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Abstract
Eighty-two boneless pork loins were used to examine the effects of chop location on longissimus muscle quality. The highest quality chops came from the posterior end. They had the lowest Warner-Bratzler shear value (most tender), highest cooking yield, and a high pH and percent extractable lipid. Visual and instrumental data suggested that the most posterior chop was lighter colored and had the highest degree of marbling. Color, firmness, and marbling evaluations were similar in the central posterior section of the loin. This suggests that this section was very uniform in visual pork quality. The anterior portion of the loin was more variable in uniformity of pork quality. The most anterior chops (17 and 19 in from posterior end) were darker but softer and more watery than chops 13 and 15 in from the posterior end. Our study suggests that locations within a loin may vary in quality characteristics, color, tenderness, cooking yield, pH, and lipid (marbling).; Swine Day, Manhattan, KS, November 19, 1998

Keywords
Swine day, 1998; Kansas Agricultural Experiment Station contribution; no. 99-120-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 819; Swine; Pork; Longissimus muscle; Quality

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

A. T. Waylan, J. A. Unruh, and R. C. Johnson [2]

Summary

Eighty-two boneless pork loins were used to examine the effects of chop location on longissimus muscle quality. The highest quality chops came from the posterior end. They had the lowest Warner-Bratzler shear value (most tender), highest cooking yield, and a high pH and percent extractable lipid. Visual and instrumental data suggested that the most posterior chop was lighter colored and had the highest degree of marbling. Color, firmness, and marbling evaluations were similar in the central posterior section of the loin. This suggests that this section was very uniform in visual pork quality. The anterior portion of the loin was more variable in uniformity of pork quality. The most anterior chops (17 and 19 in from posterior end) were darker but softer and more watery than chops 13 and 15 in from the posterior end. Our study suggests that locations within a loin may vary in quality characteristics, color, tenderness, cooking yield, pH, and lipid (marbling).

(Key Words: Pork, Longissimus Muscle, Quality.)

Introduction

Fresh pork quality has been defined as a combination of traits that include appearance, taste, nutritional value, and wholesomeness. Color is a primary quality factor considered when meat is purchased, along with other visual characteristics. Consumer concerns about meat quality have led livestock producers, packers, processors, purveyors, and retailers to consider production practices that affect pork quality, value, and consistency. Genetics, slaughter practices, and chill conditions affect pork quality. However, chop location within a loin may also contribute to inconsistency in pork quality. Therefore, the objective of this study was to determine the influence of chop location within a boneless loin on quality characteristics.

Procedures

Eighty-two boneless pork loins were obtained from a commercial packing facility. They were selected from hogs with similar carcass weights (between 180 and 210 lb) and had similar lengths (20-22 in). At 7 d postmortem, the loins were cut from posterior to anterior ends into 1 in chops. Chop surfaces were allowed to bloom for 30 min before the Longissimus muscle (LM) was evaluated at 1, 3, 5, 7, 9, 11, 13, 15, 17, and 19 in, posterior to anterior. Visual color, firmness and wetness, and marbling were evaluated using NPPC (1991) guidelines. Visual color was evaluated on a 1 to 5 scale, with 1 representing a muscle that was pale-pinkish-gray and 5 being a muscle that was dark-purplish red in color. Visual firmness and wetness were evaluated on a 1 to 5 scale, with 1 being very soft and watery and 5 being very firm and dry. Visual marbling was evaluated on a 1 to 5 scale, with 1 being practically devoid and 5 being moderately

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abundant or greater. Following the visual evaluations, L*a*b* values were measured utilizing a HunterLab Miniscan (Hunter and Associates, Reston, VA) with a 10° observer and Illuminant C. Each chop was scanned at two locations (lateral and medial) within the LM and averaged. The L* value is a measure of lightness (0 to 100), the a* value measures green to red (-60 to 60), and the b* value measures blue to yellow (-60 to 60).

Chops at 2, 7, 12, and 17 in, posterior to anterior, were used to determine thawing and cooking losses, as well as Warner-Bratzler shear (WBS) evaluations. Chops were frozen and held at -40°F, thawed at 38°F for 24 h, and then weighed and cooked to an internal temperature of 160°F in a Blodgett dual-air-flow oven. Temperature was monitored using thermocouples attached to a Doric Minitrend 205 temperature monitor. Chops were cooled at room temperature for 1 h and reweighed. Chops then were chilled 24 h at 38°F before six .5 in cores were taken parallel to the muscle fibers and sheared perpendicular to the muscle fibers using a Universal Instron.

Forty of the above boneless pork loins were selected randomly to determine excess water binding capacity, cooking yield, and percents extractable lipid and moisture. Water binding capacity, cooking yield values, and pH measurements were taken on four chops at 4, 9, 14, and 19 in, posterior to anterior. Excess water binding capacity and cooking yield were determined by grinding the longissimus muscle through a .125 in plate, randomly selecting a 15 ± .05 g sample, and mixing it with a .6 M NaCl and .04 M Na_2HPO_4 solution. The mixture was centrifuged and cooked in a 176°F water bath for 30 min. Excess water binding capacity is an indication of the total amount of hydrating solution the ground meat is capable of holding. The equation used was [(((total weight before cooking - tube weight) - 15)/15) × 100]. Cooking yield is an indication of the capability of meat proteins to bind water upon cooking. It is the proportion of the uncooked, hydrated meat pellet retained after heating and centrifugation. The equation used was [((total weight after cooking - tube weight)/(total weight before cooking - tube weight)) × 100]. pH was measured using a Metoxy stainless steel pH electrode and meter (Model HM-17MX; TOA Electronics, Ltd., Tokyo, Japan).

Four chops located at 3, 8, 13, and 18 in, posterior to anterior were analyzed for percent extractable lipid and moisture using AOAC (1992) procedures.

Results and Discussion

Visual characteristics for chop surfaces taken at 2-in intervals are reported in Figure 1. The LM chop surfaces were more reddish-pink (P<.05) at 3 to 11 in from the posterior end than surfaces of chops located at 1, 13, and 15 in from the posterior end. The chop at 19 in from the posterior end of the loin (anterior portion) was darker, more (P<.05) reddish-pink than all other chops. In general, chops became softer and more watery from the posterior to anterior locations. Chops located 1 through 9 in from the posterior end were firmer and less watery (P<.05) than chops located between 13 and 19 in from the posterior end. In addition, chops at 17 and 19 in from the posterior end were the softest and most watery (P<.05). Visual marbling was higher (P<.05) at the posterior end (chops located 1 and 3 in from the posterior end) than for the rest of the loin (chops located 5 through 19 in from the posterior end).

Instrumental values (L*, a*, and b*) are presented in Figures 2 to 4. Values for L*, measure of lightness were darker (P<.05) for chops located 3 to 11 in from the posterior end than for chops from the posterior end (1 in) and anterior end (13 and 15 in from the posterior end). The most anterior chops (17 and 19 in from the posterior end) also were darker (P<.05) than chops located 13 and 15 in from the posterior end. The a* values (measure of redness) of the anterior chops (17 and 19 in from the posterior end) were redder (P<.05) than those for the rest of the loin. Chops located at 13 and 15 in from the posterior end were (P<.05) more yellow than chops located 9 and 19 in from the posterior end.

Both visual and instrumental data suggest that the most posterior chop was lighter colored but had a high degree of marbling and firmness. Through the central posterior section (3 to 11 in from the posterior end), chops had somewhat similar color, firmness, and marbling evaluations. This suggests that this section was very uniform in pork quality. The anterior portion of the loin was more variable in quality. Chops 13 and 15 in from the posterior end, which are below the spinalis dorsi (cap muscle), were lighter colored and generally softer than chops from the adjoining posterior central location. The most anterior chops (17 and 19 in from the posterior end) were darker and tended to have more intramuscular lipid but were softer and more watery than chops from 13 and 15 in from the posterior end.

The LM quality characteristics are presented in Table 1. The posterior chop (2 in from the posterior end) had the lowest ($P<.05$) WBS value (most tender). The central anterior chop (12 in from the posterior end) had a lower WBS value (more tender) than the central posterior chop (7 in from the posterior end). Although no differences were detected ($P>.05$) for cooking and thawing losses and excess water binding values, the posterior chop had a higher ($P<.05$) cooking yield than those from the other locations. The anterior end (19 in from the posterior end) had the highest ($P<.05$) pH, and the posterior end (4 in from the posterior end) had a higher pH than the central anterior location (14 in from the posterior end). Chops from the anterior (18 in from the posterior end) and posterior (3 in from the posterior end) locations had more extractable lipid than the central posterior (8 in from the posterior end) location.

The highest quality chops appear to come from the posterior end. They had the lowest WBS value (most tender), highest cooking yield, and a high pH and percent extractable lipid. The higher lipid content corresponded with the higher visual marbling score. However, the other three sections were more variable in quality-related traits.

This study suggests that locations within the same loin may vary in color, tenderness, cooking yield, pH, and lipid (marbling). However, some sections within the same loin have similar quality characteristics. Therefore, pork loins potentially can be sectioned to increase the consistency of quality characteristics and provide a more uniform purchasing unit for consumers.

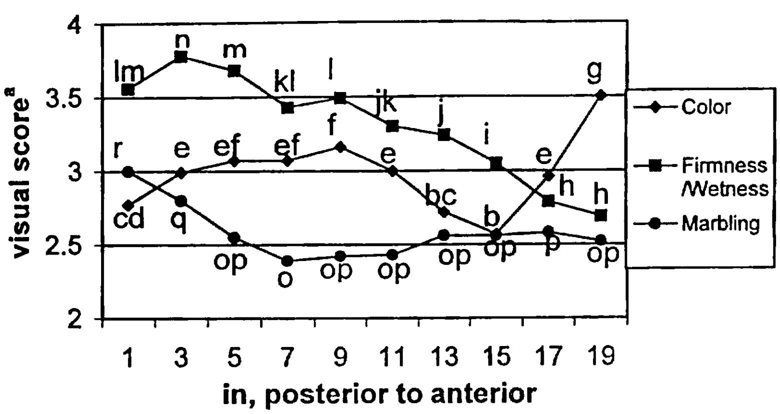

Figure 1. The Influence of Chop Location on Visual Characteristics.

[a]5-point scale (2=grayish pink, soft and watery, or traces to slight; 3=reddish-pink, slightly firm and moist, or small to modest; 4= purplish red, firm and moderately dry, or moderate to slightly abundant). [b,c,d,e,f,g]Means for visual color without a common superscript differ ($P<.05$). [h,i,j,k,l,m,n]Means for visual firmness and wetness without a common superscript differ ($P<.05$). [o,p,q,r]Means for visual marbling without a common superscript differ($P<.05$).

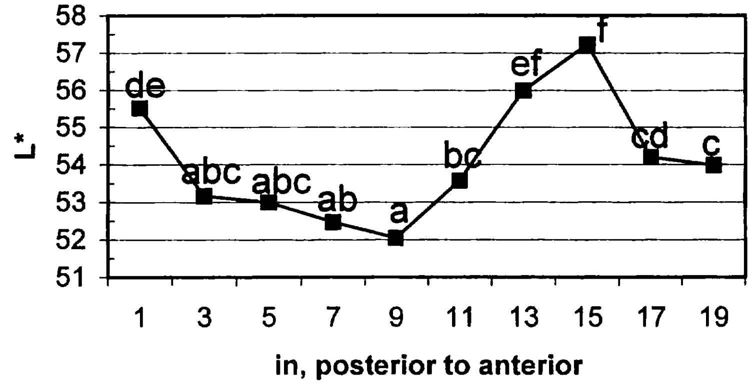

Figure 2. The Influence of Chop Location L* Values.

a,b,c,d,e,f Means without a common superscript letter differ ($P<.05$).

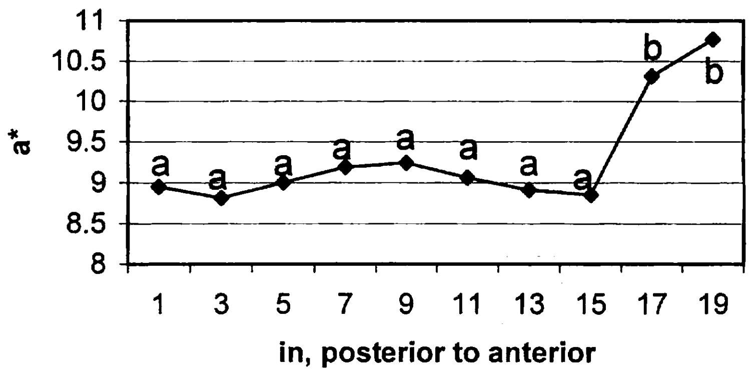

Figure 3. The Influence of Chop Location on Longissimus Muscle a* Values.

a,b Means without a common superscript letter differ ($P<.05$).

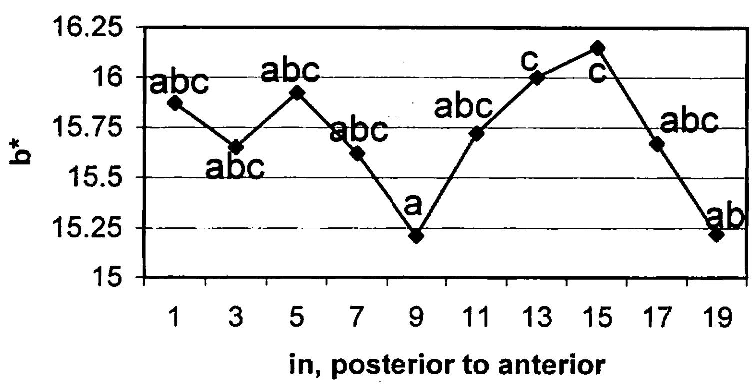

Figure 4. The Influence of Chop Location on Longissimus Muscle b* Values.

a,b,c Means without a common superscript letter differ ($P<.05$).

Table 1. The Influence of Chop Location on Longissimus Muscle Quality Characteristics

	Posterior		Central		Central Anterior		Anterior	
Item	Mean	SE	Mean	SE	Mean	SE	Mean	SE
WBS[a], lb[b]	6.33[e]	.047	7.05[g]	.047	6.72[f]	.048	6.81[fg]	.050
Cooking loss, %[b]	21.90	.480	21.93	.480	22.02	.480	21.02	.480
Thawing loss, %[b]	2.78	.063	2.94	.063	2.98	.063	2.83	.063
Excess water[c]	62.72	3.92	69.08	3.92	64.58	3.92	57.85	3.97
Cooking yield[c]	73.85[f]	.740	71.42[e]	.740	70.89[e]	.740	71.46[e]	.749
pH[c]	5.80[f]	.037	5.74[ef]	.037	5.68[e]	.037	6.01[g]	.039
Lipid, %[d]	2.32[f]	.154	1.58[e]	.156	1.90[ef]	.154	2.30[f]	.156
Moisture, %[d]	73.48	.163	73.74	.165	73.60	.163	73.72	.165

[a]Warner-Bratzler Shear.
[b]Chop location is posterior=2 in, central posterior=7 in, central anterior=12 in, anterior=17 in, measured posterior to anterior; n=82 loins.
[c]Chop location is posterior=4 in, central posterior=9 in, central anterior=14 in, anterior=19 in, measured posterior to anterior; n=40 loins.
[d]Chop location is posterior=3 in, central posterior=8 in, central anterior=13 in, anterior=18 in, measured posterior to anterior; n=40 loins.
[e,f,g]Means in the same row without a common superscript letter differ (P<.05).

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