


**EXECUTIVE
SUMMARY**



**2010/2011
National
Beef
Tenderness
Survey**

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Background

Beef palatability is determined by tenderness, juiciness, and flavor, with tenderness being the most important economic and quality factor, since consumers are willing to pay a premium for guaranteed-tender meat products. Traditionally, retail cuts from the rib and loin have demanded a higher price because of their higher palatability attributes, whereas more connective tissue in the chuck and round have made these cuts more marketable as ground beef, thus generating less revenue. Today, however, considering evolving consumer trends toward more convenient, last-minute meal decisions, the beef industry can profit by marketing identified tender cuts from the chuck and round and pinpointing cuts from all primals that need improved tenderness ratings.

With funding from the beef checkoff, the industry has been tracking beef tenderness for 20 years with the first benchmarking survey conducted in 1990 by Texas A & M University using Warner-Bratzler shear (WBS) force and trained sensory panels. In successive surveys conducted in 1999 and 2005/2006, foodservice cuts were added and a consumer sensory panel was substituted for the trained sensory panel because the consumer's perception of tenderness is the ultimate determinant of a cut's success. WBS has been a consistent component of all surveys.

The 1999 Survey revealed a 20% increase in tenderness as compared to 1990. The improvements were attributed to several factors, including the availability of fewer "no-roll" steaks (steaks without



a grade designation) at retail and an increased availability of steaks grading Choice or Prime. The longer, more gradual chilling procedures detected in the 1999 Survey, as opposed to the 1990 Survey, likely reduced toughness problems associated with cold shortening/cold toughening. Tenderness aging periods for retail cuts also increased in 1999. The increased tenderness noted from 1990 to 1999, to a large extent, is attributable to the checkoff-funded science which has increased the industry's understanding of beef palatability. Nevertheless, the 1999 Survey results still identified several existing tenderness issues, most noticeable in cuts from the round.

Results of the 2005/2006 Survey showed an approximate 18% overall increase in tenderness as compared to 1999. WBS values improved and most



steaks evaluated were considered tender. Several industry trends were considered responsible for this marked improvement including increased aging times, longer and slower chill rates, processors paying more attention to tenderness parameters, and an increased number of retailers participating in branded programs focused on tenderness. In 2005/2006, approximately 47% of retail cuts were marketed through packer or branded programs designed to guarantee certain quality traits such as phenotype, genetic makeup, aging times and electrical stimulation. However, as in 1999, the data again revealed that round cuts needed increased postmortem attention to achieve optimal tenderness.


To ensure comparable results across all primals, a single cooking method (electric grill) was employed for all cuts. While maintaining the consistency required, the electric

grill does not allow for the use of alternative cooking methods, like moist-heat cooking, that might increase palatability in those cuts with greater connective tissue. Authors of the 2005/2006 Survey suggested that efforts were needed to emphasize appropriate cooking methods for the variety of available retail cuts.

2010/2011 Survey

In 2010/2011, the beef checkoff commissioned the fourth in the series of National Beef Tenderness Surveys to quantify the current status of tenderness compared to previous surveys. Researchers at Texas A&M University collaborated with those from Texas Tech University, California Polytechnic State University, the University of Florida, the University of Missouri, North Dakota State University, Oklahoma State University, and Penn State University to complete the survey. Cities were chosen to represent a broad geographical range and to maintain some historical linkage with the cities used in previous surveys. Cities included New York, NY; Philadelphia, PA; Los Angeles, CA; San Francisco, CA; Denver, CO; Las Vegas, NV; Tampa, FL; Atlanta, GA; Kansas City, MO; Houston, TX; Chicago, IL; and Seattle, WA. Over a 12-month time period, each city was sampled once between March 2010 and February 2011.

In each city, two to three retail chains, representing at least one-third of the total-area-market share, were sampled for product in four stores per chain; thus, a total of 8 to 12 supermarket stores per metropolitan area were sampled. In addition, if a membership-based retail store existed in the city and was not included in the one-third market share, one store of the chain representing the largest market share was sampled. Representatives of the National Cattlemen's



Beef Association's retail marketing team assisted with identifying and obtaining permission from the participating retail chains.

Within each store, brand names and grades of product available, as well as post-fabrication aging times as a measure of postmortem age, were recorded. Retail cuts were shipped to Texas A & M University in insulated containers with dry ice and were processed under refrigerated conditions (2-4°C) upon arrival. Before vacuum-packaging and freezing at -40°C, each steak was measured for average fat thickness and steak thickness.

The following steaks were sampled from the retail case: Top Blade Steak; Ribeye Steak, lip on, boneless; Ribeye Steak, lip on, bone-in; Top Loin Steak, boneless; Top Loin Steak, bone-in; T-Bone Steak; Porterhouse Steak; Top Sirloin Steak, boneless, cap off; Top Round Steak; and Bottom Round Steak. In a random assignment, steaks were shipped to one of the collaborating universities to be evaluated by a consumer sensory panel or tested by WBS.

Collaborators also sampled one foodservice facility in five cities including Houston, TX; Tampa, FL; Denver, CO; Las Vegas, NV; and Philadelphia, PA. A product representing each quality grade for each USDA subprimal, fabricated by the facility into a steak, was sampled, identified by brand designation, marketing claims, enhancement with percentage pumped, sodium content, and method of tenderization, and shipped to Texas A&M University. Foodservice cuts sampled included Ribeye Roll Steak; Top Loin Steak, boneless; and Top Sirloin Butt Steaks, center cut, boneless. After being processed in the same manner as the retail cuts, the foodservice cuts

were shipped to the University of Missouri for random assignment to either a consumer sensory panel or WBS evaluation.

In order to accurately detect tenderness differences among cuts, it was important to hold cookery method and endpoint temperature constant across all samples because these have a significant impact on ultimate eating quality. Unlike the 2005/2006 Survey, steaks from the round were assigned to one of two cooking methods – moist-heat cookery in a convection oven or dry-heat cookery on a grated, non-stick electric grill. All other retail cuts were cooked on an electric grill. Foodservice steaks were cooked on a gas grill. Cooking methods were identical across all sites.



2010/2011 Survey Significant Findings

- Approximately 64% of retail cuts were labeled with a store brand. Results of the 2005/2006 Survey showed 47% of cuts with a store or packer label.
- Retail beef was aged an average of 20.5 days compared to 22.6 days in 2005/2006. The aging period for retail cuts ranged from 1 to 358 days as opposed to a range of 3 to 83 days in 2005/2006. The mean percentage of subprimals aged less than 14 days increased from 19.6 % in 2005/2006 to 35.7% in 2010/2011. [Table 1]
- For foodservice cuts, the average aging time remained relatively constant at 28.1 days compared to 30.1 in 2005/2006. The aging period for foodservice subprimals ranged from 9 to 67 days. [Table 1]
- As seen in previous surveys, steaks cut from the rib and loin were the thickest whereas steaks from the round and chuck were cut

Table 1.

Postfabrication Aging Times

Postfabrication aging times (d) for subprimal cuts audited in the cold storage facilities of retail stores and at the foodservice level

Retail Subprimals	Mean	Min ^b	Max ^c	% < 14 ^d
Shoulder Clod	20.3	1	51	27.2
Ribeye Roll	19.6	2	112	34.8
Bone-In Ribeye	31.5	6	358	11.1
Strip Loin	21.6	2	334	36.2
Bone-In Strip Loin	29.5	2	69	20
Short Loin	19.1	2	91	44.2
Top Sirloin	20.3	1	51	32.4
Top Round	16.4	2	47	46.6
Bottom Round	17.2	3	63	41.5
Eye Round	17.3	5	76	48.5
Overall	20.5	1	358	35.7
Foodservice Subprimals				
Ribeye Roll	29.3	13	67	10.5
Top Loin	29.8	9	61	15.8
Top Sirloin	24.7	9	66	6.2
Overall	28.1	9	67	11.4

^b Min = minimum value.

^c Max = maximum value.

^d % < 14 d = percentage of subprimals aged less than 14 days.

How Tender Is It?

Warner-Bratzler Shear values (lbs)

Retail Cuts (all grades combined)

Top Blade	4.8b
Ribeye, Lip-On, Boneless	5.4b
Ribeye, Lip-On, Bone-In	5.4b
Top Loin	5.2b
Top Loin, Bone-In	5.5b
T-Bone	5.2b
Porterhouse	5.3b
Top Sirloin, Boneless, Cap Off	5.4b
Top Round	6.7a
Bottom Round	7.0a

Foodservice Cuts (all grades combined)

Ribeye	6.1b
Top Loin	5.8b
Top Sirloin	6.8a

Within a column, means lacking a common letter (a and b) differ (P < 0.05).

Table 2.

the thinnest. Top Sirloin Steaks were the thickest at 2.89 cm (compared to the 2005/2006 thickest being Top Loin Steaks at 2.60 cm) and Bottom Round Steaks were the thinnest at 1.59 cm.

- In foodservice, steak thickness averaged between 2.91 cm and 2.95 cm.
- Bottom Round and Top Round Steaks had the highest WBS values compared to all other cuts. [Table 2] Top Blade Steaks, in both the enhanced and non-enhanced group, had the lowest WBS values.
- All foodservice cuts had low WBS values with the lowest being steaks from the Top Loin and Ribeye. [Table 2]
- The total percentage of Top Round and Bottom Round Steaks with a WBS value in the "tough" category was lower than in the 2005/2006 Survey. Consistent cooking methods used in 2005/2006 and 2010/2011 allowed for tenderness comparisons between cuts in each survey. [Table 3]

- Foodservice Top Loin Steaks had the highest percentage of steaks in the “very tender” category. [Table 3]
- Comparing retail cuts, consumer

sensory panelists rated the Top Blade Steak, the boneless Ribeye Steak, the boneless Top Loin Steak and the bone-in Top Loin Steak the highest for

overall like. Consumers rated the Top Blade Steak and the boneless Ribeye Steak the highest for tenderness. The Top Blade Steak rated the highest score for tenderness level. [Table 4]

- In retail, the Top Sirloin Steak, Top Round Steak, and Bottom Round Steak were rated lowest by consumers for overall like, tenderness like and tenderness level. [Table 4]
- Among foodservice cuts, the Top Loin Steak took all honors, rating highest across all attributes, including overall like, tenderness like, tenderness level, flavor like, flavor level, juiciness like, and juiciness level. [Table 4]
- Among foodservice cuts, USDA Choice and ungraded Ribeye Steaks received the lowest ratings for overall like than did all other grades, while USDA Prime Ribeye Steaks received the highest ratings for tenderness like, tenderness level, juiciness like and juiciness level when rating grade.

Table 3.

Tenderness Categories

Percentage distribution of retail steaks stratified into tenderness categories

Cut	Very Tender	Tender	Intermediate	Tough
Top blade	91.89	5.41	2.7	
Ribeye, lip- on, bnls	95.45	4.55		
Ribeye, lip-on, bone-in	95.65	4.35		
Top loin	84.78	10.87	2.17	2.17
Top loin, bone-in	71.74	15.22	8.7	4.35
T-bone	95.56	4.44		
Porterhouse	91.11	8.89		
Top sirloin, bnls, cap off	91.11	6.67	2.22	
Top round	76.09	13.04	6.52	4.35
Bottom round	47.37	23.68	23.68	5.26

Percentage distribution of foodservice steaks stratified into tenderness categories

Cut	Very Tender	Tender	Intermediate	Tough
Ribeye	81.08	14.86	4.05	
Top loin	83.78	13.51		2.7
Top sirloin	58.11	32.43	5.41	4.05

Very Tender = WBS < 7.05 lbs (3.2 kg); Tender = WBS > 7.05 lbs (3.2 kg) < 8.6 lbs (3.9 kg); Intermediate = WBS 8.6 lbs (3.9 kg) < 10.1 lbs (4.6 kg); Tough = WBS > 10.1 lbs (4.6 kg).

Sensory Attributes

10 = highest or best; 1 = lowest or worst

Retail Steaks	Overall like/dislike	Tenderness like/dislike	Tenderness level	Flavor like/dislike	Flavor level	Juiciness like/dislike	Juiciness level
Top blade	6.4a	6.8a	6.8a	6.3a	6.1ab	6.5a	6.5a
Ribeye, lip-on, bnls	6.3ab	6.3b	6.2b	6.3a	6.2a	6.0b	5.8b
Ribeye, lip-on, bone-in	5.9cd	6.1bc	6.1bc	5.7c	5.6cd	5.7bc	5.7bc
Top loin, bnls	6.1abc	6.2bc	6.2b	6.1ab	6.1ab	5.9b	5.8b
Top loin, bone-in	6.1abc	6.2bc	6.2bc	5.9bc	5.9abc	5.9b	5.7bcd
T-bone	5.9cd	5.9cd	5.8cd	5.9bc	5.9bc	5.7bc	5.7bc
Porterhouse	5.9bcd	6.0bcd	5.9bcd	6.1ab	6.2ab	5.6bcd	5.6bcd
Top sirloin, bnls	5.7d	5.6d	5.6d	5.7c	5.7c	5.5cd	5.5cde
Top round	5.1e	5.0e	5.0e	5.2d	5.3d	5.3d	5.3de
Bottom round	5.1e	5.0e	5.0e	5.2d	5.3d	5.3d	5.2e
Foodservice Steaks							
Ribeye	6.8	6.8b	6.8b	6.8	6.7b	6.6b	6.6b
Top loin	7.3	7.5a	7.4a	7.2	7.2a	7.2a	7.1a
Top sirloin	7.0	6.9b	6.8b	7.0	6.9b	6.9ab	6.8ab

Within a column, means lacking a common letter (a and b) differ (P < 0.05).

Table 4.

Conclusion

Most steaks evaluated in the 2010/2011 Survey were considered tender. Perhaps due to the increased prevalence of round cuts in the marketplace in recent years, and a possible plateau of beef tenderness, the WBS values in this survey are similar to those of the 2005/2006 Survey. Several factors may have played a role in the fixed tenderness values. Aging was found to be less consistent in the 2010/2011 Survey. Average aging times were down and the aging-day range was significantly wider in 2010/2011. Additionally, the percentage of some retail steaks aged less than 14 days, the industry-recommended minimum, was considerably higher in 2010/2011 versus 2005/2006. This could be a function of increased featuring activity at retail which can result in short in-store supply and consequently, short aging. Conversely, the bone-in ribeye and boneless strip loin subprimals had greater aging times in the 2010/2011 Survey than those reported in the last Survey. Perhaps because of the relatively higher cost of these subprimals and the decreased level of disposable income in the United States in recent years, some of these cuts may have been frozen at a point during this time period and subsequently thawed before being processed at retail, resulting in aging times significantly longer than what would normally be considered an extreme time period. For this group, determining actual postmortem aging under refrigerated conditions would be difficult, making the assessment of factors affecting these products more challenging.

The least tender cuts continue to be from the round, suggesting the need for improved aging practices and increased consumer education focused on proper preparation and cooking to enhance consumer satisfaction.

Currently, numerous programs focus on beef tenderness, and these will continue to play a role in achieving optimal tenderness and maximizing customer satisfaction. The results of this Survey will be used by both the retail and foodservice sectors to benchmark the tenderness of U.S. beef.

Beef quality, when you think about it, means a lot of things to a lot of people, but, to a consumer, quality has everything to do with consistency, flavor, tenderness and overall taste.

Molly McAdams, PhD

Chair, Joint Product Enhancement Committee

Information from the National Beef Tenderness Survey has been very important in setting priorities for additional research that needs to be conducted in product enhancement, to look at where there are gaps in information or lack of information in certain areas.

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Funded by The Beef Checkoff

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