Yield and Fabrication Time for Value Added Beef from the Chuck and Round

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Story in Brief

Individual beef chuck and round muscles representing various USDA quality grades were evaluated to assess their potential as a value-added foodservice steak from underutilized beef muscles. Four chuck muscles and four round muscles were utilized in this study. Individual muscles were trimmed free of visible connective tissue and further processed into 0.2 kg (seven oz) portion sized steaks. Fabrication time and yield data were collected for both sub-primals and steaks. The supraspinatus had the highest yields of all sub-primals sampled. While the infraspinatus and teres major performed very well in sensory and tenderness evaluations, these muscles represent a relatively small portion of the shoulder clod. The denuded muscle yield of all muscles from the shoulder clod were markedly lower when compared to other sub-primals. The semimembranosus produced the highest mean number of 0.2 kg steaks, as well as the highest percentage yield of steaks. The teres major produced the lowest mean number of 0.2 kg steaks, while the triceps brachii had the lowest percent yield of steaks. Sub-primal fabrication time varied, with the shoulder clod generally taking the longest to fabricate. The biceps femoris and semimembranosus took the longest time to fabricate into 0.2 kg steaks but produced the highest number of 0.2 kg steaks. These data show that muscles isolated from the round generally produce the most steaks with high yields, however, previous data suggest that muscles isolated from the chuck generally produce more palatable steaks.

Key Words: Beef, Muscle Profiling, Fabrication Time, Fabrication Yield

Introduction

The wholesale beef chuck and round represents 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 quality grades (Choice, Select, and Standard) were sampled to determine the yields and fabrication times 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 (NAMP1997); 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 per grade; chuck tender, n=35 per grade; knuckle, n=30 per grade; inside round, n=20 per grade; and outside round, n=20 per grade. 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). Fabrication time and yield data, including purge loss, were collected. 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. Muscles were randomly segregated into two groups (a treated group and a control group) to obtain an equal representation of each muscle and grade per treatment. The control muscles were fabricated into 0.2 kg (7 oz) steaks by expert cutters at NSP, and fabrication time and yield data were collected.

Data were summarized using simple statistical parameters. Means, standard deviations, minimum values and maximum values were generated using SAS Procedures (version 8.2, SAS Institute, Cary, NC).

Results and Discussion

Tables 1 through 5 show the percentage yield and purge loss data of the sub-primals and muscles sampled by grade. Tables 6 through 8 show steak yield data and fabrication times for both sub-primals and steaks. It should be noted that sub-primal yield and purge data represents USDA Standard products that were commodity trimmed, whereas USDA Choice and Select products were closely trimmed.

The supraspinatus had the highest yields of all sub-primals sampled (Table 4). While previous data suggest that the infraspinatus and teres major performed very well in sensory and tenderness evaluations, these muscles represent a relatively small portion of the shoulder clod. The denuded muscle yield of all muscles from the shoulder clod were markedly lower when compared to other sub-primals. (Table 5). Purge loss varied among the muscles sampled with mean values approaching 0.50 lb (0.23 kg) for the semimembranosus and supraspinatus. Purge loss values this high could represent a substantial loss in value.

Table 1. Denuded muscle yield and amount of purge loss for outside rounds from various grades

	% Yield				Purge (lb)			
Muscle	Mean	SD	Min	Max	Mean	SD	Min	Max
Biceps femoris								
Choice	53.88	4.42	45.25	60.49	.16	.14	.04	.64
Select	61.96	3.34	57.09	66.63	.29	.12	.02	.46
Standard	42.10	5.32	33.82	54.42	.33	.16	.12	.64

Table 2. Denuded muscle yield and amount of purge loss for inside rounds from various grades

	% Yield				Purge (lb)			
Muscle	Mean	SD	Min	Max	Mean	SD	Min	Max
Semimembranosus								
Choice	49.94	2.82	45.65	54.76	.47	.14	.28	.88

Select	52.27	2.74	46.42	56.12	.46	.18	.10	.96
Standard	42.27	3.03	36.54	46.81	.37	.20	.00	.70

Table 3. Denuded muscle yield and amount of purge loss for beef knuckles from various grades

	% Yield				Purge (lb)			
Muscle	Mean	SD	Min	Max	Mean	SD	Min	Max
Rectus femoris								
Choice	25.05	2.61	18.77	29.82	.07	.05	.00	.18
Select	24.59	2.33	18.05	27.90	.09	.17	.00	.76
Standard	23.54	2.07	19.41	28.16	.15	.17	.00	.76
Vastus lateralis								
Choice	34.62	1.99	31.27	39.41	.07	.05	.00	.18
Select	34.39	1.12	32.25	36.30	.09	.17	.00	.76
Standard	30.64	2.16	25.52	34.92	.15	.17	.00	.76

Table 4. Denuded muscle yield and amount of purge loss for chuck tenders from various grades

	% Yield				Purge (lb)			
Muscle	Mean	SD	Min	Max	Mean	SD	Min	Max
Supraspinatus								
Choice	83.47	4.26	74.89	88.85	.00	.00	.00	.00
Select	83.76	2.23	81.19	86.84	.41	.13	.18	.60
Standard	71.13	3.78	66.21	77.29	.45	.33	.20	1.18

Table 5. Denuded muscle yield and amount of purge loss for shoulder clods from various grades

	% Yield				Purge (lb)			
Muscle	Mean	SD	Min	Max	Mean	SD	Min	Max
Infraspinatus								
Choice	15.48	2.11	12.51	19.98	.24	.11	.06	.46
Select	17.83	1.96	14.33	21.43	.32	.17	.06	.68
Standard	15.31	2.25	10.89	19.82	.32	.20	.00	.66
Triceps brachii								
Choice	26.02	2.48	21.01	29.64	.24	.11	.06	.46
Select	27.25	2.01	23.26	30.40	.32	.17	.06	.68
Standard	27.10	2.42	23.14	33.23	.32	.20	.00	.66
Teres major								
Choice	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Select	3.04	.60	1.98	4.00	.32	.17	.06	.68

Standard	3.27	.65	2.00	4.97	.32	.20	.00	.66

The semimembranosus produced the highest mean number of 0.2 kg (7 oz) steaks, as well as, the highest percent yield of steaks. The teres major produced the lowest mean number of 0.2 kg steaks. The triceps brachii had the lowest percent yield of steaks (Table 6).

Table 6. Steak yield and number of .2 kg steaks from each denuded muscle

	Steak yield, % of denuded muscle				Number of .2 kg steaks obtained			
Muscle	Mean	SD	Min	Max	Mean	SD	Min	Max
Biceps femoris	81.56	3.97	70.73	87.88	15.60	2.49	12.00	21.00
Infraspinatus	60.10	9.03	36.84	76.19	5.17	1.15	3.00	7.00
Rectus femoris	82.20	9.12	50.00	100.00	4.53	1.07	2.00	6.00
Semimembranosus	87.45	4.07	80.00	94.34	20.67	2.70	16.00	27.00
Supraspinatus	82.31	6.76	68.75	93.33	4.87	.86	4.00	7.00
Teres major	63.61	14.95	44.44	100.00	1.07	.25	1.00	2.00
Triceps brachii	46.00	4.26	35.13	54.79	6.70	.92	5.00	9.00
Vastus lateralis	85.47	7.36	64.71	94.12	6.73	1.20	4.00	9.00

Sub-primal fabrication time varied, with the shoulder clod generally taking the longest to fabricate (Table 7). The biceps femoris and semimembranosus took the longest time to fabricate into 0.2 kg steaks (Table 8), but produced the highest number of 0.2 kg steaks. Biceps femoris, triceps brachii, infraspinatus, and semimembranosus muscles proved to be the most labor intensive muscles to fabricate for steak cutters, while teres major steaks had the shortest steak fabrication times. It should also be noted that the infraspinatus was one of the lowest yielding, most labor intensive muscles to fabricate. However, the infraspinatus proved to be the most palatable muscle sampled. Industry leaders need to determine market acceptability of sub-primal yields, steak numbers, and fabrication times.

Table 7. Fabrication time for sub-primal fabrication into denuded muscles

	Fabrication time (s)			
Sub-primal	Mean	SD	Min	Max
Outside round	94.60	16.01	60.00	117.00
Inside round	238.60	24.75	210.00	286.00
Shoulder clod	238.80	57.35	148.00	349.00
Knuckle	120.22	18.05	96.00	157.00

Table 8. Fabrication times for denuded muscle fabrication into steaks

	Fabrication time (s)			
Muscle	Mean	SD	Min	Max
Biceps femoris	151.30	31.04	102.00	230.00
Infraspinatus	105.13	19.12	64.00	151.00
Rectus femoris	45.53	16.41	16.00	86.00
Semimembranosus	130.30	21.52	94.00	183.00
Supraspinatus	32.30	8.22	3.00	44.00
Teres major	18.47	9.53	.00	37.00

Triceps brachii	115.63	22.40	71.00	169.00
Vastus lateralis	47.07	11.76	28.00	73.00

Conclusion

While more research is needed to explore consumer and industry acceptance of these muscles, results show several muscles have potential as foodservice steaks. These data show that while some muscles from the round can produce large quantities of steaks with high percent yields, previous research indicates that other muscles may be more palatable. This project has focused on evaluating the potential of eight underutilized cuts for foodservice. While some muscles perform exceptionally well, others do not. However, one must realize that the beef industry must serve many markets. Muscles that do not perform well as enhanced foodservice steaks, might do exceptionally well in pre-cooked entrees where palatability can be enhanced further through processing and cooking. Moreover, one must be careful not to add “too much” value through product enhancement so as to avoid economically unfeasible cuts. Finally, production personnel from all segments of the beef industry must determine which processing costs, processing yields, raw material costs, and palatability traits are acceptable. 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

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