Consumer Evaluation of Value Added Beef from the Chuck And Round

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Story in Brief

USDA Choice beef chuck and round muscles were evaluated to assess their potential as a value-added foodservice steak from underutilized beef muscles. Four chuck muscles (infraspinatus, triceps brachii, teres major, and supraspinatus) and four round muscles (rectus femoris, vastus lateralis, biceps femoris, and semimembranosus) were utilized in this study. Individual muscles were trimmed free of visible connective tissue and further processed into 0.2 kg portion sized steaks. Steaks were then subjected to one of two treatments (treated or negative control). Treated muscles were mechanically tenderized twice, using a needle tenderizer, and their steaks were marinated for two 6-min cycles in a vacuum tumbler utilizing a marinade consisting of water, Aspergillus oryzae, and salt. Steaks were then allowed to reach a combined (sub-primal and steak) age of 21 days before consumer sensory evaluations. The infraspinatus, rectus femoris, and teres major received the highest consumer overall acceptability and tenderness ratings, whereas the vastus lateralis had the lowest overall acceptability scores among all muscles evaluated. The vastus lateralis, biceps femoris, semimembranosus, and supraspinatus received the lowest tenderness ratings among all steaks evaluated by consumers. Treated steaks from the eight muscles ranked significantly higher for all consumer sensory attributes when compared to their non-treated control. These data suggest that treated steaks isolated from the infraspinatus, rectus femoris, and teres major, exhibit the most potential for producing palatable steaks.

Key Words: Beef, Muscle Profiling, Consumer Panel

Introduction

The wholesale beef chuck and round represent a large percentage of a beef carcass. Unfortunately, cuts from the chuck and the round have traditionally been of low value and fabricated into low-priced roasts, steaks, and or ground beef. The objective of this study was to evaluate the potential for developing palatable steaks from underutilized beef muscles. To carry out this study, four chuck muscles (infraspinatus, triceps brachii, teres major, and supraspinatus) and four round muscles (rectus femoris, vastus lateralis, biceps femoris, and semimembranosus) were identified. USDA Choice steaks were sampled to determine the effect of mechanical tenderization and marination on the consumer ratings of steaks produced from individual muscles coming from the chuck and the round.

Materials and Methods

Sub-primals. Beef chuck and round sub-primals consisting of the shoulder clod, Institutional Meat Purchase Specifications (IMPS) #114 (NAMP 1997); chuck tender, IMPS #116B (NAMP 1997); knuckle, IMPS #167A (NAMP 1997); inside round, IMPS #169A (NAMP 1997); and outside round, IMPS #171B (NAMP 1997) were obtained from a federally inspected beef processing plant in Dodge City, Kansas and shipped to the Food and Agricultural Products Center (FAPC) at Oklahoma State University. Sample sizes consisted of: shoulder clod, n=35;

chuck tender, n=35; knuckle, n=30; inside round, n=20; and outside round, n=20. Upon arrival, the sub-primals were fabricated into individual muscles and completely denuded of fat and connective tissue using a Townsend® skinner (Townsend Engineering Co., Des Moines, IA). Individual muscles were then vacuum packaged and stored in a 4ºC cooler until transport to National Steak and Poultry (NSP) in Owasso, Oklahoma for further processing.

Fabrication, Marination and Tenderization of Steaks. Muscles were randomly segregated into two groups (a treated group and a control group) to obtain an equal representation of each muscle per treatment. The treated muscles were mechanically tenderized twice, utilizing a ROSS® needle tenderizer (Ross Industries, Inc., Midland, VA). The treated muscles were then cut into 0.2 kg (7 oz) steaks and marinated for two 6-min cycles in a vacuum tumbler utilizing a marinade consisting of water, Aspergillus oryzae (tenderizer), and salt. The control muscles were fabricated into 0.2 kg steaks and vacuum packaged. All steaks were then individually vacuum-packaged and allowed to reach 21 d of aging (combined age for sub-primal and steak) in a 4ºC cooler before being frozen at -30°C. After the samples were completely frozen they were stored at -10ºC.

Consumer Panel. The consumer panel evaluations were held on three consecutive evenings, in a restaurant setting, at Taylor Dining (Human Environmental Science Building, on the Oklahoma State University Campus). Panelists were recruited by flyers and mailings. Before being served, panelists were asked to answer a series of questions pertaining to their demographic makeup and steak purchasing habits. The panelists were then served a meal consisting of a salad, vegetable, bread, and three unseasoned steak samples, followed by dessert. All steaks were cooked to 70°C (medium degree of doneness) on a commercial flame-broil grill located on site. The steak samples consisted of a treated portion, a non-treated potion of the same muscle, and a portion of untreated Certified Angus Beef® (CAB®) top loin steak that had been aged for 21 days postmortem. Each sample was approximately 99 g (3.5 oz). Panelists ranked the steaks using a nine-point scale for overall like, flavor, juiciness, tenderness, and a five-point scale for purchase intent.

Data were analyzed using least squares analysis of variance (PROC GLM; SAS Institute, Cary, NC). Model included muscle and treatment to evaluate their effect on sensory attributes. Means were separated using least significant difference.

Results and Discussion

Least squares means for consumer panel responses, excluding CAB® steaks, are presented in Table 1. Steaks fabricated from the infraspinatus, rectus femoris, and teres major received the highest (*P*<.01) overall acceptability and tenderness ratings, whereas the vastus lateralis had the lowest overall acceptability scores among all muscles evaluated. The vastus lateralis, biceps femoris, semimembranosus, and supraspinatus received the lowest (*P*<.01) tenderness ratings among all steaks evaluated by consumers. Steaks from the infraspinatus, teres major, biceps femoris, and rectus femoris all received mean flavor scores of 6 or higher indicating "slightly like", with the infraspinatus receiving the highest scores of all muscles sampled. However, mean scores for the teres major, biceps femoris, and rectus femoris were not significantly different from mean flavor scores received by the triceps brachii, semimembranosus, vastus lateralis, and

supraspinatus, which all received scores in the range of five, indicating "neither like nor dislike". Steaks from the infraspinatus received the highest juiciness scores while steaks from the vastus lateralis received the lowest. All other juiciness scores were not significantly different. All muscles, excluding the vastus lateralis, received mean purchase intent scores of 3 or higher, indicating they "might or might not purchase" these steaks if they were offered on a foodservice menu. However, scores for the triceps brachii and biceps femoris were not significantly different from the vastus lateralis. Overall, treated steaks from the eight muscles ranked significantly higher ($P<.01$) for all consumer evaluated traits when compared to their non-treated controls (Table 2).

Table 1. Least squares means for consumer responses by muscle

Item	Triceps[1]	Infra[2]	Teres[3]	Biceps[4]	Semi[5]	Vastus[6]	Rectus[7]	Supra[8]
Overall[f]	5.7[b]	7.0[c]	6.1b[c]	5.6[b]	5.7[b]	4.8[a]	6.4[bc]	6.0[b]
Flavor[g]	5.5[ab]	6.7[c]	6.0[c]	6.0[bc]	5.5[ab]	5.1[a]	6.2[bc]	5.9[b]
Juiciness[h]	5.6[b]	7.0[c]	5.6[b]	5.8[b]	5.6[b]	4.3[a]	5.7[b]	5.9[b]
Tenderness[i]	5.7[bcd]	7.1[e]	6.3[cde]	5.3[ab]	5.2[ab]	4.8[a]	6.4[de]	5.6[abc]
Purchase[j]	3.0[ab]	3.8[c]	3.2[b]	3.0[ab]	3.0[b]	2.6[a]	3.4[bc]	3.1[b]

[a,b,c,d,e]Within a row, means without a common superscript letter differ ($P<.01$)
[f]Overall: 4=slightly dislike; 5=neither like nor dislike; 6=slightly like; 7=like
[g]Flavor: 5=neither like nor dislike; 6=slightly like
[h]Juiciness: 4=moderately dry; 5=slightly dry/slightly juicy; 6=moderately juicy; 7=very juicy
[i]Tenderness: 4=moderately tough; 5=slightly tough/slightly tender; 6=moderately tender; 7=very tender
[j]Purchase: 2=Probably would not buy if this steak were offered on foodservice menu; 3=Might or might not buy if this steak were offered on a foodservice menu
[1]Triceps=Triceps brachii; [2]Infra=Infraspinatus; [3]Teres=Teres major; [4]Biceps=Biceps femoris; [5]Semi=Semimembranosus; [6]Vastus=Vastus lateralis; [7]Rectus=Rectus femoris; [8]Supra=Supraspinatus

Table 2. Least squares means for consumer responses by treatment (all muscles combined)

Item	Control	Treated
Overall[c]	5.2[a]	6.6[b]
Flavor[d]	5.2[a]	6.6[b]
Juiciness[e]	5.1[a]	6.3[b]
Tenderness[f]	5.0[a]	6.6[b]
Purchase[g]	2.7[a]	3.5[b]

[a,b]Within a row, means without a common superscript letter differ ($P<.01$)
[c]Overall: 5=neither like nor dislike; 6=slightly like
[d]Flavor: 5=neither like nor dislike; 6=slightly like
[e]Juiciness: 5=slightly dry/slightly juicy; 6=moderately juicy
[f]Tenderness: 5=slightly tough/slightly tender; 6=moderately tender
[g]Purchase: 2=Probably would not buy if this steak were offered on foodservice menu; 3=Might or might not buy if this steak were offered on a foodservice menu

Evaluations were also used to determine consumer acceptance of the eight muscles sampled when compared to steaks typically used in foodservice. Consumer responses relating to treated muscles and non-treated CAB® steaks are presented in Table 3. Treated infraspinatus steaks significantly outperformed ($P<.05$) non-treated CAB® steaks in all sensory categories evaluated. All other treated muscles received scores that were not significantly different from non-treated

CAB[®] steaks, excluding the vastus lateralis which received juiciness and tenderness scores that were significantly lower ($P<.05$) than non-treated CAB[®] steaks.

Table 3. Least squares means of consumer responses for treated muscles including non-treated Certified Angus Beef[®]

Muscle	Overall[1]	Flavor[2]	Juiciness[3]	Tenderness[4]	Purchase[5]
			Sensory Characteristic		
Triceps bracii	6.9[bc]	6.5[ab]	6.7[bc]	6.7[bcd]	3.5[a]
Infraspinatus	7.6[c]	7.4[b]	7.7[c]	7.7[d]	4.2[b]
Teres major	6.3[ab]	6.5[ab]	5.8[ab]	6.7[bcd]	3.4[a]
Biceps femoris	6.4[ab]	6.7[ab]	6.4[b]	5.7[ab]	3.5[a]
Semimembranosus	6.7[bc]	6.4[a]	6.4[b]	6.5[abc]	3.7[ab]
Vastus lateralis	5.6[a]	6.1[a]	4.6[a]	5.6[a]	3.1[a]
Rectus femoris	6.8[bc]	6.6[ab]	6.4[b]	7.5[cd]	3.7[ab]
Supraspinatus	6.6[b]	6.4[a]	6.2[b]	6.2[ab]	3.3[a]
Certified Angus Beef	6.4[ab]	6.4[a]	6.4[b]	6.5[bc]	3.5[a]

[a,b,c,d]Within a column, means without a common superscript letter differ ($P<.05$)
[1]Overall: 5=neither like nor dislike; 6=slightly like; 7=like
[2]Flavor: 6=slightly like; 7=like
[3]Juiciness: 5=slightly dry/slightly juicy; 6=moderately juicy; 7=juicy
[4]Tenderness: 5=slightly tough/slightly tender; 6=moderately tender; 7=tender
[5]Purchase: 2=Probably would not buy if this steak were offered on foodservice menu; 3=Might or might not buy if this steak were offered on a foodservice menu; 4=Probably would buy if this steak were offered on a foodservice menu

Conclusion

While more research is needed to explore consumer and industry acceptance of these muscles, data show several muscles have potential as foodservice steaks. These data suggest that treated steaks, especially those isolated from the infraspinatus, rectus femoris, and teres major, exhibit the most potential for producing palatable value-added steaks, based on their overall consumer sensory values. Ultimately the value of these muscles will, to some extent, be based on packer's willingness to isolate these muscles. Labor cost, excess trimmings, and purge loss are factors which must be weighed and considered. Consideration of these factors, along with the palatability ratings and shear force values, will determine which muscles truly add value to beef carcasses.

Literature Cited

NAMP. 1997. The Meat Buyers Guide. 1st ed. North American Meat Processors Assoc, Reston, VA.

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