

Beef Customer Satisfaction: Cooking Method and Degree of Doneness Effects on the Top Loin Steak¹

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ABSTRACT: The objective of this research was to evaluate the consumer-controlled factors of cooking method and degree of doneness on Top Choice, Low Choice, High Select, and Low Select top loin steaks. The in-home product test was conducted in Chicago, Houston, Philadelphia, and San Francisco. Consumers (n = 2,212) evaluated each top loin steak for overall like (OLIKE), tenderness (TEND), juiciness (JUIC), flavor desirability (DFLAV), and flavor intensity (IFLAV) using 23-point hedonic scales. Respondents in San Francisco and Philadelphia cooked their top loin steaks to lower degrees of doneness than those in Chicago and Houston. Outdoor grilling was the most

common method of cookery for top loin steaks in all cities. Consumers had the highest preference for Top Choice steaks ($P < .05$) and the lowest preference for Low Select steaks ($P < .05$). Consumer OLIKE scores were the highest ($P < .05$) for steaks cooked to a medium rare or lesser degree of doneness. Consumers preferred ($P < .05$) medium and well done or more degrees of doneness over medium well. The interaction of city \times cooking method was significant for all steak palatability attributes. The differences in consumer preparation techniques among cities present challenges for the beef industry to develop market-specific promotional campaigns.

Key Words: Beef, Market Research, Meat Grades, Consumer Preferences

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Introduction

In the Beef Customer Satisfaction Study (Neely et al., 1998), consumers in Chicago, Philadelphia, Houston, and San Francisco evaluated top loin, top round, and top sirloin steaks representing the Top

Choice, Low Choice, High Select, and Low Select grades. For all analyses reported by Neely et al. (1998), the three main effects controlled in the study (city, grade, cut, and their interactions) were examined to determine their impact on beef palatability.

Even though Neely et al. (1998) reported the effects of cities, cuts, and grades on consumer responses, the impact of how products were prepared in the home was not addressed. Previous research has shown that preparation techniques, cooking methods, and end point temperature affect beef palatability (Savell et al., 1987, 1989; Berry and Leddy, 1990; Belk et al., 1993; Berry and Bigner, 1995).

The top loin steak may be the most studied cut in meat science. Its place at the retail counter as a premium steak is based on the palatability characteristics of this cut compared with other less tender cuts of beef (Savell and Shackelford, 1992). This article, focusing on top loin steak palatability, is the first of a series dealing with in-home cooking methods and degree of doneness used by beef consumers in four cities. The interactions of these consumer-controlled factors with city and USDA quality grade also were examined.

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Materials and Methods

This study is an extension of the Beef Customer Satisfaction Study; carcass selection, steak processing, and consumer recruitment followed procedures described by Neely et al. (1998). Briefly, Top Choice, Low Choice, High Select, and Low Select carcasses (n = 150 each) were selected from three packing facilities in Colorado, Texas, and Nebraska, and the strip loin, top sirloin, and top (inside) round subprimals from each side were obtained. Steaks from each subprimal were cut, packaged, frozen, and shipped to consumer households (n = 300 in each city) in Houston,

Chicago, Philadelphia, and San Francisco. Each household had two respondents who evaluated steaks for a total of 600 consumers in each city and 2,400 consumers in the study (2,212 consumers completed the study).

In-Home Product Test

Only consumer responses for top loin steaks are discussed. Respondents (two per household) were asked to prepare the steaks as they would when buying the same cut in the supermarket; however, no instructions were given for beef preparation. The

Table 1. Consumer rating means (standard deviations) within USDA quality grade, city, degree of doneness, and cooking method

	Consumer rating ^a				
	OLIKE	TEND	JUIC	DFLAV	IFLAV
USDA quality grade					
Top Choice	18.9 (3.7)	18.8 (3.6)	18.3 (3.9)	18.9 (3.7)	18.7 (3.7)
Low Choice	18.7 (3.7)	18.6 (3.8)	17.9 (4.1)	18.8 (3.8)	18.6 (3.8)
High Select	18.3 (4.2)	18.3 (4.1)	17.8 (4.4)	18.4 (4.3)	18.3 (4.1)
Low Select	18.3 (4.0)	18.2 (4.1)	17.4 (4.6)	18.3 (4.1)	18.1 (4.2)
City					
Chicago	18.5 (4.1)	18.5 (4.1)	18.0 (4.2)	18.6 (4.0)	18.5 (4.0)
Houston	19.2 (3.5)	19.1 (3.6)	18.4 (4.1)	19.3 (3.5)	19.1 (3.6)
Philadelphia	18.6 (3.9)	18.5 (4.0)	17.9 (4.3)	18.5 (4.1)	18.3 (4.1)
San Francisco	18.0 (4.0)	17.9 (4.1)	17.3 (4.3)	18.0 (4.1)	17.9 (4.0)
Degree of doneness					
Medium rare or less	18.8 (3.7)	18.7 (3.8)	18.7 (3.6)	18.7 (3.9)	18.6 (3.9)
Medium	18.4 (4.0)	18.5 (4.0)	18.1 (4.0)	18.5 (4.1)	18.4 (4.0)
Medium well	18.2 (4.0)	18.2 (4.0)	17.5 (4.3)	18.4 (4.1)	18.2 (4.1)
Well done or more	18.6 (3.9)	18.5 (4.0)	17.1 (4.9)	18.7 (3.9)	18.5 (3.9)
Cooking method					
Outdoor grill	18.7 (3.8)	18.5 (3.9)	18.1 (4.0)	18.8 (3.8)	18.6 (3.8)
Broil	18.2 (4.0)	18.1 (4.1)	17.4 (4.4)	18.2 (4.2)	18.0 (4.2)
Indoor grill	18.4 (4.2)	18.5 (4.1)	17.9 (4.4)	18.6 (4.2)	18.5 (4.0)
Pan-fry	18.6 (3.8)	18.7 (3.9)	17.9 (4.4)	18.7 (3.8)	18.6 (3.7)
Other ^b	18.6 (4.0)	18.7 (3.9)	17.6 (4.5)	18.6 (4.1)	18.4 (4.2)

^aOLIKE = overall like, TEND = tenderness, JUIC = juiciness, DFLAV = flavor desirability, and IFLAV = flavor intensity. Consumers used a 23-point hedonic scale: 23 = like extremely, extremely tender, extremely juicy, like extremely, and an extreme amount of flavor; 1 = dislike extremely, not at all tender, not at all juicy, dislike extremely, and no flavor at all.

^bOther 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.

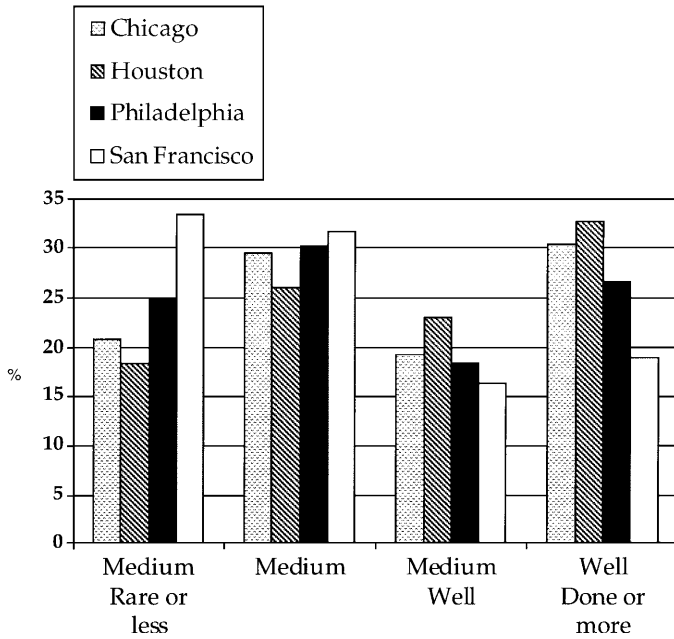


Figure 1. Degree of doneness frequency distributions for beef top loin steaks stratified by city.

preparer was asked how the beef was cooked and was given choices among different dry heat (outdoor grill, indoor grill, broil, oven-roasted uncovered, pan-broil, pan-fry, and stir-fry), moist heat (braise and simmer and stew), and other (deep-fry) methods (National Live Stock and Meat Board, 1992).

Consumers evaluated each top loin steak for overall like (**OLIKE**), tenderness (**TEND**), juiciness (**JUIC**), flavor desirability (**DFLAV**), and flavor intensity (**IFLAV**) using 23-point hedonic scales (23 = like extremely, extremely tender, extremely juicy, like extremely, and an extreme amount of flavor; 1 = dislike extremely, not at all tender, not at all juicy, dislike extremely, and no flavor at all). Sample unadjusted main effect means and standard deviations for OLIKE, TEND, JUIC, DFLAV, and IFLAV by USDA quality grade, city, degree of doneness, and cooking method are presented in Table 1. Each respondent completed separate evaluation forms and was instructed to complete the evaluation form immediately following the meal. Each evaluation form also included a question relative to the degree of doneness of the steaks at the time of consumption. Participants used the National Live Stock and Meat Board beef steak color guide as an aid and responded to this question by making one of the following choices: very rare, rare, medium rare, medium, medium well, well done, or very well done.

Data Analysis

The statistical model for consumer satisfaction ratings included main effects of city, USDA quality grade, degree of doneness, and cooking method and

their two-way interactions. In addition, steak location nested within cut, week nested within city, animal nested within USDA quality grade, and packing facility were included in the model.

Statistical analyses were performed using SAS (1991). For all data, Box-Cox transformations (Neter et al., 1989) were used to produce normally distributed errors. Dependent variables were tested for significance by ANOVA using the GLM procedure of SAS (1991). Only significant terms ($P < .05$) were retained in the model. Least squares means were generated and tested for significance ($P < .05$) using Bonferroni's procedure (Lentner and Bishop, 1993). Frequency distributions were generated for degree of doneness and cookery method within city for top loin steaks.

Results

Frequency distributions for degree of doneness and cookery method by city are presented in Figures 1 and 2. Because all cooking methods and degrees of doneness were not used frequently, some categories were combined. "Other" cookery methods included oven-roasted uncovered, pan-broil, stir-fry, braise, simmer and stew, and deep-fry. Respondents in San Francisco and Philadelphia cooked their top loin steaks to a lower degree of doneness, whereas those in Chicago and Houston more frequently cooked to medium and well done or more degrees of doneness (Figure 1). Outdoor grilling was the most common method of cookery for top loin steaks in all cities (Figure 2).

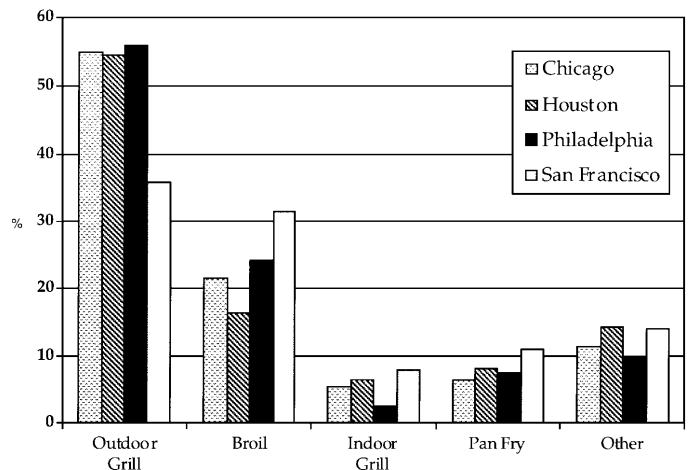


Figure 2. Cooking method frequency distributions for top loin steaks stratified by city. Other cooking methods include oven-roasted uncovered, pan-broil, stir-fry, braise, simmer and stew, and deep-fry. These methods were used infrequently by the consumers in this study.

Table 2. Least squares means for quality grade effect on overall like ratings (23 = like extremely; 1 = dislike extremely)

Top Choice	Low Choice	High Select	Low Select
19.3 ^a	19.0 ^b	18.9 ^{bc}	18.7 ^c

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

Consumer Overall Like Ratings

Consumers had the highest preference for Top Choice ($P < .05$) and the lowest preference for Low Select steaks ($P < .05$, Table 2). Consumer OLIKE scores were the highest ($P < .05$) for steaks cooked to a medium rare or less degree of doneness (Table 3). Consumers preferred ($P < .05$) medium and well done or more cooking end points over medium well (Table 3).

Only one significant interaction (city \times cooking method) existed for OLIKE ($P = .0001$, Table 4). In Chicago, steaks cooked by indoor grilling and "other" cooking methods generally were rated the highest, and broiled steaks were rated lowest. In Houston, steaks that were cooked over an indoor grill were lowest ($P < .05$) for OLIKE. In Philadelphia, steaks that were grilled outdoors were rated the highest ($P < .05$), and all other cooking methods were rated lower. Regardless of cooking method, overall like ratings given by consumers in Chicago and Houston generally were higher than ratings given by consumers in Philadelphia and San Francisco.

Consumer Tenderness Ratings

Three significant interactions were found for TEND: cooking method \times degree of doneness ($P = .03$), city \times cooking method ($P = .0001$), and USDA quality grade \times cooking method ($P = .003$). Consumers detected no TEND differences ($P > .05$) among cooking methods when steaks were cooked to medium rare or less, medium, or medium well degrees of doneness (Table 5). However, steaks that were cooked to a well done or greater degree of doneness by indoor grilling, pan-frying, and "other" cooking methods were more tender ($P < .05$) than steaks cooked to the same degree of doneness by outdoor grilling or broiling. Degree of doneness did not affect

Table 3. Least squares means for degree of doneness effect on overall like ratings (23 = like extremely; 1 = dislike extremely)

Medium rare or less	Medium	Medium well	Well done or more
19.3 ^a	19.0 ^b	18.7 ^c	19.0 ^b

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

Table 4. Least squares means for cooking method \times city effect on overall like ratings (23 = like extremely; 1 = dislike extremely)

Cooking method	City			
	Chicago	Houston	Philadel- phia	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 ^f	19.4 ^{ab}	19.7 ^a	18.6 ^{cde}	18.3 ^e

^{a,b,c,d,e}Means lacking a common superscript letter differ ($P < .05$).

^fOther 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.

TEND ratings ($P > .05$) for broiling, pan-frying, and "other" cooking methods (Table 5).

City \times cooking method effects on TEND ratings are presented in Table 6. Steaks cooked by outdoor grilling were rated the lowest for TEND in San Francisco ($P < .05$). In Houston, pan-frying produced steaks with the highest numerical TEND ratings compared with all other cooking methods. City had no effect ($P > .05$) on TEND ratings when steaks were cooked by indoor grilling.

Although few significant differences were observed, Choice steaks tended to have higher TEND ratings for outdoor grilling, broiling, and indoor grilling than did Select steaks (Table 7). The USDA quality grade did not ($P > .05$) affect TEND for steaks cooked by "other" methods. Among pan-fried steaks, those from High Select carcasses were less tender ($P < .05$) than those from Low Choice carcasses but were similar in tenderness ($P > .05$) to steaks from Low Select and Top Choice carcasses. Low Choice, pan-fried steaks did not differ ($P > .05$) in tenderness from Top Choice and Low Select pan-fried steaks (Table 7).

Table 5. Least squares means for cooking method \times degree of doneness effect on tenderness ratings (23 = extremely tender; 1 = not at all tender)

Cooking method	Degree of doneness			
	Medium rare or less	Medium	Medium well	Well done or more
Outdoor grill	19.3 ^{ab}	19.0 ^{abc}	18.5 ^c	18.6 ^c
Broil	19.0 ^{abc}	18.8 ^{bc}	18.5 ^c	18.4 ^c
Indoor grill	19.3 ^{ab}	18.3 ^c	18.7 ^{bc}	19.1 ^{ab}
Pan-fry	19.2 ^{ab}	19.1 ^{abc}	18.9 ^{abc}	19.4 ^a
Other ^d	18.9 ^{abc}	18.8 ^{bc}	18.8 ^{bc}	19.1 ^{ab}

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

^dOther 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.

Table 6. Least squares means for cooking method × city effect on tenderness ratings (23 = extremely tender; 1 = not at all tender)

Cooking method	City			
	Chicago	Houston	Philadel- phia	San Francisco
Outdoor grill	18.9 ^c	19.4 ^b	19.0 ^{bc}	18.1 ^d
Broil	18.6 ^{bc}	19.4 ^{bc}	18.6 ^{cd}	18.1 ^d
Indoor grill	19.4 ^{bc}	18.6 ^{cd}	18.4 ^{cd}	19.0 ^{bc}
Pan-fry	19.3 ^{bc}	20.0 ^a	18.5 ^{cd}	18.6 ^c
Other ^f	19.2 ^{bc}	19.5 ^{ab}	18.4 ^{cd}	18.5 ^{cd}

^{a,b,c,d}Means lacking a common superscript letter differ ($P < .05$).

^eOther 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.

Consumer Juiciness Ratings

Consumers rated Top Choice steaks highest and Low Select steaks lowest ($P < .05$) for JUIC (Table 8), but did not detect a JUIC difference ($P > .05$) between High Select and Low Choice steaks. High Select and Low Choice steaks were ranked intermediate in JUIC.

Two significant interactions for JUIC ratings were found: cooking method × degree of doneness ($P = .004$) and city × cooking method ($P = .0001$). The interaction for cooking method × degree of doneness appears to be caused by the differential response in JUIC at higher degrees of doneness for steaks cooked by indoor grilling and pan-frying compared with the very clear decline in JUIC with advanced degrees of doneness for steaks grilled outdoors and broiled steaks (Table 9).

Effects of cooking method × city on JUIC ratings are presented in Table 10. Within broiling, consumers in San Francisco gave among the lowest ($P < .05$) JUIC ratings. Within outdoor grilling, consumers in Houston gave among the highest ($P < .05$) JUIC ratings. In Chicago and Houston, pan-frying and “other” cooking methods produced juicier steaks ($P < .05$) than in Philadelphia and San Francisco.

Table 7. Least squares means for cooking method × USDA quality grade effect on tenderness ratings (23 = extremely tender; 1 = not at all tender)

Cooking method	USDA quality grade			
	Top Choice	Low Choice	High Select	Low Select
Outdoor grill	19.2 ^{ab}	18.9 ^b	18.7 ^{bc}	18.6 ^{bc}
Broil	19.2 ^{ab}	18.6 ^{bc}	18.5 ^{bc}	18.4 ^c
Indoor grill	18.8 ^{bc}	19.8 ^a	18.6 ^{bc}	18.2 ^c
Pan-fry	19.1 ^{ab}	19.5 ^a	18.8 ^{bc}	19.2 ^{ab}
Other ^d	18.8 ^{bc}	18.9 ^b	19.2 ^{ab}	18.7 ^{bc}

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

^dOther 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.

Table 8. Least squares means for USDA quality grade effect on juiciness ratings (23 = extremely juicy; 1 = not at all juicy)

Top Choice	Low Choice	High Select	Low Select
18.6 ^a	18.3 ^b	18.2 ^b	17.9 ^c

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

Consumer Flavor Desirability Ratings

Consumers rated Top Choice and Low Choice steaks highest ($P < .05$) for DFLAV, followed by High Select, and then Low Select top loin steaks, which were rated the lowest (Table 11). Steaks cooked to a medium rare or lesser degree of doneness had the highest DFLAV ratings and steaks cooked to medium well had the lowest ratings ($P < .05$, Table 12).

Only one significant interaction was found for DFLAV: city × cooking method ($P = .0001$, Table 13). Consumers in Houston reported higher ($P < .05$) DFLAV ratings for outdoor grilling, pan-frying, and “other” cooking methods; in addition, they found indoor grilling to produce the least desirable beef flavor ($P < .05$). In Philadelphia, there were no differences between all cooking methods for DFLAV ratings.

Consumer Flavor Intensity Ratings

Cooking top loin steaks to a medium rare or lesser degree of doneness produced the most intense beef flavor ($P < .05$, Table 14). Two interactions were detected for IFLAV: USDA quality grade × cooking method ($P = .04$) and city × cooking method ($P = .006$). Houston tended to have the highest IFLAV ratings for each cooking method (Table 15). With the exception of San Francisco, outdoor grilling tended to result in the highest IFLAV ratings for each city (Table 15).

Table 9. Least squares means for cooking method × degree of doneness effect on juiciness ratings (23 = extremely juicy; 1 = not at all juicy)

Cooking method	Degree of doneness			
	Medium rare or less	Medium	Medium well	Well done or more
Outdoor grill	19.2 ^a	18.7 ^{bcde}	18.0 ^{fg}	17.6 ^g
Broil	19.0 ^{ab}	18.4 ^{cde}	17.8 ^g	16.8 ^h
Indoor grill	19.2 ^{ab}	17.9 ^{fg}	18.1 ^{cdefg}	18.0 ^{defg}
Pan-fry	18.9 ^{abc}	18.8 ^{abcd}	18.0 ^{efg}	18.4 ^{cdef}
Other ⁱ	18.7 ^{abcde}	18.6 ^{cdefg}	17.9 ^{fg}	17.7 ^g

^{a,b,c,d,e,f,g,h}Means lacking a common superscript letter differ ($P < .05$).

ⁱOther 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.

Table 10. Least squares means for cooking method \times city effect on juiciness ratings (23 = extremely juicy; 1 = not at all juicy)

Cooking method	City			
	Chicago	Houston	Philadel- phia	San Francisco
Outdoor grill	18.5 ^{bc}	18.9 ^{ab}	18.6 ^{bc}	17.5 ^e
Broil	18.1 ^{cd}	18.8 ^{ab}	17.9 ^{de}	17.2 ^e
Indoor grill	18.7 ^{abc}	17.9 ^{cde}	18.0 ^{cde}	18.6 ^{abc}
Pan-fry	19.0 ^{ab}	19.2 ^a	18.0 ^{cde}	17.8 ^{de}
Other ^f	18.7 ^{abc}	19.0 ^{ab}	17.5 ^e	17.4 ^e

^{a,b,c,d,e}Means lacking a common superscript letter differ ($P < .05$).

^fOther 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.

Effects of USDA quality grade \times cooking method are presented in Table 16. USDA quality grade did not affect ($P > .05$) IFLAV ratings of steaks cooked by outdoor grilling or pan-frying. Top Choice steaks received the highest ($P < .05$) IFLAV ratings when broiled. Low Choice steaks were rated the highest ($P < .05$) and Low Select steaks rated the lowest ($P < .05$) for IFLAV when cooked by indoor grilling.

Discussion

USDA Quality Grade

In general, top loin steaks with higher degrees of marbling received higher consumer ratings than those with lower degrees of marbling. Smith et al. (1984) found similar trends for the top loin steak when evaluating steaks over a wider range of marbling scores. Berry and Leddy (1990) showed that steaks from Moderate and Modest marbling groups received higher sensory ratings than those from the Small and Slight marbling groups.

In the marketplace, Top Choice beef strip loins receive higher prices than Low Choice, and Low Choice beef strip loins receive higher prices than Select. Data from this study support the relationship of marbling/grade to the market value of this subprimal.

Table 11. Least squares means for USDA quality grade effect on flavor desirability ratings (23 = like extremely; 1 = dislike extremely)

Top Choice	Low Choice	High Select	Low Select
19.4 ^a	19.2 ^a	19.1 ^b	18.9 ^c

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

Table 12. Least squares means for degree of doneness effect on flavor desirability ratings (23 = like extremely; 1 = dislike extremely)

Medium rare or less	Medium	Medium well	Well done or more
19.4 ^a	19.1 ^b	18.9 ^c	19.1 ^b

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

City

Consumers in Houston generally rated top loin steaks the highest for all of the evaluated palatability attributes. Consumers in San Francisco and Philadelphia generally rated top loin steaks as similar to each other and slightly lower than did consumers in Houston. Ratings from Chicago consumers tended to be intermediate among those of consumers from the other cities.

Differential responses to the same kinds of beef by consumers in different cities have been shown by Savell et al. (1987, 1989). Product availability, consumer preference, and cultural differences may play a role in how consumers in each city evaluate beef.

Degree of Doneness

In this study, JUIC, IFLAV, and DFLAV ratings were higher at lower degrees of doneness. Luchak et al. (1998) reported decreased trained sensory panel ratings with increased degree of doneness for juiciness, muscle fiber, and overall tenderness. Wulf et al. (1996) found subprimal cut, which included strip loin, to have the greatest impact on juiciness.

One of the interesting findings of this study is that even though consumer ratings, especially OLIVE, tend to be the highest for steaks cooked to lower degrees of doneness, steaks cooked "well done or more" were

Table 13. Least squares means for cooking method \times city effect on flavor desirability ratings (23 = like extremely; 1 = dislike extremely)

Cooking method	City			
	Chicago	Houston	Philadel- phia	San Francisco
Outdoor grill	19.2 ^{bc}	19.9 ^a	19.3 ^{bc}	18.6 ^d
Broil	19.2 ^c	19.3 ^{bc}	18.8 ^{cd}	18.4 ^f
Indoor grill	19.7 ^{ab}	18.5 ^d	18.8 ^{cd}	19.4 ^{bc}
Pan-fry	19.3 ^{bc}	20.0 ^a	18.8 ^{cd}	19.0 ^{bc}
Other ^g	19.5 ^b	19.9 ^a	18.6 ^{cd}	18.5 ^e

^{a,b,c,d,e,f}Means lacking a common superscript letter differ ($P < .05$).

^gOther 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.

Table 14. Least squares means for degree of doneness effect on flavor intensity ratings (23 = extreme amount; 1 = none at all)

Medium rare or less	Medium	Medium well	Well done or more
19.3 ^a	19.0 ^b	18.8 ^c	19.0 ^{bc}

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

more closely related to those cooked “medium” than those cooked “medium well.” In the higher degrees of doneness, flavor may play a stronger role in determining customer satisfaction than does tenderness.

In a study involving consumers in a restaurant setting, Cox et al. (1997) found that, when consumers received beef steaks cooked to their ordered degree of doneness, customer satisfaction was the highest, but when steaks were delivered over- or under-cooked compared with their ordered degree of doneness, customer satisfaction was significantly lower. Degree of doneness has a profound effect on customer satisfaction in the home and in dining away from home. Without question, more work needs to be conducted on why and how degree of doneness results in particular customer satisfaction ratings.

Cooking Method

An important question that must be addressed is why some cooking methods result in higher palatability ratings in one city than in another. Steaks cooked by indoor and outdoor grilling present an interesting challenge for data interpretation. Consumers in Chicago rated steaks cooked by indoor grilling among the highest, but consumers in Houston rated steaks cooked by indoor grilling the lowest within that city. Steaks cooked by outdoor grilling were rated among the highest in Chicago, Houston, and Philadelphia,

Table 15. Least squares means for cooking method × city effect on flavor intensity ratings (23 = extreme amount; 1 = none at all)

Cooking method	City			
	Chicago	Houston	Philadel-phia	San Francisco
Outdoor grill	19.1 ^{cd}	19.7 ^b	19.1 ^{cd}	18.4 ^e
Broil	18.9 ^d	19.3 ^c	18.6 ^{de}	18.2 ^f
Indoor grill	19.4 ^{bc}	18.9 ^{cd}	18.7 ^{de}	19.3 ^{cd}
Pan-fry	19.4 ^{bc}	19.9 ^a	18.7 ^{de}	18.8 ^{de}
Other ^g	19.2 ^{cd}	19.6 ^{bc}	18.7 ^{de}	18.3 ^e

^{a,b,c,d,e,f}Means lacking a common superscript letter differ ($P < .05$).

^gOther 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.

Table 16. Least squares means for cooking method × USDA quality grade effect on flavor intensity ratings (23 = extreme amount; 1 = none at all)

Cooking method	USDA quality grade			
	Top Choice	Low Choice	High Select	Low Select
Outdoor grill	19.3 ^{ab}	19.2 ^b	19.0 ^b	18.8 ^{bc}
Broil	19.1 ^b	18.7 ^c	18.6 ^c	18.6 ^c
Indoor grill	19.0 ^b	19.8 ^a	18.6 ^c	18.8 ^b
Pan-fry	19.3 ^{ab}	19.5 ^{ab}	19.1 ^b	18.9 ^b
Other ^d	18.8 ^b	19.0 ^b	19.3 ^{ab}	18.7 ^c

^{a,b,c}Means lacking a common superscript letter differ ($P < .05$).

^dOther 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.

but consumers in San Francisco rated steaks cooked in this manner among the lowest. Why palatability ratings for top loin steaks cooked by different methods differ among and within cities is an issue that must be addressed by both research and marketing approaches.

Implications

Consumers in different regions of the country did not consistently cook top loin steaks to the same degree of doneness. Even though outdoor grilling was the cooking method most often used, broiling, indoor grilling, and pan-frying were used frequently in all four cities. These differences present challenges for the beef industry to develop market-specific promotional campaigns. Additionally, the variation in degree of doneness reported by consumers should be considered when designing consumer-specific research studies.

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