Meat and Muscle Biology™

Beef Chuck, Sirloin and Round Determined Suitable for Use as Beef Finger Steaks

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Abstract: Finger steaks, an Idaho culinary tradition, are historically made with beef loin cuts which command a higher value than other beef primals. The primary objective of the current study was to evaluate tenderness and sensory characteristics of beef finger steaks made from the loin and lower valued cuts from the chuck, sirloin, and round. Beef cuts conforming to the Institutional Meat Purchasing Specifications (IMPS) included strip loins (IMPS #180), top rounds (IMPS #169A), clod hearts (IMPS #114E), and top sirloins (IMPS #184B) from USDA Choice carcasses ($n = 12$) that were aged for 21 d. Following the aging period, all subprimals were fabricated into strips (1.27 cm × 1.27 cm × 7.62 cm), breaded and fried. Warner-Bratzler shear force (WBSF) was conducted on each treatment to assess objective tenderness. Consumer sensory panelists ($n = 120$) and trained sensory panelists ($n = 7$) assessed each muscle based on the following traits: appearance, flavor, and tenderness. In addition, the consumer sensory panel assessed overall product acceptability. Objective tenderness differed ($P < 0.01$) between treatments with strip loin and top sirloin being the most tender. Consumer sensory panels indicated a difference in acceptability ($P < 0.01$), tenderness ($P < 0.01$), juiciness ($P < 0.01$), and flavor ($P < 0.01$) between treatments. The beef strip loin samples had mean consumer acceptability values greater than the other muscles in nearly all palatability categories ($P < 0.05$). Trained panelists identified the clod heart as having superior juiciness ($P = 0.02$) while the top round samples were identified as having a lower tenderness value compared to the other treatments ($P = 0.01$). Based on their mean WBSF and sensory panel results, meat from the chuck and round were determined to be acceptable alternatives to the current traditional higher cost loin cuts commonly used for beef finger steak production.

Key words: beef, battered product, consumer acceptability, underutilized
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Introduction

An Idaho culinary tradition known as the "finger steak" appeared in the 1960s and is believed to be created by a restaurateur in Boise, Idaho, who originally breaded and battered a bitesize product made from beef tenderloin (Guilhem, 2017). Contemporarily, the tenderloin can be quite cost prohibitive with an average weekly wholesale cost of nearly $25 per kilogram (USDA-NASS, 2023). With the consumption of battered and breaded meat products increasing over the last 40 years (Barbut, 2013; Barbut, 2015), as well as the rising cost of beef cuts in the US (USDA-ERS, 2024), there is a demand to look at lower-cost alternative cuts. More recently, the beef finger steak is often made from the beef strip loin; however, cuts from the beef sirloin, chuck and round are generally less costly and are often underutilized compared to cuts from the rib and loin sections (Von Seggern et al., 2005).

The current study was conducted to determine if differences between traditional and alternative beef cuts used in beef finger steaks can be observed through consumer acceptance assessments and tenderness values.

Materials and Methods

Product preparation

Commercially available United States Department of Agriculture (USDA) Choice beef subprimals fabricated according to the Institutional Meat Purchasing Specifications (IMPS) were obtained from a commercial beef harvest facility. The subprimals that were used in the study were obtained from carcasses that were of native beef cattle origin, finished on a conventional North American concentrate ration, and harvested under USDA inspection. Carcasses chilled at 0°C; for 24 h prior to fabrication. Beef subprimals assessed in the study were boneless strip loins (IMPS #180, *longissimus lumborum*), top rounds (IMPS #169A, *semimembranosus* [SM]), clod hearts (IMPS #114E, *triceps brachii* [TB]), and center-cut top sirloins (IMPS #184B, *gluteus medius*). The subprimals were transported from the slaughter facility under refrigeration (3.5 h; 4°C) to the University of Idaho Meat Laboratory. Twelve of each subprimal were used for the study. The vacuum-sealed subprimals were allowed to age at 0°C for 21 d post-fabrication. Following the aging period, all raw products were trimmed of external fat before further fabrication. The subprimals were cut with the grain using a mechanical meat slicer (Berkel, Louisville, Kentucky) to 1.27 cm thickness. Following the slicer, steaks were fabricated, once again with the grain, using the Strip Cutter and Tenderizer S111 (Bizerba International, Balingen, Germany) with a 1.27 cm stripping cradle to obtain beef strips of 1.27 cm × 1.27 cm × 7.62 cm in dimension. Raw finger steak strips were sorted to remove pieces containing connective tissue, cartilage, and excess fat. The finger steaks that met the dimensional requirements and visual selection were vacuum packaged, frozen at −20°C, and assigned to subsequent analysis groups including WBSF and sensory taste panels. Product remained in constant frozen storage for 6 mo, in the −20°C environment, prior to further assessments being conducted.

Preparation

A batter was formulated within guidelines commonly applied to battered meat products (Loewe, 2011). The formulated batter is presented in Table 1. Finger steaks were tempered for 24 h at 4°C prior to battering and cooking. Finger steaks were cooked in cooking oil at 188°C (Great Value Vegetable Oil, Wal-Mart Stores, Inc., Bentonville, AR) in a countertop electric fryer (Avantco F102 Dual Tank Electric Countertop Fryers, Avantco Equipment, Meridian, ID) to an internal temperature of 71°C. Fry time was determined at 2.5 min in pre-trials to meet 71°C degrees of internal temperature doneness for the finger steaks. For each muscle, initial weights (g) were recorded and used to calculate batter pick-up. The term "pick-up," or percentage batter present, refers to the amount of coating material adhering to the product and is based on the final weight (USDA-AMS, 2014). Pick-up was calculated as:

$$Percent\ Pick-up = \frac{Finished\ fried\ weight - initial\ weight}{Finished\ fried\ weight} \times 100$$

Table 1. Batter recipe used for beef finger steak production

Ingredient	Amount(g)
Pre-dust	
All-Purpose Flour	400g
Wet ingredients	
Eggs	56g
Buttermilk	217g
Dry ingredients	
All-Purpose Flour	300g
Garlic Powder	15g
Paprika	15g
Salt	15g
Pepper	15g
Cornstarch	100g

Warner-Bratzler shear force

WBSF was used to evaluate objective tenderness of finger steak treatments. There were ($n = 72$) samples evaluated per treatment. Cooked finger steak samples were allowed to equilibrate to room temperature prior to shearing. Each sample was sheared perpendicular to the muscle fiber orientation using a WBSF machine (G-R Manufacturing, Manhattan, KS) at a crosshead speed of 225 mm/s. Peak shear force in kilograms of force (kgf) measurements were recorded and averaged to obtain a single shear force value for each subprimal. Additionally, shear force data were analyzed qualitatively to evaluate the proportion of pieces acceptable at USDA tenderness thresholds of 4.4 and 3.9 kg of shear force which are representative of USDA "tender" and "very tender", respectively (ASTM, 2008).

Consumer taste panel

The study was found to be exempt by the University of Idaho Institutional Review Board (IRB

Protocol 21-100, Reference No. 013095). Samples were assigned, and panels set up in accordance with American Meat Science Association (AMSA) guidelines (AMSA, 2016). All panelists ($N = 120$) provided written, informed consent for inclusion prior to their participation in the study. Before sampling and evaluations, panelists were given verbal instructions and any necessary forms. Consumer panelists were instructed that the study was investigating beef finger steaks. It was a requirement that panelists were a minimum of 18 years old and identified as consumers of beef. Prior to sampling panelists were asked to complete a demographics survey. Three separate panels were conducted with a minimum target of 40 panel participants per panel. Within each panel, samples were assigned to panelists according to a complete block design which represented all muscle treatments equally. To minimize bias, panelists were randomly assigned 3-digit, blind-coded samples. Each panelist was provided with a ballot to evaluate each sample along with an expectorant cup, a cup of room temperature water, unsalted soda crackers (Premium Unsalted Tops Saltine Crackers, Mondelez Global LLC, East Hanover, NJ), a toothpick, and a napkin. Panelists were then asked to evaluate a finger steak sample from each subprimal treatment group based on the following traits: overall acceptability, appearance, flavor, juiciness, tenderness, color of the coating, and amount of coating using a 10-point hedonic scale where 1 = dislike extremely and 10 = like extremely. In addition, consumers were asked if they would make future purchases for the sample with options of "yes" or "no/unsure." Order of treatment samples was randomized to account for order bias.

Trained taste panel

Samples and panels were assigned in accordance with AMSA guidelines (AMSA, 2016). However, AMSA guidelines do not account specifically for battered beef products leading to the current study having to incorporate sensory guidelines from other battered proteins to expand the knowledge on battered beef. Subjective evaluations of appearance, texture, and binding were measured using guidelines set forth in Batters and Breading in Food Processing (Loewe, 2011). Additionally, Meilgaard et al. (2006) assessments for crispiness were utilized. Reference standards were used to help illustrate attributes and can be reviewed in Table 2. Twenty-eight finger steaks from each subprimal were assessed for trained sensory evaluation. Training occurred for 4 d, twice a day, and each session was an hour long. Trained panelists ($N = 7$) evaluated finger steaks from each muscle based on the following traits: coating appearance, batter adhesion, crispiness, juiciness, tenderness, beef flavor intensity, and overall flavor intensity. Panelists rated the sensory attributes on a 1 to 10 scale with anchor points at each end where 1 = extremely poor appearance/poor batter adhesion/soft/dry/tough/bland/lacking flavor intensity and 10 = extremely good appearance/good batter adhesion/crispy/juicy/tender/flavor/intense flavor. The assessors used direct entry into a computerized survey (Qualtrics XM, Seattle, WA) to record their results. This allowed for performance to be monitored regularly to provide feedback until the panelists had a clear understanding of all attributes. Order of treatment samples was randomized to account for order bias.

Table 2. Definitions and anchors of sensory attributes for trained sensory panel

Sensory attribute	Definition	Reference
Appearance	Coating color evenness on the surface of the product Meilgaard et al. (2006)	*Less*: Tofu *Very:* Ginger snap
Batter adhesion	Act as a 'glue' to bind subsequent layer to the substrate Loewe (2011)	*Less*: Zucchini chip *Very:* Chicken nugget
Crispiness	The force (noise) with which a product breaks or fractures characterized by many small breaks Meilgaard et al. (2006)	*Less*: Granola bar *Very:* Melba toast
Juiciness	Amount of liquid released during the first bite using the molar teeth AMSA (2016)	*Less:* Eye of round steak grilled to 90°C *Very*: Strip loin steak grilled to 60°C
Tenderness	Necessary force to bite (first bite) the meat sample using incisor teeth AMSA (2016)	*Less*: Old cow steak grilled to 70°C *Very*: Tenderloin steaks grilled to 65°C
Beef flavor intensity	Amount of beef flavor intensity in the sample (AMSA 2016). The Beef flavor lexicon defined by Adhikari et al. (2011)	*Less:* Swanson's beef broth *Very:* Beef brisket
Overall flavor intensity	A measurement of the strength of a flavor in a particular food AMSA (2016)	*Less:* 80% lean ground beef cooked to 70°C *Very:* 80% lean ground beef cooked to 70°C mixed with 30% Swanson's beef broth

Statistical analysis

WBSF and consumer sensory panel data were analyzed using SAS V9.4 (SAS Institute, Inc., Cary, NC). Individual subprimal cuts (strip loins, clod hearts, top sirloins, and top rounds) served as the experimental

units ($n = 12$); thereby, 12 replications per treatment were observed. The experiment was set up as a randomized complete block design. Yield, WBSF, and consumer and trained panel responses were used as dependent variables. A generalized linear mixed model was used to fit the data where treatments were fixed effects and blocks (sensory panels days) by treatment were random effects. A binary distribution analysis was assessed for willingness to purchase responses. Differences in the estimated marginal means were compared through pair-wise comparisons. Significance was interpreted at $P < 0.05$.

Results and Discussion

Processing and pick-up yields

Batter "pick-up" and product yield was assessed for all muscles in the cooking process. Table 3 depicts the results for each muscle's average weight in grams and the batter pick-up percentages. "Pick-up" and "yield" are commonly used terms when producing battered products. It can be cost-beneficial to add a high percentage of pick-up for product acceptance without loss of quality (Loewe, 2011). The term "pick-up" or percentage batter present refers to the amount of coating material adhering to the product and is based on the final weight (USDA-AMS, 2014). Variation was observed between the subprimals indicating that the top round had the highest batter pick-up percentage compared to the clod heart, which had the lowest pick-up percentage ($P < 0.05$). Overall, many factors can affect the coating operation, ranging from meat surface to batter viscosity and temperature, breading size, and frying temperature (Barbut, 2015). In the current study, because the top round was adhering the most batter, one could postulate a greater saleable product yield potential of that cut using the current batter procedure.

Table 3. Results for muscle average weight in grams and the batter pick-up percentages ($n = 12$)

	Strip Loin	Clod Heart	Top Round	Top Sirloin	SEM	*P*
Initial Weight (g)	11.5	13.0	13.2	12.0	0.7	0.20
Pre-dust Weight (g)	12.5	13.8	14.1	12.9	0.8	0.38
Wet Ingredient Weight (g)	15.2	16.6	17.4	15.3	0.9	0.25
Batter Weight (g)	16.3^{b}	18.2^{ab}	20.4^{a}	17.2^{b}	1.1	0.03
Fried Weight (g)	12.4^{b}	13.6^{ab}	15.5^{a}	13.0^{b}	0.8	0.04
Batter Pick-up (%)	7.0^{b}	3.5^{b}	14.0^{a}	7.81^{b}	<0.1	< 0.01

[a,b]Means within a row without a common superscript differ ($P < 0.05$).

Warner-Bratzler shear force

Mean WBSF differences were observed between treatments where the strip loin was more tender than all other muscle treatments (Table 4; $P < 0.05$). The top round had the highest average WBSF mean of 3.73 kgf. To be considered "tender" and "very tender," shear force values must be below the USDA thresholds of 4.4 and 3.9 kgf, respectively (ASTM, 2008, ASTM, 2011). Table 3 demonstrates that all treatment means were considered "very tender" based on USDA thresholds. Previous research has grouped muscles into tenderness classifications of tender, intermediate and tough. These levels are based on thresholds for tenderness identified by Shackelford et al. (1991) and Huffman et al. (1996). Muscles deemed tough had a WBSF value of >4.6 kgf, tender muscles had a WBSF value of <3.9 kgf, and intermediate muscles had WBSF values between 3.9 and 4.6 kgf. The previous research of Shackelford et al. (1991) and Huffman et al. (1996) classified the TB and the SM muscles as intermediate tenderness while the *gluteus medius* muscle was classified as tough. In contrast, the muscles in the current research were all deemed very tender. The 2015 National Beef Tenderness Survey (Martinez et al., 2017) noted top round steaks had higher WBSF values compared to other loin muscles and advised processors and merchandisers to increase post-fabrication aging times to improve consumer acceptance of beef steaks.

Consumer sensory analysis

Consumer sensory panelists were recruited in the state of Idaho. Consumer demographics are reported in Table 5. The consumer group of 53 men and 63 women were between 18 and 91 years. Moreover, the data presented in Table 5 indicated that almost half of the panelists eat beef 2 to 4 times per week. Consumer sensory panel results (Table 6) indicated a difference in overall acceptability ($P < 0.01$), flavor ($P < 0.01$), tenderness ($P < 0.01$), and juiciness ($P < 0.01$) between treatments. As could have been anticipated, the strip loin outperformed the other cuts in tenderness, juiciness, and overall acceptability.

Table 4. Estimated means for WBSF (kgf) for each subprimal ($n = 12$)

	Strip loin	Clod heart	Top round	Top sirloin	SEM	*P* value
WBSF[1] (kgf)	2.85^{b}	3.51^{a}	3.74^{a}	3.44	0.16	< 0.01

[a,b]Means without a common superscript differ ($P < 0.05$).

[1]Warner-Bratzler shear force.

Table 5. Consumer taste panel summary statistics of panelist demographics ($N = 120$)

	n	%
Age		
18–19	9	7.5
20–29	49	40.8
30–39	18	15.0
40–49	18	15.0
50+	26	21.7
Gender		
Male	53	44.2
Female	63	52.5
Not Indicated	4	3.3
Beef Consumed Per Week[1]		
0–1	8	6.7
2–4	59	49.2
5–7	44	36.7
8+	8	6.7
Not Indicated	1	0.8
Most Consumed[2]		
Ground	64	53.3
Roast	2	1.7
Steak	33	27.5
Other	21	17.5

[1]Please indicate the number of meals a week in which you consume beef: 0–1, 2–4, 5–7, 8+.

[2]Please indicate the form in which you most commonly consume beef: Ground, Roast, Steak, Other.

Table 6. Mean consumer sensory panel scores for overall acceptability, flavor, juiciness, tenderness, coating, and appearance for strip loin ($n = 12$), clod heart ($n = 12$), top round ($n = 12$), and top sirloin ($n = 12$) of beef finger steaks

	Strip loin	Clod heart	Top round	Top sirloin	SEM	*P*
Overall acceptability[1]	8.6[a]	7.9[b]	7.4[c]	7.8[b]	0.1	<0.01
Flavor[2]	8.2[a]	7.9[a]	7.4[b]	7.8[a]	0.2	<0.01
Juiciness[3]	7.6[a]	7.0[b]	6.6[b]	6.7[b]	0.2	<0.01
Tenderness[4]	9.2[a]	7.8[b]	6.8[c]	7.7[bc]	0.3	<0.01
Coating[5]	8.3[a]	7.9[b]	7.8[b]	7.8[b]	0.2	0.04
Appearance[6]	8.5[a]	8.0[b]	8.1[ab]	8.0[b]	0.1	0.04

[a–c]Means within a row without common superscript differ ($P < 0.05$).

[1]Scale Overall Acceptability, 10 = like extremely, respectively; 1 = dislike extremely, respectively.

[2]Scale Flavor, 10 = like flavor extremely, respectively; 1 = dislike flavor extremely, respectively.

[3]Scale Juiciness, 10 = extremely juicy, respectively; 1 = extremely dry, respectively.

[4]Scale Tenderness, 10 = extremely tender, respectively; 1 = extremely tough, respectively.

[5]Scale Coating, 10 = like coating extremely, respectively; 1 = dislike coating extremely, respectively.

[6]Scale Appearance, 10 = like color extremely, respectively; 1 = dislike color extremely, respectively.

Previous research has demonstrated fairly comprehensive rankings of beef muscles demonstrating the relative overall superiority in palatability of the *Longissimus lumborum* (strip loin) over the clod heart, top round, and top sirloin muscle cuts (McKeith et al., 1985; Carmack et al., 1995; Rhee et al., 2004; Hunt et al., 2014). In the categories of tenderness and acceptability, the clod heart and top sirloin were second highest compared to the strip loin. Clod heart, top sirloin and strip loin consumer assessment results showed a superior flavor to that of top round. Flavor is often affected by the amount of intramuscular fat, or marbling, within a cut. Intramuscular fat has a significant impact on marketing and palatability of fresh meat, particularly beef (Corbin et al., 2015; Lonergan et al., 2019). The top round treatment resulted in less acceptable flavor than the other cuts of meat. The investigators hypothesize that the top round flavor rating was due to the fact that the SM muscle, the primary muscle in the top round, is characterized as fast-twitch glycolytic muscle, with relatively low marbling and high collagen content (Jurie et al., 2007). Moreover, Voges et al. (2007) rated different retail cuts for palatability attributes and reported that the top round was liked less with respect to overall liking and tenderness than other meat contents, which is similar to the results from the previous study. The mechanical tenderness evaluation (WBSF) of the treatments complements the consumer tenderness assessment.

Coating and appearance differed between treatments. The strip loin treatment had the preferred coating over all other treatments ($P < 0.05$). Similarly, the mean appearance values of the strip loin treatment were greater than that of the clod heart and top sirloin ($P < 0.05$). The top round was observed to have no difference in mean appearance acceptance values from any of the other treatments ($P > 0.05$). Color and appearance parameters play an important role in the evaluation of fried foods (Cao et al., 2020). Color of fried foods will directly affect consumer acceptance (Cao et al., 2020). The color of the food surface is the first quality parameter evaluated by consumers and is critical in the acceptance of the product (Pedreschi et al., 2005). A study performed by Pedreschi et al. (2005) evaluated potato chips according to their sensory quality as determined by color and saw that consumers prefer a golden-brown color, not a burnt color.

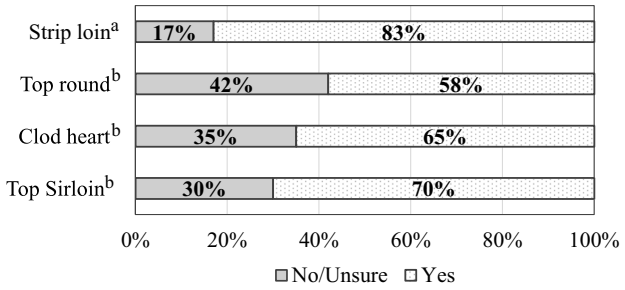

Figure 1. Affirmative purchase response by cut in a battered beef finger steak application. Treatments with different adjacent superscripts ([a, b]) differ ($P < 0.05$).

Controlling frying temperature, time and heat led to a golden-brown surface color preferred by consumers. Barbut (2012) found the same effect in coated chicken breast fillets. The strip loin in the current study had the greatest mean color and coating acceptability even though all products were the same size and prepared in the same manner. Overall beef eating quality is predominantly dependent upon all 3 factors: tenderness, juiciness, and flavor, as well as the interaction among these traits (O'Quinn et al., 2018). However, a steak may be deemed acceptable by consumers due primarily to the outstanding level of a single trait despite the lower or even unacceptable levels of one or both of the other traits (O'Quinn et al., 2018). It is possible that this trait compensation theory was also applied by consumers to color scores; however, more research would be needed to come to this conclusion.

There was a significant response in consumers' willingness to purchase ($P < 0.01$). Affirmative purchases for the muscles in a battered application were reported in Figure 1. The strip loin treatment was the most likely to be purchased based on consumer responses (83% Yes response, $P < 0.05$). All other treatments were not significantly different in consumer affirmative purchase responses.

The researchers wanted to also consider the fact that the science of assessing one's texture preferences are becoming more of a consideration among the meat science community (Miller et al., 2022). These considerations may need to be more of a factor in research assessing overall consumer acceptance of battered meat products in the future.

Trained sensory analysis

Trained taste panelists ($n = 7$) were recruited in the state of Idaho. Trained sensory panel scores are reported in Table 7. Panelists evaluated samples for color appearance, batter adhesion, crispiness, juiciness, tenderness, and flavor intensity. Acceptance of fried food is directly affected by the color appearance and often determines their selection or rejection of fried food as demonstrated by studies performed on potato chips (Segnini et al., 1999; Mendoza et al., 2007). Consumers tend to associate visual appearance with the taste and crispiness preferences, enjoyment level, safety, health, and storage conditions among other physicochemical properties (Segnini et al., 1999; Mendoza et al., 2007). Another essential feature of fried food is ensuring that the adhesion of the batter to the product throughout the cooking process. Lack of adhesion can negatively impact product perception. In addition, although it may be a difficult sensory impression to quantify, crispiness is certainly one, if not the most, critical coating characteristic (Loewe, 2011). For the present study, no differences were observed among the trained sensory panelists for coating appearance ($P = 0.46$), batter adhesion ($P = 0.34$), or crispiness ($P = 0.23$). These findings demonstrate that the products tested were prepared in a consistent and controlled manner and that differences observed by the trained panelists were the result of the beef cuts assessed.

The traits of tenderness, juiciness, and flavor have long been considered the most important palatability traits affecting beef eating quality (O'Quinn et al., 2018). A muscle profiling study performed by Sullivan and

Table 7. Mean trained sensory panel scores for overall acceptability, flavor, juiciness, tenderness, coating, and appearance for strip loin ($n = 12$), clod heart ($n = 12$), top round ($n = 12$), and top sirloin ($n = 12$) of beef finger steaks

	Strip loin	Clod heart	Top round	Top sirloin	SEM	*P* value
Appearance[1]	6.57	6.11	6.37	6.46	0.21	0.46
Batter adhesion[2]	5.11	4.5	4.41	5.18	0.38	0.34
Crispiness[3]	4.68	3.96	3.70	4.57	0.39	0.23
Juiciness[4]	4.75[ab]	5.57[a]	4.19[b]	4.36[b]	0.32	0.02
Tenderness[5]	6.71[a]	5.82[a]	4.22[b]	5.71[a]	0.40	0.01
Beef flavor intensity[6]	5.93	6.0	5.04	5.96	0.32	0.12
Overall flavor intensity[7]	2.21	2.07	1.96	2.25	0.15	0.53

[a,b]Means within sensory trait without common superscript differ ($P < 0.05$).

[1]Scale Appearance, 10 = extremely good appearance; 1 = extremely poor appearance.

[2]Scale Batter adhesion, 10 = overly bound; 1 = no binding.

[3]Scale Crispiness, 10 = extremely crispy; 1 = extremely dry.

[4]Scale Juiciness, extremely juicy; 1 = extremely dry.

[5]Scale Tenderness, 10 = extremely tender; 1 = extremely tough.

[6]Scale Beef flavor intensity, 10 = intense beef flavor; 1 = no beef flavor.

[7]Scale Overall flavor intensity, 10 = intense overall flavor; 1 = lacking overall flavor intensity.

Calkins (2011) found the TB muscle to possess palatability attributes suitable for retail steak fabrication. The results of the current study support that the clod heart was comparable in juiciness to the strip loin ($P > 0.05$) and superior to top round and top sirloin. The strip loin, clod heart, and top sirloin were more tender than the top round ($P < 0.05$). Nyquist et al. (2018) evaluated the palatability of beef chuck, loin, and round muscles and found through trained sensory panels that round muscles were less juicy and tender and had less flavor intensity in comparison to the *longissimus lumborum* and chuck muscles. Previously, it was stated that muscles from the round are less desirable due to lower tenderness influenced by fiber type and an increased level of connective tissue (Anderson et al., 2012). Carmack et al. (1995) ranked 12 muscles for flavor intensity, and with the exception of the TB (clod heart), the hindquarter muscles of the carcass, excluding the SM, exhibited the most-intense beef flavor. By contrast the current study results showed no significant difference for beef flavor intensity ($P = 0.12$) and overall flavor intensity ($P = 0.53$). Voges et al. (2007) advised that, because of their WBSF values and consumer ratings, round retail cuts still require more attention to ensure acceptable tenderness. The WBSF results of the current study are concomitant with results of the trained sensory panel tenderness assessment.

Conclusions

Although significant differences between muscle cuts were observed throughout the study, sufficient data demonstrated that the beef cuts assessed remain suitable as raw product options for finger steak application, albeit the strip loin did still consistently perform to a higher degree than the others. The clod heart and top sirloin consistently demonstrated similar palatability characteristics to that of the strip loin. Increasing consumer acceptance and the consistency of finger steaks could permit greater marketing, product development, and value discovery opportunities. The present study supports the idea that several cut options exist as acceptable alternatives to beef finger steaks while allowing for potential price discovery due to commonly observed differences in cost of the different cuts evaluated. Moreover, the cuts used in the current study suggest potential for use in other battered and breaded applications.

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