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RETAIL CUTTING CHARACTERISTICS FOR CHUCK AND ROUND SUBPRIMALS FROM TWO GRADE GROUPS

K. L. Voges, K. D. Pfeiffer, K. K. Mason*, B. E. Baird, D. A. King, H. K. Johnson, D. B. Griffin, J. W. Savell*

Meat Science Section, Department of Animal Science, Texas Agricultural Experiment Station, Texas A&M University, 2471 TAMU, College Station, TX 77843-2471, USA

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Introduction

Merchandising chuck and round subprimals can often be challenging and require reduced prices. This creates a problem because these subprimals represent about 38% of the weight of an average beef carcass (Griffin, Savell, Morgan, Garrett, & Cross, 1992). Through efforts to optimize value from these areas, it has been found that merchandising single-muscle cuts allows the industry to provide a more consistent, higher quality product to consumers (NCBA, 2001). With the shift of consumers toward smaller, single-muscle cuts, McKenna, Griffin, Johnson, Covington, and Savell (2003) found that percentage retail yields decreased and processing times increased with this type of cutting style. In addition, Beef Value Cuts have been shown to have desirable characteristics in terms of palatability and visual appeal, but there is a lack of standardized information regarding cut out yields and labor requirements of subprimals fabricated to this endpoint (McKenna et al., 2003).

In order for retailers to evaluate the price/value relationship of beef subprimals, the CARDS (Computer Assisted Retail Decision Support) software was developed (Garrett et al., 1991). This program serves as a valuable reference to assist retailers in the process of making adecisions regarding meat purchasing and merchandising. This project was designed to evaluate cuts not previously included for the program and to update the Beef CARDS database with these cuts. Emphasis was put on providing the retail industry of processing yields and time allocations in the expanded database. Because of the extensive number of cutting tests conducted and the need to narrow the scope to be reported, the information presented herein encompasses the chuck and round cuts.

Objectives

The objective of this study was to perform a thorough evaluation of chuck and round cuts included in the present version of Beef CARDS in order to pinpoint deficiencies and/or inconsistencies in the data, while obtaining current yield and time data for a new updated list of subprimals. This should allow for improvement and expansion of the existing Beef CARDS program for the benefit of the retail and foodservice industry.

Methodology

Product Selection

Beef subprimals (n = 116) from the chuck and round (Table 1), representing USDA Choice and Select grades, were obtained from a major beef processor and shipped to the Rosenthal Meat Science and Technology Center at Texas A&M University. Specifications for all subprimals complied (within packer variations) with Institutional Meat Purchase Specifications (IMPS) as described by USDA (1996) and NAMP (2003).

Table 1
USDA (1996) Institutional Meat Purchase Specifications (IMPS) descriptions of chuck and round subprimals used for retail cutting tests

IMPS #	Subprimal
114C	Beef Chuck, Shoulder Clod, Trimmed
114D	Beef Chuck, Shoulder Clod, Top Blade, Roast
116A	Beef Chuck, Chuck Roll
168	Beef Round, Top (Inside)
171B	Beef Round, Outside Round (Flat)
171C	Beef Round, Eye of Round (IM[a])

[a] IM = Individual muscle.

Cutting tests

Controlled retail cutting tests were conducted as described in Voges (2004). A refrigerated cutting room in the Rosenthal Meat Science and Technology Center was modified to simulate a retail market environment, and experienced meat merchandisers were enlisted to perform cutting yield tests. Universal Product Code (UPC) descriptions (Industry-Wide Cooperative Meat Identification Standards Committee, 2003) were used as the naming convention for retail cuts.

Trimmed shoulder clods (IMPS #114C) were cut initially by removing accessory muscles from the *Mm. triceps brachii* and converting them into Beef for Stew (UPC 1727). The *M. triceps brachii caput longum* then was cut into 2.54 cm Shoulder Center Steaks (UPC 1162) and the *M. triceps brachii caput laterale* was cut into 2.54 cm Shoulder Top Steaks (UPC 1163). Top blade roasts (IMPS #114D) were trimmed of all fat and connective tissue. The *M. infraspinatus* was filleted horizontally into two separate flat pieces with the heavy connective tissue removed before portioning into Shoulder Top Blade Steaks (UPC 1166).

Chuck rolls (IMPS #116A) were cut initially by removing the *M. trapezius* and *M. latissimus dorsi*. The *M. serratus ventralis* was removed and designated as a Chuck Eye Edge Pot Roast (UPC 1092). The remaining pieces of the *M. serratus ventralis* were cut into boneless short ribs. Chuck steaks then were cut from the posterior end of the

remaining chuck roll section until seam fat was no longer present between the *M. longissimus thoracis* and the *M. rhomboideus thoracis*. Chuck Eye Steaks (UPC 1102), were separated from the Underblade Steaks, Boneless (UPC 1158). Chuck Eye Roasts (UPC 1095) then were cut into 5.08 cm portions from the remainder of the chuck roll. The remaining anterior end of the chuck roll was separated into Beef for Stew (UPC 1727) or Lean Trimmings (UPC 1653).

For the Top (Inside) Rounds, Untrimmed (IMPS #168), the *M. gracilis*, *M. pectineus*, and *M. sartorius* were removed and portioned into pieces for Beef Round for Cubed Steak (UPC 1577). The Top Round Steak, 1st Cut (UPC 1556) was cut 3.81 cm thick from the proximal edge of the *M. semimembranosus* and *M. adductor*. Subsequent Top Round Steaks (UPC 1553) were cut 1.27 cm thick until the remaining distal portion was deemed not suitable for steaks. This portion, after trimming, was merchandised as a Top Round Roast, Cap Off (UPC 1454).

Outside rounds (flat) (IMPS #171B) were cut two ways. The initial cutting style consisted of removing the ishiatic head of the *M. gluteobiceps*, trimming all heavy connective tissue, and preparing it as a Bottom Round Roast (UPC 1464). The remainder of the *M. gluteobiceps* was portioned into 3.81 cm Bottom Round Steaks (UPC 1466) by cutting perpendicular to the muscle fiber orientation with remaining product merchandised as material for Beef Round for Cubed Steak (UPC 1577). The second style consisted of removal of the ishiatic head and the distal portion of the *M. gluteobiceps* producing two Bottom Round Roasts (UPC 1464). Two or three subsequent 3.81 cm Bottom Round Steaks (UPC 1466) were cut, and the remaining proximal portion of the *M. gluteobiceps* was designated as a Bottom Round Rump Roast (UPC 1519).

Eye of rounds (IM) (IMPS #171C) were cut three ways. Initially, all styles were trimmed practically free of fat and connective tissue. The first style consisted of cutting the *M. semitendinosus* in half with one portion cut into 1.27 cm to 1.91 cm Eye of Round Steaks (UPC 1481) and the other left intact as an Eye of Round Roast (UPC 1480). In the second style, the subprimal was cut in half to make two Eye of Round Roasts (UPC 1480). The third style merchandised the entire muscle as an Eye of Round Roast (UPC 1480).

Statistical analysis

The experiment was planned as a completely randomized design. Data were analyzed, by subprimal, using SAS (SAS Institute, Inc., Cary, NC) PROC GLM with quality grade tested as the main effect. Least squares means were generated, and when an alpha-level of $P < 0.05$ was found, least squares means were separated with the PDIFF option.

Results & Discussion

Retail yields and processing times for the chuck and round subprimal cut are reported in Tables 2-9. These cutting tests will be useful to beef merchandisers in making informed purchase and cutting decisions to optimize value of closely-trimmed beef subprimals. Having standardized cutting tests and associated time requirements allows the beef industry to have benchmark information not previously available.

U.S. Select shoulder clods (IMPS #114C) had a higher percentage of shoulder top steaks ($P < 0.01$) and boneless shoulder pot roasts ($P < 0.03$), thus allowing them to

produce a higher percentage (3.5%) of total saleable yield similar to the findings of Garrett et al. (1991) and McKenna et al. (2003). The U.S. Choice shoulder clods possessed more trimmable fat, and required a longer amount of time to process (Table 2). Retail yields for shoulder clods were higher (85-88%) than those found by McKenna et al. (2003) (73-78%), but lower than the retail yield reported by Garrett et al. (1991) using a traditional fabrication style.

Table 2. Least squares means of retail yields (%) and processing times (s) for fabrication of Beef Chuck, Shoulder Clod, Trimmed (IMPS #114C), from different USDA quality grades

Item	UPC[a]	U.S. Choice (n=9)	U.S. Select (n=9)	SEM	*P*-value
Net weight, kg		5.92	5.60	0.35	0.53
Retail yield			%		
Shoulder center steak	1162	19.80	16.82	1.12	0.11
Shoulder top steak	1163	8.87	14.53	1.12	0.01
Shoulder pot roast, boneless	1132	5.52	10.69	1.4	0.03
Beef for stew	1727	23.60	23.54	0.67	0.95
Lean trimmings (90% lean)	1653	27.91	30.37	1.31	0.22
Fat		13.76	11.93	1.35	0.37
Purge		0.89	0.76	0.21	0.68
Cutting loss		0.10	0.00	0.11	0.30
Total saleable yield		85.32	88.82	1.69	0.19
Processing time, per subprimal			s		
Bag opening time		8.9	7.8	0.8	0.36
Trimming/cutting time		514.7	500.2	37.1	0.79
Total time		523.6	508.0	37.2	0.78

[a] UPC = Universal product code.
[b] SEM is the standard error of the least squares means.

Contrary to the shoulder clod, U.S. Select top blade roasts (IMPS #114D) yielded a greater percentage of fat, while U.S. Choice top blade roasts produced a greater amount of purge (Table 3). No difference ($P < 0.05$) was found in saleable yield between U.S. Choice and U.S. Select supporting McKenna et al. (2003) findings. McKenna et al. (2003) also reported slightly higher saleable yields, mainly due to the increase of fat in the present study.

Table 3. Least squares means of retail yields (%) and processing times (s) for fabrication of Beef Chuck, Shoulder Clod, Top Blade, Roast (IMPS #114D), from different USDA quality grades

Item	UPC[a]	U.S. Choice (n=9)	U.S. Select (n=9)	SEM[b]	*P*-value
Net weight, kg		2.25	2.12	0.15	0.57
Retail yield			%		
Shoulder top blade steak (flat iron)	1166	50.55	48.86	1.58	0.46
Lean trimmings (90% lean)	1653	31.43	32.01	1.67	0.81
Fat		17.35	18.81	1.25	0.42
Purge		0.71	0.40	0.20	0.29
Cutting loss		0.00	0.00	0.07	0.60
Total saleable yield		81.98	80.87	1.21	0.53
Processing time, per subprimal			s		
Bag opening time		7.0	7.1	0.6	0.83
Trimming/cutting time		280.3	262.7	25.5	0.63
Total time		287.3	269.8	25.5	0.63

[a] UPC = Universal product code.
[b] SEM is the standard error of the least squares means.

U.S. Choice chuck rolls (IMPS #116A) tended to possess a greater percentage of underblade steaks and fat. U.S. Select chuck rolls had higher yield percentages for lean trimmings and beef for stew when compared to U.S. Choice chuck rolls (not in tabular form).

U.S. Choice inside rounds (IMPS #168) had a higher percentage of fat ($P < 0.001$), thus resulting in a greater amount of cutting ($P < 0.03$) and total time ($P < 0.04$) required when compared to U.S. Select inside rounds. U.S. Select inside rounds displayed a significantly higher percentage of roasts and purge when compared with U.S. Choice rounds (Table 4).

Table 4. Least squares means of retail yields (%) and processing times (s) for fabrication of Beef Round, Top (Inside) (IMPS #168), from different USDA quality grades

Item	UPC[a]	U.S. Choice (n=9)	U.S. Select (n=9)	SEM[b]	*P*-value
Net weight, kg		11.0	9.10	0.48	0.01
Retail yield		---------- % ----------			
Top round roast, cap off	1454	23.79	28.92	1.32	0.02
Top round steak	1553	21.11	20.81	0.99	0.83
Top round steak, 1st cut (London Broil)	1556	7.09	8.29	1.38	0.55
Cap		6.38	7.44	0.40	0.08
Beef round for cubed steak	1577	5.05	6.73	0.66	0.09
Lean trimmings (90% lean)	1653	16.71	15.15	0.90	0.24
Fat		18.93	10.94	1.09	<0.001
Purge		0.90	1.75	0.22	0.02
Cutting loss		0.04	0.00	0.04	0.24
Total saleable yield		80.13	87.34	1.13	0.004
Processing time, per subprimal		---------- s ----------			
Bag opening time		11.4	15.7	1.4	0.04
Trimming/cutting time		606.0	509.5	28.7	0.03
Total time		617.3	525.2	28.8	0.04

[a] UPC = Universal product code.
[b] SEM is the standard error of the least squares means.

Retail yield cutting percentages and times for the initial cutting style of outside rounds (IMPS #171B) consisting of steaks, bottom round roasts, and cubed steaks are reported in Table 5. U.S. Select outside rounds displayed a higher percentage of steaks ($P < 0.02$) and U.S. Choice outside rounds had a three-percentage points decrease ($P < 0.05$) in saleable yield than U.S. Select outside rounds, with most of the difference accounted for by more ($P < 0.05$) trimmable fat when compared to U.S. Choice rounds. Additionally, purge and cutting loss was significantly greater for U.S. Select rounds preventing an even larger difference in saleable yield when compared to U.S. Choice rounds. The second outside round cutting style including steaks, rump roasts, and bottom round roasts, displayed significant differences between U.S. Choice and U.S. Select (Table 6), with U.S. Select outside rounds yielded a higher percentage of bottom round roasts ($P < 0.001$) and having greater amount of purge loss when compared with U.S. Choice rounds. The U.S. Choice outside rounds had a significantly higher percentage of lean trim and trimmable fat, and required a greater amount of time for cutting ($P < 0.03$) and total time ($P < 0.04$). The total saleable yield is very similar to the data found by Garrett et al. (1991) (92%) and by McKenna et al. (2003) (91%). The second cutting style had a saleable yield of 89-92%, which is greater than the initial cutting style's saleable yields of 87-90%. This is most likely due to the greater amount of fat trim in the initial style. Less lean trim between styles primarily caused the second cutting style to produce a

greater percentage (78-86%) of roasts and steaks when compared to the initial cutting style (65-73%).

Table 5. Least squares means of retail yields (%) and processing times (s) for fabrication of Beef Round, Outside Round (IMPS #171B) cut to include roasts, steaks, and cubed steak from different USDA quality grades

Item	UPC[a]	U.S. Choice (n=6)	U.S. Select (n=6)	SEM[b]	*P*-value
Net weight, kg		5.60	6.44	0.22	0.02
Retail yield			%		
Bottom round steak	1466	47.05	49.88	0.72	0.02
Bottom round roast	1464	12.33	13.33	0.55	0.22
Beef round for cubed steak	1577	5.89	9.87	1.81	0.14
Lean trimmings (90% lean)	1653	22.34	17.20	2.13	0.11
Fat		10.82	6.03	0.73	0.001
Purge		1.44	3.38	0.51	0.02
Cutting loss		0.13	0.31	0.04	0.01
Total saleable yield		87.61	90.28	0.84	0.05
Processing time, per subprimal			s		
Bag opening time		14.3	12.8	1.0	0.30
Trimming/cutting time		405.8	306.1	33.4	0.06
Total time		420.1	318.9	33.9	0.06

[a] UPC = Universal product code.
[b] SEM is the standard error of the least squares means.

Table 6. Least squares means of retail yields (%) and processing times (s) for fabrication of Beef Round, Outside Round (IMPS #171B) cut to include steaks and roasts from different USDA quality grades

Item	UPC[a]	U.S. Choice (n=6)	U.S. Select (n=6)	SEM[b]	*P*-value
Net weight, kg		5.86	6.27	0.37	0.44
Retail yield			%		
Bottom round steak	1466	6.88	7.59	1.41	0.72
Bottom round rump roast	1519	30.83	31.58	0.78	0.50
Bottom round roast	1464	40.48	46.83	0.95	<0.001
Lean trimmings (90% lean)	1653	11.31	6.09	1.15	0.01
Fat		8.73	4.33	1.08	0.02
Purge		1.54	3.57	0.53	0.02
Cutting loss		0.25	0.007	0.09	0.09
Total saleable yield		89.49	92.09	1.22	0.16
Processing time, per subprimal			s		
Bag opening time		10.9	12.8	15.0	1.87

Trimming/cutting time	337.3	240.4	27.3	0.03
Total time	348.3	255.4	27.7	0.04

[a] UPC = Universal product code.
[b] SEM is the standard error of the least squares means.

U.S. Select eye of rounds (IMPS #171C), cut to include steaks and a roast, had a significantly larger percentage of purge loss when compared to U.S. Choice eye of rounds that displayed a significantly larger cutting loss percentage (Table 7). U.S. Choice eye of rounds cut to include two roasts appeared to yield a higher percentage of roasts when compared to fatter U.S. Select eye of rounds (Table 8). Retail yields and processing times for eye of rounds left as intact roasts are presented in Table 9. U.S. Choice eye of rounds tended to have a greater percentage of roast weight thus resulting in a higher percentage of total saleable product when compared to fatter U.S. Select eye of rounds. U.S. Select eye of rounds had a higher percentage of trimmable fat. The initial cutting style of steaks and roast produced a greater percentage of lean trim and required a longer processing time when compared with the cutting styles containing only roasts. McNeill et al. (1998) and Weatherly et al. (2001) found similar results, observing an increase in total processing time as the number of retail cuts from subprimals increased.

Table 7. Least squares means of retail yields (%) and processing times (s) for fabrication of Beef Round, Eye of Round (IMPS #171C) cut to include steaks and a roast from different USDA quality grades

Item	UPC[a]	U.S. Choice (n=6)	U.S. Select (n=6)	SEM[b]	*P*-value
Net weight, kg		2.60	2.99	.037	0.14
Retail yield			%		
Eye of round steak	1481	38.84	37.27	1.78	0.55
Eye of round roast	1480	52.65	52.62	2.26	0.99
Lean trimmings (90% lean)	1653	3.56	3.80	0.63	0.80
Fat		3.63	4.49	1.02	0.57
Purge		0.87	1.72	0.17	0.006
Cutting loss		0.44	0.10	0.06	0.002
Total saleable yield		95.06	93.69	1.07	0.39
Processing time, per subprimal			s		
Bag Opening time		9.16	7.74	0.89	0.29
Trimming/cutting time		100.41	90.81	10.77	0.54
Total time		109.57	98.55	11.25	0.51

[a] UPC = Universal product code.
[b] SEM is the standard error of the least squares means.

Table 8. Least squares means of retail yields (%) and processing times (s) for fabrication of Beef Round, Eye of Round (IMPS #171C) cut into two roasts from different USDA quality grades

Item	UPC[a]	U.S. Choice (n=6)	U.S. Select (n=6)	SEM[b]	*P*-value
Net weight, kg		2.35	2.47	0.10	0.38
Retail yield		%			
Eye of round roast	1480	93.50	92.61	0.87	0.49
Lean trimmings (90% lean)	1653	1.41	2.76	0.58	0.20
Fat		3.84	4.48	0.85	0.61
Purge		1.63	1.74	0.34	0.83
Cutting loss		0.45	0.08	0.16	0.20
Total saleable yield		93.31	92.17	1.15	0.54
Processing time, per subprimal		s			
Bag opening time		6.96	6.33	0.66	0.52
Trimming/cutting time		55.32	59.16	7.27	0.72
Total time		62.28	65.49	7.64	0.77

[a] UPC = Universal product code.
[b] SEM is the standard error of the least squares means.

Table 9. Least squares means of retail yields (%) and processing times (s) for fabrication of Beef Round, Eye of Round (IMPS #171C) cut into one roast from different USDA quality grades

Item	UPC[a]	U.S. Choice (n=6)	U.S. Select (n=6)	SEM[b]	*P*-value
Net weight, kg		2.31	2.47	0.32	0.52
Retail yield		%			
Eye of round roast	1480	92.01	89.76	1.63	0.36
Lean trimmings (90% lean)	1653	2.52	2.24	0.73	0.79
Fat		4.03	6.84	1.33	0.17
Purge		1.24	1.39	0.29	0.70
Cutting loss		0.20	0.09	0.13	0.56
Total saleable yield		94.53	91.16	1.36	0.12
Processing time, per subprimal		s			
Bag opening time		6.51	6.89	0.28	0.55
Trimming/cutting time		74.18	67.07	9.65	0.61
Total time		80.69	73.93	9.90	0.64

[a] UPC = Universal product code.
[b] SEM is the standard error of the least squares means.

Conclusions

In addition to providing these cutting tests for comparative purposes, there are several key points to be made based on our findings. Only total saleable yields of the inside

round and outside round were affected by USDA quality grade, where U.S. Select rounds had higher ($P < 0.05$) yields than U.S. Choice rounds. This difference was driven by a higher percentage of fat trimmed from the U.S. Choice rounds compared to the U.S. Select rounds. Voges (2004) found little or no effect for USDA quality grade on total saleable yield from the rib and loin subprimals.

It was also found that several U.S. Select subprimals had less fat than the same U.S. Choice cuts and greater purge losses. Specifically, greater ($P < 0.05$) purge losses were found for the U.S. Select inside round, outside round, and eye of round compared to U.S. Choice round subprimals.

Finally, a challenge that retailers face when merchandising cuts from the round and chuck is the variety of retail cuts that are generated, such as steaks and roasts, beef for stew, lean trimmings, etc. This variety could cause processing times to be quite long, which could add to the labor requirements. This elevated requirement is often reflected in increased retail prices or limited merchandising options.

These cutting test data will be used to update the Beef CARDS software program. By incorporating new information into this dynamic decision-making program, users will be able to evaluate pricing and labor costs to determine how purchase and merchandising factors affect profitability.

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