THE INFLUENCE OF CHOP LOCATION ON PORK LOIN QUALITY[1]

J.W. Homm, J.A. Unruh, and R.C. Johnson[2]

Summary

Pork longissimus muscle quality characteristics were evaluated on 109 center cut boneless loins. After 21 d aging, loins were cut into 1-inch chops and allowed to bloom for 30 minutes before visual measurements (color, marbling and firmness) and instrumental color were recorded for each chop. Overall, visual color was the lightest on the anterior and posterior ends and was the darkest from approximately 50% to 80% of the length of the loin. Marbling was the highest at the posterior end, lowest in mid-loin, then higher toward the anterior end. Loins were the softest at the anterior end and became firmer toward the posterior end.

From the anterior to approximately 40-50% of the loin length, chops became darker (lower L*), redder (higher a*), and less yellow (lower b*). Near the center of the loin, color was constant, but became lighter (higher L*) and more yellow (higher b*) at the posterior end.

Chops located at 25% (anterior), 50% (middle) and 75% (posterior) of the length of each loin were collected and further analyzed. Section chops within loins had similar pH values. The chop from the anterior section contained the highest percentage of crude fat, followed by the posterior section chop, and the middle section chop contained the lowest percentage. The middle section chop contained the highest percentage of moisture. The posterior section chop had more moisture display loss than the anterior and middle section chops. The anterior section chop had more cooking loss than the posterior section chop. Chops became progressively less tender the more posterior the section location.

(Key Words: Chop Location, Pork Quality, Longissimus)

Introduction

Pork quality and consistency is important to consumers. Fresh pork color, tenderness, cooking loss, display loss, fat, moisture and pH are all contributing characteristics. Production, slaughter, chilling, retail, and cooking variables can affect these characteristics. In addition, variation within a pork loin may contribute to inconsistency of quality. Previous research conducted at Kansas State University showed considerable variation of pork quality within the same loin. The objective of this experiment was to further investigate the variation of pork quality characteristics within a loin.

Procedures

One-hundred-nine center-cut boneless pork loins (seventh rib through the sixth lumbar vertebra) were obtained from a commer-

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[2]Director of Pork Quality, Triumph Pork Group.

cial packing facility on four different days (n=31, 32, 31, and 15). After aging for 21 days, loins were cut into 1-inch chops, from anterior to posterior, and allowed to bloom for 30 minutes.

Using the NPPC Official Color and Marbling Standards (1999), subjective color and marbling scores were assigned to the longissimus muscle of each chop. Visual color was evaluated on a 1 to 6 scale, with 1 representing a pale pinkish-gray to white and 6 representing a dark-purplish red color. Visual marbling was evaluated on a scale corresponding to the predicted percentage of intramuscular lipid content. Firmness was evaluated on a scale of 1 to 3 to the nearest 0.5, with 1=very soft and 3=very firm.

Each chop was also scanned with a HunterLab Miniscan™ XE Spectrophotometer (Hunter and Associates, Reston, VA) with a 1.25 in aperture under illuminant C, to obtain L*, a* and b* values. Each chop was scanned at two locations (lateral and medial) within the longissimus muscle and averaged. The L* value is a measure of darkness to lightness. The a* value is a measure of green to red, and the b* value measures blue to yellow.

The pair of chops closest to 25% (anterior), 50% (middle) and 75% (posterior) of the length of the loin was collected. The anterior chop at each location was analyzed for crude fat, moisture and pH. Crude fat and moisture were preformed using the CEM by AOAC (1999) procedures. Using the procedures from "The handbook for meat chemists," pH was measured. The posterior chop at each location was weighed and placed into a diapered styrofoam tray, overwrapped to simulate retail conditions, and displayed under fluorescent lighting in open-top display cases. Case temperature (34 to 36°F) was monitored using temperature data loggers. Following a 24 hour display period, instrumental color and final display weights were recorded, and each chop was cooked to an internal temperature of 158°F in a Blodgett dual-air-flow oven. While cooking, temperature was monitored using thermocouples attached to a Doric Minitrend 205 temperature monitor. Chops were cooled at room temperature for 20 minutes and reweighed. Finally, chops were chilled for 24 hours at 38°F before six 0.5-inch cores were taken parallel to the muscle fibers and sheared perpendicular to the muscle fibers using a Universal Instron with a Warner Bratzler attachment.

For analysis, all data were blocked by loin. To standardize chop location within a loin for regression analysis, chops were assigned a percentage of loin length location and rounded to the nearest five percent.

Results and Discussion

Visual measurements for chops taken after 30 minutes bloom are reported in Figure 1. Both a linear and quadratic relationship ($P<0.05$) was observed for visual color from the anterior to the posterior loin. Visual color was the lightest in the anterior quadrant and increased towards the middle of the loin. Color was darkest from approximately 50 to 75% of the length of the loin before decreasing towards the posterior end. The quadratic regression model had an R^2 of 0.83. Visual marbling had both a linear and quadratic relationship ($P < 0.05$) from the anterior to the posterior loin. Visual marbling was the highest on the anterior and posterior ends and was the lowest at approximately 50% of the length of the loin. The quadratic regression model for marbling had an R^2 of 0.81. Visual firmness had a linear increase ($P<0.05$) from anterior to posterior. The linear model had an R^2 of 0.97.

Instrumental values for color (L*, a*, b*) taken after 30 minutes of bloom are presented in Figure 2. Instrumental L* and b* measurements had both linear and quadratic relationships (P<0.05) from the anterior to the posterior end of the loin. The L* value was the lightest at the anterior end and was progressively darker to approximately 50% of the length of the loin, then again was lighter toward the posterior end. The quadratic regression model for L* had an R^2 of 0.79. The a* value was the lowest at the anterior quadrant, increased in redness toward the middle of the loin, and then remained constant toward the posterior end. The quadratic regression model for a* had an R^2 of 0.85. For b* a linear relationship did not exist (P=0.67), but a significant quadratic relationship existed (P<0.05). The b* value was the most yellow at the anterior end, decreased toward the middle of the loin and then increased again toward the posterior end. The quadratic model had an R^2 of 0.61.

Visual and instrumental values suggest that chops from the anterior and posterior end are lighter in color than chops from the middle of the loin. Instrumental values also indicate that the anterior end is lighter, less red, and more yellow. The posterior end of the loin begins to lighten and become more yellow than the center loin region.

Influence of chop location on pork quality traits at three loin locations are presented in Table 1. Location of chops did not affect pH (P=0.48). Crude fat content was the highest in the anterior section chop and lowest in the middle section chop (P<0.05). Moisture content was similar in the anterior and posterior section chops (P=0.13) and slightly higher (P<0.05) in the middle section chop. After 30 minutes of bloom, chops were progressively lighter in the anterior section chop to the posterior section chop (L*, P<0.05), and chops were more red from the posterior chop section to the anterior chop section (a*, P<0.05). The anterior and posterior section chops were more yellow than the middle section chop (b*, P<0.05). The anterior section chop was the lightest after 24 hour display. The middle section chops were redder (a*, P<0.05) than the anterior section chops after 24 hours of display. Yellowness (b*) was the higher (P<0.05) in the posterior section chops compared to the anterior section chops. Display moisture loss was the highest in the posterior section chop (P<0.05), and the anterior and middle section chops were similar (P=0.18). Cooking loss was higher (P<0.05) at the anterior section location than the posterior section location, and the middle section chop was intermediate. The anterior section chop was the most tender followed by the middle, then the posterior section chop (P<0.05).

Location within a pork loin affects quality characteristics. Within a loin, variation in visual color, instrumental color, chop composition and cookery traits were observed. Packaging chops by sections of the loin could improve the consistency of pork quality.

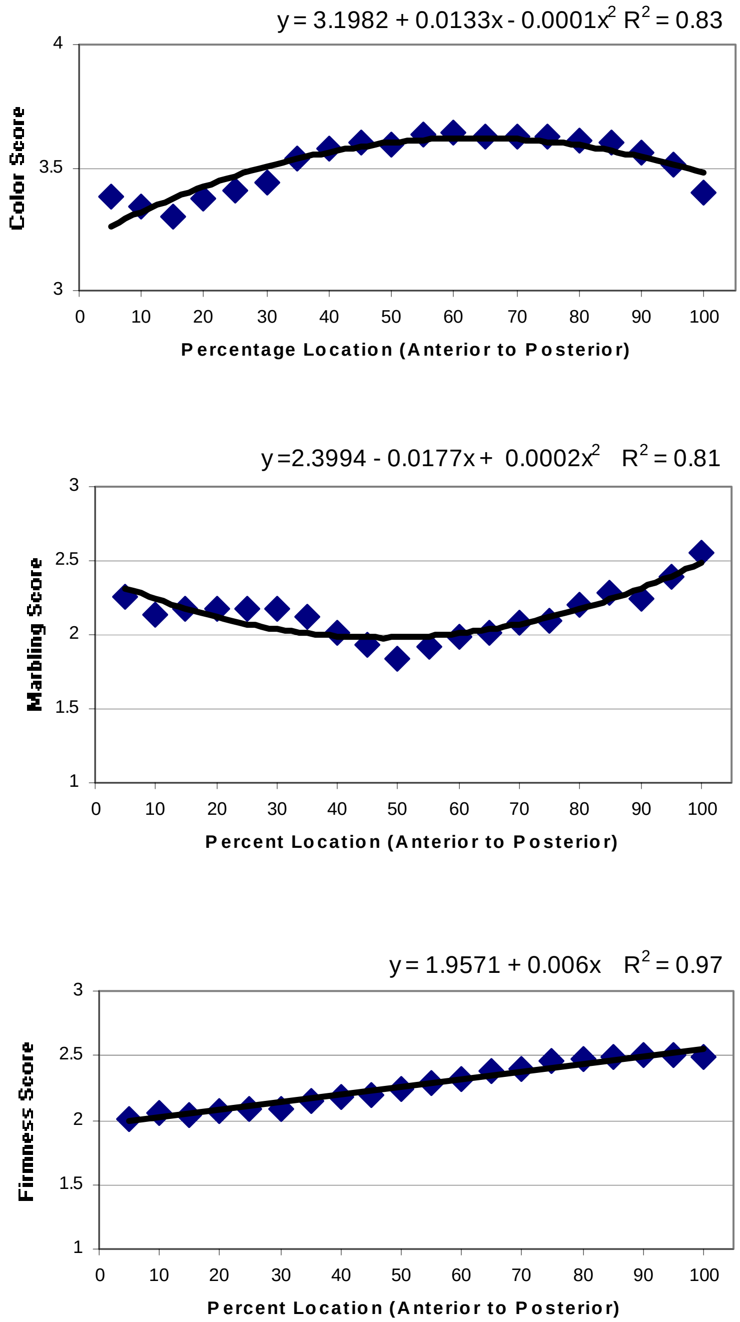

Figure 1. Influence of chop location (%) within a center cut boneless loin on visual measurements. Visual color (3=reddish pink and 4=dark reddish pink) and marbling (corresponding to intramuscular lipid content) were evaluated using NPPC Official Color and Marbling Standards (1999). Firmness was evaluated on a scale of 1 to 3 to the nearest 0.5 with 2= slightly firm and 3=very firm.

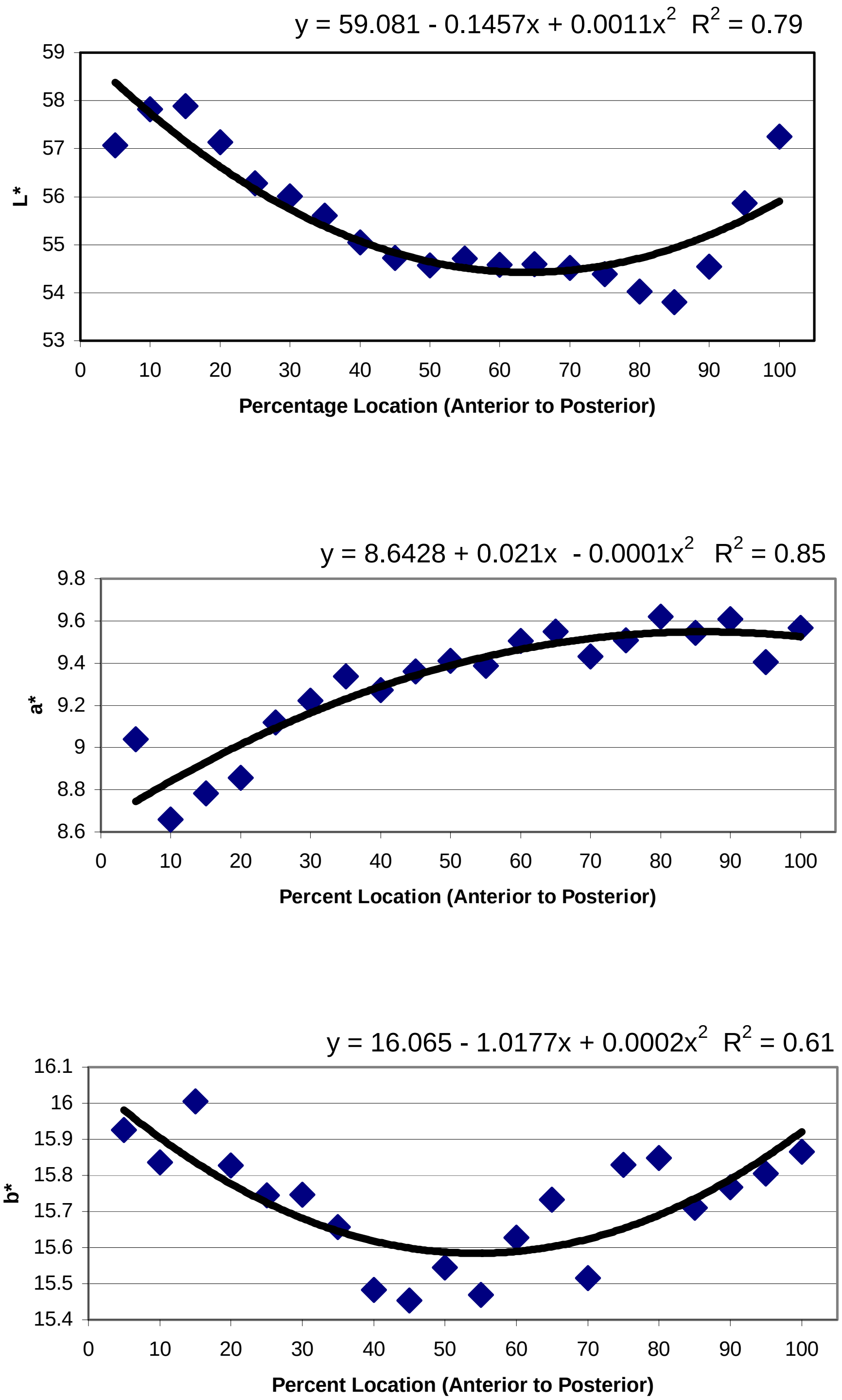

Figure 2. Influence of chop location (%) within a center cut boneless loin on instrumental color.

Table 1. Influence of Chop Location within a Center Cut Boneless Loin on Pork Quality

	Chop Location[a]			
Item	Anterior	Middle	Posterior	SE[b]
pH	5.72	5.73	5.73	0.02
Crude Fat, %	1.93[e]	1.35[f]	1.59[g]	0.08
Moisture, %	73.36[e]	73.76[f]	73.43[e]	0.07
Instrumental Color[c], 30 min				
L*	56.21[e]	54.69[f]	53.99[g]	0.30
a*	9.17[e]	9.39[f]	9.61[g]	0.12
b*	15.74[e]	15.48[f]	15.85[e]	0.12
Instrumental Color[c], 24 h				
L*	51.67[e]	50.19[f]	50.15[f]	0.31
a*	11.12[e]	11.40[f]	11.23[ef]	0.13
b*	17.42[e]	17.47[ef]	17.60[f]	0.11
Display loss, %	0.83[e]	0.87[e]	1.06[f]	0.03
Cooking Loss, %	21.96[e]	21.05[ef]	20.18[f]	0.40
WBS[d], lb	6.14[e]	6.62[f]	7.00[g]	0.12

[a]Anterior, middle and posterior represent 25, 50, and 75% of the length of the loin, respectively.

[b]Standard error.

[c]Instrumental color was measured using HunterLab Miniscan (Illuminant C with a 1.25 in aperture).

[d]Warner-Bratzler Shear (average of six, 0.5 in cores from chops cooked to 158°F).

[e,f,g]Means in the same row without a common superscript differ ($P<0.05$).