40	.5615
a*	11.20	11.06	11.33	11.32	.28	.8907
b*	17.70	17.62	17.68	17.43	.14	.4386
Day 5 shelf						
Color	2.38	2.38	2.39	2.43	.04	.8561
L*	60.67	60.59	59.94	60.73	.40	.4659
a*	10.28	9.56	10.69	10.12	.26	.0262
b*	17.41	17.16	17.16	16.98	.13	.1563
Change during shelf display day 3-1						
Color	.01	-.02	.07	.05	.04	.3241
L*	1.83	1.10	1.71	1.64	.26	.2066
a*	.26	-.45	.47	.76	.66	.5957
b*	2.53	2.40	2.62	2.59	.19	.8424
Change in shelf display days 5-1						
Color	-.05	-.07	-.03	-.02	.04	.8549
L*	1.60	1.44	1.33	2.07	.34	.4211
a*	-.68	-1.95	-.22	-.39	.64	.2198
b*	2.20	1.95	2.08	2.11	.18	.8081

Table 2. Effect of CLA on shelf and storage life.

Trait	CLA	No CLA	SE	Signif.
24 hours postmortem				
Color	2.44	2.27	.04	.0035
L*	58.23	58.79	.60	.4945
a*	10.18	9.56	.30	.1854
b*	13.39	13.56	.17	.4781
Effect of Storage				
Purge	5.70	5.60	.21	.7086
Color	-.06	.20	.04	.0001
L*	.59	-.25	.46	.2079
a*	.25	1.55	.34	.0093
b*	1.52	1.55	.22	.9430
Day 1 shelf				
Color	2.41	2.47	.04	.2586
L*	58.91	58.83	.29	.8338
a*	10.79	11.15	.40	.5144
b*	15.05	15.13	.10	.6290
Day 3 shelf				
Color	2.47	2.45	.03	.6639
L*	60.53	60.30	.28	.5683
a*	11.26	11.21	.20	.8355
b*	17.63	17.59	.10	.7566
Day 5 shelf				
Color	2.40	2.39	.03	.8148
L*	60.63	60.35	.28	.4565
a*	10.12	10.20	.19	.7615
b*	17.16	17.20	.09	.7772
Change during shelf display 3-1				
Color	.07	-.01	.03	.0313
L*	1.67	1.47	.19	.4434
a*	.47	.05	.47	.5228
b*	2.61	2.47	.13	.4621
Change during shelf display 5-1				
Color	-.006	-.08	.03	.0726
L*	1.71	1.51	.24	.5446
a*	-.66	-.95	.50	.6562
b*	2.10	2.07	.13	.8497

Table 3. Effect of duration of freezing on color scores.

Trait	Day 14	Day 35	SE	Signif.
Day 1 shelf				
Color	2.51	2.36	.04	.0051
L*	58.43	59.32	.28	.0303
a*	10.34	11.60	.40	.0258
b*	15.01	15.17	.10	.3067
Day 5 shelf				
Color	2.45	2.34	.03	.0080
L*	59.81	61.16	.28	.0007
a*	10.91	9.42	.19	.0001
b*	16.77	17.58	.09	.0001