National Beef Quality Audit
2009 Retail Beef Satisfaction Benchmark

An Executive Summary for the Beef Industry

Beef Information Centre

Benchmark Study Goals

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Benchmark Study Goals

1. **Determine Consumer Satisfaction Drivers**
   To measure the relative importance of juiciness, tenderness, and flavour as drivers of beef satisfaction.

2. **Measure Consumer Satisfaction Levels**
   To determine the level of consumer satisfaction with beef steak.

3. **Assess Beef Tenderness Objectively**
   To assess the tenderness of beef products using laboratory measurements and determine the impact of tenderness on consumer or subjective perceptions of steak eating quality.

4. **Enhance Beef Eating Quality**
   To use the results of the current and 2001 study to improve palatability by sharing information with retailers and the beef industry in general. Industry priorities for palatability enhancement strategies can then be identified.

Consumer and Product Statistics

Satisfaction Driver Analysis and Levels

Beef Tenderness Assessment

Enhancement Beef Eating Quality

Study Methodology Overview

The study methodology used both consumer and laboratory testing to determine factors related to beef eating quality or palatability. In the consumer portion of the study, juiciness, flavour, and tenderness were examined separately to determine their contribution to overall satisfaction with beef products. A summary of the methods used are found in the table below.

Study Stage	Methodology
Sample Collection	1,152 samples were purchased from 60 stores in Calgary, Montreal, Toronto, and London for consumer testing. Additionally, 1,200 extra samples were saved for evaluation at the AAFC Lacombe Research Centre.
Consumer Recruitment	1,152 consumers were randomly selected from shopping malls to try steaks at home. Consumers were screened to ensure they had some experience in preparing beef products and had consumed beef in the past year.
Consumer Evaluation of Beef Products	Consumers prepared one of four types of steak at home and recorded their impressions during consumption. Steaks tested were boneless cross rib, top sirloin, inside round and strip loin.
Follow-up Interview	A professional interviewer then contacted each consumer by telephone and obtained detailed information on product perceptions as well as supporting data on cooking methods, historical beef satisfaction, and demographic information. Consumers were asked to evaluate the following factors on a numerical scale of 1 to 10. ▪ Tenderness – Amount and Satisfaction ▪ Juiciness – Amount and Satisfaction ▪ Flavour – Amount and Satisfaction ▪ Overall Rating
Scientific Analysis	An additional 1,200 samples were frozen and later measured to determine tenderness using Warner-Bratzler analysis. Measurements for maximum, minimum and average fat and lean depth were also recorded.

Consumer and Product Statistics

Table 1: **Summary Statistics for Retail Product Evaluated by Consumers**

Cut	#	Unit Price	$/kg	Average Weight (g)	Lean Thickness (mm)	Branded %
Top Sirloin	291	$7.23	$16.41	441	16.8	10
Strip Loin	290	$7.13	$25.26	293	18.6	22
Boneless Cross Rib	287	$5.21	$11.65	455	16.2	2
Inside Round	284	$5.65	$13.09	439	15.8	13

Product Sampled

Table 1 summarizes product parameters for the steaks purchased for consumer evaluation. The number of steaks purchased from the retail chains represented in the study was proportional to their market share for the given beef steak category.

The four types of steaks selected for the study were chosen for their ability to represent different cooking categories, price ranges, and portions of the carcass.

Table 2:
Steaks the Study Consumers Say They Buy Most Often

Cut	%
Top Sirloin	**30.0%**
T-bone	**26.0%**
Strip Loin	**19.0%**
Tenderloin	**18.0%**
Rib Eye	**14.0%**
Inside Round	**12.0%**
Sirloin Tip	**8.0%**
Boneless Cross Rib	**8.0%**
Rib Steak	**7.0%**
Eye of Round	**6.0%**
Blade	**5.0%**
Bottom Sirloin	**4.0%**
Outside Round	**2.0%**

Consumers were not prompted and accordingly results may have been influenced by their ability to remember cut names. Steaks in italics were of the types utilized in the benchmark study.

Consumers Sampled

The 1,152 consumers sampled were selected from four Canadian cities (Toronto, Calgary, London and Montreal). The number of consumers selected from each region was based on regional beef consumption volumes.

When asked what type of steaks they buy most often, study consumers identified two of the study cuts (top sirloin, strip loin) among their most frequent choices (see table 2).

As table 3 shows, the randomly selected consumer sample consumed beef at approximately 43% of evening meals. Females comprised approximately 67% of the sample.

Table 3:
Consumer Statistics

Gender	**386 male /766 female**
Average Household Income	**$48,000.00**
Beef Consumption (% evening meal)	**43%**
Average Age	**46 years**
Average Household Size	**2.7**

Satisfaction Driver Analysis

As described in the methods section, consumers were asked to rate tenderness, juiciness, flavour and overall impression for the four types of steaks. The first goal of the benchmark study was to determine the relative importance of tenderness, juiciness, and flavour as drivers or predictors of overall satisfaction. In order to determine this, a statistical value known as a correlation coefficient was calculated using survey responses. (In this case, the higher the value of the correlation coefficient the more important the strength of the attribute as a driver of overall satisfaction with eating quality.)

The results for females in the study produced higher values* for the tenderness correlation coefficient when compared to flavour and juiciness (see table 4). This indicates that for females, tenderness was slightly more important in determining overall satisfaction.

For male study participants, flavour, juiciness and tenderness produced values which were all relatively equal. This indicates that tenderness, juiciness, and flavour are of similar importance. The correlation between palatability attributes can be influenced by the so called "halo" effect where enhanced tenderness leads to greater satisfaction with other aspects of eating quality.

Table 4:
Satisfaction Driver Analysis

Satisfaction Driver	Males	Females	Total Sample
Tenderness Satisfaction	**0.83**	**0.85**	**0.84**
Juiciness Satisfaction	**0.79**	**0.76**	**0.77**
Flavour Satisfaction	**0.82**	**0.79**	**0.80**

*Values shown are correlation coefficients, the closer the value to 1 the stronger the driver. * Significance testing at the 90% confidence level.*

Satisfaction Levels

Table 5: **Percentage of Satisfied Customers***

Steak Type	Tenderness	Juiciness	Flavour	Overall
Top Sirloin	**83%**	**88%**	**90%**	**86%**
Strip Loin	**84%**	**87%**	**86%**	**87%**
Boneless Cross Rib	**71%**	**72%**	**79%**	**75%**
Inside Round	**63%**	**65%**	**70%**	**69%**

The second goal of the study was to determine consumer satisfaction levels. In our analysis, a consumer was considered to be satisfied if they gave a score of 7 out of 10 or higher for the attribute being evaluated. In terms of overall satisfaction levels, top sirloin and strip loin were significantly higher than cross rib and inside round. Reduced consumer satisfaction with all three palatability or eating quality attributes was shown to contribute to this difference (see table 5).

Table 6 shows the percentage of consumers satisfied with the different attributes of eating quality. For steaks, flavour had the highest levels of consumer satisfaction followed closely by juiciness and then tenderness. This trend was generally observed in all four of the steaks tested in the study.

Table 6: **Attribute Satisfaction**

Attribute	% Satisfied Consumer*
Tenderness	**76%**
Juiciness	**78%**
Flavour	**82%**

A satisfied consumer in this study is defined as one who gave a rating of **7/10 or higher for the attribute being evaluated.*

Beef Tenderness Assessment

The third goal of the consumer satisfaction benchmark was to determine in a laboratory, using a procedure known as the Warner-Bratzler method, the tenderness of beef steaks. By comparing the laboratory measurements of beef tenderness with consumer ratings, we can better determine the extent that perceptions of eating quality are influenced the inherent tenderness of the beef versus consumer taste preferences or preparation methods.

The results in table 7 show that strip loin had lower values of shear force than the other three cuts and was therefore the most tender steak we tested. Inside round on average was the toughest cut of the steaks tested.

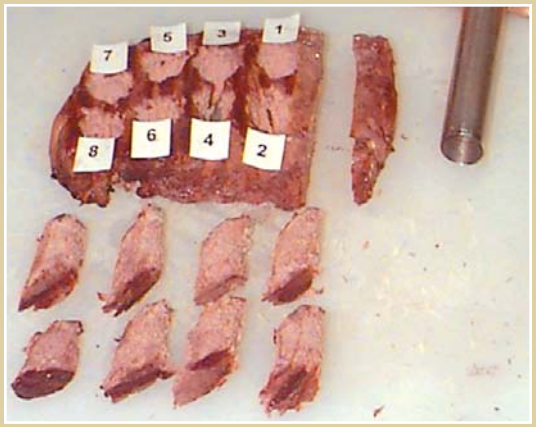
How Warner-Bratzler Tenderness Analysis is Performed

The laboratory tenderness assessment used the Warner-Bratzler method. This involves taking core samples from beef cooked to the same degree of doneness and measuring the force needed to cut through the meat using a standardized blade shown at the lower right.

The lower the shear force value the more tender the meat sample.

Table 7:
Warner-Bratzler Shear Results

Steak Type	Shear Values in kgs
Top Sirloin	2.5 kg
Strip Loin	2.1 kg
Boneless Cross Rib	2.8 kg
Inside Round	3.0 kg



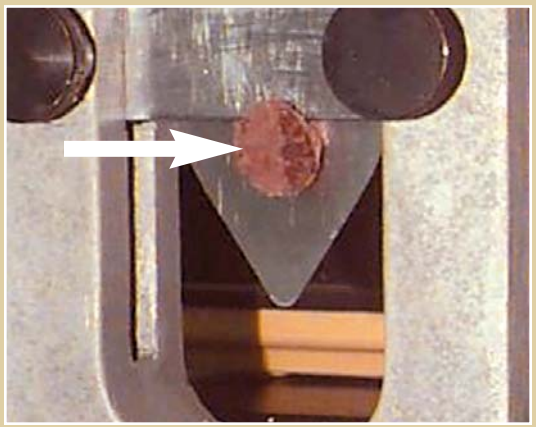


Table 8:
Percentage of Steaks Requiring Tenderness Enhancement Strategies

	NEED FOR TENDERNESS ENHANCEMENT		
Steak Type	**None (<2.5 kg)**	**Slight to Moderate (2.5 to 4.3 kg)**	**Significant (>4.3 kg)**
Top Sirloin	**60.0%**	**40.0%**	**0%**
Strip Loin	**84.0%**	**16.0%**	**0%**
Boneless Cross Rib	**34.7%**	**64.0%**	**1.3%**
Inside Round	**30.9%**	**63.0%**	**6.0%**

Previous Canadian research has shown that for retail beef steaks a shear force value of higher than 4.3 kg often corresponds to meat which will be judged by consumers as "tough."[1] In our study less than 2% of top sirloin, strip loin and boneless cross rib were found to be in this range (see table 8). Inside round results showed that 6% of steaks were on the tougher side, which supports this product's classification as a marinating steak and indicates the importance of including a tenderizing agent in the marinating process to enhance eating satisfaction. In the same way that there is a threshold value for tougher meat there may also be a point at which consumers do not recognize and/or require more tender products. In our study approximately 84.0% of the strip loin steaks had shear forces of 2.5 kg or less. The <2.5 kg standard corresponds to a shear force which is associated with meat judged by consumers to be tender. If we apply this threshold to other types of steaks, approximately 60.0%, 34.7%, 30.9% of top sirloin, boneless cross rib and inside round steaks do not require tenderness enhancement strategies to produce meat of acceptable tenderness to virtually all consumers.

[1] *1. J. Aalhus et.al, Canadian Beef Tenderness Strategy*

Enhancing Beef Eating Quality

The fourth goal of the study was to determine ways in which palatability could be enhanced. Clearly improvements and reductions in the ultimate eating quality of a steak can occur anywhere from the farm to consumer plate and further, weakness in one sector may be compensated for by strengths in others. Our results suggested that some retail stores had significantly above average shear force values (tougher meat) (see figure 1). The reason why some stores had higher average values requires further exploration to determine if retailer, supplier or farm related factors were responsible. For the vast majority of stores, the inherent tenderness of the steaks did not appear to limit consumer satisfaction and consumer cooking practices and taste preferences became most important.

In total, study results support the conclusion that tenderness problems within a steak category are optimally dealt with by strategies aimed to reduce the toughest product. Making the most tender existing meat even more tender will likely have far less impact on overall consumer satisfaction ratings within a steak category. The challenge remains to create a practical means for industry to identify tougher meat so that it can be targeted for further treatment. While some progress is being made in this regard using imaging techniques, further research will be required before routine usage of these techniques can be recommended. Interventions such as mechanical tenderization are presently being utilized by the Canadian industry and can be particularly useful for cuts from the round.

Figure 1:
Average Tenderness Values for Steaks from Individual Retail Stores

This graph shows store average tenderness values (shear force) for all four types of steaks combined.

Increasing values of shear force indicate steaks that were less tender. Differences of 1 kg or greater would likely be detectable by consumers.

Table 9:
Consumer Satisfaction and Proper Cooking Method

Steak Type	Cooked Correctly	Satisfaction
Top Sirloin	**94%**	**86%**
Strip Loin	**97%**	**87%**
Boneless Cross Rib	**6%**	**75%**
Inside Round	**5%**	**69%**

As noted previously, there were large differences in consumer satisfaction between the two grilling steaks (strip loin and top sirloin) and the marinating inside round and simmering cross rib steaks. While some differences are no doubt due to the eating quality of the muscles from which these cuts are made, there is still an opportunity to enhance satisfaction through increased use of correct cooking methods (see table 9). While consumers correctly prepare grilling steaks over 94% of the time, the simmering and marinating steaks were correctly prepared by only 5% – 6% of study consumers.

Enhancing Beef Eating Quality *(continued)*

Table 10 illustrates that the presence of package cooking instructions did make the use of the recommended cooking method more likely for cross rib and inside round steak. While consumers had no difficulty correctly preparing grilling steaks without cooking instructions, increased efforts to get these labels on simmering and marinating steaks would likely increase their overall satisfaction levels.

Table 10 also illustrates that even with instructions, only 4.2% of individuals cooked inside round steaks using the recommended method. This may be due to consumers reluctance to marinate steaks because of time or other limitations and/or the possibility they may also not be convinced that following the instructions will lead to improved eating quality. Although substantial industry efforts have been made to provide quick marinades, interventions to enhance tenderness before the product reaches the consumer will be beneficial.

Table 10: **Impact of Package Instruction on Appropriate Cooking Method Selection**

	Percent Cooked Correctly	
Steak Type	With Instructions	Without Instructions
Boneless Cross Rib	**4.5%**	**1.4%**
Inside Round	**4.2%**	**0.7%**

Table 11: **Why Was Your Steak Not Perfect?**

Didn't Know	Product Related	Consumer Related
0.0%	**81%**	**19%**

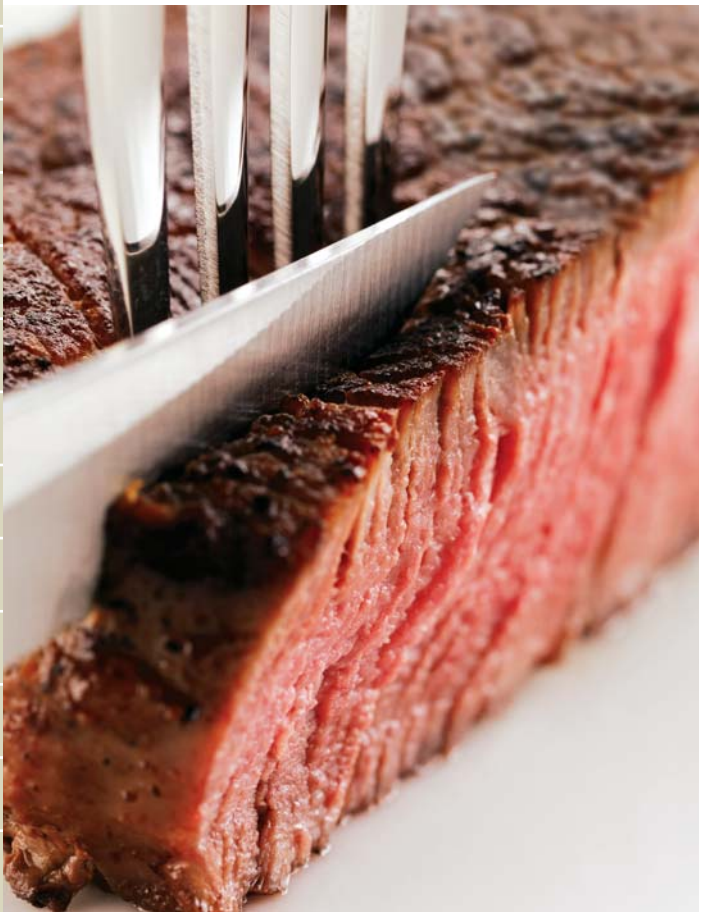
In the study approximately 264 of the 1,152 consumers gave their steak a perfect rating (10/10). When the remainder were asked, "Why wasn't it perfect?", approximately 19% of study consumers felt their preparation methods were solely or partially responsible, while 81% felt the product was somehow to blame (see table 11).

Although it could be argued that consumers underestimate the importance of their own cooking practices on steak eating quality, it does not change the fact that in their view, the vast majority of concerns are due to the product they purchased. Accordingly the largest share of the responsibility for enhancing eating quality is assigned to the beef industry.

Table 12:
Consumer Concerns with Study Steaks

Concern	%
Tough/Not tender/Chewy/Stringy	39%
Dry/Not juicy	14%
Not much flavour, Unpleasant taste	10%
Cooked it the wrong way	9%
Too much gristle	7%
Prefer other cuts	7%
Overcooked it	7%
Too much fat	6%
Cut too thin	5%
Had better steaks	4%
Not a good cook	2%
Cut too thick	2%
Cheaper cut of beef	1%
Took too long to cook	1%

In table 12 we can see that complaints related to tenderness were most prevalent. Juiciness and flavour concerns were next in order of magnitude but even when added together did not reach the level of tenderness related concerns. This finding lends support to the previous conclusion that tenderness improvement is the most important factor to enhancing eating quality of beef steaks.



Comparisons to the 2001 Benchmark

Product Characteristics

The tables below compare the results of the 2001 benchmark to the 2009 study findings. Both studies utilized the same methodology which makes comparisons meaningful.

Relative to the 2001 benchmark the price per unit increased by 30% (see table 13). The reasons for this increase include both an increased average weight of the steak in the package as well as an increase in the price per kilogram. The average thickness of the lean tissue in the steaks was slightly lower in 2009, so by inference the diameter of the cuts must have increased. A long term trend towards increasing carcass weights may have contributed to this observation. The total number of steaks evaluated by consumers was 1,152 in the 2009 versus 1,100 in the 2001 benchmark.

Table 13: **Summary Statistics for Retail Product Evaluated by Consumers**

Parameter*	2009	2001	Difference
Total Steaks Sampled	**1,152**	1100	**+5%**
Unit Price ($/unit)	**$6.30**	$4.86	**+30%**
Price per Kilogram ($/kg)	**$16.60**	$14.99	**+11%**
Weight (grams)	**407**	351	**+16%**
Lean Thickness (mm)	**16.8**	17.4	**-3.3%**

** Simple average all 4 steak types*

Consumer Characteristics

The percentage of consumer participants that were female was decreased in the 2009 study by 9% (see table 14). The average age of the respondents was very similar as was household income in 2001 and 2009. The average number of people in participant households decreased and there was slightly less beef consumption in terms of evening meals by participants in the 2009 benchmark.

Table 14: **Summary Statistics for Consumer Study Participants (Averages)**

Parameter	2009	2001	Difference
% Females	**66%**	72%	**-9%**
Age	**46**	45	**+2%**
Beef Consumption (% evening meals)	**43%**	45%	**-4%**
Household Income	**$48,000**	$47,000	**+2%**
Household Size	**2.7**	2.9	**-7%**

Cooked Methods and Doneness Levels

In 2009, fewer respondents cooked their steaks to a medium level of doneness (see table 15). Interestingly, there was a trend towards higher level of satisfaction with eating quality at a well/medium well doneness versus medium. As in 2001, the most popular cooking methods for steaks continue to be grilling/BBQ and frying. These cooking methods were used for 88% of steaks in both study years.

Table 15: **Level of Doneness**

Parameter	2009	2001	Difference
Well/Medium Well	**49%**	44%	**+5%**
Medium	**27%**	35%	**- 8%**
Med. Rare/Rare/Blue	**24%**	21%	**+3%**

Use of Marinades

In 2009, 35% of study participants reported they marinated their steak versus 24% in 2001. Only 29% of those that marinated utilized an effective tenderizing agent or ingredient in the marinade in the current study. This was nearly identical to the 26% figure from the 2001 benchmark. Unlike 2001, the use of a tenderizing agent or ingredient was not significantly greater for inside round steak (see table 16).

Table 16: **Use of a Tenderizer in the Marinade**

Steak Type	2009	2001	Difference
Strip Loin	**24%**	19%	**+5%**
Top Sirloin	**28%**	19%	**+9%**
Inside Round	**35%**	39%	**-4%**
Boneless Cross Rib	**29%**	19%	**+10%**

Concerns with Eating Quality

In both study years, a similar percentage of individuals gave their steaks a 10/10 rating, (20% and 23% in 2001 and 2009 respectively). When the remainder where asked "why was your steak not perfect?", 19% of consumers in 2009 indicated their preparation methods were solely or partly responsible versus 11% in 2001. The remaining consumers reported that eating quality concerns were due primarily to quality of the product they had been provided. As in 2001, approximately 39% identified concerns related to tenderness of the product. Concerns with tenderness were significantly more prevalent than issues with juiciness or flavour.

As shown in table 17, Warner Bratzler testing indicated that the average value of shear force for all 4 type of steaks combined was reduced in 2009.. While even small differences in laboratory methods or sample storage can influence results and may partially explain the differences observed, it is likely that beef sampled by consumers in 2009 was more tender than in 2001.

Table 17: **Warner Bratzler Tenderness Testing Results**

Average for Study Steaks	2009	2001	Difference
Shear Force (kg)	**2.6 kg**	3.6 kg	**-1 kg**

Satisfaction Drivers

The 2009 driver analysis confirmed that all three attributes (tenderness, flavour and juiciness) continue to be positively correlated with overall satisfaction ratings. That being said, when the strength of the correlation was analyzed, there was a slightly stronger influence of tenderness versus juiciness or flavour. In terms of the gender of the respondents, the stronger influence of tenderness in predicting overall satisfaction ratings was found for females in both 2001 and 2009. As for 2001, the male results indicate that while all three attributes are positively correlated with overall satisfaction ratings, there is no one product characteristic that had significantly more impact than another.

Table 18: **Percentage of Satisfied Customers***

	Tenderness		Juiciness		Flavour		Overall	
Steak Type	**2009**	2001	**2009**	2001	**2009**	2001	**2009**	2001
Strip Loin	**84%**	82%	**87%**	82%	**86%**	85%	**87%**	84%
Top Sirloin	**83%**	76%	**88%**	81%	**90%**	82%	**86%**	83%
Boneless Cross Rib	**71%**	58%	**72%**	62%	**79%**	69%	**75%**	65%
Inside Round	**63%**	55%	**65%**	61%	**70%**	69%	**69%**	59%

Relative to the 2001 benchmark, consumers in the 2009 study assigned numerically higher ratings for tenderness, juiciness, flavour and overall satisfaction for all types of steak sampled (see table 18). While some differences would be expected due to chance alone, the improvement seen for boneless cross rib and in particular its tenderness ratings likely reflect improved satisfaction with this product. Overall ratings for inside round also showed a trend toward improvement.

When comparing ratings for palatability attributes across all steak types, the ranking of attributes was similar to the 2001 benchmark, with higher satisfaction levels being associated with flavour versus tenderness (see table 19). In 2009 there was a statistically significant improvement in satisfaction with tenderness, juiciness and flavour compared to 2001 when the ratings for all steak types studied were combined.

Table 19: **Attribute Satisfaction across all Study Steaks***

Attribute	2009	2001	Difference
Tenderness	**76%**	68%	**+8%**
Juiciness	**78%**	72%	**+6%**
Flavour	**82%**	76%	**+6%**

Most importantly, as shown in table 20, consumer ratings for overall satisfaction increased by 7% in the 2009 benchmark study. The higher reported values of consumer satisfaction with the steaks they usually purchase held steady in 2009.

Table 20: **Overall Satisfaction with Steaks***

Steak Type	2009	2001	Difference
Steaks Usually Purchased	**88%**	88%	**0%**
Study Steaks	**80%**	73%	**+7%**

A satisfied consumer in this study is defined as one who gave a rating of **7/10 or higher for the attribute being evaluated.*

Reaching 100% Consumer Satisfaction

It is the ultimate goal of the Canadian beef industry to achieve 100% consumer satisfaction with beef products. As part of our survey we asked consumers participating in the study how satisfied they were with the steaks they usually prepare at home. As table 20 shows, 88% of consumers gave beef steaks an overall rating of 7/10 or better. When we average the results from the four steaks in this study, we obtain a result of 80%. Given that consumers were not permitted to select which of the four study steaks to sample, they did not always receive their first choice and this may explain why ratings for this measure are lower. Most likely, the best estimate of consumer satisfaction with steaks lies somewhere between the two measurements at approximately 84%.

Table 20:
Consumer Satisfaction with Steaks

Measurement	% Satisfied Consumers
Steaks usually prepared	**88%**
Steak sampled in study	**80%**

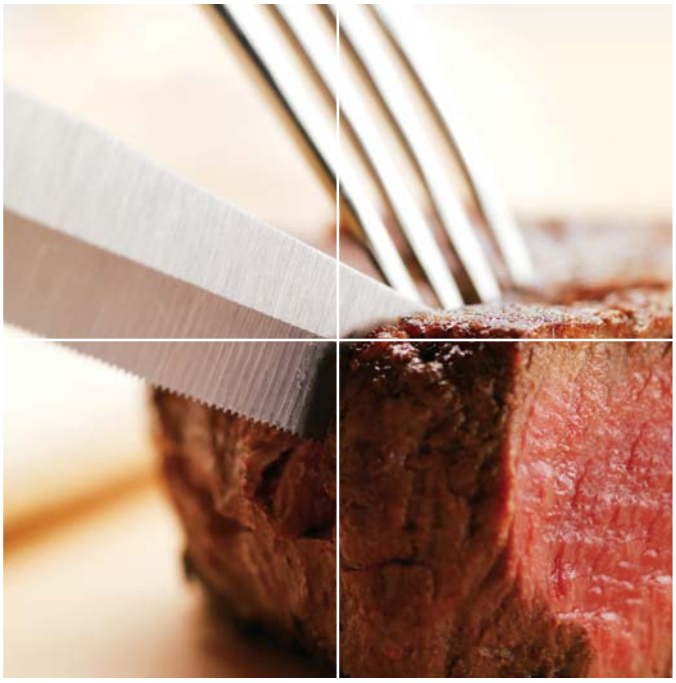
The response for "Steaks usually prepared" was for any type of steak usually prepared by the consumer.

Conclusions and Next Steps

The 2009 Retail Beef Satisfaction Benchmark results indicate that eating quality of the steaks sampled has been enhanced. Consumer ratings for tenderness, juiciness, flavour and overall satisfaction were increased relative to the 2001 study. These results are supported by laboratory findings of increased tenderness using Warner Bratzler shear force testing. The reasons for this improvement likely involve increased utilization of interventions such as mechanical tenderization and also the cumulative impact of enhanced practices throughout the supply chain. As a follow-up to the current study, a national survey of carcass quality at packing plants will be undertaken in 2010 – 2011.

This second component of the National Beef Quality Audit will provide valuable feedback to beef producers and processors on how carcass attributes can be further enhanced. These results will be benchmarked against the previous Canadian plant survey performed in 1999.

Looking to the future, there will be new and significant opportunities to support continued movement towards our ultimate goal of 100% consumer satisfaction with Canadian Beef. Some of the most important are the implementation of computer vision grading systems and the sharing of this information throughout the value chain by the Beef Information Exchange System (BIXS).



A Beef Research Cluster Initiative

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