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ASSESSMENT OF PALATABILITY ATTRIBUTE OF *Gluteaus Medius* STEAKS (BEEF TOP SIRLOIN BUTT)

J.B. MACHETE [1]*, J.P. APPLE [2], Z.B. JOHNSON [2], R.G. STACKHOUSE [2] and C. KEYS [2]

[1]*Botswana College of Agriculture, Department of Animal Science & Production, Botswana*
[2]*University of Arkansas, Department of Animal Science, Arkansas State, USA*

*Email: jmsmachete@yahoo.com

ABSTRACT: *Beef top sirloin butts (n = 48) were selected on the bases of USDA quality grade (USDA Choice or Select) and USDA yield grade category (yield grades 1 and 2 or 4 and 5) to measure Warner-Bratzler shear force (WBSF) variation within the gluteus medius (GM). Eight 2.54-cm-thick steaks were cut from the GM, with 2 steaks removed from the anterior (ANT), middle (MID) and posterior (POST) sections of the GM. One steak cut into 3 equal length steaks designated as lateral (LAT), central (CENT), and medial (MED) portions. The second steak of each pair was subsequently cut from each location pair and cooked to 71◦C in an air-impingement oven for WBSF determinations. Cooking losses were not (P>0.05) affected by yield grade or steak location; however, top Choice steaks had lower (P<0.01) cooking loss percentages than Select steaks and cooking losses were the greatest (P<0.05) and least (P<0.05) in the medial and central portions of the GM steaks, respectively. Neither quality grade category (P0.133) nor yield grade category (P = 0.485) affected the WBSF values of GM steaks, but the central portion of anterior GM steaks received the lowest (P<0.05) WBSF values, whereas the medial portion of middle steaks received the greatest (P<0.05) WBSF values (steak location × within-steak position, P<0.001). This study indicated that central portion of anterior steaks was less tough portion.*

Key words: *USDA Quality & Yield Grades, Instrumental Tenderness, Beef, Gluteus medius Steaks*

ORIGINAL ARTICLE

INTRODUCTION

The meat industry is still trying hard to produce beef in order to satisfy consumers` palatability needs at lower costs. Tenderness, juiciness and flavour are evaluated through palatability, and consumers consider tenderness as the most liked attribute (Huffman et al., 1996).The most valuable attribute of palatability of meat is tenderness, because it is the primary measure of meat quality (Dikeman, 1987). Therefore, the consumers' overall eating experience is determined by tenderness as an important attribute of palatability (Dikeman, 1987). Some other researchers have found that the extent of modification of the muscle structural and associated proteins determines the ultimate tenderness of meat (Hopkins and Taylor, 2002). Furthermore, tenderness had been valued as one of the top 10 concerns by the USA retailers and restaurateurs (Smith et al., 1992). A typical character of tenderness is designated by the substantial difference among muscles, carcasses, cuts of meat and animals (Searls et al., 2005). Research findings by (Reuter et al., 2002) revealed that tenderness in a cut of meat differ within its own borders.

The objective of this study was to assess the interactive effect of USDA quality and yield grades on palatability of beef top sirloin butts.

MATERIALS AND METHODS

Top sirloin butt selection and fabrication

Beef top sirloin butts selection was based on USDA quality grade (USDA Choice [modest and moderate degrees of marbling] or USDA Select [slight degree of marbling]) and USDA yield grade category (yield grades 1 and 2 or 4 and 5). Yield grade data were obtained via the facility's video-image analysis, and the plant also supplied the USDA quality grade data for each selected carcass. Individually-identified top sirloin butts (n = 48) from left carcass sides were captured during carcass fabrication, vacuum-packaged, and transported under refrigeration to the University of Arkansas Red Meat Abattoir for further processing. Top sirloin butts were allowed to age at 2°C for 14 days from the box date before removal from vacuum-sealed packages. Beginning at the posterior end of the resulting *gluteus medius* (GM), eight 2.54-cm-thick steaks were cut: 1) first and second steaks designated as

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posterior (POST) steaks; 2) third steak cut and discarded; 3) fourth and fifth steaks designated as middle (MID) steaks; 4) sixth steak cut and discarded; and 5) seventh and eighth steaks designated as anterior (ANT) steaks. One steak was randomly chosen from each location pair, individually identified, vacuum-packaged, and frozen at -20°C for Warner-Bratzler shear force (WBSF) determination.

Warner-Bratzler shear force analysis

Steaks were allowed to thaw for 16 hours in a 4°C commercial refrigerator before removal from packages and identified with heat-resistant tags. Thereafter, steaks were weighed and oriented with the medial side to the left side on the belt of a gas-fired, air-impingement oven (Lincoln Impinger; Food Service Products, Inc., Ft. Wayne, IN, USA). The oven was preheated to 165°C, to produce a desired endpoint temperature of 71°C, and endpoint temperature of each cooked steak was confirmed at the completion of cooking with a hand-held thermometer (model KM28; Co-mark Instruments Inc., Beaverton, OR, USA). Cooked steaks were allowed to cool to room temperature, weighed, and the difference between the pre-cooked and cooked steak weights was used to calculate cooking loss percentage. Cooked steaks were then wrapped in an oxygen-permeable, PVC film and chilled overnight in a 4°C commercial refrigerator before 1.27-cm-diameter cores were removed parallel to the muscle fibre orientation from the LAT, CENT and MED areas (6 cores / area) of steak. Each core was sheared once through the center with a WBSF device attached to an Instron Universal Testing Machine (Instron Corp., Canton, MA, USA) equipped with a 981-N load cell and set at a crosshead speed of 250 mm/min. The peak WBSF of the 6 cores/within steak location was averaged before statistical analyses.

Statistical analyses

The general carcass data were analyzed using PROC MIXED of SAS (SAS Inst., Inc., Cary, NC, USA), with quality grade (QG) and yield grade (YG) categories, as well as the QG × YG interaction, included in the model as the fixed effects. The experiment was conducted as a split-split plot design, with QG and YG as the whole plot, steak location within the GM (POST, MID, or ANT) as the sub-plot, and the within steak position (LAT, CENT, and MED) as the sub-sub-plot. Cooked steak data were generated with PROC MIXED, and the fixed effects included in the statistical model included QG, YG, steak location (STK), within-steak position (WSP), whereas the random effects were QG × YG × top sirloin butt, and STK × WSP × top sirloin butt. Least squares means calculated for all main and interactive effects, and when significant ($P<0.05$) *F* values were observed, least squares means were statistically separated with pair-wise *t*-tests PDIFF option).

RESULTS

Cooking loss

Even though steaks from top Choice carcasses had lower ($P<0.01$) cooking loss percentages than steaks from Select carcasses, cooking losses were similar ($P>0.53$) between steaks of YG 1 and 2 and YG 4 and 5 carcasses (Table 1). Furthermore, the interactions between quality and yield grades were similar in terms of cooking loss percentage. However, the percentage losses for quality grades were significantly different ($P< 0.05$) (Table 2). The interaction between quality grade and yield grade showed no significantt difference in cooking loss percentage. Cooking losses did not ($P>0.53$) differ among anterior-, middle- and posterior-located steaks, but cooking loss percentages were greatest ($P<0.05$) in the medial portion and least ($P<0.05$) in the central portion of the GM steaks (Table 2). Nevertheless, the cooking loss percentage within steak position showed a great significant different ($P<0.001$). However, the interaction between steak location and within steak position revealed no significant difference.

Warner-Bratzler shear force (WBSF)

Neither quality grade category ($P=0.133$) nor yield grade category ($P=0.485$) affected the WBSF values of GM steaks. Although there were main effect differences associated with steak location and within-steak position, the central portion of anterior GM steaks received the lowest ($P<0.05$) WBSF values, (Figure 1). This indicated that less force was used to shear that particular steak portion. On the other hand, the medial portion of middle steaks received the greatest ($P<0.05$) WBSF values (steak location × within-steak position, ($P<0.001$); (Figure 1). Within anterior steaks, the lateral position had greater ($P<0.05$) WBSF values than either the central or medial positions, but the medial position had greater ($P<0.05$) WBSF values than the lateral position within middle steaks. Findings showed that there was little to no variation ($P>0.05$) among the lateral, central and medial portions of steaks originating from the posterior of the GM.

Table 1 - Effects of USDA quality grade (QG) and yield grade (YG) categories on shear force and cooking characteristics of *gluteus medius* steaks

Variable	USDA Top Choice		USDA select		P > F		
	1 & 2	4 & 5	1 & 2	4 & 5	QG	YG	QG xYG
Cooking Loss, %	29.5 ± 0.65	30.1 ± 0.65	31.8 ± 0.68	32.1 ± 0.65	0.003	0.533	0.496
Shear Force, N	34.04 ± 2.57	34.43 ± 2.56	40.22 ± 2.69	36.19 ±2.55	0.133	0.485	396

Probability value of the main and interactive effects included in the statistical model

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Table 2 - Main effects of steak location (S) and within steak position (P) on shear force and cooking characteristics of *gluteaus medius* steaks.

	Steak location[1]				Within steak position[2]				P > F[3]		
Variable	ANT	MIDD	POST	SE	LAT	CENT	MED	SE	S	P	S × P
Cook loss, %	31.2	30.8	30.6	0.44	32.0^{X}	29.5^{z}	31.1^{y}	0.4	0.536	<0.001	0.425
Shear force, N	34.64^{y}	38.36^{x}	35.61^{y}	1.52	37.47	34.82	36.39	1.45	0.025	0.06	<0.001

^{x,y,z} Within a row and main effect, least squares means lacking common superscript letters differ ($P < 0.05$). [1] Steak location: ANT = anterior; MIDD = middle; and POST = posterior; [2] Within steak position: LAT = lateral; CENT = central; and MED = medial; [3] Probability value of the main and interactive effects included in the statistical model.

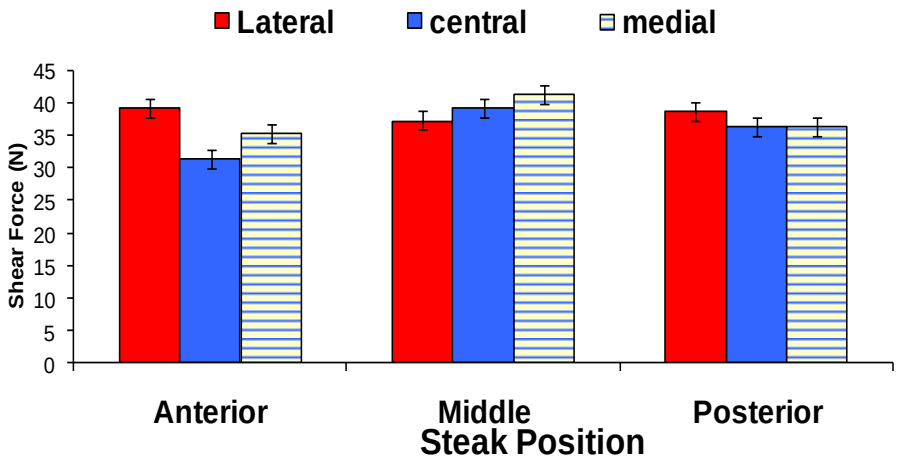

Figure 1 - Interactive effect of steak location and within steak position (P<0.001) on Warner-Bratzler shear force values of *gluteus medius*. [a-e] Bars lacking common letters are different (P<0.05).

DISCUSSION

Cooking loss and Warner-Bratzler shear force

The cook loss was found to have significant difference within the steak positions on quality grades: Choice and Select grades estimates. High cooking loss may result in low water holding capacity. For any muscle, water holding capacity is minimal at low ultimate pH. The variations in cooking loss were attributed to specific species. This study revealed that cooking losses were the same between steaks of YG 1 and 2 and YG 4 and 5 carcasses, although top Choice had lower cooking loss percentage than Select carcasses.

GM muscle was observed not to be uniform regarding instrumental tenderness in relation to within steak location and position. The less tougher, anterior-central steak was measured with force of 30.71 N, and middle-medial being the toughest steak, needed more force to shear and measured 40.12 N. (Figure 1). This supports the study in which textural properties differed to a greater extent particularly from lateral to medial than origin to insertion (Segars et al., 1974). The differences in instrumental tenderness within GM sectioned steaks might be due to the same interpretations made by Hannula and Puolanne, (2004) on *semi-membranosus* muscle who stated that the rate of muscle temperature effecting rigor development or muscle fiber may have an influence on the variations within the muscle. Dikeman and Tuma (1971) reported that the palatability of beef is affected by various factors; for instance, intramuscular collagen solubility reduces as cattle age, developing into a tougher beef. It was noticed that shear force measurement and taste panel tenderness of beef steaks were greatly related to collagen solubility. Finally, the central portion of anterior was noted to be most tender part of GM muscle because the results in fig.1 showed that less force was used to shear the central portion.

CONCLUSION

The study focused on assessment of tenderness areas within the *gluteus medius* steaks. The results indicated that Warner-Bratzler shear force values can be utilised as criteria for establishing steaks which will meet the satisfying consideration in tenderness by consumers prior to dissemination to the retail of food service outlets. The results of the study could be used to add value to the beef top sirloin butts by utilising those muscles with uniform tender areas for fabrication and marketing them as single muscle steaks.

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