

Consumer Preference and Willingness-to-Pay for Flavor in Beef Steaks

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Introduction

In recent years, much research and discussion has been focused on the decline in the demand for beef relative to pork and poultry. This decrease in demand has been attributed to several factors, including the relative price of poultry, changing consumer eating trends and overall dissatisfaction with beef as a product. Numerous surveys have revealed that consumers are not only concerned with the fat and cholesterol content of steaks, but they are increasingly concerned with the quality and consistency of beef. Such concerns likely affect the purchasing behavior of consumers when buying beef steaks. Consumers may buy a steak that looks to contain a low amount of fat, is less marbled, because they perceive it to be healthy, but this steak may not produce a favorable eating experience for them.

Currently, the beef industry is trying to regain market share by improving beef's quality and consistency, thus, improving consumers' satisfaction with beef. In order to do this, the beef industry must strive to create a product that meets consumers' expectations for beef palatability. Consumers' preferences for different palatability characteristics must be identified.

Palatability of beef and consumer taste preferences are based on three components: tenderness, flavor, and juiciness. Most of the recent research regarding consumers palatability preferences has focused on consumers' perceptions and willingness-to-pay for tenderness (Savell et al., 1989; Morgan et al., 1992; Boleman, et al., 1997; and Lusk et al., 1999). However, recent studies have shown that beef flavor is of equal or of greater importance to consumers. Neely et al. (1998) reported that both flavor and tenderness were highly correlated with consumer overall like ratings for beef steaks. Morgan et al. (1998) stated that flavor was of greater importance

than tenderness when consumers evaluated top round and top sirloin steaks. These results show that flavor is a key component of consumer satisfaction for fresh beef products.

Several aspects such as marbling level, length and type of aging, and feeding practices contribute to the flavor of beef. Marbling level clearly affects the type of flavor imparted to fresh beef products and is an obvious factor to use in order to begin studying consumer perception of beef flavor. Savell et al. (1989) found that consumers in both San Francisco and Philadelphia liked the flavor of USDA Choice beef over the taste of USDA Select beef; however, the leanness of Select beef appealed to consumers. Obviously, some consumers like the flavor of high marbled steaks, but fat content is still a significant consideration for consumers when purchasing beef. In addition, Neely et al. (1998) found that steaks in the upper two-thirds of the USDA Choice quality grade were rated significantly higher in overall like ratings than steaks of lower USDA quality grades. Consumers in Chicago and Philadelphia rated steaks graded upper two-thirds Choice significantly higher in flavor desirability. Thus, flavor is a key component in consumer satisfaction for fresh beef products.

While the studies discussed above provide information on the role of USDA quality grades in consumer evaluation of flavor, no effort was made to hold tenderness constant between different quality grades. By using steaks with similar tenderness values, one can focus on the importance of flavor alone without confounding the issue with tenderness. Determining consumer perceptions of beef flavor when tenderness is held constant could give the beef industry a better indication of the importance of beef flavor to the consumer. In addition, identification of the price premium that consumers are willing-to-pay to purchase beef having the flavor that they prefer would also be a valuable to the beef industry.

The world is becoming more of a global market place and trade agreements between nations continue to reduce barriers to trade. One of the benefits of trade is that consumers get a greater variety of products to choose from in the market place. Argentina is currently the fourth largest exporter of beef to the U.S. If a free trade agreement is negotiated for all of the Americas, North, Central and South, trade with Argentina will likely increase.

The Argentine beef industry is quite different from the U.S. beef industry. In the U.S. most cattle are placed in a feedlot for 100 to 200 days prior to slaughter and fed a high-energy diet. This feeding program increases the intramuscular fat, or marbling, in the meat and gives U.S. beef a distinct corn-fed flavor. In contrast, most cattle in Argentina are not fed high-energy diets for an extended period. Rather, the cattle are more typically grass-fed. This grass-fed beef also has a distinct flavor. Can consumers determine a difference in grass-fed versus corn-fed beef and are there U.S. consumers who prefer grass-fed beef to corn-fed beef? How much will U.S. consumers pay for their preferred beef flavor?

Objectives

The overall objectives of this research are to identify if consumers can perceive flavor difference in beef steaks and to determine if consumers are willing to pay a premium for their preferred flavor. Consumers will taste paired steak samples where tenderness is held constant but where marbling levels differ or where feeding practices have differed.

The specific objectives of this paper are: 1) to analyze consumer preferences for flavor in beef steaks by comparing: a) highly marbled USDA upper 2/3 Choice versus low marbled USDA Select steaks and b) Argentine grass-fed beef versus U.S. corn-fed beef; and 2) to establish the price premium that consumers are willing-to-pay for their flavor preference. Before

addressing the two main objectives, demographic data and meat purchasing behavior of the sample participants will be quantified.

Methodology

Three basic methods are generally used to elicit consumer's economic value or willingness-to-pay for their preferences: personal interviews, written surveys, and experimental auctions. In this study, an experimental auction market procedure was used to elicit consumer willingness-to-pay for steaks with varying flavor. Experimental auction methods are cited as having the "potential to provide more reliable measures of willingness-to-pay than a hypothetical survey method (Lusk et al., 1999)." Fox et al. (1995) stated four main advantages to using experimental valuation methods where winning participants are required to purchase the product: 1) bidding is designed to reveal true preferences, 2) the use of real money, real food, and repeated participation ensures reliability of the data, 3) use of the requirement-to-eat factor reinforces the non-hypothetical aspect of the research and 4) less bias from non-responses.

A commonly used experimental auction design is the Vickrey sealed-bid, second-price auction where each participant submits a written bid on a particular product (Friedman and Sunder, 1994). The highest bidder is determined to be the "winner" of the auction and must purchase the product at the second highest bid. Second-price auctions have been used to determine the price premium consumers were willing-to-pay for vacuum packaged steaks versus overwrapped steaks (Menkhaus et al., 1992), to determine the value of genetically modified pork (Buhr et al., 1993), to elicit consumer willingness-to-pay for food safety (Hayes et al., 1995) and to place a value on consumer preferences for various quality attributes of fresh pork chops (Melton et al., 1996).

Based on the second-price Vickrey auction methodology, an experimental valuation process using a fourth-price Vickrey auction, was developed to elicit consumers' true willingness-to-pay for their preferred steaks. In the case of this research, the fourth highest bid determined the market price with the top three bidders required to purchase steaks at the fourth highest (market) price.

Procedures

Consumers from Chicago, IL and San Francisco, CA² were selected and screened on a broad range of questions regarding demographics and meat eating practices. Individuals meeting the trial specifications were invited to participate in a research experiment where they would sample various New York Strip steaks. They were told that they would receive \$25 or \$35 for their participation and that they would have the option to purchase steaks similar in quality to those they had sampled. Taste panels of six to twelve consumers each were scheduled for a total of 124 participants in Chicago and 124 participants in San Francisco.

Once at the research facility, consumers were first paid the amount specified over the phone and were then asked to complete surveys that described their meat purchasing behavior, eating preferences, knowledge of beef and demographic characteristics. Next, they visually evaluated a pair of overwrapped steaks of similar external fat trim with different levels of marbling (upper two-thirds USDA Choice and USDA Select). Consumers indicated which steak they would prefer to purchase in a grocery store and how much they would be willing-to-pay for each steak.

The Vickrey auction process was then explained to the consumers. The theory behind the Vickrey auction was explained and participants were encouraged to bid exactly what they

² The Chicago market is typically characterized as a Choice beef market while the San Francisco market is characterized as a Select beef market.

believed the product to be worth to them. Two practice auctions were performed on the visually evaluated steaks in order to familiarize the consumers with the auction process. Consumers were then brought into taste panel booths where they were given a warm-up sample of steak to taste and completed another practice auction. Next, consumer panelists tasted six samples from three paired sets of steaks. The first two pairs were high marbled versus low marbled steaks (USDA upper two-thirds Choice versus USDA Select). The third pair was U.S. corn-fed beef versus imported Argentine grass fed beef (both were graded USDA Select). Each pair of steaks had similar Warner-Bratzler shear force values, therefore, holding tenderness constant within the paired comparisons³. The steaks were all cooked to the same degree of doneness (70°C, a medium degree of doneness).

After consumers tasted each pair of steaks, they then rated each steak sample on sensory traits (juiciness, tenderness, flavor and overall acceptability). Consumers were given a set of “bid sheets” where they wrote down their bid price for each steak. Each bid was for one pound of frozen, packaged New York Strip steaks from the same loin as the steak that they had tasted. It was explained to consumers that if they submitted a successful bid, they were obligated to purchase the steaks. The process was repeated for the other high/low marbling pair and again for the domestic/Argentine pair. Therefore, each consumer’s bids reflected a comparison between the two samples within a pair. The fourth highest price was announced as the market price and the top three bidders all purchased steaks at the market price. The “winners” of each of the auctions remained anonymous to the group of panelists until the entire process was finished and

³ The Warner Bratzler shear force test measures the amount of force required to penetrate a cut of meat and allows a numerical value to be assigned to the cut of steak indicating its tenderness level. It is the most accurate measurement of the variation in steak tenderness currently available (Shackelford et. al., 1996)

consumers reconciled their bids with the auction monitor and purchased their steaks. Therefore, because consumers were given money “up front” prior to tasting and bidding on steaks, and were not required to purchase steaks, the results from the experimental auctions should represent the true value consumers place on their preference.

Demographics of Participants

In total, 248 consumers actually participated in the study, 124 in Chicago and 124 in San Francisco. Demographic summary statistics are provided in Table 1. Approximately 80% of the consumers participating in the study were female with slightly more male consumers participating in San Francisco. The dominant ethnic background of the consumers was White/Caucasian and the average age of the consumers was 45 years. On average, most participants had some college experience with mean annual household income levels around \$60,000 to \$69,000 and lived in households with three to four family members. The participants were primarily employed either part- or full-time.

Table 2 provides the results from the purchasing behavior and consumption preferences survey questions. On average meat products are prepared and eaten at home 3.22 times per week with Chicago participants preparing meat .65 more times a week than San Francisco participants. Beef (65%) and chicken (26%) are the products that participants most prefer to consume. When consuming meat at home, participants most commonly consumed beef (67%) with chicken being the second most consumed meat (30%). The majority of the participants preferred to consume steak (76%) or roast beef (16%). Most consumers preferred to grill or to broil their steak to a medium degree of doneness. When surveyed about their satisfaction with the flavor, tenderness and juiciness of the beef products that they consumed, 87% of the consumers were satisfied.

Quality was marked most commonly as being the “driver” of shopping decisions. Forty-eight percent of the participants indicated that they typically bought USDA Choice grade steaks, sixteen percent usually purchase USDA Select steaks and thirty-three percent did not know what quality grade they purchased. Forty-four percent of the consumers indicated that they had stopped purchasing a beef product because they were unsatisfied with the products flavor, tenderness or juiciness. If they stopped purchasing a beef product due to dissatisfaction, forty-three percent indicated that they did not ever purchase the beef product again.

Results

Figure 1 shows the results of the sensory evaluations for Chicago and San Francisco. No significant differences were found between cities in taste panel ratings. Panelists made significantly higher ratings for all traits for the high marbled versus the low marbled steaks. These results suggest that consumers can detect differences in sensory traits between the two marbling categories and that they also tended to perceive tenderness advantages as well (even though tenderness was held constant).

When comparing the domestic versus imported pair of steaks, consumers strongly preferred the domestic product on all sensory traits (flavor desirability, juiciness, tenderness, and overall acceptability). Of particular interest is the magnitude of the flavor desirability ratings. A mean difference of one full panel rating is seldom observed in beef sensory panel research. It is clear from these results that consumers in both Chicago and San Francisco felt strongly about flavor and, as a result, about overall satisfaction (Figure 2).

After completing the sensory evaluations, participants bid on each pair of steaks. A few participants only wanted to participate in the research trial for the cash and chose not to bid on any steaks. Participants who bid zero on all six steaks were eliminated from the data set leaving

a total of 226 usable participants. On average, consumers were willing to pay a slightly higher price for the more marbled beef, which they perceived to have a higher overall acceptability rating. In Chicago, these differences were valued at an additional \$.25 per pound (Table 3). Although consumers in San Francisco also found the higher marbled steaks to have a more desirable flavor, greater juiciness and higher overall acceptability, they were only willing-to-pay \$.03 more per pound.

The results from the auction on the domestic versus imported pair (Table 3) showed that on average, consumers preferred the domestic sample. The differences in sensory ratings translated into significant bid differentials of \$.82 and \$.55 per pound in Chicago and San Francisco, respectively. Once again, the greatest price differential occurred in Chicago.

There were consumers in both markets that preferred the Select steak to the upper Choice steak and who were willing to bid more for Select steak. Likewise, some panelists in each market preferred the Argentine steak over the domestic steak and bid a higher price. Research on this project is ongoing to determine if there are demographic factors that explain some of these differences in taste preferences.

Summary and Conclusions

These results indicate that: 1) consumers can determine a difference between steaks of varying degrees of marbling and also differentiate the flavor of U.S. steaks versus Argentine steaks, and 2) consumers are willing to pay a significant difference for the steak that they prefer. Consumers were willing-to-pay a higher market price in 34 of 48 auctions for the upper Choice steak compared to the Select steak. The market price was \$0.25 and \$0.03 per pound higher for Choice compared to Select steaks at Chicago and San Francisco, respectively. The majority of panelists in Chicago preferred the U.S. steak and the market price was \$.82 per pound higher for

the U.S. steak than for the Argentine steak. More panelists in San Francisco preferred the Argentine steak; however, the average auction price was still \$0.55 higher for the U.S. steaks.

The results of this study should be of great interest to agribusiness firms interested in creating branded beef products. It may be possible to target specific consumer groups and price both upper Choice quality beef product and Select quality beef product at a higher price than commodity beef. Any regional differences will also be of value in marketing specific branded beef products. As more is learned about consumer preferences for beef and as those preferences are met with the appropriate product, it is likely that demand for beef in the U.S. can be increased.

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Table 1. Definitions of Demographic Variables and Summary Statistics

Variable	Definition	Chicago		San Francisco		Overall	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Gender	1= Male, 2 = Female	1.82	.38	1.78	.41	1.80	0.40
Age	Age of respondent: 1 = Under 25 years, 2 = 25 – 34 years, 3 = 35 – 44 years, 4 = 45 – 54 years, 5 = 55 – 64 years, 6 = Over 64 years	3.51	.86	3.66	1.04	3.58	.95
Ethnic	Ethnic background: 1 = White/Caucasian, 2 = African American 3 = Hispanic, 4 = Asian, 5 = Native American 6 = Other	1.05	.34	1.55	1.36	1.30	1.02
Education	Education level of respondent: 1 = Elementary school, 2 = Some high school 3 = High school graduate, 4 = Some college 5 = Completed junior college, 6 = Completed 4-year university 7 = Completed graduate school	4.69	1.34	4.61	1.11	4.65	1.83
Income	Household income level: 1 = Less than \$20,000, 2 = \$20,000 to \$29,000, 3 = \$30,000 to \$39,999, 4 = \$40,000 to \$49,999, 5 = \$50,000 to \$59,999, 6 = \$60,000 to \$69,999, 7 = \$70,000 to \$79,999, 8 = \$80,000 to \$89,999, 9 = \$90,000 to \$99,999, 10 = Greater than \$100,000	6.16	2.12	6.11	2.61	6.14	2.61
Size	Number of family members living in household	3.76	1.26	3.27	1.26	3.51	1.28
Marital	Marital Status: 1 = Single, 2 = Divorced, 3 = Separated, 4 = Married, 5 = Widowed, 6 = Domestic partnership	3.63	.94	3.27	1.27	3.45	1.13
Employment	1 = Student, 2 = Part-time, 3 = Full-time, 4 = Not employed	2.97	.86	2.95	.79	2.96	0.83

Table 2. Definitions of Meat and Beef Purchasing Behavior Variables and Summary Statistics

Variable	Definition	Chicago		San Francisco		Overall	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Meat Home	Number of times meat products are prepared and eaten in home.	3.55	1.48	2.90	1.23	3.22	1.40
Consume	Preferred meat product for consumption: 1 = Beef, 2 = Pork, 3 = Chicken, 4 = Lamb, 5 = Fish, 6 = Duck	1.79	1.15	1.81	1.25	1.80	1.20
Home	Meat product consumed most often at home: 1 = Beef, 2 = Pork, 3 = Chicken, 4 = Lamb, 5 = Fish, 6 = Other	1.69	1.02	1.73	1.09	1.71	1.05
Beef Eat	Number of times per week beef products like steaks, roasts or ground beef eaten in home.	2.15	1.12	1.94	.89	2.04	1.01
Beef Type	Preferred type of beef to consume: 1 = Steak, 2 = Ground Beef, 3 = Roast, 4 = No preference 5 = Marinated beef	1.48	.83	1.38	.80	1.43	.81
Preparation	Preparation method for cooking beef steaks: 1 = Broiling, 2 = Grilling, 3 = Pan Broiling 4 = Pan Frying, 5 = Roasting, 6 = Stir-Frying, 7 = Braising, 8 = Cooking in Liquid	2.04	1.14	2.27	1.44	2.16	1.30
Doneness	Preferred degree of doneness: 1 = Very Rare, 2 = Rare, 3 = Medium rare, 4 = Medium, 5 = Medium well, 6 = Well done 7 = Very well done	4.37	1.16	3.88	1.28	4.13	1.25
Satisfaction	Satisfaction with the flavor, tenderness, juiciness of the beef products that you consume. 1 = Extremely satisfied, 2 = Very satisfied, 3 = Satisfied, 4 = Unsatisfied, 5 = Very unsatisfied, 6 = Extremely Unsatisfied	2.69	.70	2.51	.70	2.60	.71
Grade	Grade of beef steaks typically purchased: 1= USDA choice, 2= USDA Select, 3 = Don't know, 4 = USDA prime	2.09	1.31	1.99	1.33	2.04	1.32
Shop	Factor "driving" shopping decisions: 1 = Price, 2 = Quality, 3= Budget, 4 = Health	2.02	.94	2.18	.16	2.10	.90
Buy	Where beef is typically bought: 1 = Grocery store, 2 = Butcher shop, 3 = Market day, 4 = Natural food market, 5 = Warehouse/discount store, 6 = Restaurant	1.17	.49	1.46	1.14	1.31	.87
Stop	Stopped purchasing beef due to dissatisfaction with product's tenderness, flavor, or juiciness: 1 = Yes, 2 = No	1.50	.50	1.63	.49	1.56	.50

Table 3. Auction Price Bids for Domestic and Imported Beef Steaks (\$/pound)

Treatment:	Chicago Mean	San Francisco Mean	Overall Mean
High Marbled (USDA Upper 2/3 Choice)	\$2.40	\$2.76	\$2.54
Low Marbled (USDA Select)	\$2.15	\$2.73	\$2.38
Difference	\$.25	\$.03	\$.16
Domestic	\$2.76	\$2.66	\$2.61
Imported (Argentine)	\$1.84	\$2.11	\$1.92
Difference	\$.82	\$.55	\$.69

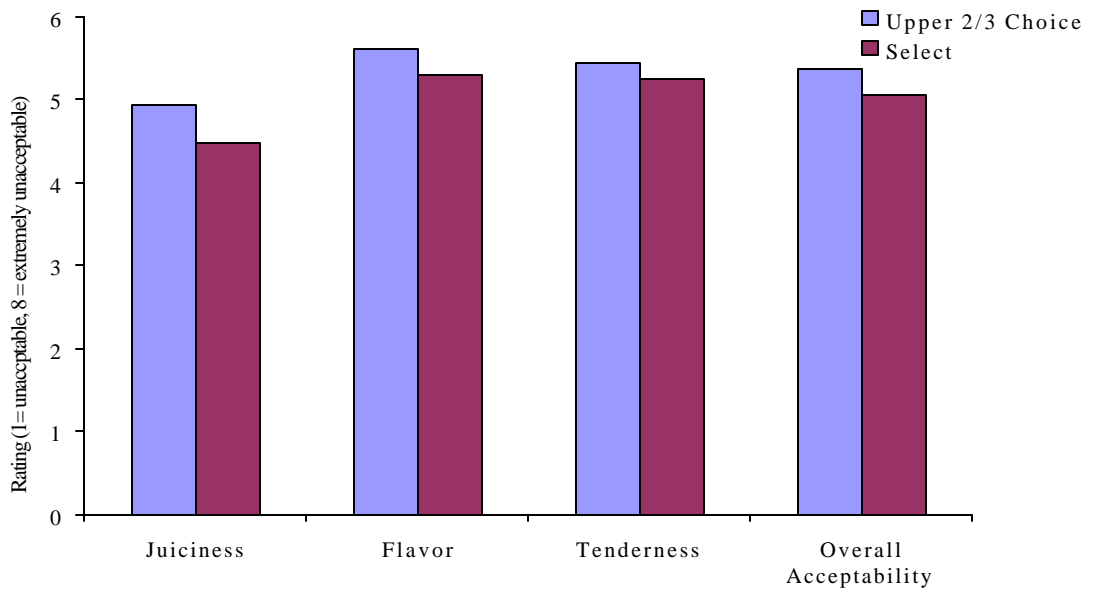


Figure 1. Taste Panel Ratings for Upper 2/3 Choice and Select Beef Steaks.

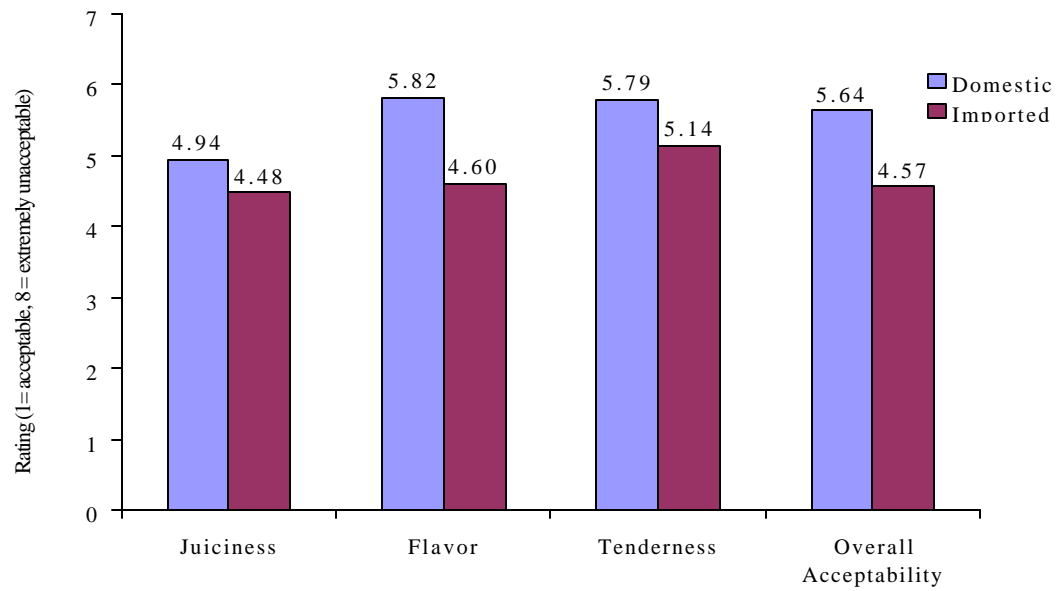


Figure 2. Taste Panel Ratings for Domestic and Imported Beef Steaks.