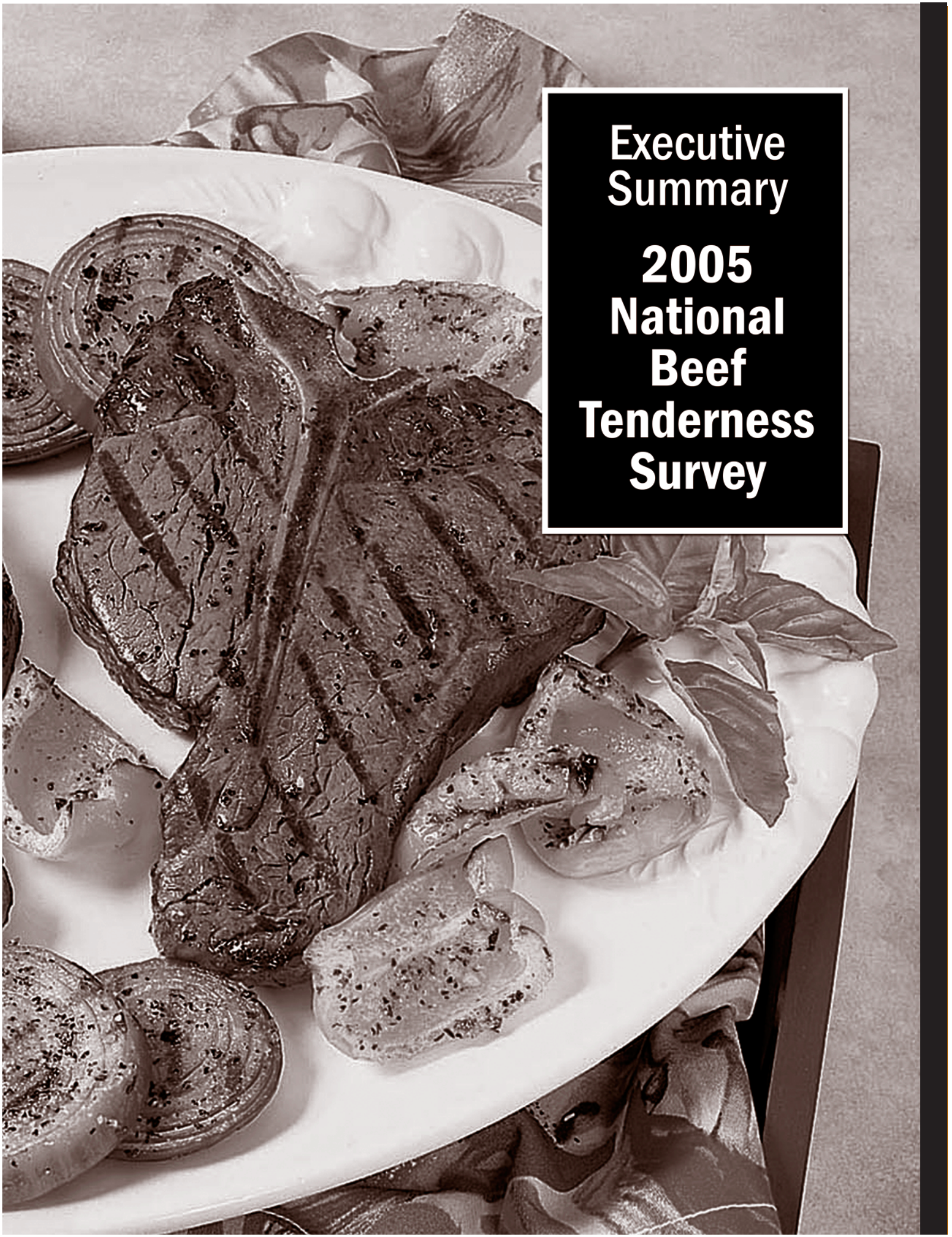

Executive Summary

2005 National Beef Tenderness Survey

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Funded by The Beef Checkoff

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Staying the Course

The first checkoff-funded National Beef Tenderness Survey was conducted in 1990 to compile baseline information on the tenderness of beef in the retail case. The 1990 Survey utilized Warner-Bratzler shear (WBS) force tests and trained sensory panels to evaluate the tenderness of retail beef and found significant problems with tenderness in cuts from the chuck, round and top sirloin. Recommendations made following this survey led to significant improvements in overall beef tenderness.

The 1999 National Beef Tenderness Survey was commissioned to evaluate the industry for progress made in tenderness following the findings of the 1990 Survey. Unlike the first study, the 1999 version was expanded to include products from foodservice facilities in order to fully characterize the state of beef tenderness throughout the industry.

The 1999 Survey revealed a 20% increase in tenderness as compared to 1990, indicating significant improvements in the management of our product. This 20% increase was attributed to several factors. First, the 1999 Survey discovered fewer 'no-roll' steaks (steaks without a grade designation) and more steaks grading High Choice or Prime than in the 1990 study. The 1999 National Beef Tenderness Survey also noted longer, more gradual chilling procedures than those seen in 1990. This shift away from rapid chilling likely reduced toughness problems associated with cold shortening/cold toughening.

Top sirloin steaks demonstrated improved performance over 1990, explained by a decrease in the incidence of injection-site blemishes and associated toughness. Continuing education efforts, supported by The Beef Checkoff, are credited with this reduction and subsequent tenderness increase. Tenderness aging periods for retail also increased as compared to 1990 survey records. "Each time we measure the eating quality of beef in these surveys, it keeps getting better. The impact of science and technology to

understand and improve beef palatability, much of which has been funded by The Beef Checkoff program, is making a difference," says Jeff Savell, Ph.D., Texas A&M University.

Despite noticeable improvements over 1990, 1999 Survey results indicated that tenderness issues still existed and needed to be properly addressed. These issues were most noticeable in cuts originating from the round.

Providing a benchmark for beef tenderness allows the industry to identify where improvements have been made and where tenderness issues may still exist. In 2005, The Beef Checkoff commissioned a follow-up study to the 1990 and 1999 Surveys to quantify continuing progress made by the beef industry to improve tenderness. "Although the beef industry has made significant advancements through The Beef Checkoff program with regard to enhancing beef tenderness and consistency, it is critical that the industry remains committed to improving beef tenderness, especially in the chuck and round cuts of the carcass," says J.O. 'Bo' Reagan, Ph.D., Vice President of Research & Knowledge Management at NCBA.

Researchers at Texas A&M University collaborated with researchers from California Polytechnic State University, Oklahoma State University, Pennsylvania State University, South Dakota State University, Texas Tech University, the University of Florida, and the University of Missouri to complete the survey.

The 2005 Survey had two main objectives:

- To provide a benchmark for beef tenderness in the United States; and
- To determine the tenderness of beef from retail and foodservice sectors based on Warner-Bratzler shear force and consumer panel evaluation.

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How the Survey Was Conducted

Researchers sampled beef from retail stores and foodservice establishments in eleven U.S. cities, including Seattle, Los Angeles, San Francisco, Denver, Houston, Chicago, Kansas City, Atlanta, Tampa, Philadelphia, and New York City. Two retail chains in each city, representing at least one-third of the total market share in their area, were sampled by auditing four stores per chain.

From the 82 retail outlets audited, researchers selected clod, ribeye, bone-in ribeye, top loin, bone-in top loin, T-bone/Porterhouse, top sirloin, bottom round, top round and eye of round steaks. Bone-in ribeye and top loin steaks were sampled for the first time in the 2005 Survey because of the strong prevalence of these bone-in cuts in the retail marketplace. Researchers also evaluated cold storage units to determine postfabrication time (as a measure of postmortem age) of the boxed subprimals representing the cuts sampled in the retail case.

The six foodservice facilities sampled were those operations that portion subprimals into steaks bound for restaurants. From foodservice facilities, researchers selected steaks that included the ribeye, top loin, and top sirloin. Postfabrication times were noted when possible, along with grade and use of mechanical tenderization.

Steaks were shipped overnight to Texas A&M University where they were individually identified, vacuum packaged and assigned to tenderness analysis by Warner-Bratzler shear force and consumer sensory panel evaluation. Warner-Bratzler shear force determines the amount of force in pounds necessary to slice a steak or beef cut. Retail shear force evaluations were completed by Texas A&M University and foodservice shear force evaluations were completed by the University of Missouri. Retail consumer panels were conducted at Pennsylvania State University, the University of Florida, Texas Tech University, Oklahoma State University, South Dakota State University, and Texas A&M University. Foodservice consumer panels were conducted at the University of Missouri.

All steaks were cooked on grated, non-stick electric grills prior to evaluation. Based on research from previous checkoff-funded Customer Satisfaction surveys, it was important to hold cookery method and endpoint temperature constant because they have a significant impact on ultimate eating quality. Control was critical in this study in order to allow for valid comparisons among different steaks and grade classifications.

Before analysis, steaks were divided into retail and foodservice groups based on steak type and grade within steak type. There were not enough steaks designated by grade in the retail stores surveyed to allow analysis of retail steaks by grade within steak type. This survey found more branded products than grade-designated products in the retail cases sampled. Warner-Bratzler shear values and consumer panel responses were analyzed using the general linear model and frequency procedures of SAS (Cary, NC).

Table 1
HOW TENDER IS IT?

Warner-Bratzler shear values (lbs)

RETAIL CUTS (all grades combined)

Cut	Warner-Bratzler shear value (lbs)
Ribeye	5.2^{bc}
Bone-In Ribeye	4.8^{ab}
Top Loin	4.7^{a}
Bone-In Top Loin	4.7^{ab}
T-Bone	5.0^{ab}
Porterhouse	5.1^{ab}
Top Sirloin	5.5^{c}
Clod	6.2^{d}
Top Round	6.7^{d}
Eye of Round	7.5^{e}
Bottom Round	8.1^{f}

^{a,b,c,d,e,f} Within a column, means lacking a common superscript letter differ (P < 0.05).

FOODSERVICE CUTS (stratified by grade)

Cut	Prime	Top Choice	Choice	Select
Ribeye	5.7	6.5	5.9	6.2
Top Loin	4.6	4.9	5.3	5.1
Top Sirloin	6.0	6.2	6.0	6.4

"Never before in the history of the beef industry have there been so many programs designed to ensure that beef delivered to the consumer is tender, juicy, and flavorful. These programs are making a difference in improving the demand in the marketplace for great tasting beef."

Initial Findings

Here are some of the differences that researchers found between retail and foodservice beef:

Beef used for retail was aged an average of 23 days, compared to 30 days for foodservice.

The average aging period for retail beef ranged from 3 to 83 days, compared to a range of 7 to 136 days for foodservice.

Twenty percent of subprimals used for retail were aged less than 14 days, compared to 30% of subprimals bound for foodservice.

Nearly half of all retail cuts were branded with a packer program label and approximately 43% of retail cuts were labeled with a store brand.

Mean external fat thickness across all cuts sampled at retail was 0.27 cm (0.1 in). Steaks originating from the round possessed less external fat than those from the loin and rib.

In general, retail steaks fabricated from the round and chuck were cut thinner than those from the rib and loin. Bottom round steaks were cut thinnest at 1.75 cm (0.7 in) compared to the thickest, top loin steaks, at 2.60 cm (1 in).

Among retail cuts, bottom round steaks had the highest (least tender) shear force values. Top loin, bone-in strip, bone-in ribeye, T-bone and Porterhouse steaks had the lowest (most tender) shear-force values.

Among foodservice cuts, top loin steaks had the lowest (most tender) shear force values compared to ribeye and top sirloin steaks. All mean shear force values were below 2.79 kg (6.15 lbs). Steaks are often considered tough if they have a Warner-Bratzler shear force value greater than approximately 4.6 kg.

The retail bone-in top loin, top loin, ribeye, T-bone and Porterhouse steaks received the highest consumer ratings for overall like. In tenderness evaluation, the retail bone-in top loin and Porterhouse steaks received among the highest ratings from consumers.

For retail steaks, the bone-in top loin steak received the highest consumer ratings across all sensory attributes.

For foodservice steaks, consumer sensory ratings for ribeye and top sirloin steaks were impacted by grade classification; however, grade classification did not impact consumer ratings for top loin steaks.

When possible, tenderization information was obtained from foodservice facilities. At least 55.6% of top loin steaks and 54.2% of top sirloin steaks bound for foodservice establishments were mechanically tenderized.

Table 2
TENDERNESS BREAKDOWN

Percentage Distribution of Retail Cuts Stratified Into Tenderness Categories

Cut	Very Tender	Tender	Intermediate	Tough
Clod	69.6	30.4	-	-
Ribeye	95.1	4.9	-	-
Bone-In Ribeye	100.0	-	-	-
Top Loin	98.7	1.3	-	-
Bone-In Top Loin	100.0	-	-	-
T-Bone	97.0	-	2.1	-
Porterhouse	93.8	6.3	-	-
Top Sirloin	87.1	12.9	-	-
Top Round	61.5	25.6	10.3	2.6
Bottom Round	22.2	48.2	18.5	11.1
Eye of Round	34.5	55.2	6.9	3.5

Percentage Distribution of Foodservice Cuts Stratified Into Tenderness Categories

Cut	Very Tender	Tender	Intermediate	Tough
Ribeye	81.4	12.7	5.1	0.9
Top Loin	96.6	3.4	-	-
Top Sirloin	73.7	22.2	2.0	2.0

Very Tender = WBS < 7.05 lbs (3.2 kg); Tender = 7.05 lbs (3.2 kg) < WBS < 8.60 lbs (3.9 kg); Intermediate = 8.60 lbs (3.9 kg) < WBS < 10.14 lbs (4.6 kg); Tough = WBS > 10.14 lbs (4.6 kg).

Table 3
HOW WE COMPARE TO PREVIOUS SURVEYS

Warner-Bratzler shear values (lbs)

Retail Cuts from the Rib and Loin

	1990	1999	2005
Ribeye	7.5	6.2	5.2
Bone-In Ribeye	N/A	N/A	4.8
Porterhouse	N/A	5.7	5.1
T-Bone	N/A	5.9	5.0
Top Loin	7.3	5.9	4.7
Bone-In Top Loin	N/A	N/A	4.7
Top Sirloin	7.9	6.4	5.5

Retail Cuts from the Chuck and Round

	1990	1999	2005
Clod	8.8	6.6	6.2
Chuck Roll	9.2	7.3	N/A
Top Round	11.4	7.9	6.7
Eye of Round	10.3	9.0	7.5
Bottom Round	9.7	11.0	8.1

Conclusions

The 2005 Survey indicates that there was approximately an 18% overall increase in tenderness as compared to 1999. When compared to past surveys, Warner-Bratzler shear force values improved and the majority of steaks evaluated in this study were considered tender. It is important to note that bone-in ribeye and bone-in top loin steaks were evaluated for the first time in the 2005 Survey.

Tenderness improvements could be due to increased aging times, longer and slower chill rates, processors paying more attention to tenderness parameters, and more participation in branded programs focused on beef tenderness.

As demonstrated in this study, approximately 47% of retail cuts were marketed as part of a packer or branded program, which places parameters on certain quality traits such as phenotype, genetic makeup, aging times and electrical stimulation. "Never before in the history of the beef industry have there been so many programs designed to ensure that beef delivered to the consumer is tender, juicy, and flavorful. These programs are making a difference in improving the demand in the marketplace for great tasting beef," says Dr. Savell. Adds Glen Dolezal, Ph.D., vice-chairman of NCBA's Joint Product Enhancement Research Committee: "The science, much of which has been provided through The Beef Checkoff program, has enabled branded beef programs to deliver consistently tender and palatable beef to consumers — despite variation in marbling and quality grade."

Despite improvements over 1999 numbers, Table 1 reveals that round cuts still require more attention postmortem to ensure acceptable tenderness. However, these cuts are traditionally very lean and are being sliced thin in many retail outlets to minimize potential tenderness issues.

Similar to 1999, the utilization of a single cooking method allowed for the determination of relative tenderness between all of the cuts sampled in 2005. However, the single cooking method did not allow for the use of alternative cooking methods that may optimize the palatability of cuts that contain higher connective tissue levels. Efforts should be made to emphasize cooking methods that optimize the palatability of all beef cuts for consumers.

The beef industry remains committed to improving the quality and tenderness of our product. Data from this survey can serve as a benchmark for tenderness of beef available in retail and foodservice channels. "A superior eating experience by every consumer every time they eat beef should be the ultimate goal of the beef industry. The 2005 National Beef Tenderness Survey demonstrates that efforts by all segments of the industry are having a positive impact on the quality and consumer acceptance of our product," says Bill Rishel, chairman of NCBA's Joint Product Enhancement Research Committee. "Further efforts in genetics, pre-harvest management, and postmortem technology will provide continued improvement in beef eating satisfaction as we move to 2010," adds Dr. Dolezal.

Table 4
CONSUMER LIKES & DISLIKES

Sensory panel ratings
(10 = highest or best; 1 = lowest or worst)

Retail Cuts (all grades combined)

Cut	Sensory Attribute: Overall like	Tenderness	Juiciness	Flavor like	Beef flavor
Clod	5.6[c]	6.0[c]	5.4[d]	5.7[b]	5.8[c]
Ribeye	6.5[ab]	6.9[ab]	6.2[b]	6.4[a]	6.4[a]
Bone-In Ribeye	5.9[bc]	6.4[bc]	5.9[bcd]	6.3[ab]	6.4[ab]
Top Loin	6.5[ab]	6.9[ab]	6.1[bc]	6.5[a]	6.6[a]
Bone-In Top Loin	6.9[a]	7.4[a]	7.0[a]	6.6[a]	6.5[a]
T-Bone	6.6[a]	7.0[ab]	6.0[bc]	6.5[a]	6.4[a]
Porterhouse	6.5[ab]	7.1[a]	5.8[cd]	6.4[a]	6.5[a]
Top Sirloin	5.5[c]	5.9[c]	5.3[d]	5.7[b]	6.1[b]
Top Round	4.8[d]	4.6[d]	4.5[e]	5.3[c]	5.5[c]
Bottom Round	4.3[e]	4.1[e]	4.4[e]	4.9[cd]	5.5[c]
Eye of Round	4.6[de]	4.6[d]	4.2[e]	4.9[d]	5.1[d]

[a,b,c,d,e]Within a column, means lacking a common superscript letter differ (P < 0.05).

Foodservice Ribeye Steaks (stratified by grade)

Sensory Attribute	Rating: Prime	Top Choice	Choice	Select
Overall like	6.8	6.8	6.9	7.4
Tenderness	7.1	7.1	7.0	7.4
Juiciness	8.0	7.6	7.7	8.1
Flavor like	6.7[b]	6.7[b]	6.7[b]	7.7[a]
Beef flavor	6.6	6.4	6.6	7.3

[a,b]Within a row, means lacking a common superscript letter differ (P < 0.05).

Foodservice Top Loin Steaks (stratified by grade)

Sensory Attribute	Rating: Prime	Top Choice	Choice	Select
Overall like	6.2	7.0	6.9	7.2
Tenderness	7.1	7.6	7.1	7.3
Juiciness	5.6	6.6	6.1	6.1
Flavor like	6.3	6.9	7.0	7.1
Beef flavor	6.5	6.9	6.6	6.9

Foodservice Top Sirloin Steaks (stratified by grade)

Sensory Attribute	Rating: Prime	Top Choice	Choice	Select
Overall like	6.7	6.1	6.4	5.8
Tenderness	7.2[a]	6.4[ab]	6.1[b]	6.0[b]
Juiciness	5.9[a]	4.8[b]	5.3[ab]	4.8[b]
Flavor like	6.5	6.4	7.0	6.5
Beef flavor	6.8	6.5	6.7	6.4

"A superior eating experience by every consumer every time they eat beef should be the ultimate goal of the beef industry. The 2005 National Beef Tenderness Survey demonstrates that efforts by all segments of the industry are having a positive impact on the quality and consumer acceptance of our product."

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