



REPORT TO THE INDUSTRY

A comprehensive
in-home product test
among frequent
beef consumers

Beef *Customer* SATISFACTION



Developed and Managed by
the National Live Stock
and Meat Board



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with
Texas A&M University
Colorado State University
Yankelovich Partners, Inc.

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INTRODUCTION

BEEF CUSTOMER SATISFACTION: REPORT TO THE INDUSTRY

The beef industry has long recognized the importance of quality and consistency in meeting the demands of customers in the marketplace. The critical nature of these product characteristics was clearly stated in the “War on Fat” report issued by the beef industry’s Value Based Marketing Task Force in 1990. That report expressed the industry’s need to define the most appropriate product mix that would achieve the highest level of consumer satisfaction and thus maximize beef demand.

The need for quality and consistency has resulted in several long range research efforts designed to develop technologies that could be used to produce carcasses that satisfy marketplace demands. But as the beef industry is dependent on consumers to drive market share and profitability, a strong data base that defines in-home preparation, endpoint cooking temperature, and the relationship of USDA quality grade with these factors is imperative to understanding what makes customers satisfied or dissatisfied with the beef they consume.

The Beef Customer Satisfaction Project fills that need. Begun in 1993, the project provides solid, comprehensive information on consumer at-home eating experiences. (The findings do not provide information on away-from-home satisfaction of beef.) Using three different retail cuts prepared and evaluated in the homes of moderate to heavy users of beef, the project was primarily designed to:

- Determine the relationship of beef quality grade level to eating satisfaction;
- Evaluate the importance of demand drivers such as flavor and tenderness to customer satisfaction;
- Obtain information regarding in-home beef cooking methods and product preparation; and
- Evaluate general cattle management practices affecting product quality and consistency.

The following report addresses the top line results of this checkoff-funded project, which was designed specifically to address consumer in-home satisfaction with beef. The report is presented in three chapters:

Chapter 1 - Consumer Attitudinal Profile. Presents an overview of the moderate to heavy users of beef who participated in the study with regard to their perceptions of beef and other meat products.

Chapter 2 - In-home Product Evaluation. Discusses the relationships of beef quality, method of preparation, and degree of doneness to customer satisfaction.

Chapter 3 - Cattle Management Practices. Examines the implications of various production/management factors with regard to improving product quality and consistency.

Tens of thousands of steaks were evaluated on several levels by more than a thousand households in four cities across the nation for this study. Numerous laboratory tests were also conducted to help interpret the information. The data base is enormous, and opportunities for additional data interpretations exist. This initial report provides an overview of some of the most significant findings of this project.



EXECUTIVE SUMMARY

While the interactions between variables were significant and individual components were difficult to single out, analysis of the extensive study data did provide insight into the level of importance of the different factors investigated. Following is a discussion of those components, listed in order of their importance to customer satisfaction.

1 Beef cut played a very major role in customer satisfaction.

Possibly the most important thing the industry can do to improve satisfaction is assure that consumers are using appropriate cuts for the appropriate meals.

Study findings suggest that the greatest impact on customer satisfaction may be achieved by improving the eating quality of any cut to the next highest plateau of satisfaction. That is, significant progress would be gained if the Top Round could achieve the satisfaction expectation of the Top Sirloin and the Top Sirloin achieve that of the Top Loin.

Among the cuts studied, Top Sirloin Steak requires the most attention, especially in terms of consistent quality. While USDA quality grade did not affect consumer ratings of this cut, Top Sirloin's sensitivity to endpoint temperature would indicate that selecting an appropriate degree of doneness and method of cookery may be the best method of ensuring optimal eating satisfaction.

2 Significant geographical differences in the level of customer satisfaction were evident.

The fact that consumers in each of the four cities rated similar cuts from the same subprimal differently clearly indicates there were geographical/city effects in the study.

Marketing different cuts appropriately for the geographical region -- and putting beef in the best possible light for those particular consumers -- is critical to effective management of product mix.

3 The method of cookery affected how well consumers liked the finished product.

Much of the method of cookery data are confounded by the degree of doneness to which consumers cooked the meat. Nevertheless, data show that cuts prepared using appropriate cooking methods had a greater chance of getting higher satisfaction scores.

Weather and seasonality also appear to be an influence. For example, consumers in some geographical areas may be more likely to use outdoor grilling, which in this study produced beef that received higher satisfaction ratings.

Increased consumer education in appropriate cooking methods seems warranted -- though would be difficult due to cultural differences, the weather, availability of certain appliances, etc.



4 USDA quality grade had a cut-specific impact on customer satisfaction.

The Top Loin Steak was affected by grade, but the Top Sirloin Steak was not. The only quality grade that had a significant impact on Top Round was Top Choice.

Higher marbling levels tended to help reduce negative effects of cooking to higher degrees of doneness. The results would suggest that additional research is needed to establish how cooking method/degree of doneness combinations could be used to optimize the various grades of beef cuts available.

Often associated with quality grade, consumer ratings for Actual Tenderness and Flavor Desirability were among several key consumer attributes that were found to be closely related to Overall Like ratings for beef. Increasing customer satisfaction is a complex problem, and by targeting for only one specific trait, such as tenderness, the industry may limit the overall degree of satisfaction achieved in the final product.

5 Degree of doneness did have an effect on customer satisfaction.

For instance, the highest ratings were given to those steaks cooked Medium Rare or less. The affect of degree of doneness, however, was influenced by other factors. More than 80% of consumers in the study cooked their beef to a Medium degree of doneness or higher.

Overall Like ratings in this study were not always directly related to degree of doneness. Top Loin Steaks cooked to Well Done, for example, had ratings similar to those cooked to Medium.

6 Production practices had little influence on customer satisfaction.

Compared to the other factors investigated in this study, mainstream production methods evaluated in the study accounted for a very small fraction of the explained variance in customer satisfaction.

CHAPTER 1: CONSUMER ATTITUDINAL PROFILE

Within each of the four cities tested -- Houston, Chicago, Philadelphia and San Francisco -- 300 households were recruited to participate in the study via telephone interviews. To qualify for the study, households had to meet the following requirements:

- Age range from 21 to 64 years of age;
- Annual household income of at least \$20,000;
- Consume beef at home at least 3 times per week; and
- Two adults willing to participate.

Once a household qualified for the study, the primary food preparer was required to complete a 45 minute telephone interview to provide additional background and attitudinal information on the participants. Specific information requested included:

- Beef share of “at home” meals;
- Preparation methods and preferred degree of doneness; and
- Desirable characteristics of ideal main dishes vs the delivery by beef, chicken and pork.

The background and attitudinal information obtained from the 1,106 households completing the six-week study provided an excellent profile of these moderate to heavy users of beef. The study participants reported the following behavior over the previous year.

Reported meat usage

- 26% of the homes claimed to serve more beef while 8% said they served less;
- Serving of chicken had increased in 33% of the homes, and decreased in 8%; and
- 10% of the homes claimed to serve more fresh pork while 40% said they had decreased their consumption of fresh pork.

Types of beef served

- Overall, ground beef represented over 50% of the beef served;
- However, more whole muscle cuts (steaks, roasts) were consumed in homes where the primary food preparer was at least 40 years of age; and
- Sirloin cuts were the second most popular form of beef.

Beef's share of the last ten meals served at home

- Beef was the main dish in over half of the meals
- Chicken main dishes were used in 25% of the meals
- Fresh pork represented a 10% share of the meals

Preparation methods used during the past three months

- 91% of the homes had prepared beef by outdoor grilling
- 60 to 74% of the households had prepared beef by oven roasting, simmering/stewing, pan frying/sauteing or broiling methods

Preferred degree of doneness

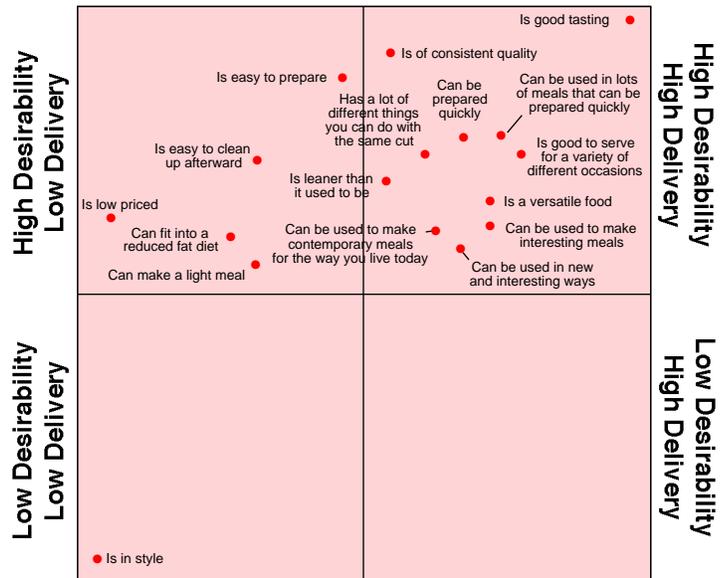
- Medium or higher degree of doneness were preferred by:
 - * 71% of the homes in Houston
 - * 65% of the homes in Chicago
 - * 66% of the homes in Philadelphia
 - * 51% of the homes in San Francisco



Consumer perceptions of highly desired traits in main dishes

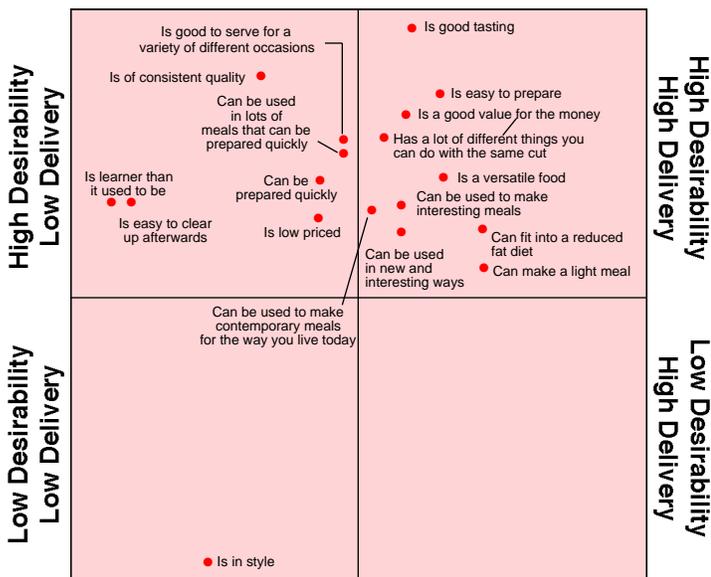
- Beef is perceived to deliver these desirable traits:
 - * Good taste
 - * Versatility
 - * Use in contemporary meals
 - * Can be quickly prepared
 - * Is leaner than it used to be
 - * Can be used in new and interesting ways
 - * Useful in a variety of meals
 - * Consistent quality
- Survey respondents said beef does not deliver the following desirable traits:
 - * Low price
 - * Easy to clean up afterwards
 - * Fits into a reduced fat diet
 - * Useful for light meals

Beef: Desirability vs. Delivery

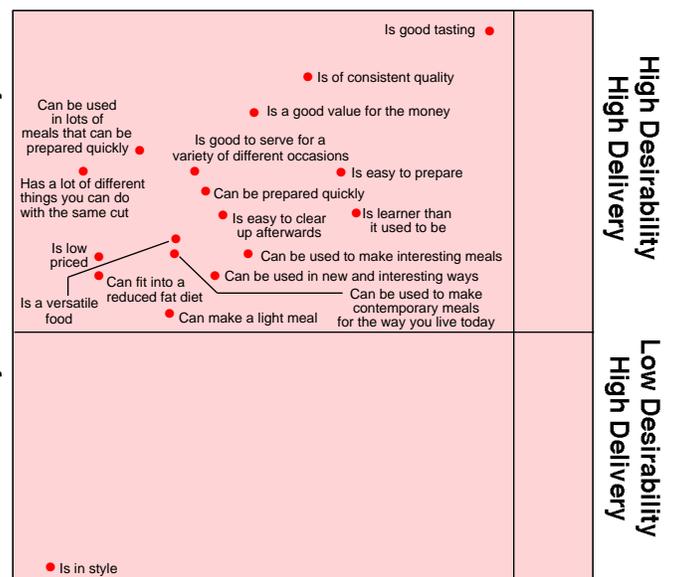


Overall, beef was perceived as being versatile, convenient and useful in a variety of meals. However, beef was not viewed as being low in price, which may have been a reflection of the price differential between beef and chicken during the period of time that the study was being conducted.

Chicken: Desirability vs. Delivery



Pork: Desirability vs. Delivery



CHAPTER 2: IN-HOME PRODUCT EVALUATION

Methodology

Carcass and subprimal selection

- Six hundred carcasses were selected from three packing plants — one each in Colorado, Nebraska, and Texas.
- Four segments of USDA quality grades were obtained: Top Choice (one-third Modest marbling; two-thirds Moderate marbling), Low Choice (Small marbling), High Select (high Slight marbling), and Low Select (low Slight marbling).
- The subprimals strip loin, top sirloin butt and inside round from both sides of each carcass were removed, vacuum packaged, boxed, and shipped to Texas A&M University for cutting into steaks.

Steak cutting and sorting

- After an aging period (14 to 21 days), each packaged subprimal was opened and steaks were cut and trimmed to uniform specifications.
- Three steaks were cut: Top Loin (Strip) Steak, Top Sirloin Steak, and Top Round Steak.
- Each steak was vacuum packaged, blast-frozen and stored in a freezer until sorting for each household. Eight steaks (or pairs of steaks for the Top Loin and Top Sirloin) from each carcass were used for the Household Panel and five steaks were used for the Sensory Panel and a mechanical measurement of tenderness, the Warner-Bratzler Shear.

Consumers

- Consumers evaluated two steak meals per week for six weeks, for a total of twelve meals. Steaks were delivered weekly with completed ratings forms for the previous week's meat picked up at the same time.
- Consumers were instructed to thaw the steaks in a refrigerator overnight and to prepare the steaks using the cooking methods and degrees of doneness they preferred.
- A number of factors were rated on 23-point scales (see appendix); for this summary, only Overall Like is reported.
- Consumers were asked what degree of doneness they consumed the beef using a standard color chart provided. Other preparation questions were asked (see Consumer Questionnaire Components in Appendix beginning on page 32) but were not included in this discussion.

Sensory Panel and Warner-Bratzler Shear

- Steaks were cooked to “medium” degree of doneness (160°F) for the trained Sensory Panel and were evaluated for numerous factors on 8-point scales.
- Four steaks from each carcass were cooked to one of four different degrees of doneness: 140°F (Rare), 150°F (Medium Rare), 160°F (Medium), and 170°F (Well Done). Cores from cooked steaks were used for Warner-Bratzler Shear force determinations with pounds of force required to shear cores recorded (lower number associated with more tender meat).



Findings

Impact of cut, USDA quality grade, and city

The first way the information was analyzed was to look at the main effects of cut, USDA quality grade and city, and the interaction effects of these factors combined. While all main effects were significant, so were the interaction effects. Significant interactions mean that one factor, such as USDA quality grade, may have a different effect in one city compared to another. The following section presents the findings of the interaction analyses for combinations of these three factors.

Cut by USDA quality grade effects

- Grade had the biggest impact on the Top Loin Steak with the Top Choice being rated higher than the remainder of the grades. High Select cuts did not differ from Low Choice or Low Select; however, Low Choice did differ from Low Select.
- Grade had no effect on the Top Sirloin Steak.
- The Top Choice Top Round was rated higher than the other grades of Top Round Steaks. No other grade-related differences were found.
- Across all USDA quality grades, Top Loin Steaks were rated higher than Top Sirloin Steaks and Top Sirloin Steaks were rated higher than Top Round Steaks.
- Sensory Panel Muscle Fiber Tenderness and Overall Tenderness Ratings generally support the trends observed in the consumer Overall Like ratings for cut by USDA quality grade.

Least-Squares Means for Cut by USDA quality grade effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)

Cut	USDA quality grade			
	Low Select	High Select	Low Choice	Top Choice
Top Loin (Strip)	18.8 ^c	18.9 ^{bc}	19.1 ^b	19.3 ^a
Top Sirloin	18.0 ^d	17.9 ^d	18.1 ^d	18.0 ^d
Top Round	16.7 ^f	16.7 ^f	16.9 ^f	17.1 ^e

^{a through f} Consumer Overall Like ratings with different superscript letters differ (P<.05).

Least-Squares Means for Cut by USDA quality grade effect on Sensory Panel Muscle Fiber Tenderness ratings (8 =extremely tender; 1 = extremely tough)

Cut	USDA quality grade			
	Low Select	High Select	Low Choice	Top Choice
Top Loin (Strip)	6.5 ^c	6.6 ^{bc}	6.6 ^b	6.8 ^a
Top Sirloin	6.1 ^d	6.1 ^d	6.2 ^d	6.2 ^d
Top Round	5.7 ^f	5.5 ^g	5.8 ^e	5.7 ^{ef}

^{a through g} Sensory Panel Muscle Fiber Tenderness ratings with different superscript letters differ (P<.05).



- Warner-Bratzler Shear force data generally support the trends observed in the consumer Overall Like ratings for cut by USDA quality grade except that USDA quality grades significantly affected shear values for the Top Sirloin Steak.

Least-Squares Means for Cut by USDA quality grade effect on Sensory Panel Overall Tenderness ratings (8 =extremely tender; 1 = extremely tough)

Cut	USDA quality grade			
	Low Select	High Select	Low Choice	Top Choice
Top Loin (Strip)	6.5 ^c	6.5 ^{bc}	6.6 ^{ab}	6.7 ^a
Top Sirloin	6.1 ^d	6.1 ^d	6.1 ^d	6.1 ^d
Top Round	5.4 ^e	5.2 ^f	5.5 ^e	5.4 ^e

^{a through f} Sensory Panel Overall Tenderness ratings with different superscript letters differ (P<.05).

Cut by USDA quality grade effect on Warner-Bratzler Shear Force (pounds) values

Cut	USDA quality grade			
	Low Select	High Select	Low Choice	Top Choice
Top Loin (Strip)	6.04 ^g	6.06 ^g	5.73 ^h	5.66 ^h
Top Sirloin	7.24 ^d	7.05 ^{ef}	7.07 ^{de}	6.88 ^f
Top Round	8.77 ^a	8.77 ^a	8.21 ^c	8.43 ^b

^{a through h} Shear force values with different superscript letters differ (P<.05).

Other key attributes

Although only Overall Like ratings are shown here and elsewhere in this report, correlations between Overall Like ratings and other key product attributes important to consumers were as follows: Actual Tenderness: .85; Actual Juiciness: .77; Flavor Desirability: .86; and Beef Flavor Amount: .79 (all highly significant at the P<0.001 level). This clearly shows that tenderness and flavor are equally important to a consumer as he/she evaluates a cooked steak.

Degree of doneness achieved

	Total %
Very Rare	0
Rare	2
Medium-Rare	16
Medium	24
Medium-Well	20
Well-Done	27
Very Well-Done	11

82%



Cut by City effects

- Consumers in Houston gave the highest ratings for each cut.
- Among cities, consumers in San Francisco rated Top Loin Steak the lowest.
- Consumers in San Francisco and Philadelphia gave Top Sirloin the lowest rating among cities.
- Top Round Steak received the lowest ratings from consumers in Philadelphia.
- Within each city, Top Loin Steaks were rated higher than Top Sirloin Steaks and Top Sirloin Steaks were rated higher than Top Round Steaks.

Least-Squares Means for Cut by City effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)

Cut	City			
	Chicago	Houston	Philadelphia	San Francisco
Top Loin (Strip)	19.1 ^b	19.6 ^a	19.0 ^b	18.5 ^d
Top Sirloin	18.0 ^e	18.8 ^c	17.7 ^{fg}	17.6 ^g
Top Round	17.1 ^h	17.8 ^{ef}	16.0 ^j	16.5 ⁱ

^{a through j} Consumer Overall Like ratings with different superscript letters differ (P<.05).

Degree of doneness by USDA quality grade effect on Warner-Bratzler Shear force

- Degree of doneness and USDA quality grade both affected Warner-Bratzler Shear Force values. However, degree of doneness within the same USDA quality grade appeared to be a greater factor in influencing shear force than was USDA quality grade within degree of doneness.
- Marbling appeared to help “insure” that advanced degrees of doneness had fewer negative effects on meat tenderness. Greater differences among USDA quality grades occurred at the 160°F and 170°F than at the 140°F and 150°F degree of doneness endpoints.

Least-Squares Means for Degree of doneness by USDA quality grade effect on Warner-Bratzler Shear Force (pounds) values

Degree of doneness	USDA quality grade			
	Low Select	High Select	Low Choice	Top Choice
140°F	6.80 ^{de}	6.93 ^d	6.60 ^f	6.78 ^d
150°F	7.16 ^c	6.90 ^d	6.68 ^e	6.73 ^{ef}
160°F	7.44 ^b	7.42 ^b	7.20 ^c	6.95 ^d
170°F	7.98 ^a	7.93 ^a	7.54 ^b	7.50 ^b

^{a through f} Shear force values with different superscript letters differ (P<.05).
¹ Lower shear force values are associated with more tender meat.



Cut by degree of doneness effect on Warner-Bratzler Shear Force

- Cuts responded differently to cooking endpoints. When cuts were cooked to more advanced degrees of doneness, the Top Sirloin was the most impacted, the Top Round was the least impacted, and the Top Loin was in the middle, with respect to increasing Warner-Bratzler Shear Force.

Cut	Degree of doneness			
	140°F	150°F	160°F	170°F
Top Loin (Strip)	5.61 ^g	5.70 ^g	5.91 ^f	6.27 ^e
Top Sirloin	6.06 ^f	6.65 ^e	7.31 ^d	8.22 ^c
Top Round	8.66 ^{ab}	8.26 ^c	8.54 ^b	8.72 ^a

^a through ^g Shear force values with different superscript letters differ (P<.05).
¹ Lower shear force values are associated with more tender meat.

- At lower degrees of doneness, the Top Sirloin was closer in Warner-Bratzler Shear values to the Top Loin; at higher degrees of doneness, it was closer to the Top Round.

Relationship of price to intent to purchase

During the in-home evaluation process, consumers were asked if they would purchase the steak they had just tasted at prices either higher or lower than the current market price. In general, as price increased, their intent to purchase decreased, and, as one would expect, as price decreased purchase intent increased (see chart below).

However, a higher percentage of the consumers were willing to pay a higher price for the lower valued Top Round Steak than for the more expensive Top Loin (Strip) Steak. While this study was not designed to test the effects of price on the intent to purchase, it does indicate that price is a sensitive consumer issue, which is in agreement with the findings reported in the attitudinal chapter of this report. The elasticity of price needs to be evaluated in the actual or a simulated marketplace.

% of Shoppers who would increase purchases of:

	Top Loin	Top Sirloin	Top Round
If price of beef was:			
30-40% higher	17	24	31
15-20% higher	26	35	40
At current price	46	54	54
15-20% lower	57	65	64
30-40% lower	71	77	74

Impact of USDA quality grade, city, cooking method and degree of doneness within each cut

The second way the information was analyzed was to sort by cut and to include cooking method and degree of doneness as factors to address. This is important from the standpoint that the choice of a particular cooking method and degree of doneness by a consumer will depend on which cut is to be prepared. Consumers cooked these steaks with many different cooking methods and to a wide variety of degrees of doneness. Charts detailing the frequencies of these combinations used for each cut within each city are located on pages 18-19 of this chapter.

As was seen in the first analysis, significant interactions among these factors were found. Discussion of these key points for each of the cuts follows.



Beef Customer SATISFACTION

TOP LOIN

Top Loin (Strip) Steak



Overall Liking
of Top Loin Steak
Relative to Grade
and Cooking Method/
Preparation

Degree of doneness effect

- Top Loin Steaks cooked to Medium Rare or less received the highest Overall Like ratings while those that were cooked to Medium Well received the lowest.
- Steaks cooked to Well Done or more received the same ratings as those that were cooked to Medium. Well Done may be preferred by those that like the flavor of meat cooked this way.

Top Loin (Strip) Steak Least-Squares Means for degree of doneness effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)			
Degree of doneness			
Medium Rare or less	Medium	Medium Well	Well Done or more
19.3 ^a	19.0 ^b	18.7 ^c	19.0 ^b

^a through ^c Consumer Overall Like ratings with different superscript letters differ (P<.05).

USDA quality grade effect

- Top Choice Top Loin Steaks were rated significantly higher in Overall Like than the other three grades.
- High Select Top Loin Steaks were intermediate in Overall Like ratings to the remaining grades. High Select did not differ from either Low Choice or Low Select Top Loin Steaks.
- Low Choice and Low Select Top Loin Steaks were statistically different in Overall Like ratings.

Top Loin (Strip) Steak			
Least-Squares Means for USDA quality grade effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)			
USDA quality grade			
Low Select	High Select	Low Choice	Top Choice
18.7 ^c	18.9 ^{bc}	19.0 ^b	19.3 ^a

^{a through c} Consumer Overall Like ratings with different superscript letters differ (P<.05).

Cooking method by city effect

- In Chicago, steaks cooked by indoor grilling generally were rated the highest while those broiled were the lowest.
- In Houston, steaks that were pan fried, outdoor grilled, or broiled generally were rated the highest while those that were cooked over an indoor grill were the lowest.
- In Philadelphia, steaks that were outdoor grilled were rated the highest while all other cooking methods were rated lower.
- In San Francisco, steaks cooked by indoor grilling or pan frying received the highest ratings while those cooked by other methods were rated lower.
- Ratings given to the Top Loin by consumers in Chicago and Houston generally were higher than those given by consumers in Philadelphia and San Francisco, regardless of cooking method.

Top Loin (Strip) Steak				
Least-Squares Means for cooking method by city effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)				
Cooking method	City			
	Chicago	Houston	Philadelphia	San Francisco
Outdoor grill	19.1 ^{bc}	19.7 ^a	19.3 ^b	18.3 ^e
Broil	18.7 ^c	19.4 ^{ab}	18.7 ^{cd}	18.3 ^{de}
Indoor grill	19.4 ^{ab}	18.5 ^{cde}	18.5 ^{cde}	19.1 ^{bc}
Pan fry	19.1 ^{bc}	19.9 ^a	18.6 ^{cde}	18.9 ^{bc}
Other ¹	19.4 ^{ab}	19.7 ^a	18.6 ^{cde}	18.3 ^e

^{a through e} Consumer Overall Like ratings with different superscript letters differ (P<.05).
¹ Other cooking methods included: oven roasted uncovered, pan broil, stir fry, braise, simmer and stew, and deep fry. These cooking methods were used infrequently by the consumers in this study.



Beef Customer SATISFACTION

TOP SIRLOIN

Beef Top Sirloin Steak



Overall Liking
of Top Sirloin
Relative to Grade
and Cooking Method/
Preparation

Cooking method by city effect

- In Chicago, Top Sirloin steaks cooked by indoor grilling were rated considerably higher than other cooking methods.
- In Houston, steaks cooked by pan frying, outdoor grilling, indoor grilling, and simmer and stewing were rated the highest. Those cooked by stir frying were rated the lowest.
- In Philadelphia, few significant differences were found among cooking methods. However, the trend was for indoor grilling to result in the highest ratings, while stir frying was among the lowest.
- In San Francisco, indoor grilling produced higher ratings than broiling, with the other methods overlapping between the two.

Top Sirloin Steak				
Least-Squares Means for cooking method by city effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)				
Cooking method	City			
	Chicago	Houston	Philadelphia	San Francisco
Outdoor grill	17.7 ^e	18.7 ^{abcd}	17.8 ^{de}	17.7 ^e
Broil	17.7 ^e	18.5 ^{bcd}	17.5 ^e	16.5 ^f
Indoor grill	19.3 ^a	18.8 ^{abc}	18.3 ^{bcde}	18.4 ^{bcd}
Pan fry	17.4 ^e	19.2 ^a	17.8 ^{de}	17.9 ^{de}
Stir fry	17.3 ^{ef}	18.2 ^{bcde}	16.8 ^{ef}	17.2 ^{ef}
Simmer and stew	17.7 ^e	18.7 ^{abcd}	17.3 ^{ef}	17.2 ^{ef}
Other ¹	18.9 ^{ab}	19.1 ^{ab}	17.3 ^{ef}	18.1 ^{cde}

^{a through f} Consumer Overall Like ratings with different superscript letters differ (P<.05).
¹ Other cooking methods included: pan broil, braise, and deep fry. These cooking methods were used infrequently by the consumers in this study.



Degree of doneness by city effect

- In Chicago, the trend was for steaks cooked to more advanced degrees of doneness to receive higher ratings.
- In Houston and San Francisco, no real trends were observed for Overall Like ratings to be influenced by degree of doneness.
- In Philadelphia, the trend was for higher ratings to be given to steaks cooked Medium Rare or less or Well Done or more, with Medium and Medium Well being intermediate.

Top Sirloin Steak				
Least-Squares Means for degree of doneness by city effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)				
Degree of doneness	City			
	Chicago	Houston	Philadelphia	San Francisco
Medium Rare or less	17.6 ^{efg}	18.9 ^{ab}	17.7 ^{defg}	17.8 ^{defg}
Medium	18.2 ^{cd}	18.5 ^{abc}	17.4 ^{efg}	17.6 ^{efg}
Medium Well	18.0 ^{cde}	18.9 ^a	17.3 ^g	17.4 ^{fg}
Well Done or more	18.3 ^{bc}	18.7 ^{ab}	17.9 ^{def}	17.6 ^{efg}

^{a through g} Consumer Overall Like ratings with different superscript letters differ (P<.05).

Cooking method by degree of doneness effect

- For outdoor grilling, broiling, and pan frying, the trend was for Overall Like ratings to decline as degree of doneness increased.
- For indoor grilling and simmer and stewing, no real trends in Overall Like ratings were evident as degree of doneness increased.
- For stir frying, Overall Like ratings increased with increased degree of doneness.

Top Sirloin Steak				
Least-Squares Means for cooking method by degree of doneness effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)				
Cooking method	Degree of doneness			
	Medium Rare or less	Medium	Medium Well	Well Done or more
Outdoor grill	18.4 ^{abc}	18.1 ^{cd}	17.9 ^{cd}	17.7 ^{de}
Broil	18.1 ^{bcd}	17.6 ^{de}	17.1 ^{de}	17.3 ^{de}
Indoor grill	19.0 ^a	18.2 ^{abcd}	18.7 ^{abc}	19.1 ^{ab}
Pan fry	18.4 ^{abc}	18.2 ^{abcd}	17.7 ^{cd}	17.8 ^{cd}
Stir fry	15.7 ^e	17.4 ^{de}	17.9 ^{cd}	18.4 ^{abc}
Simmer and stew	17.0 ^{de}	18.3 ^{abcd}	17.6 ^{de}	18.0 ^{bcd}
Other ¹	18.9 ^{ab}	17.7 ^{cde}	18.3 ^{abcd}	18.5 ^{abc}

^{a through e} Consumer Overall Like ratings with different superscript letters differ (P<.05).

¹ Other cooking methods included: pan broil, braise, and deep fry. These cooking methods were used infrequently by the consumers in this study.



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Cooking method by USDA quality grade effect

- For outdoor grilling, broiling, and pan frying, no significant USDA quality grade effects were found.
- Top Choice Top Sirloin Steaks cooked by indoor grilling received the highest ratings while Low Select steaks cooked by stir frying were among the lowest rated.

Top Sirloin Steak				
Least-Squares Means for cooking method by USDA quality grade effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)				
Cooking method	USDA quality grade			
	Low Select	High Select	Low Choice	Top Choice
Outdoor grill	18.0 ^{bcdef}	17.8 ^{bcdef}	17.9 ^{bcdef}	18.2 ^{bcde}
Broil	17.7 ^{cdef}	17.3 ^{fg}	17.7 ^{defg}	17.5 ^{efg}
Indoor grill	18.6 ^{abc}	18.4 ^{bcd}	18.6 ^{ab}	19.4 ^a
Pan fry	18.1 ^{bcde}	18.1 ^{bcde}	18.4 ^{bcd}	17.6 ^{defg}
Stir fry	16.6 ^g	17.4 ^{efg}	18.1 ^{bcdef}	17.4 ^{efg}
Simmer and stew	17.5 ^{efg}	17.8 ^{bcdefg}	18.2 ^{bcde}	17.5 ^{defg}
Other ¹	18.4 ^{bcd}	18.6 ^{ab}	18.3 ^{bcd}	18.1 ^{bcde}

^{a through g} Consumer Overall Like ratings with different superscript letters differ (P<.05).
¹ Other cooking methods included: pan broil, braise, and deep fry. These cooking methods were used infrequently by the consumers in this study.



Beef Customer SATISFACTION

TOP ROUND

Beef Top Round Steak



Overall Liking
of Top Round
Relative to Grade
and Cooking Method/
Preparation

City effect

- There were clear and distinct Overall Like ratings differences for Top Round Steaks among the four cities with the highest ratings given by consumers in Houston and the lowest ratings given by consumers in Philadelphia.
- This city effect has two possible explanations: (1) historical use and acceptance of Top Round Steaks by consumers, and (2) method of cookery used to prepare these cuts. Philadelphia consumers had the highest usage of outdoor grilling and broiling for this cut, which were both inappropriate cooking methods for the Top Round Steak as cut and prepared in this study.

Top Round Steak
Least-Squares Means for city effect on
Consumer Overall Like ratings
(23 = like extremely; 1 = dislike extremely)

City			
Chicago	Houston	Philadelphia	San Francisco
17.1 ^b	17.9 ^a	16.2 ^d	16.5 ^c

^a through ^d Consumer Overall Like ratings with different superscript letters differ (P<.05).

Cooking method effect

- Cooking method had a pronounced effect on Overall Like ratings for the Top Round Steak, with simmering and stewing among the highest rated. Outdoor grilling and broiling were the lowest rated.
- Consumers in Philadelphia, who had a high usage of outdoor grilling and broiling for the Top Round Steak, rated this steak the lowest among the four cities.

Top Round Steak Least-Squares Means for cooking method effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)							
Cooking Method							
Outdoor grill	Pan fry	Stir fry	Pan broil	Broil	Braise	Simmer and stew	Other ¹
16.2 ^d	16.9 ^c	17.2 ^{bc}	17.0 ^{bc}	16.4 ^d	16.9 ^{bc}	17.5 ^a	17.3 ^{ab}

^{a through d} Consumer Overall Like ratings with different superscript letters differ (P<.05).
¹ Other cooking methods included indoor grill and deep fry. These cooking methods were used infrequently by the consumers in this study.

Degree of doneness by USDA quality grade effect

- Higher ratings generally were given to those steaks that were cooked to lower degrees of doneness (Medium Rare or less) and to those steaks from the Top Choice category, regardless of degree of doneness.

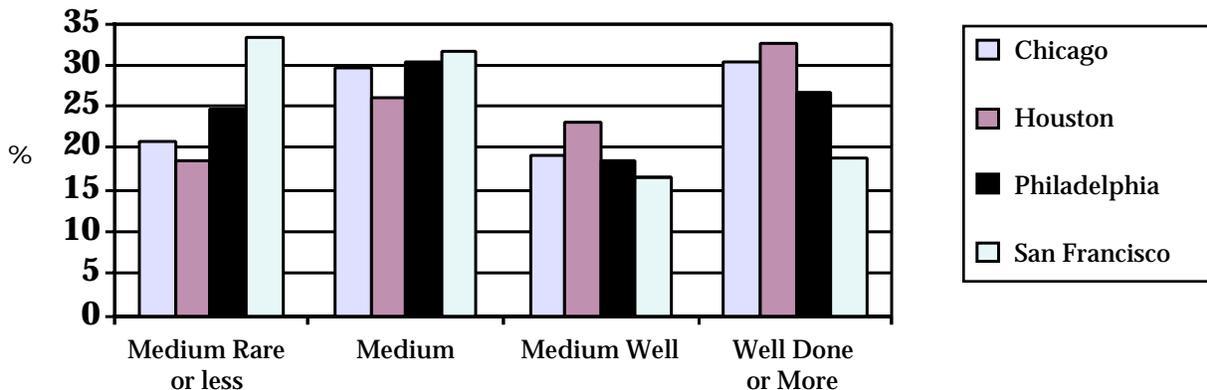
Top Round Steak Least-Squares Means for degree of doneness by USDA quality grade effect on Consumer Overall Like ratings (23 = like extremely; 1 = dislike extremely)				
Degree of doneness	USDA quality grade			
	Low Select	High Select	Low Choice	Top Choice
Medium Rare or less	17.3 ^{abc}	17.2 ^{abcd}	17.2 ^{abcd}	17.3 ^{abc}
Medium	16.6 ^{de}	16.8 ^{cd}	17.0 ^{abcd}	17.4 ^{ab}
Medium Well	16.7 ^{cde}	16.9 ^{bcd}	16.7 ^{cde}	16.6 ^{de}
Well Done	16.7 ^{de}	16.3 ^e	16.8 ^{cd}	17.4 ^a
Very Well Done	16.8 ^{cd}	17.1 ^{abcd}	17.2 ^{abcd}	16.8 ^{cde}

^{a through e} Consumer Overall Like ratings with different superscript letters differ (P<.05).

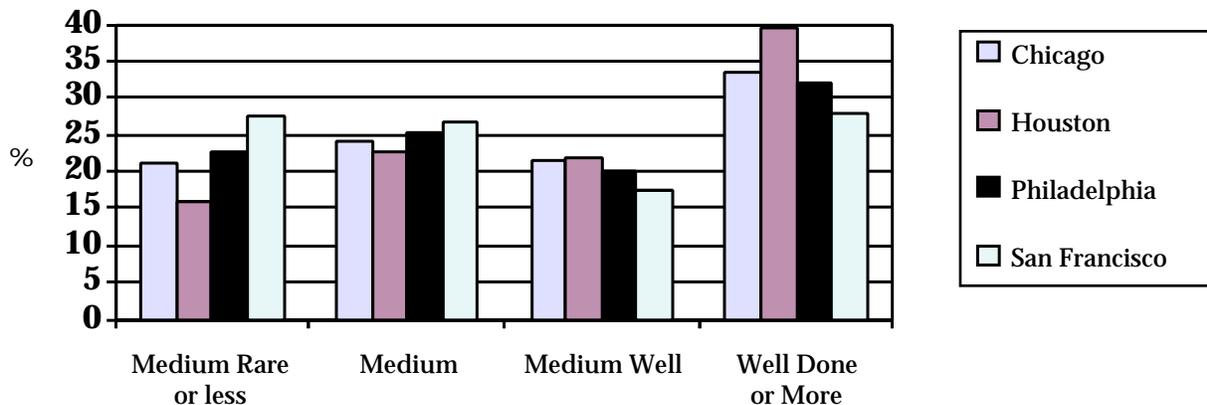


Degree of Doneness Frequency by City

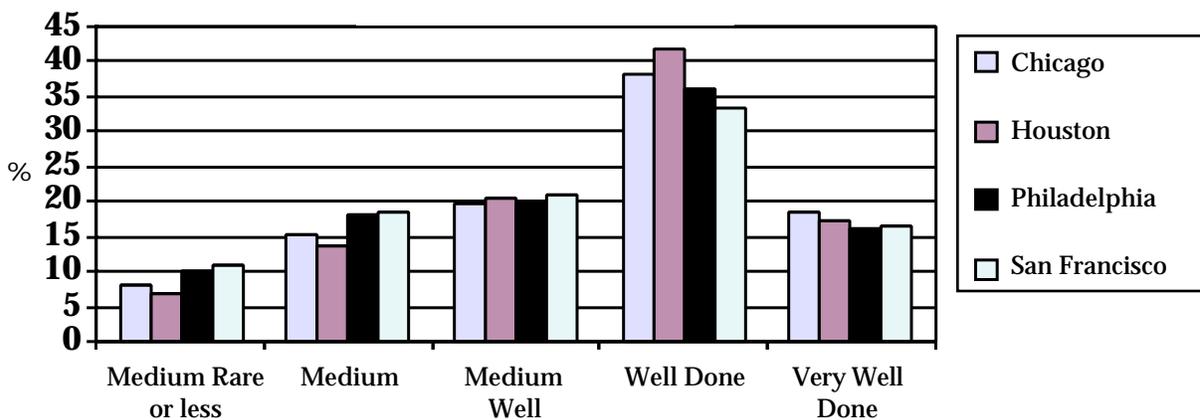
Top Loin Steaks



Top Sirloin Steaks

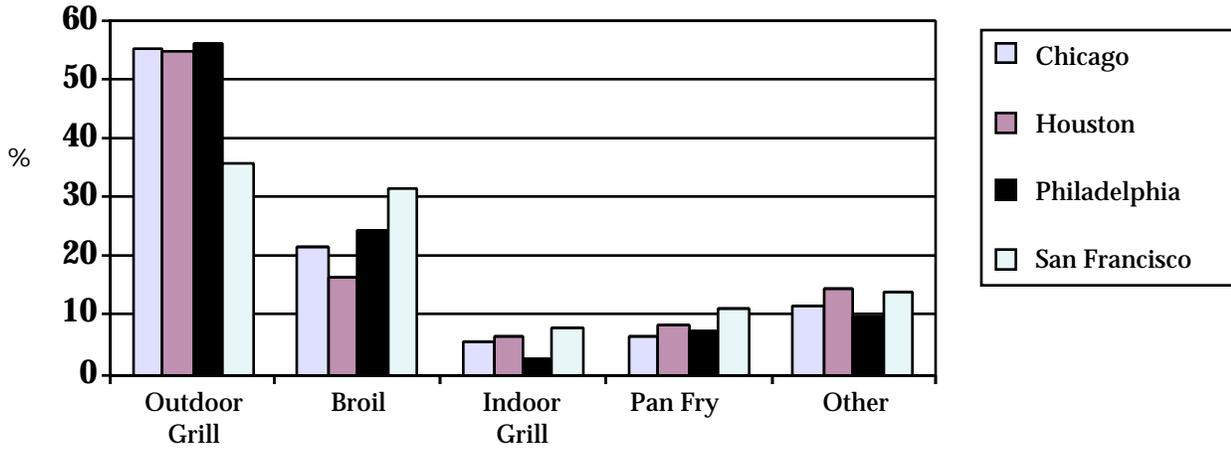


Top Round Steaks

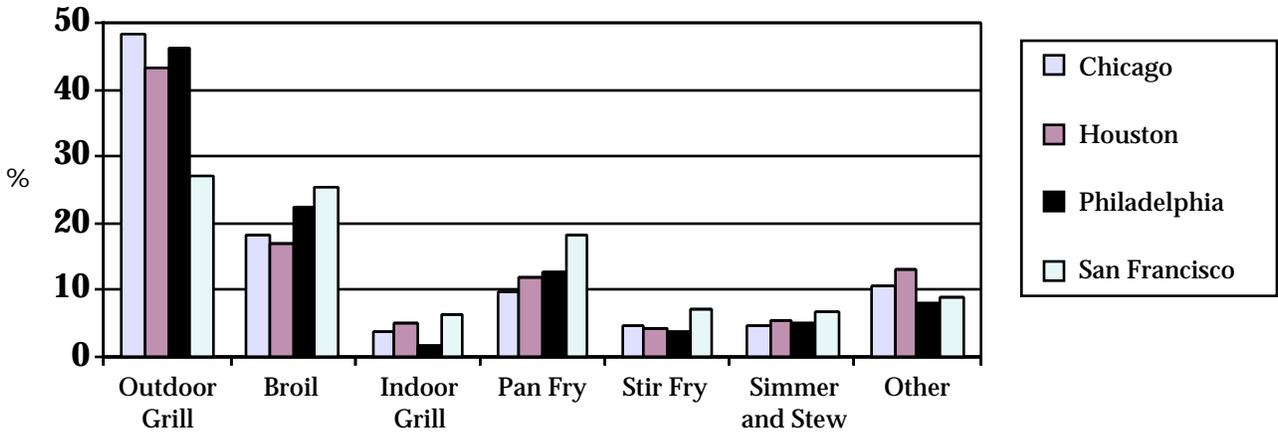


Cookery Method Frequency by City

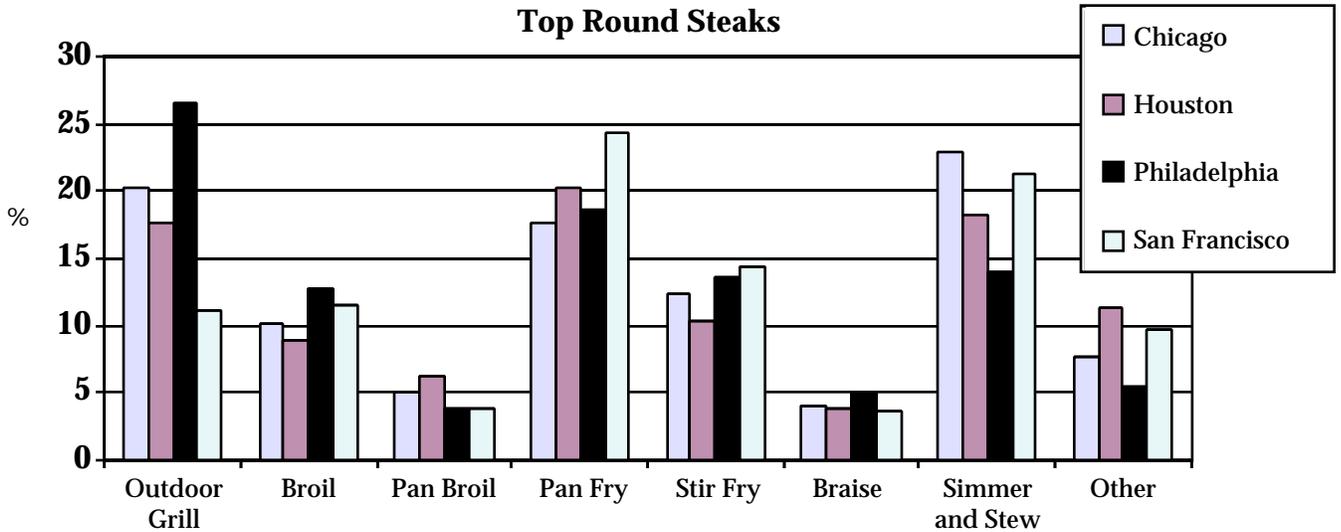
Top Loin Steaks



Top Sirloin Steaks



Top Round Steaks



Chapter 2: Summary of Results and Implications

Cuts

- In all instances, the Top Loin Steak was rated higher than the Top Sirloin Steak and the Top Sirloin Steak was rated higher than the Top Round Steak. This should not be a surprise to anyone. However, it reflects that although many factors may influence customer satisfaction, the most important factor is to select a cut that has an inherently high potential for delivering maximum flavor, juiciness and tenderness to the consumer.

USDA quality grades

- The impact of USDA quality grade was cut-specific. The cut that was most affected by grade was the Top Loin Steak. Top Choice was rated higher than the other grades evaluated. The remaining three grades overlapped somewhat. No differences existed between Low Select and High Select or between High Select and Low Choice, but Low Select was different from Low Choice.
- USDA quality grade did not influence consumers' ratings of the Top Sirloin Steak. Based on other findings in this study, other factors, such as cooking method and degree of doneness, play much greater roles in determining how consumers will like or dislike this cut.
- The only real grade-related factor for the Top Round Steak was that Top Choice differed in Overall Like ratings from the other three grades. Additional research should be conducted to see whether there are more appropriate cooking method/degree of doneness combinations that may optimize ratings from Low Choice, High Select or Low Select cuts, or if there are ways to take advantage of initially higher ratings for Top Choice with different preparation techniques.

Cities

- Consumers in the four cities prepared steaks with a variety of cooking methods, to different degrees of doneness, and with different levels of satisfaction. Consumers in Houston generally gave the highest ratings for all cuts regardless of USDA quality grade and regardless of how the steaks were prepared. Ratings given by Chicago's respondents generally were slightly behind Houston's. Philadelphia and San Francisco consumers generally gave the lowest ratings of the cities studied. One of the possible reasons for these lower ratings seemed to be that certain cooking methods, degree of doneness endpoints and cut combinations fared poorly in these cities.
- Determining why a particular city responds the way it did in this study is quite perplexing. Geographical differences in preparation and eating habits do exist. However, it was difficult to understand why there were such large differences among cities in how consumers rated similar cuts from the same subprimals. The question warrants further investigation.

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Degree of doneness

- Because the Top Sirloin is so sensitive to endpoint temperature, cooking recommendations should reflect this. This is particularly important because USDA quality grade did not affect consumer ratings, and because selecting an appropriate degree of doneness may be the best method to ensure that optimal eating satisfaction is achieved.
- Overall Like ratings were not always directly related to degree of doneness. For example, Top Loin Steaks cooked to Well Done or more had similar ratings as those cooked to Medium. There may be a segment of consumers who prefer steaks cooked so done as to eliminate any red or pink color and to enhance the cooked meat flavor component. These consumers may be more tolerant of slightly tougher steaks so that appropriate cooked color can be achieved and that cooked beef flavor can be maximized.
- Higher marbling levels help reduce the negative effects of cooking to higher degrees of doneness. In this study, and based on findings of other in-home consumer studies, most consumers cook beef to higher degrees of doneness than levels delivering the maximized tenderness score.

Cooking method

- Method of cookery seems to play an important role in consumers' evaluation of beef. Which cooking method is "best" appears to be greatly influenced by the particular city being evaluated. Grilling, whether outdoor or indoor, seemed to produce the highest ratings for the Top Loin Steak most of the time, while broiling seemed to result in lower ratings. For the Top Sirloin Steak, indoor grilling again seemed to produce high ratings while cutting this steak into pieces for stir frying resulted in lower ratings. Top Round Steaks were prepared by the greatest number of methods and had a variety of frying or pan broiling methods that consumers found to be quite acceptable for this cut. Grilling Top Round Steaks, as would be expected, usually failed to produce ratings that were as high as those of other methods of cookery. (Most preparation techniques did not include a marination step.)
- Steering consumers to cooking methods most appropriate for particular cuts may prove to be a difficult task. Consumer decisions to select certain cooking methods are based on history and experience, ownership of particular appliances, availability of areas for – or restrictions to – outdoor grilling, and general preference. Encouraging some consumers to adopt different cooking methods with the previously mentioned constraints would be a great challenge that would need to be carefully studied.



CHAPTER 3: PRODUCTION / MANAGEMENT EFFECTS

No study of this size and scope has addressed the effects of production and management practices on beef customer satisfaction. By creating a means for identifying lots of cattle from which specific cuts came, this study provided a unique opportunity to determine the importance of cattle type and management on consumers' ratings of various cuts and grades of beef prepared and consumed at home.

This study was not designed specifically to determine the effects of cattle production and management practices on beef customer satisfaction. But general trends concerning the relationships of breed-type/gender class, implant protocol, age of cattle when placed in the feedlot and time-on-feed to consumer ratings could be tested. During the carcass selection process background information was obtained to document types and previous management of cattle included in the study. This information was used to help identify cattle management strategies for improvement of product quality and consistency.

Methodology

- Carcasses were selected from 44 different lots of slaughter cattle, and management information was available for 39 lots.
- Production and background information was provided by the feedlots in which the cattle were finished.
- Production information only could be obtained for each entire lot, not for individual cattle.
- Information obtained for each lot included:

Gender	Age Class
Breed-Type	Origin
Weight Into Feedlot	Finished Live Weight
Days on Feed	Average Daily Gain
Implants Used	Dressed Yield
Hot Carcass Weight	% Cattle Grading Choice

- Cattle that provided product for the study were slaughtered at three locations (Plainview, Tex.; Greeley, Colo.; Lexington, Neb.); however, the cattle originated from 16 different states, as well as from Canada and Mexico. A map showing the geographic origin of each lot of cattle selected from each plant is shown below.

Overall Origin of Cattle From Three Plants



Descriptive data showing the average, minimum, and maximum values for various production traits are provided in the following table.

Average, minimum and maximum values for various production traits			
Trait	Avg	Min	Max
Weight Into Feedlot (lb)	664	277	858
Days on Feed	170	88	335
Average Daily Gain (lb/d)	2.57	1.94	3.62
Finished Live Weight (lb)	1105	989	1290
Hot Carcass Weight (lb)	698	623	795
Dressed Yield (%)	63.2	60.2	66.0
Percentage Choice (in lot)	49.8	12.1	87.5

The distribution of cattle with respect to gender, age-class, breed-type, number of implants, and type of implant follows.

Distribution of Cattle		
Category		Percent
Gender:	Steers	72.8
	Heifers	27.2
Age Class:	Calf-feds	43.7
	Yearlings	56.3
Breed-Type:	Continental	40.0
	British	36.3
	Brahman-crossbred	15.7
	Holstein	8.0
Number of Implants:	1X	25.2
	2X	72.1
	3X	2.7
Terminal Implant Type:	Estrogenic	30.5
	Androgenic	27.2
	Combination	42.3



Findings

Breed-type/gender effects

- Beef produced by British heifers was rated highest by consumers, and received higher consumer ratings for Overall Like than did beef from British steers, Continental steers, Continental heifers, and Brahman crossbred steers.
- Holstein steers produced beef that was comparable to products from beef-type steers and heifers. Beef from Holstein steers was rated second highest by consumers.
- Consumers rated beef produced by Brahman crossbred steers as similar to beef produced by British steers, Holstein steers, and Continental steers and heifers.

Effects of breed-type/gender class on Overall Like ratings

Breed-type/gender class	Overall Like ratings
British steers	17.8 ^b
British heifers	18.3 ^a
Continental steers	17.7 ^b
Continental heifers	17.8 ^b
Brahman crossbred steers	17.7 ^b
Holstein steers	17.9 ^{ab}

^a through ^b Consumer Overall Like ratings with different superscript letters differ ($P < .05$).

Implant effects

- Implanting with a single (1X) estrogenic, androgenic, or combination (estrogenic plus androgenic) implant, or with successive (2X) estrogen/estrogen or estrogen/combination implants did not seem to have a detrimental effect on consumer ratings for Overall Like.
- However, there was a tendency for beef from cattle implanted with successive (2X) androgen/androgen or combination/combination implants to receive lower ratings for Overall Like.



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Effects of Implant on Overall Like ratings	
Implant Protocol	Overall Like Ratings
Estrogen (1X)	18.1 ^a
Androgen (1X)	18.0 ^{ab}
Combination (1X)	17.8 ^{ab}
Estrogen/Estrogen (2X)	18.0 ^{ab}
Estrogen/Combination (2X)	18.1 ^a
Androgen/Androgen (2X)	17.7 ^b
Combination/Combination (2X)	17.5 ^b

^a through ^b Consumer Overall Like ratings with different superscript letters differ (P<.05).

Age-class effects

- The age at which cattle were placed in the feedlot did not affect consumer ratings. Beef produced by calf-feds and yearlings received similar ratings for overall like.

Effects of age-class on Overall Like ratings	
Age-Class	Overall Like ratings
Calf-feds	17.8 ^a
Yearlings	17.9 ^a

^a Consumer Overall Like ratings with different superscript letters differ (P<.05).

Time-on-feed effects

- Days on feed within age-class had no effect on Overall Like ratings.



The “Best” and “Worst” Cattle

- The “best” 100 cattle (those with the lowest frequency of “unacceptable” consumer ratings for overall like) and the “worst” 100 cattle (those with the highest frequency of “unacceptable” consumer ratings for overall like) had almost identical production/management traits (see table below).
- However, the “best” 100 cattle included more cattle with quality grades of Top Choice and fewer cattle with quality grades of High Select compared with the “worst” 100 cattle.

Profile of the “Best” 100 cattle and “Worst” 100 cattle		
Trait	“Best” 100 cattle	“Worst” 100 cattle
Frequency of “Unacceptable” ratings (%)	2.2	23.7
Weight into feedlot (lb)	667	658
Days on feed (d)	167	172
Average daily gain (lb/d)	2.59	2.54
Finished live weight (lb)	1105	1100
Hot carcass weight (lb)	697	695
Dressed yield (%)	63.1	63.3
Choice in lot (%)	52.6	45.2
Terminal implant:		
Estrogenic (%)	34	24
Androgenic (%)	27	25
Combination (%)	39	51
Breed distribution:		
British (%)	39	33
Continental (%)	40	46
Brahman crossbred (%)	14	15
Holstein (%)	7	6
Age-class distribution:		
Calf-feds (%)	40	49
Yearlings (%)	60	51
Grade distribution:		
Low Select (%)	27	38
High Select (%)	13 ^b	30 ^a
Low Choice (%)	26	21
Top Choice (%)	34 ^a	11 ^b

^a through ^b Percentages with different superscript letters differ (P<.05).



Chapter 3: Overall Results and Implications

- Including production/management factors in the statistical model used to analyze Overall Like ratings only accounted for a small amount (1.5%) of additional variation in Overall Like ratings. Other factors accounted for a much greater proportion of the explained variance. For example, type of cut accounted for 66.8% of the explained variation in Overall Like ratings. This suggests that effects of management practices, while statistically significant, had only a minor effect on customer satisfaction.
- Efforts to improve beef customer satisfaction via modification of management practices represented in this study would not be expected to result in significant progress. However, results of this study indicate that use of anabolic implants containing androgens or a combination of androgens and estrogens slightly decreased beef customer satisfaction.
- Cattle selected for use in this study represented typical management practices. In other words, cattle that had not been fed in the feedlot, bulls, older cattle or cattle subjected to other than normal management practices were not included in the study.



Detailed Methodology

Live animal information

Background information was traced by lots of cattle back to feedlots and suppliers. Breed type, age class, time on feed, implant scheme, and other production and management related information was gathered.

Product selection

Product was selected in three regions of the country from different processing facilities:

Monfort, Inc. plant in Greeley, Colorado

IBP, Inc. plant in Lexington, Nebraska

Excel Corp. plant in Plainview, Texas

Cattle selected from these facilities represented 16 states and included Canada and Mexico.

Carcasses selected

Limited to A maturity, Yield Grade 2 or 3, weighing between 550 and 800 pounds. Dark cutters, bullocks, and blood splashed lean were omitted.

Number of carcasses selected

600

Carcass data

Data collected 24 hours postmortem included: Lot number, hot carcass weight, right and left marbling scores (both marbling scores had to be within the same quality grade), skeletal and lean maturity, preliminary yield grades, rib eye area, KPH fat, and gender.

Marbling scores and grades selected

Modest (2/3) and Moderate (1/3) or **Top Choice** — 150 carcasses

Small or **Low Choice** — 150 carcasses

Upper half of Slight or **High Select** — 150 carcasses

Lower half of Slight or **Low Select** — 150 carcasses

Subprimals selected

Strip loin, boneless (IMPS#180) from both carcass sides.

Top sirloin butt (IMPS#184) from both carcass sides.

Inside round (IMPS#168) from both carcass sides.

All subprimals were vacuum packaged, boxed and shipped by refrigerated truck to the Rosenthal Meat Science and Technology Center at Texas A&M University and were stored at refrigeration temperatures (32 to 34°F) until cut.



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Aging time

Subprimals were cut into steaks between 14 and 21 days postslaughter.

Steaks cut with specifications

Top loin (strip) steak, (IMPS#1180B), *Longissimus dorsi* muscle, one-inch thick, fat trim of one-eighth inch, and one-half inch tail. Heavy connective tissue over top edge of steak and connective tissue and associated fat near where finger bones were attached were trimmed.

Top sirloin steak, (IMPS#1184B), one-inch thick, *Gluteus medius* muscle only, no external fat remained. Steaks were cut into left and right halves.

Top round steak, (IMPS#1168), five-eighths-inch thick, *Semimembranosus* muscle only, no external fat remained. Steaks were cut into left and right halves.

Mirror-image **Top Loin (Strip) Steaks** were packaged together (two to the package), as were mirror-image **Top Sirloin Steaks**, for delivery into each household. **Top Round Steak** were packaged individually with only one steak destined for a household.

Steak packaging and freezing

Steaks were vacuum packaged on an American National Can Bivac[®] machine with roll stock film and were blast-frozen at -40°F immediately.

What each household received

Each household received two steak meals per week for six weeks (12 meals total): either **Top Loin (Strip) Steaks** and **Top Sirloin Steaks**, **Top Sirloin Steaks** and a **Top Round Steak**, or **Top Loin (Strip) Steaks** and a **Top Round Steak**. Meal order and grades were randomized into the households.

Steaks were labeled for name of cut only. Consumers were not informed of grade-related factors. Each steak meal along with a questionnaire for the consumer to fill out was identified by a corresponding number to facilitate data retrieval.

Before the beginning of the study, consumers in each household signed a Consent Form from Texas A&M University detailing general and accepted risks associated with participation. This is standard protocol for studies involving human subjects.



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Markets targeted

Two “USDA Select” and two “USDA Choice” markets were targeted:

Houston, Texas (Select)

Chicago, Illinois (Choice)

Philadelphia, Pennsylvania (Choice)

San Francisco, California (Select)

Consumer recruitment

300 households were selected in each city and met the following requirements:

Two participants per household

Moderate-to-heavy beef users

Ages 21 to 64

Minimum income = \$20,000

Demographics

Consumer recruitment was designed to match the demographics of each region.

The consumer’s response

Consumers recorded their preferences on a questionnaire which accompanied each steak. They recorded their overall liking of the product along with tenderness, juiciness, and flavor components. In addition, participants reported preparation and cooking methods used and to what degree of doneness that each steak was prepared.

Warner-Bratzler Shear

A device that measures the force it requires to cut a core of cooked meat in half. The higher the number the greater likelihood that it will be tougher to chew through.

Warner-Bratzler Shear Force measurements were taken on one-half inch in diameter cores that were removed parallel to the muscle fiber from cooked steaks that had been cooled to room temperature (72°F).

Shear steaks were cooked to four degrees of doneness to depict the wide range desired by consumers and to test the effects of final internal temperature on the tenderness of the steaks. The degrees of doneness tested were 140°F, 150°F, 160°F, and 170°F better known as rare, medium-rare, medium, and well-done, respectively.



Sensory evaluation

Unlike consumer testing, individuals are trained to put their own preferences aside and become instruments providing objective measurements for juiciness, tenderness, and flavor attributes.

Steaks used in sensory testing were cooked to a medium degree of doneness only. Due to the volume of steaks to be evaluated, additional degrees of doneness were not possible.

Panelists evaluated each steak for juiciness, muscle fiber and overall tenderness, connective tissue amount, overall flavor intensity, cooked beefy/brothy flavor and cooked beef fat flavor on an eight-point scale. Presented below are the scale used for muscle fiber and overall tenderness and a description of the basis for panelist ratings.

Muscle Fiber and Overall Tenderness Ratings

8 = Extremely Tender

7 = Very Tender

6 = Moderately Tender

5 = Slightly Tender

4 = Slightly Tough

3 = Moderately Tough

2 = Very Tough

1 = Extremely Tough

Muscle Fiber Tenderness ratings are an evaluation of how easily the meat sample breaks during chewing. For example, a steak with a rating of 8 on the scale would be a very tender tenderloin steak that required almost no force to chew, whereas an 1 on the scale would be similar to an extremely overcooked brisket steak from an old beef animal. Top Loin Steaks are usually rated at a 4, 5, or 6 on this scale.

Overall Tenderness rating is the average of Muscle Fiber Tenderness and Connective Tissue Amount ratings when the Connective Tissue Amount is a 6 or less. When Connective Tissue Amount is rated a 7 or 8, Overall Tenderness rating is the same as Muscle Fiber Tenderness.



APPENDIX

Consumer Questionnaire Components

All Participants

Please **X** the appropriate box below. If you participated in the telephone interview you are the "main preparer/shopper." If you did not, you are the "other participant."

MAIN PREPARER/SHOPPER

OTHER PARTICIPANT

PLEASE MAKE AN "X" INSIDE THE APPROPRIATE ANSWER BOX. PLEASE CONSIDER THE ENTIRE SCALE WHEN MAKING YOUR EVALUATIONS.

1. How much did you like or dislike this beef overall? (Please **X** just one.)

Dislike Extremely

Like Extremely

ACTUAL:

2. How TENDER was THIS BEEF when you ate it? (Please **X** just one.)

Not at all Tender

Extremely Tender

DESIRED:

3. How TENDER did you WANT THIS BEEF TO BE? (Please **X** just one.)

Not at all Tender

Extremely Tender

ACTUAL:

4. How JUICY was THIS BEEF when you ate it? (Please **X** just one.)

Not at all Juicy

Extremely Juicy

DESIRED:

5. How JUICY did you WANT THIS BEEF TO BE? (Please **X** just one.)

Not at all Juicy

Extremely Juicy



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Beef Preparers Only

1. How did you thaw the beef? (Please X as many as apply).

- Placed in refrigerator day before.....
- Placed in refrigerator same day.....
- In microwave.....
- At room temperature
- Under cold water.....
- Under hot water.....
- Cooked frozen.....

2. How appealing was the appearance of this meat compared with what you would have expected this cut to look like? Was this beef: (Please X just one).

- Much more appealing than you expected
- Somewhat more appealing than you expected
- About as you expected.....
- Somewhat less appealing than you expected.....
- Much less appealing than you expected

3. Which of these, if any, did you do to the meat before cooking? (Please X as many as apply).

- Cut it into small pieces.....
- Cut it into large chunks
- Cut it into slices/strips
- Pound it to flatten it
- Use a fork or other utensil to pierce the surface.....
- Grind it.....
- None of these.....

4. What was added to the beef, if anything, as it was prepared or cooked? (Please X as many as possible).

- Salt
- Pepper
- Spices/herbs, such as garlic, oregano.....
- Tenderizer such as Adolph's.....
- Marinade.....
- Flour, crumbs or other coating to top and/or bottom.....
- Sauces, such as soy, BBQ, etc.....
- Other (EXPLAIN) _____
- _____
- Nothing



.....

5. How did you cook the beef? Refer to the Preparation Definitions page for guidance to answer this question. (Please X just one).

- Outdoor grill.....
- Broil.....
- Indoor grill.....
- Oven roast uncovered.....
- Pan broil.....
- Pan fry/sauté.....
- Stir fry.....
- Braise.....
- Simmer and stew.....
- Deep fry.....
- Other (EXPLAIN) _____
- _____

6. Was this meat the main course on the plate, or was it combined with other ingredients as the main course, such as stew, soup or casserole? (Please X just one).

- Main course on plate.....
- Combined with other ingredients.....



Preparation Definitions

Dry Heat Methods

Outdoor Grill: Meat grilled outdoors on a grid or rack over coals, heated ceramic briquets or an open fire, using direct or indirect heating.

Indoor Grill: Also can be used with direct or indirect heating. Meat grilled indoors using special types of range tops or newer appliances.

Broil: Meat cooked using the oven broiler.

Oven Roast (uncovered): Meat is cooked uncovered, without the addition of water or oils.

Pan Broil: Meat is placed in an uncovered preheated skillet and heated without additional water or oil.

Pan Fry/Sauté: A small amount of oil is added to the pan first and/or allowed to accumulate during cooking.

Stir Fry: Similar to panfrying, except that the meat is stirred almost continuously. Cooking is done with high heat, using small or thin pieces of meat.

Moist Heat Methods

Braise: The meat is browned initially, then a small amount of moisture is added, with the dish then covered with a tight-fitting lid.

Poach: The meat is browned initially in a small amount of oil. The excess drippings are discarded and the meat is covered with liquid, then brought to a boil. Heat is then reduced, the container is covered with a tight fitting lid and the meat is simmered.

Simmer & Stew: Meat is cut into smaller pieces, initially browned, then additional liquids are added and the cooking container is covered. The meat is then simmered on low heat.

Other Methods

Deep Fry: Usually the meat is coated with egg and crumbs or a batter, or it is dredged in flour or corn meal and immersed in hot oil.



WHAT'S AHEAD FOR CUSTOMER SATISFACTION?

Customer Satisfaction has provided the industry with a tremendous insight into the relationship of beef quality to customer satisfaction. At the same time it has identified new issues which need to be addressed in additional customer satisfaction studies. Important issues which merit further research include:

- The relationship of price to consumers' intent to purchase beef continues to be a perplexing question. If price is to be used to enhance beef's marketability in the marketplace, the consumers perceived value of tenderness and flavor must be established.
- Beef quality was found to be closely related to customer satisfaction in the higher valued top loin strip steaks and in the lower valued top round steaks. Does the relationship of quality to customer satisfaction exist for other lower valued cuts?
- The Top Sirloin Steak remains a troublesome cut for the beef industry due to its sensitivity to degree of doneness. When cooked to a medium rare degree of doneness it performs similar to the Top Loin (Strip) Steak, however, if cooked the medium well, it is more similar to the Top Round. The possibility of using new technologies such as calcium chloride injection to reduce the sensitivity of the Top Sirloin to degree of doneness and ultimately enhance customer satisfaction ratings should be investigated.



About the Beef Industry Council

The Beef Industry Council is an operating division of the National Live Stock and Meat Board, established in 1922 to enhance profit opportunities for the livestock and meat industry through research, education information and promotion. The first checkoff for market development programs in American agriculture was initiated with the creation of the Meat Board, which continues to be funded through livestock and meat industry checkoffs.

