TX

RESEARCH REPORT

MRC 84-1R

CONSUMER EVALUATION OF LEANNESS IN BEEF: A NATIONAL TEST

TEXAS AGRICULTURAL MARKET RESEARCH & DEVELOPMENT CENTER
in cooperation with the
DEPARTMENT OF ANIMAL SCIENCE
and the
DEPARTMENT OF AGRICULTURAL ECONOMICS

TEXAS A&M UNIVERSITY • TEXAS AGRICULTURAL EXPERIMENT STATION • TEXAS AGRICULTURAL EXTENSION SERVICE • College Station, Texas

Consumer Evaluation of Leanness in Beef: A National Test

Phase I - Household Panels

Robert E. Branson, Julie J. Martin,
Richard Edwards

Department of Agricultural Economics

and

Gary C. Smith, H. Russell Cross, Jeff W. Savell

Department of Animal Science

This research was conducted under
a cooperative agreement with the
Agricultural Marketing Service
U.S. Department of Agriculture
and contributions from
the beef industry through
the National Cattlemen's
Research Foundation

TEXAS AGRICULTURAL EXPERIMENT STATION
College Station, Texas

August 1984

Second Edition

THE TEXAS AGRICULTURAL
MARKET RESEARCH AND DEVELOPMENT CENTER

An Education and Research Service
of
The Texas Agricultural Experiment Station
and
The Texas Agricultural Extension Service

The purpose of the Center is to be of service to agricultural producers, groups and organizations, as well as procesing and marketing firms in the solution of present and emerging market problems. Emphasis is given to research and educational activities designed to improve and expand the markets for food and fiber products related to Texas agriculture.

The Center is staffed by a basic group of professional agricultural and marketing economists from both the Experiment Station and Extension Service. In addition, support is provided by food technologists, statisticians and specialized consultants as determined by the requirements of individual projects.

Robert E. Branson
Coordinator

Acknowledgements

The fielding and analysis of this consumer panel beef research would not have been possible without the excellent contribution of Julie Martin, research associate in the Market Research Center and Mary Lou Price, who preceded her. Their responsibilities included day-to-day supervision of the field staff operations, data editing and coding of the survey questionnaires, and management of the computer entry and analysis of the data. Other members of the outstanding technical support staff included Cindy Laird, Linda Hearne Locke, Beth Braznell, all research assistants; and Susie Ragland who performed almost endless secretarial tasks to the research. In the Meats and Muscle Biology section excellent research support was provided by Davy Griffin, Ray Riley, Jeni Harris and Pansy Gilmore.

Appreciation is also expressed to those in the beef industry and marketing firms that provided valuable comments and suggestions. Thanks go to Kroger, Safeway, and Acme food chains for providing or arranging for product storage facilities in the test cities.

This research was made possible by a grant from the Agricultural Marketing Service, U.S. Department of Agriculture and beef industry funds made available through the National Cattlemen's Association, The Beef Industry Council, and the Beef Councils from Nebraska, Oklahoma, Colorado, and Kansas. Special thanks go to Don Nelson, NCA, for his tireless efforts in support of this research.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

** The optimum strategy to maximizing consumer demand for beef has to be based upon a foundation of detailed knowledge of consumer likes and dislikes, and overall preferences, for beef and other competing meats.

** A series of consumer studies to learn more about consumer attitudes and preferences for beef have been made in recent years.

** Two opposing conclusions resulted from these previous studies. One is that consumers give better ratings to beef steaks as the degree of marbling (intramuscular specks of fat) increases. The conclusion of other research studies was that consumers show little or no beef preferences in relation to beef marbling.

** Almost, if not all, tests show that consumers dislike large amounts of external, trimmable, fat around the outside of steaks and roasts.

** Recent research concerning the desirability of improving consumer diets has resulted in considerable adverse publicity about eating most forms of animal fats.

** In order to help answer the question of consumer preferences, a major multi-city consumer market test was conducted to obtain answers to the question of consumer preferences among leanness levels in beef top loin steaks.

** The participating consumers were residents of the following cities: Houston, Texas; San Francisco Bay Area, California; Kansas City, Missouri; and Philadelphia, Pennsylvania.

** Grades of beef (marbling levels) tested included the following: U.S. Low Prime, High Choice, Middle Choice and Low Choice, High and Low Good, and Standard.

** On the basis of the four-city combined results, involving about 1,000 consumer's testing of 8,000 steaks, the overall rating of the beef steaks generally increased significantly with each increase in the seven beef grade levels.

** Differences in ratings for Medium and Low Choice grade steaks versus High Good grade steaks were less in Houston and San Francisco than in Kansas City and Philadelphia.

** All degrees of doneness and generally prevalent cooking methods were well

represented in the panelist households.

** Ratings of the leanness levels in the steaks by an expert laboratory panel were very similar to those of the household panel.

** Further analyses, which are available in a more extensive separate report, indicated that possibly as many as 20 to 25 percent of the household panelists were equally satisfied with the leaner U.S. Good grade steaks as compared to the U.S. Choice grade. Suggested thereby is a consumer market segment that might increase their beef purchases, if the leaner, U.S. Good grade, was generally available in meat markets of retail food chains.

** The research clearly and very specifically indicates that a sufficiently large consumer panel, 350 to 500 households, must be used, if adequate and meaningful readings of consumer preferences are to be obtained from steak tests.

** A series of retail store market tests, of marketing U.S. Choice plus a leaner line of beef, is recommended as a follow-up to this extensive consumer panel preference test.

** Light and medium users of beef responded more to marbling in beef steaks than did heavy users.

** Higher income beef consumers also responded more favorably to beef marbling than did others.

** The foregoing findings suggest the presence of segmentation in consumer demand for beef. Marketing a lean line of beef as well as the U.S. Choice beef by food stores is a strategy that should be used to increase the overall demand for beef through properly applied marketing strategies and promotion programs. These should be industry supported to the fullest extent possible.

** A one-quarter inch trim on steak outside fat is preferred for loin and round steaks. A one-quarter to three-eighths inch trim is desired for T-bone steaks.

** Close to 40 percent of the panelists indicated some concern about avoiding animal fats, but they remain as beef consumers.

CONSUMER EVALUATION OF LEANNESS IN BEEF: A NATIONAL TEST

Phase I - Household Panels

Robert E. Branson, Julie J. Martin, Richard Edwards, Gary C. Smith, H. Russell Cross and Jeff W. Savell*

Part I The Marketing Problem and Research Design

Present Uncertainty In Beef Marketing

Differing opinions have prevailed within the U. S. beef industry, during recent months and years, as to the degree of leanness consumers desire in retail beef cuts. Evidence of the differences is the present division of food chains into three divergent beef marketing strategies.

One group of food chains markets a lean beef ordered from packers on either a specification or a "no-roll" carcass basis. Such beef may or may not be preselected "on the rail" at packing plants. Like most of the food retailing industry, these stores resist marketing lean beef under a USDA Good grade label, the grade for which much of the lean beef would qualify. Instead, they opt for private label name brands such as Quality Lean, Tender Lean, "X"-Chain Lean or Quality Beef.

---

*Respectively, Professor and Director of Market Research Center, Department of Agricultural Economics; Research Assistant, Market Research Center; Assistant Professor, Extension Economist-Marketing, Food Distribution, Department of Agricultural Economics; Professor and Head, Department of Animal Science; Professor and Head, Meats and Muscle Biology Section, Animal Science; Associate Professor, Meats and Muscle Biology Section, Department of Animal Science.

A second segment of the food chain industry meanwhile has continued, and, in some cases, re-emphasized marketing and retail labeling of USDA Choice grade beef. Re-emphasis often stresses the term "grain-fed" beef. An innovative third, and small minority of, food chains has embarked upon marketing two grades of beef, usually USDA Choice plus a private labeled leaner beef.

If all consumers had equal access, in their usual food shopping, to two grades of beef, the market itself would probably answer, within about twelve months, the questions regarding consumer leanness preferences in beef. However, the large majority of consumers do not have that equal access. Even if they did, the variation in the "no-roll" beef specifications leaves largely undefined to the industry the leanness degree consumers prefer.

Because of the foregoing consumer demand uncertainty, more specific knowledge of consumer beef preferences is essential so that industry production-marketing goals can be established.

Key Beef Marketing Questions

Since a rather broad spectrum of beef quality can be produced in the United States, within the typical "A" maturity cattle, the following questions needed to be answered.

1. At what degrees of leanness differences (marbling within muscle finish) can consumers recognize quality differences in retail beef steak cuts?

2. What degree of finish in terms of marbling is the most acceptable to consumers and what is the relative preference order for the remaining distinguishable leanness levels?

3. Do regional geographic differences exist in beef leanness (marbling) preferences within the U. S. consumer market?

4. Based on the foregoing findings, what appears to be the optimum combination of beef leanness levels consumers want, so that these can be included in a final set of retail market tests?

The first step in the research process, as usual, was to review recent research literature to assess what information is available and determine what information gaps remained to be resolved.

Review of Previous Research

Recent consumer national attitudinal research, sponsored by the beef industry, appears to support the opinion that consumers prefer leaner beef (Yankelovich). Interest in leanness is presumed to be part of the overall national trend toward lower calorie foods. Because of that indication, several research projects in recent years have been directed toward consumer preferences research. Two relatively recent examples are relevant.

Research at the Louisiana Agricultural Experiment Station reported in 1981 (Bidner, Schupp, Montgomery, and Carpenter), found non-significant differences in overall desirability of beef from four different feeding regimes ranging from all forage fed to feedlot fed production systems. These feeding systems affect the leanness of the beef produced. The feeding systems and resulting beef grades achieved were as follows: forage feeding, Low Good; forage plus grain, High Good; forage plus grain, followed by feedlot, Low Choice; feedlot only, Low Choice. Average overall desirability ratings from a consumer household panel ranged from a high of 2.3 to a low of 2.5 based on a seven point rating scale in which 1.0 was very desirable and 7.0 very undesirable. The statistical standard error of these ratings was determined to be 0.20. Therefore, it was concluded that there was no statistically significant difference in consumer preferences among these grades, Table 1. A further compo-

Table 1. Mean Sensory Expert Panel Ratings of Beef by Steak and USDA Quality Grade, L.S.U. Research

Feeding Regime	USDA Grade of Beef	Overall Palatability
		- - - rating - - -
Forage	Low Good	2.4 [a]
Forage plus grain	High Good	2.3 [a]
Forage plus grain and feedlot	Low Choice	2.5 [a]
Feedlot	Low Choice	2.3 [a]

Means in the same column followed by a common letter superscript are not statistically significantly different.

Source: T. D. Bidner, A. R. Schupp, R. E. Montgomery, and J. C. Carpenter, "Acceptability of Beef Finished on All-Forage, Forage Plus Grain or High Energy Diets," Journal of Animal Science, Vol. 53, No. 5, 1981.

nent phase of the research used a nine-point scale and reached the same conclusion. Tenderness and flavor, in both cases, as in other similar research, were rated highest for the feedlot beef, but without statistical significance. The LSU research involved consumer ratings of loin, round and chuck steaks.

Another palatability test of beef leanness was conducted jointly by scientists at the ARS, USDA, laboratories, the Texas A&M, Kansas State and Colorado State agricultural experiment stations (Gary C. Smith and Russell Cross). Approximately 1,000 carcasses were evaluated by expert taste panels. For loin steaks, significant differences were found in average palatability ratings for each USDA grade class from Prime through the High Standard grade. For round steaks, only the USDA Prime grade tested significantly higher than the other grades. Ratings were on an eight-

point scale, with an 8 being extremely desirable and 1 being extremely undesirable. The ratings appear in an appendix, Table A-1.

Two significant research questions arose from the foregoing, and other related, studies. One is whether or not consumers can detect as finite a product difference as can expert laboratory panels. Trained panels, theoretically, should be better detectors. That question, however, was not a part of, therefore not addressed in, the thousand carcass test. The second question related to the basic matter of sample size requirements for experimental research into consumer preference ratings. If sample size is under that required for statistically separating rating differences, useful conclusions cannot be drawn. It appears that because of the sample size difficulty in research, the beef industry has been left without clear cut research-based findings upon which to base its production and marketing strategies. It appeared clear from the review of recent research that further research was needed that would deal with these two major unanswered questions.

The Research Design

To help assure meeting the research objectives, a pilot test was designed for application in Houston, Texas — one of the nation's ten largest metropolitan markets. Statistical analysis of prior research indicated the likely statistical variances to be encountered in consumer's product ratings. Based on that information, sampling formulas indicated that 180 households (about 300 persons) would be required for decisive panel testing. The design was set to detect a significant rating difference at 0.25 points in a 9.0 point, 5.0 centered, hedonic rating scale. The rating scale and associated semantic and numeric terms used in this research appear in Table 2.

A survey among market research departments of major national food marketing firms indicated that a nine-point scale is the most useful and dependable for product evaluations by consumers.

Table 2. Hedonic Scale Used in Household Panel Test

Numeric Rating	Semantic Rating
9	Extremely desirable
8	Very desirable
7	Moderately desirable
6	Slightly desirable
5	Neither desirable nor undesirable
4	Slightly undesirable
3	Moderately undesirable
2	Very undesirable
1	Extremely undesirable

The next research step was to develop the Houston household sample. Residential listings were obtained from a current criss-cross directory, providing street addresses and telephone numbers in the total Houston metropolitan area. Sampling was restricted to Harris County since the contiguous sub-cities lie within that county. Thirty sampling points were established by systematic probability sampling and six households were recruited per sampling point sub-area. Recruitment of the test panel households was by telephone by the Market Research Center personnel. Households were screened to eliminate non-beef eaters.

The research was designed to provide each sample household a total of ten loin steaks, one steak per week, over a period of ten successive weeks. Steaks provided were prepared at Texas A&M University by the Department of Animal Science from

carcasses selected at several packing plants in and out of Texas. Leanness levels were judged from marbling of the thirteenth rib–eye, as used in USDA carcass grading. Carcasses selected graded Low Prime, High Choice, Middle Choice, Low Choice, High Good, Low Good, and High Standard. To these were added two additional carcass classes, short–fed and bullocks. Steaks from all carcasses were numbered as to their rib position, carcass side, and the thickness of external carcass fat. Each steak was individually wrapped, coded and frozen to preserve its quality until delivery to a panel household.

The one steak per week was delivered to each panel household in a pre–selected computer generated random number order. The sequence was balanced for inclusion of all ten samples for each household. An example of the randomized order is provided in the following sub–set illustration.

Example Cluster No. 5	Week Number 1 2 3 4 5 6 7 8 9 10
Household No	Steak Number Tested
1	6 8 4 2 3 5 9 1 7 1
2	2 6 8 7 5 1 9 4 3 4
3	4 1 5 9 3 7 8 6 2 8
4	9 1 5 7 8 6 3 4 2 7
5	7 8 9 2 3 1 6 4 5 6
6	3 1 9 5 6 4 2 7 8 3

The tenth, or last, week each household received a repeat sample of one of the steaks previously received. The repeat steak was a random selection of one of

the nine different steaks included in the research, in order to determine whether the panel could replicate its ratings of the same steak on a second trial.

Performance of the Houston test met with design expectations. Therefore, the decision was made to expand the research to include three additional major cities nationally.

Implementation of the Additional Three-City Research

Whereas the Houston pilot research was conducted in the summer of 1982, funding of the three-city expansion did not occur until the fall of 1983.

The San Francisco Bay Area, Kansas City, and Philadelphia were the cities selected for further consumer preference tests. These cities were selected after extensive screening of demographic and socio-economic data for all metropolitan markets of near to or above one million in population. A panel of 180 households centered around thirty clusters of six each was developed in each city by the same systematic probability sampling procedures from criss-cross directories that were used in the Houston research. Again, all households recruited were screened to eliminate non-beef eating consumers.

Following three months of detailed designing and planning of the research, implementation field work began in early February 1984 and was completed in mid-April. All phases were supervised jointly by the Agricultural Market Research Center and the Department of Animal Science at the Texas Agricultural Experiment Station. Field operations in each city were implemented by commercial field research services employed by other market research professionals nationally. Any panel substitutions, of which there were only a few, were under the Center's direction. Despite the length of the test, panel attrition was less than five percent in all cities.

Beef for the test was again selected by and prepared for shipment to the test cities by members of the Meats and Muscle Biology Section, Department of Animal

Science at the Texas Agricultural Experiment Station. Selection was in cooperation with USDA grading personnel. Beef was selected at large commercial packing plants in Texas, Kansas, and Colorado that are nationwide market suppliers.

Seven levels of beef marbling were selected for the three-city research. The marbling levels again were from the equivalent of USDA Low Prime to High Stan-

Table 3. Beef Loin Steak Leanness Levels and Co-hort USDA Grade

Marbling Score	USDA Grade Equivalent
Slightly abundant	Low Prime
Moderate	High choice
Modest	Medium Choice
Small	Low Choice
Upper slight	High Good
Lower slight	Low Good
Traces	High Standard

dard grade as in the Houston test, Table 3. Short-fed beef and bullock beef were omitted at the suggestion of industry advisory representatives. Thus the three-city (San Francisco Bay Area, Kansas City, and Philadelphia) consumer test was planned on an eight-week design.

The beef steaks provided to the panel were prepared at the Meat Science Technology Center at Texas A&M University. All steaks were appropriately coded as to their source carcasses and rib positions. Steaks were boxed to match the week and household number for deliveries in each of the three cities, and were then shipped to on-site cold storage facilities. Weekly withdrawals were made and deliv-

ered to the panel households in accordance with the designated steak sequence for the respective households. As in Houston, each household received one steak a week in a randomized order. The eighth week, all households received, unknown to them, a repeat of the Low Choice steak. This steak was from the same rib position and opposite side of the identical carcass as the first Low Choice steak received by the household.

Characteristics of the Four-City Household Panels

The validity of the research results rests in part upon the representativeness of the characteristics of the panel households compared to the areas they represent. Three demographic measures—age, education, and income—were used as monitors. Although the households were not asked to give ethnic origin information, the sample census tracts were tested against the metro area's socio-economic composition.

The age of the food buyers, within the four city panels, compared reasonably well with available market data considering that not all households are beef steak users, Table 4. Age classifications of the panel household food shoppers were reduced to three groups. As compared with ages of the head of the household data, some sampling short-fall occurred in the under 29 year old category, especially in Houston. Two factors contributed. In large cities, more of the single-member households are young people beginning employment before marriage. These households are less inclined to participate in research that extends over several weeks, especially during summer months. Secondly, young professionals, are inclined to eat more meals away from home, making them less inclined to do at-home cooking and eating tests. The X^2 value of the four-city age distribution was not significant except in Houston where the requirement of ten weeks participation in the test during the summer reduced availability of younger adults where single person households

Table 4. Age of Food Buyer in Panel Household Sample in Four-City Nationwide Beef Research, by City

Age	San Francisco		Kansas City		Houston		Philadelphia		Four City	
	Sample	City	Sample	City	Sample	City	Sample	City	Sample	Cities
	percent									
29 and younger	15	21	20	20	8	26	10	16	14	20
30 - 49	45	42	40	39	45	44	39	34	42	40
50 and older	40	37	40	41	47	30	51	50	44	40
TOTAL	100	100	100	100	100	100	100	100	100	100
χ^2	1.91		0.05		20.89		2.70		10.10	
probability (χ^2)	.6159		.0242		.9999		.7403		.9936	

Source: Sample information from field research data, Houston 1982, other cities, 1984.
City figures from Survey of Buying Power Data Service, Sales Management, New York, N.Y., relate to age of head of household in 1982.

are a factor. The X^2 value was 10.10 compared to 9.21 at the 99 percent confidence level.

Education level of the food buyers was about evenly divided between those without a college education and those with, Table 5. College education was higher in the San Francisco Bay Area, as would be expected since the survey included the so-called Silicon Valley cities. Educational distribution of food buyers in the sample households versus that of persons 25 years or older in the four cities produced a X^2 value of 38.95, indicating a significant difference, but not an undue one considering the sample sizes of the panels involved.

Incomes of households buying steaks, on the average, would be expected to be skewed toward the middle and upper income ranges, Table 6. Incomes of the panelists' households range from under $15,000 per year to over $50,000. A X^2 test value of 28.96 compared with 9.21 at the 99% confidence level confirms that the income of the panelists differed significantly from that of the general population in the four combined cities.

Therefore, it can be said that the four-city panelists represented slightly older, more educated and somewhat better income households than the population of the respective cities. Comparison of the demographics averages are made in Table 7, which provides an additional perspective. If the indicated household sample differences were not present, concern properly would arise as to the adequacy of the sampling and screening procedures. Beef steak and roast using households, because of comparative prices of competing meats are inclined toward somewhat older and higher income consumers as confirmed by national survey statistics from the USDA Food Consumption Study.

Household Beef Cooking Methods

One of the chief advantages of household panel food product tests is that

Table 5. Education of Food Buyer in Consumer Household Panels, by City

Education	San Francisco		Kansas City		Houston		Philadelphia		Four City	
	Sample	City	Sample	City	Sample	City	Sample	City	Sample	City
	percent[1]								percent[2]	
Grammar School	2	7	2	6	3	10	3	11	3	8
Jr. - Sr. High School	28	45	45	59	37	48	46	63	39	54
Technical School	6	--	10	--	6	--	6	--	7	--
College	63	48	43	35	54	42	45	26	51	38
TOTAL	100	100	100	100	100	100	100	100	100	100
Sample size[3]	177	1,810,191	176	760,799	168	1,342,703	174	1,430,361	695	5,344,054
χ^2 [4]	10.26		5.43		9.46		19.49		38.95	
probability (χ^2)	.9941		.9339		.9911		.9999		.9999	

Sources: Sample information from field survey data.
City data is for persons over 25 years of age, U.S. Census of Population -- Social and Economic Characteristics, 1980.

1 Sampling error for 95% probability level as follows: at 50% = ±6.2 percentage points; at 30% = ±5.6; at 5% = ±2.7.

2 Sampling error for 95% probability level as follows: at 50% = ±3.1 percentage points; at 30% = ±2.8; at 5% = ±1.3.

3 Sample size for cities is for persons over 25.

4 Analysis combines high school and technical school categories to eliminate zero observations in the "city" data because of lack of information.

Table 6. Income of Panel Households Versus the Population Households

Income	San Francisco		Kansas City		Houston		Philadelphia		Four City	
	Sample	City	Sample	City	Sample	City	Sample	City	Sample	City
					- - - percent - - -					
Less than $15,000	14	22	14	28	19	23	23	35	18	27
$15,000 - $24,999	15	20	29	24	19	22	18	23	20	22
$25,000 - $49,999	41	43	49	40	40	41	47	34	44	40
$50,000 and over	30	15	8	8	22	14	12	8	18	11
TOTAL	100	100	100	100	100	100	100	100	100	100
χ^2	13.48		10.95		4.37		9.03		28.96	
probability (χ^2)	.9963		.9880		.7757		.9711		.9999	

Source: Sample information from field research data, Houston 1982, other cities, 1984.
City figures from Survey of Buying Power Data Service, Sales Management, New York, N.Y., relate to income of household in 1982.

Table 7. Comparison of Statistical Averages of Panel Versus Population Household Demographics

Averages	Unit	Panel Average[1]	Panel Average[1]	Difference
Age	Years	49	47	2
Education	Grades	12.2	11.5	0.7
Income -- annual	Thous. $	33.8	28.6	5.2

Source: previous tables

[1] Unweighted averages

products are subjected to the rigors of preparation method variations among the panelists. The household panelists were asked to use their own usual cooking method for beef steaks to prepare the test steaks. Indications from the 8,000 reports were that almost half of the steaks were oven broiled. Pan frying and grilling each accounted for about 25 percent. Microwaving was primarily the "other" category, Table 8. Thus all basic cooking methods were well represented. Greater use of outside grills in Houston reflected the summer months during which the research was conducted there.

Since panelists were permitted to cook the steaks to their preferred degree of doneness, panelists in Houston were provided a five-point scale to use in reporting the degree of doneness estimated for their steaks (bottom line, Table 9). For the expanded 3-city research, a color photograph depicting six degrees of steak doneness was provided as a reference by courtesy of the National Livestock and Meat Board.

Table 8. Percent of Household Panelists According to Cooking Method for Their Test Steaks

City	COOKING METHOD					TOTAL	
	Outside Grill	Inside Grill	Oven Broiler	Pan Fry	Other	Percent	Panel Steak Ratings
	percent of steaks[1]						
San Francisco Bay	17	10	43	29	1	100	2,267
Kansas City	23	7	43	26	1	100	2,331
Philadelphia	4	7	64	25	--	100	2,065
Houston	32	8	35	25	--	100	3,080
Four-City average	20.5	8.6	44.8	25.6	0.5	100	9,743

1 For individual cities, approximate sampling error at 95 percent probability level is for 50% = ±1.8 percentage points; at 25% = ±1.5; at 5% = ±0.8.
For four-city data, sampling error at 95 percent probability level is for 50% = ±0.9 percentage points; at 25% = ±0.8; at 5% = ±0.2.

Table 9. Degree of Doneness to which Panelists Cooked the Test Steaks

City	DONENESS						TOTALS		
	Very Rare	Rare	Medium Rare	Medium	Well Done	Very Well Done	Percent	Panel Steaks	Household Panelists
	percent of panelists[1]						number		
Three-City Test									
San Francisco Bay	2	11	33	29	18	7	100	2,266	284
Kansas City	1	5	24	35	25	10	100	2,331	291
Philadelphia	1	7	24	32	23	13	100	2,065	258
Three-City Average	1	8	27	32	22	10	100	6,663	833

City	DONENESS					TOTALS		
	Rare	Medium Rare	Medium	Medium Well	Well Done	Percent	Panel Steaks	Household Panelists
Houston Test								
Houston	4	23	25	26	22	100	3,080	312

[1] For individual cities, sampling error at 95 percent probability level is for 25% = ± 1.5 percentage points; for 10% = ± 1.1; at 5% = ± 0.8

For three-city average, sampling error at 95 percent probability level is for 25% = ± 0.9; for 10% = ± 0.6

The number of steaks cooked medium-rare, medium, and well-done were about equal, Table 9. San Franciscans tended somewhat more toward rare and medium-rare steaks than panelists in the other cities, but it was clear that a sufficiently wide range of doneness levels was represented in the consumer test.

Part II The Research Results

Test of Comparative Ratings by Expert, Consumer Laboratory and Household Panels

It is traditional among food scientists to train and utilize expert taste panels as one guide to food product evaluations. Their use is usually related to product R and D programs. However, to determine consumer market demand preferences, consumer panels are employed. These may be consumer laboratory panels and or household panels. For this research all three panels were used.

An expert laboratory panel was trained by the meat technology scientists at the Texas Agricultural Experiment Station. A sub-set of the steaks used in the Houston household consumer test was set aside and evaluated by this expert panel. A panel was comprised of ten persons conducted through one hundred sessions to evaluate the seven levels of leanness to be tested in loin steaks. All expert panel test steaks were broiled to an internal temperature of 70 degrees at the Department of Animal Science Sensory Testing Laboratory. That was equivalent to a medium done steak. Average ratings of the steaks ranged from a high of 6.96 to a low of 5.28 on a nine-point hedonic scale, with a 1.0 being the lowest rating, Table 10. In general, as the degree of intramuscular marbling (fat within the lean or muscle portion) decreased so did the palatability ratings.

Another sub-set of steaks, prepared in the same manner, was evaluated at the Sensory Testing Laboratory by a general probability sample consumer panel drawn

Table 10. Average Ratings of Beef Loin Steak Marbling Levels by Expert, Consumer Laboratory and Household Panels, 1982 -- Houston

Marbling Level	USDA Quality Grade	Expert Panel	Consumer Laboratory Panel	Household Panel
		rating[1]		
Slightly abundant	Low Prime	6.96	6.72	7.17[a]
Moderate	High Choice	6.54	6.58	7.13[a]
Modest	Medium Choice	6.28	6.15	6.87[a]
Small	Low Choice	5.89	6.02	6.83[b]
Upper Slight	High Good	5.53	5.77	6.81[b]
Lower slight	Low Good	5.28	5.44	6.82[b]
Traces	High Standard	5.64	5.84	6.78[b]
Slight	Bullock[2]	5.47	5.65	6.54[c]
Slight	Short-fed[2]	5.32	5.47	6.51[c]
Panel ratings correlations:				
Expert vs. consumer lab.		0.98		
Consumer lab. vs. household			0.88	
Expert vs. household		0.86		
Total number panelists:		10	459	312
Number of observations:		2,700	4,000	2,800

Source: Expert and laboratory panels at Texas A&M University; household panel in Houston, Texas

[1] Based on nine-point, five centered, hedonic scale with 9 extremely desirable and 1 extremely undesirable

[2] Cattle type

from the non-student Bryan-College Station metropolitan area population. Average ratings by the consumer laboratory panel ranged from a high of 6.72 to a low of 5.44, using again the same nine-point hedonic rating scale, Table 10. Ratings declined as steak marbling decreased. The scale, in all cases, was both numeric and semantic.

The ratings by the household panel in Houston ranged from a 7.17 high to a 6.51 low, generally declining as the degree of intramuscular marbling was reduced, Table 10. Correlation was used as a test of the degree of relationship in the ratings from the three panels. That between the expert and consumer panels was highest, having a coefficient of determination (r^2) of 0.98, compared to one of 0.86 between the expert and household laboratory panels. Thus the results support the use of expert panels or consumer laboratory panels as pre-indicators of likely product ratings by consumers. Nonetheless the consumer household tests were preferable for further beef testing nationally.

Another question was whether there are differences in product ratings by different population demographic segments. If not, future sampling could ignore providing separate market segment data. Houston results suggested that the younger and also higher income panelists perceived sharper differences among the beef leanness levels, Figures 1 and 2, or else they reacted more strongly in their product ratings than those at other age and income levels. Therefore, the research in the other cities also endeavored to measure such differences.

Individual City Analysis Scope

Results of the household panel steak ratings are evaluated on a city by city as well as a combined basis. Such comparisons are possible because of the same research design applied to the four cities, located from coast to coast. Approximately 25,000 questionnaire reports were generated by the research and a sample of

HOUSTON, REGRESSION OF AGE GROUPS

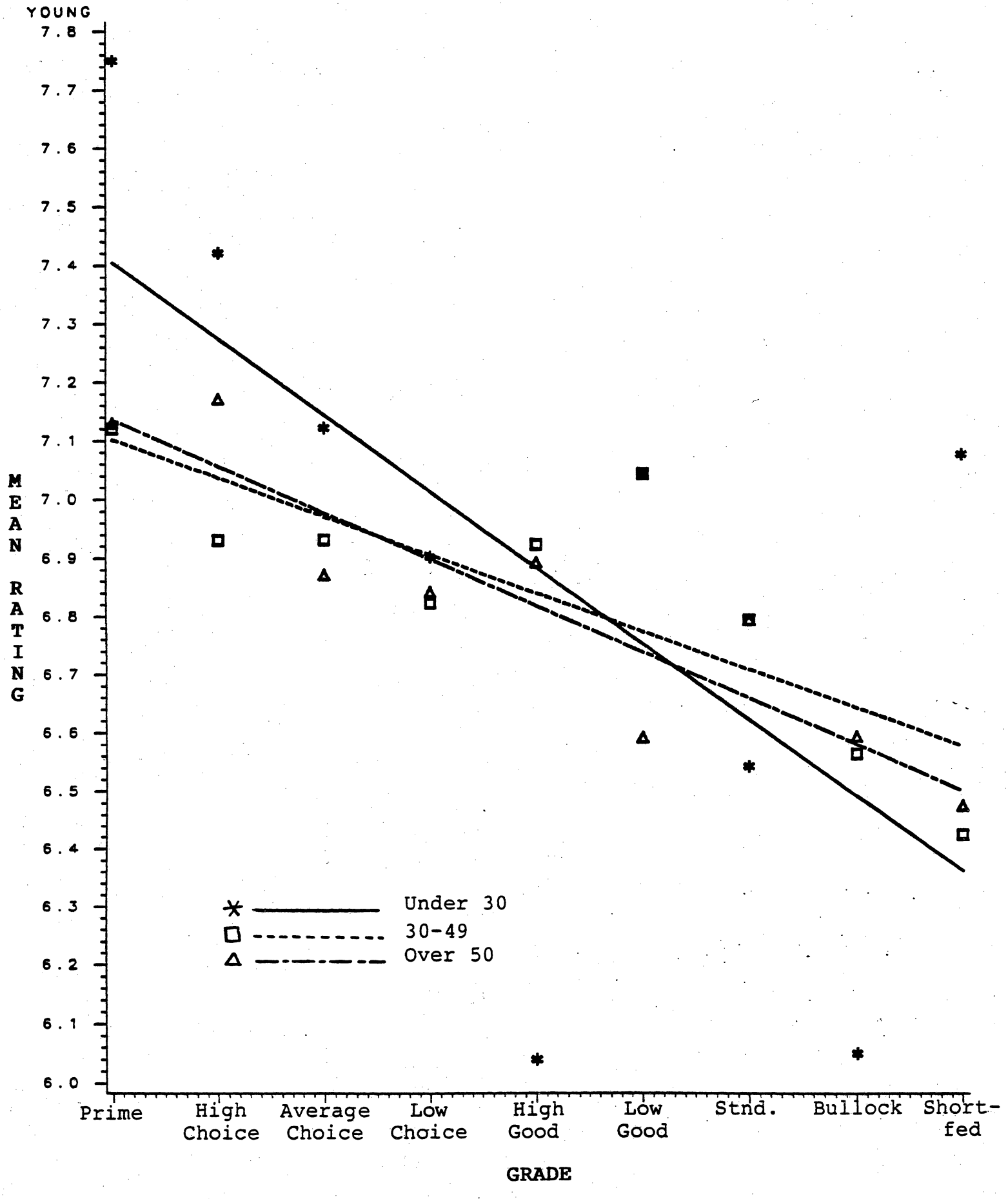


Figure 1

HOUSTON, REGRESSION OF INCOME GROUPS

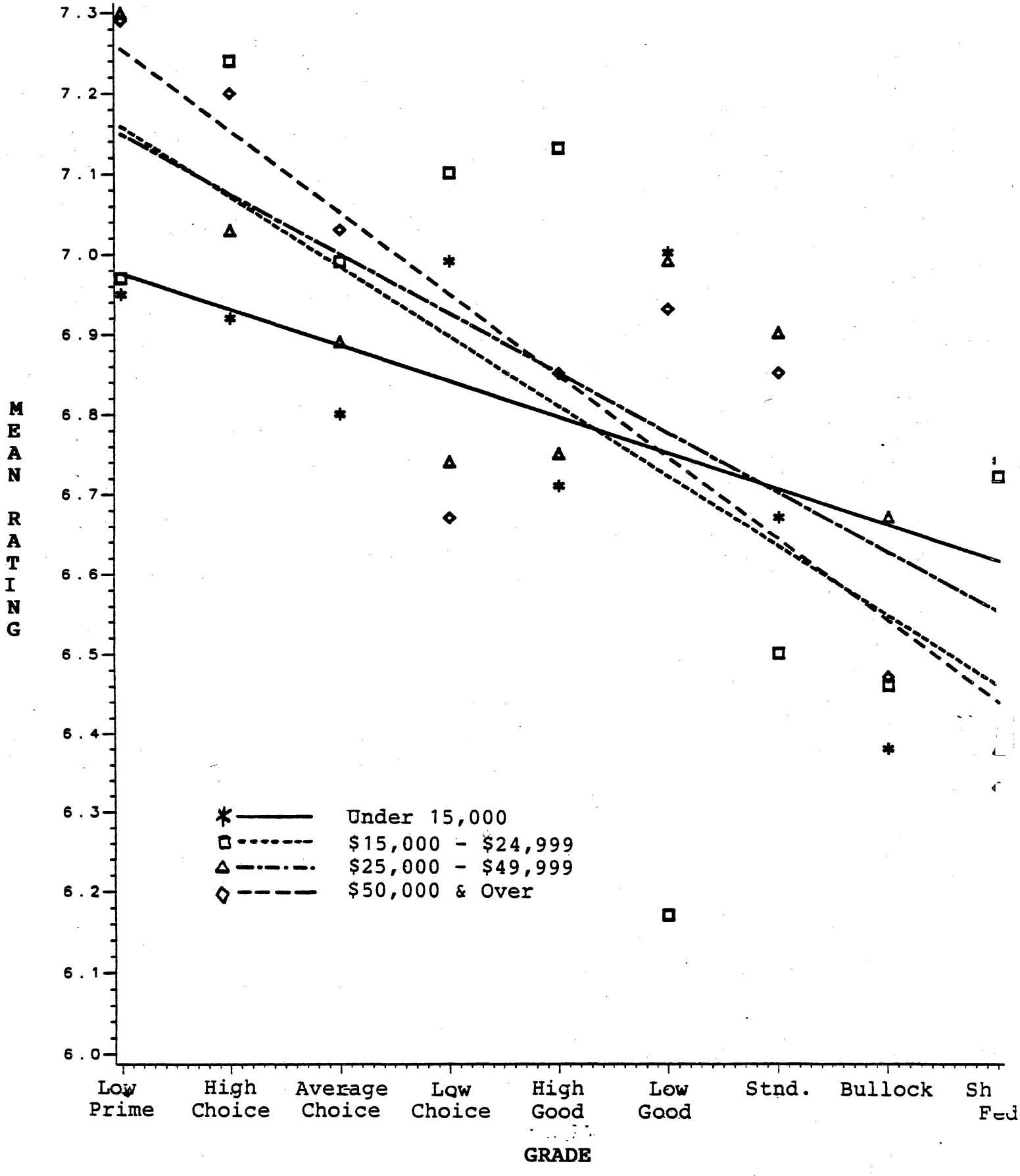


Figure 2

the questionnaires may be found in the appendix. The research endeavors to relate consumer acceptance of degrees of beef leanness to consumer demographic and psychographic segments of the market. The latter is considered more specifically in the combined four-city research findings.

Consumer panel average ratings in each city represent the composite of between 2,000 to 2,200 individual steak evaluations. The four-city research data are based on a total of over 8,000 steak ratings. These figures, reflect the extensive physical size of this research endeavor.

Product ratings reported in the data tables may show the original, or raw score, as well as the normalized ratings. The normalization of ratings permits the removal from the data of the effects of interpersonal differences among panelists to rate all products higher or lower on the rating scale. Thus it gives a truer between steak comparison.

The Houston Panel Results

Average ratings of loin steaks by Houston panelists were higher as the level of marbling increased, Table 11. On the basis of the raw rating scores, four groupings of marbling levels were significantly different.

Group 1	Low Prime High Choice
Group 2	Medium Choice Low Choice
Group 3	High Good Low Good High Standard
Group 4	Bullocks Short-fed

Another view of the Houston panelists ratings is provided by examining their reported intentions to buy with respect to each individual steak, Table 12. Buying

Table 11. Mean Overall Desirability Rating of Loin Steaks by Marbling Level--Houston, 1982

Marbling Level	USDA Quality Grade	Mean		Standard Error	
		Raw Score	Normalized Score	Raw Score	Normalized Score
			---- Rating[1] ----		
Slightly Abundant	Low Prime	7.18[a]	7.17[a]	.09	.08
Moderate	High Choice	7.13[a]	7.13[a]	.08	.07
Modest	Average Choice	6.87[b]	6.87[b]	.09	.07
Small	Low Choice	6.85[b]	6.83[b]	.09	.08
Upper Slight	High Good	6.81[b]	6.81[b]	.09	.07
Lower Slight	Low Good	6.82[b]	6.82[b]	.09	.07
Traces	High Standard	6.78[b]	6.78[b]	.09	.08
Slight	Bullock[2]	6.54[c]	6.54[c]	.10	.08
Slight	Short-Fed[2]	6.50[c]	6.51[c]	.11	.08
Total number of household panelists			312		

[1] Based on nine-point, five centered, hedonic scale with 9.0 as hgihest rating

[2] Means followed by same letter superscript are not significantly different by the "z" test at the 95% confidence level using the single-tail, or adjacent sides of rating distributions, test.

Table 12. Purchase Intentions of Consumers as Related to Beef Loin Steak Ratings - Houston, 1982

Steak Rating		n	Would Buy	Probably Buy	Buy Only at Reduced Price	Would Not Buy at Any Price
Numeric	Semantic					
				- - - Percent of Food Shoppers[1] - - -		
9	Extremely Desirable	58	79.3	17.2	---	1.7
8	Very Desirable	174	64.6	26.4	2.8	1.7
7	Moderately Desirable	126	22.2	45.2	14.3	1.6
6	Slightly Desirable	47	6.4	40.4	21.3	10.6
5	Neither Desirable nor Undesirable	35	5.7	22.9	28.6	17.1
4	Slightly Undesirable	27	11.1	3.7	44.4	29.6
3	Moderately Undesirable	19	10.5	---	36.8	47.4
2	Very Undesirable	10	10.0	---	30.0	60.0
1	Extremely Undesirable	1	---	---	100.0	100.0

[1] Raw percentages which do not add to 100 are due to those food shoppers who were "undecided" being omitted

intentions dropped perceptably when the steak ratings fell to a 6 or less. This corresponds with the experience of major national food marketing corporations. Their market research departments report that ratings of 7 or higher are associated with successful products. Ratings of 5 to 7 result in only moderately successful sales. Ratings below 5 result in extremely marginal, if not outright market failure.

Philadelphia Results

Philadelphia panelists also generally reduced steak ratings as marbling declined, Table 13. The high-low range in raw score rating averages was 0.71 points compared to 0.68 in Houston, or nearly the same. The normalized scores range was 0.70 versus 0.66 in Houston. In the normalized ratings, Low Prime and High Choice, based on significant differences between means, formed one preference group. Low Choice and High Good were significantly different. The lowest rating group was Low Good and High Standard.

Intentions to buy the steaks made its largest drop when the steak rating fell from 7 to 6. This conclusion is based upon the combined percentage that "would buy" and "probably buy" at each of the steak rating levels, Table 14.

Kansas City Panel Results

In Kansas City, panelists as in the other four cities, rated Low Prime loin steaks highest and the High Standard lowest. Significant differences in the ratings again occurred between the Low Choice and High Good grades in the raw as well as the normalized rating scores, Table 15. Also, buying intentions again decreased sharply when ratings declined from a 7 to a 6, Table 16.

San Francisco Panel Results

San Francisco panel households discriminated less among the beef marbling

Table 13. Mean Overall Desirability Rating of Loin Steaks by Marbling Level — Philadelphia, 1984

Marbling Level	USDA Quality Grade	Mean		Standard Error	
		Raw Score	Normalized Score	Raw Score	Normalized Score
		ratings[1]			
Slightly abundant	Low Prime	7.29[a][2]	7.28[a]	.08	.07
Moderate	High Choice	7.25[a]	7.26[a]	.08	.07
Modest	Medium Choice	6.90[b]	6.88[b]	.09	.07
Small	Low Choice	7.15[a]	7.16[a]	.09	.07
Upper slight	High Good	6.79[bc]	6.77[bc]	.10	.08
Lower slight	Low Good	6.58[c]	6.58[c]	.11	.09
Traces	High Standard	6.65[c]	6.68[c]	.10	.08
Total number of household panelists					258

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different by the "z" test at the 95% confidence level using the single-tail or adjacent sides of the ratings distributions, test.

Table 14. Purchase Intentions of Consumers as Related to Beef Loin Steak Ratings - Philadelphia, 1984

Steak Rating		n	Would Buy	Probably Buy	Buy Only at Reduced Price	Would Not Buy at Any Price
Numeric	Semantic					
			- - - Percent of Food Shoppers[1] - - -			
9	Extremely Desirable	138	91.3	6.5	1.5	.7
8	Very Desirable	449	65.7	26.5	3.6	---
7	Moderately Desirable	458	20.3	46.1	10.3	0.9
6	Slightly Desirable	170	4.1	19.4	30.0	8.2
5	Neither Desirable nor Undesirable	74	2.7	8.1	31.1	24.3
4	Slightly Undesirable	44	---	---	40.9	47.7
3	Moderately Undesirable	20	5.0	5.0	10.0	75.0
2	Very Undesirable	23	---	---	8.7	91.3
1	Extremely Undesirable	6	---	---	---	100.0

[1] Raw percentages which do not add to 100 percent are due to omission of shoppers who were "undecided"

Table 15. Mean Overall Desirability Rating of Loin Steaks by Marbling Levels — Kansas City, 1984

Marbling Level	USDA Quality Grade	Mean		Standard Error	
		Raw Score	Normalized Score	Raw Score	Normalized Score
		ratings[1]			
Slightly abundant	Low Prime	7.24[a][2]	7.24[a]	.08	.07
Moderate	High Choice	7.20[a]	7.20[a]	.08	.07
Modest	Medium Choice	7.23[a]	7.24[a]	.07	.06
Small	Low Choice	7.17[a]	7.17[a]	.07	.06
Upper slight	High Good	6.98[b]	6.97[b]	.08	.07
Lower slight	Low Good	6.91[b]	6.91[b]	.09	.07
Traces	High Standard	6.84[b]	6.85[b]	.08	.07
Total number of household panelists					291

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different by the 95% confidence level using the single-tail, adjacent sides of the ratings distributions, test.

Table 16. Purchase Intentions of Consumers as Related to Beef Loin Steak Ratings - Kansas City, 1984

Steak Rating		n	Would Buy	Probably Buy	Buy Only at Reduced Price	Would Not Buy at Any Price
Numeric	Semantic					
			Percent of Food Shoppers[1]			
9	Extremely Desirable	128	92.2	3.9	2.3	—
8	Very Desirable	519	70.3	25.2	2.9	—
7	Moderately Desirable	466	20.6	50.2	7.3	1.1
6	Slightly Desirable	164	3.1	25.6	24.4	4.9
5	Neither Desirable nor Undesirable	69	---	8.7	46.4	5.8
4	Slightly Undesirable	48	4.2	4.2	39.6	39.6
3	Moderately Undesirable	10	---	---	---	80.0
2	Very Undesirable	12	---	8.3	8.3	75.0
1	Extremely Undesirable	2	---	---	---	100.0

[1] Raw percentages which do not add to 100 percent are due to omission of shoppers who were "undecided"

Table 17. Mean Overall Desirability Rating of Loin Steaks by Marbling Level — San Francisco Bay Area, 1984

Leanness Level	USDA Quality Grade	Mean		Standard Error	
		Raw Score	Normalized Score	Raw Score	Normalized Score
		ratings[1]			
Slightly abundant	Low Prime	7.26[a][2]	7.28[a]	.08	.06
Moderate	High Choice	7.00[b]	7.00[b]	.09	.08
Modest	Medium Choice	6.98[b]	7.00[b]	.08	.08
Small	Low Choice	7.10[a]	7.07[b]	.08	.07
Upper slight	High Good	7.03[b]	7.04[b]	.08	.07
Lower slight	Low Good	6.94[bc]	6.92[bc]	.08	.07
Traces	Standard	6.75[c]	6.76[c]	.09	.07

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95 percent confidence level based on single-tail tests which compare adjacent sides of the distribution of the ratings.

Table 18. Purchase Intentions of Consumers as Related to Beef Loin Steak Ratings - San Francisco Bay Area, 1984

Steak Rating		n	Would Buy	Probably Buy	Buy Only at Reduced Price	Would Not Buy at Any Price
Numeric	Semantic					
			Percent of Food Shoppers[1]			
9	Extremely Desirable	113	86.7	11.5	1.8	---
8	Very Desirable	479	69.1	27.1	1.9	.2
7	Moderately Desirable	447	23.3	46.1	8.1	2.5
6	Slightly Desirable	172	6.4	27.9	20.9	7.0
5	Neither Desirable nor Undesirable	67	---	6.0	43.3	14.9
4	Slightly Undesirable	46	---	4.4	45.7	43.5
3	Moderately Undesirable	26	---	3.9	23.1	73.1
2	Very Undesirable	10	10.0	---	---	90.0
1	Extremely Undesirable	3	33.3	---	33.3	33.3

[1] Raw percentages which do not add to 100 percent are due to omission of shoppers who were "undecided"

levels than in either of the other three cities. Differences between Low Prime and the other steaks were clearly recognized, as well as the quality of Low Good and High Standard steaks compared with the others, Table 17. Ratings from the High Choice steaks down to the High Good grade were not significantly different. Industry sources report that considerable effort has been made in California during the last few years to promote lean beef. That program may affect California consumers' perceptions of leanness in beef.

Purchase intentions among the panelists again had the sharpest decline between the 7 and 6 average rating scores. An additional 35 percent of the San Francisco panelists dropped out of the category of willingness to buy the steak. Underscored again is the similarity in experience in this test and that of the national food marketing corporations, Table 18.

The Four-City Overview

As noted at the outset of this report, (review of previous research), a major problem encountered was lack of sufficient sample size to adequately separate the mean (average) ratings of the different leanness levels among the test steaks. Analyses of the city data sets also exhibited some degree of the same problem. Consequently, it is of special interest to examine the research from the combined four-city basis, (see Figure AIII-1). A chi-square analysis indicated no significant difference in the ratings distributions by grade among the three cities that received beef from the same supply.

The combined cities ratings analysis is based on over 8,000 observations from a panel of nearly 720 households. Ratings, using the normalized scores, ranged from an average of 7.24 for Low Prime loin steaks to 6.77 for High Standard grade steaks - a range of 0.47 rating points, Table 19. The shortness of this ratings range to a layman likely appears as insignificant. However, a test of the significant differences

among the means of the seven marbling levels reveals that each adjacent mean, except the Middle and Low Choice, is statistically significantly different from the others at the 95 percent confidence level. Differences among ratings are noted by the letter superscripts beside each means.

Of possible significance, or concern, is the finding that the average ratings of all marbling levels below Low Choice grade are below the critical rating level of 7.0, where consumer purchase resistance becomes substantial, Table 19. Purchase intentions of the panelists dropped 38 percent when the steak rating moved below a 7.0 rating, Table 20.

Differences in steak ratings exist by household income level, as noted in initial Houston tests. Consumers with under $15,000 annual income households show less rating differences among the grades of steaks than higher income consumers. Panelists in the above $50,000 income category were the most discriminating, Table 21. The high-low range in steak ratings by the top income consumers was nearly double that in the lowest income consumers. The comparatively smaller number of observations, when the sample is divided by income groups, reduces the ability to show significant differences among the rating means.

Effect of education did not appear to have a significant effect, except as reflected within the income effect above, Table 22.

It appears that the age of the panelist may have influenced the ratings of quality differences in the steaks. The high-low range in desirability ratings was largest for consumers under 30 years of age, Table 23.

Relationship Between Overall Desirability, and the Component Sensory Factors

Six different product attribute ratings were obtained from all participants for each steak. A high degree of similarity existed among the set of six ratings, Tables

24, 25, 26, 27 and 28.

A statistical test of the degree of relationship among the six evaluations was made by multiple correlation analysis. Overall desirability, tenderness desirability, juicyness desirability and flavor were jointly compared. The coefficient of determination (R^2) for Houston was 0.98, Philadelphia 0.97, Kansas City 0.99, and San Francisco 0.91, Tables 29, 30, 31 and 32. A value of 1.00 indicates perfect association in these three key ratings.

Ratings by Low, Medium and Heavy Steak Consumers

Product perceptions by light, medium and heavy users of a product is important to marketers. Therefore, steak ratings were examined by these three market segments, Table 33. The consumer panelists were grouped as to their frequency of serving of steaks in the previous three months. It ranged from zero, for a few panelists, to one steak a day at the other extreme. The consumers were grouped into three categories: 1 - 3 steaks per month; 4 - 6 steaks per month; and seven or more monthly. Light users discriminate most, finding four levels of quality difference among the steaks. Medium and heavy users found three levels of difference. The smaller sample size representing heavy users may possibly have influenced the results.

Expert Laboratory Panel Versus Shear Test Results

The consumers panel from the Bryan-College Station area involved twenty different panelists for each of twenty steak testing sessions. An 8-point laboratory panel scale was used. Ratings ranged from a high of 5.99 for Low Prime to a low of 5.47 for High Standard, Table 34. Three levels of significant differences in steak flavor were found, based on the Duncan's multiple range test. Tenderness evaluations

Table 19. Mean Overall Desirability Rating of Loin Steaks by Marbling Level, Normalized Data — Four Cities Combined

Marbling Level	USDA Quality Grade	Mean	Standard Error
		------ ratings[1] ------	
Slightly abundant	Low Prime	7.24[a2]	.03
Moderate	High Choice	7.15[b]	.03
Modest	Medium Choice	7.00[c]	.04
Small	Low Choice	7.05[c]	.03
Upper slight	High Good	6.90[d]	.04
Lower Slight	Low Good	6.81[de]	.04
Traces	High Standard	6.77[e]	.04

Total sample size: 720 households, comprising 1,145 panelists

1 Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

2 Means followed by same letter superscript are not significantly different by "z" tests at the 95% confidence level for paired comparisons that consider adjacent sides of the two rating distributions.

Table 20. Purchase Intentions of Consumers as Related to Beef Loin Steak Ratings - Four cities Combined[1]

Steak Rating		n	Would Buy	Probably Buy	Buy Only at Reduced Price	Would Not Buy at Any Price
Numeric	Semantic					
			- - - Percent of Food Shoppers[2] - - -			
9	Extremely Desirable	12	88.8	8.5	1.6	.5
8	Very Desirable	55	68.1	26.3	2.8	.3
7	Moderately Desirable	75	21.4	47.3	9.0	1.5
6	Slightly Desirable	165	4.7	25.7	24.8	7.1
5	Neither Desirable nor Undesirable	245	1.6	9.8	38.4	15.5
4	Slightly Undesirable	553	3.0	3.0	42.4	41.2
3	Moderately Undesirable	1497	4.0	2.7	20.0	68.0
2	Very Undesirable	1625	3.6	1.8	10.9	81.8
1	Extremely Undesirable	437	8.3	0	16.7	75.0

1 Includes three responses per panelist in Houston and eight responses per panelist in the other three cities

2 Raw percentages which do not add to 100 are due to those food shoppers who were "undecided" being omitted

Table 21. Mean Overall Desirability Ratings of Loin Steaks by Level of Income, Normalized Data -- Four Cities Combined

Marbling Level	USDA Quality Grade	Income Under $15,000		Income $15,000 - $24,999		Income $25,000 - $49,999		Income $50,000 & over	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		Ratings[1]							
Slightly Abundant	Low Prime	7.12[a2]	.09	7.21[a]	.09	7.22[a]	.05	7.30[a]	.08
Moderate	High Choice	7.08[a]	.08	7.25[a]	.07	7.12[ab]	.05	7.11[ab]	.10
Modest	Average Choice	6.93[ab]	.09	6.95[bc]	.09	7.02[bc]	.05	7.04[bc]	.09
Small	Low Choice	7.08[a]	.09	7.13[ab]	.07	7.01[bcd]	.06	7.03[bc]	.09
Upper Slight	High Good	6.82[b]	.07	6.96[bc]	.08	6.94[cd]	.06	6.86[cd]	.09
Lower Slight	Low Good	6.94[ab]	.09	6.56[d]	.10	6.90[d]	.05	6.87[cd]	.09
Traces	High Standard	6.81[b]	.10	6.84[c]	.08	6.76[e]	.06	6.73[d]	.10
Ratings Range		0.31		0.41		0.46		0.57	
Correlation and coefficient of determination:									
r		.7998		.79749		.9795		.9694	
r^2		.6396		.6360		.95949		.9397	
Number of Panelists:		162		209		487		208	

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95 percent confidence level

Table 22. Mean Overall Desirability Ratings of Loin Steaks by Level of Education Attended, Normalized Data -- Four Cities Combined

Marbling Level	USDA Quality Grade	Grammar and High School		Technical School		College or University	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		Ratings[1]					
Slightly Abundant	Low Prime	7.22[a][2]	.05	7.30[a]	.13	7.23[a]	.05
Moderate	High Choice	7.13[ab]	.05	7.17[ab]	.11	7.12[ab]	.05
Modest	Average Choice	7.01[c]	.05	6.88[bc]	.16	7.03[bc]	.05
Small	Low Choice	7.05[bc]	.05	7.23[a]	.13	7.06[b]	.05
Upper Slight	High Good	6.85[d]	.05	6.91[bc]	.13	6.94[c]	.05
Lower Slight	Low Good	6.83[d]	.06	7.08[ab]	.14	6.78[d]	.05
Traces	High Standard	6.79[d]	.06	6.62[c]	.17	6.76[d]	.06
Ratings Range		0.43		0.68		0.47	
Correlation and coefficient of determination:							
r		.96449		.7098		.9697	
r^2		.9303		.5039		.9404	
Number of Panelists:		454		71		587	

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95% confidence level

Table 23. Mean Overall Desirability Ratings of Loin Steaks by Age Level, Normalized Data -- Four Cities Combined

Marbling Level	USDA Quality Grade	Age - Under 30		Age - 30-49		Age - Over 50	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		Ratings[1]					
Slightly Abundant	Low Prime	7.20^{ab}[2]	.10	7.21^{a}	.05	7.25^{a}	.06
Moderate	High Choice	7.04^{bc}	.10	7.06^{b}	.06	7.23^{a}	.05
Modest	Average Choice	7.00^{bc}	.10	7.02^{b}	.06	7.02^{b}	.05
Small	Low Choice	7.41^{a}	.10	7.06^{b}	.06	6.97^{b}	.05
Upper Slight	High Good	6.88^{cd}	.13	6.88^{c}	.06	6.93^{b}	.05
Lower Slight	Low Good	6.97^{bc}	.10	6.86^{c}	.06	6.73^{c}	.06
Traces	High Standard	6.71^{d}	.10	6.83^{c}	.06	6.72^{c}	.06
Ratings Range		0.70		0.38		0.53	
Correlation and coefficient of determination:							
r		.5941		.9416		.9753	
r^2		.3530		.8867		.9512	
Number of Panelists:		144		414		489	

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95% confidence level

Table 24. Comparison Among Sensory Factor Ratings Associated With Overall Steak Ratings - Houston

Marbling Level	USDA Quality Grade	Overall Desirability		Juiciness		Juiciness Desirability		Tenderness		Tenderness Desirability		Flavor	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		---------- Ratings[1] ----------											
Slightly Abundant	Low Prime	7.17[a2]	.08	7.24	.07	7.33	.07	7.24	.07	7.25	.07	7.16	.08
Moderate	High Choice	7.13[a]	.07	7.15	.07	7.33	.06	7.09	.07	7.22	.07	7.28	.07
Modest	Average Choice	6.87[b]	.07	6.78	.07	6.99	.07	6.76	.07	6.85	.07	7.05	.06
Small	Low Choice	6.83[b]	.08	6.77	.07	7.02	.07	6.71	.07	6.83	.08	6.95	.07
Upper Slight	High Good	6.81[b]	.07	6.82	.07	7.02	.07	6.69	.07	6.84	.08	7.00	.07
Lower Slight	Low Good	6.82[b]	.07	6.74	.07	6.99	.07	6.74	.08	6.77	.08	6.92	.07
Traces	High Standard	6.78[b]	.08	6.66	.08	6.92	.08	6.67	.08	6.87	.08	6.90	.07

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95% confidence level

Table 25. Comparison Among Sensory Factor Ratings Associated With Overall Steak Ratings - Philadelphia

Marbling Level	USDA Quality Grade	Overall Desirability		Juiciness		Juiciness Desirability		Tenderness		Tenderness Desirability		Flavor	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		Ratings[1]											
Slightly Abundant	Low Prime	7.28[a][2]	.07	7.13	.07	7.27	.07	7.22	.07	7.24	.08	7.18	.08
Moderate	High Choice	7.26[a]	.07	6.95	.07	7.09	.07	7.14	.07	7.23	.07	7.20	.07
Modest	Average Choice	6.88[b]	.07	6.76	.07	6.87	.08	6.84	.08	6.77	.09	6.75	.08
Small	Low Choice	7.16[a]	.07	6.96	.07	7.09	.07	6.95	.08	6.96	.08	7.09	.07
Upper Slight	High Good	6.77[bc]	.08	6.72	.08	6.83	.08	6.78	.08	6.83	.08	6.80	.08
Lower Slight	Low Good	6.58[c*]	.09	6.45	.08	6.69	.09	6.53	.09	6.49	.10	6.58	.09
Traces	High Standard	6.68[c]	.08	6.48	.09	6.62	.09	6.62	.09	6.60	.09	6.59	.08

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95% confidence level

* Indicates significance at the 90% confidence level

Table 26. Comparison Among Sensory Factor Ratings Associated with Overall Steak Ratings - Kansas City

Marbling Level	USDA Quality Grade	Overall Desirability		Juiciness		Juiciness Desirability		Tenderness		Tenderness Desirability		Flavor	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		Ratings[1]											
Slightly Abundant	Low Prime	7.24[a][2]	.07	7.10	.06	7.20	.07	7.24	.06	7.08	.07	7.33	.06
Moderate	High Choice	7.20[a]	.07	7.06	.06	7.22	.06	7.03	.07	7.13	.07	7.15	.07
Modest	Average Choice	7.24[a]	.06	7.02	.06	7.21	.06	7.03	.07	7.12	.07	7.24	.06
Small	Low Choice	7.17[a]	.06	6.91	.06	7.06	.07	7.03	.07	7.10	.07	7.24	.06
Upper Slight	High Good	6.97[b]	.07	6.72	.07	6.93	.07	6.84	.07	6.93	.08	6.96	.07
Lower Slight	Low Good	6.91[b]	.07	6.58	.07	6.80	.08	6.72	.07	6.87	.08	6.98	.07
Traces	High Standard	6.85[b]	.08	6.65	.07	6.76	.08	6.71	.08	6.78	.09	6.86	.07

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95% confidence level

Table 27. Comparison Among Sensory Factor Ratings Associated With Overall Steak Ratings - San Francisco

Marbling Level	USDA Quality Grade	Overall Desirability		Juiciness		Juiciness Desirability		Tenderness		Tenderness Desirability		Flavor	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		Ratings[1]											
Slightly Abundant	Low Prime	7.28[a][2]	.06	7.30	.06	7.36	.06	7.27	.06	7.31	.07	7.17	.07
Moderate	High Choice	7.00[b]	.08	7.04	.07	7.18	.07	7.05	.07	7.12	.08	7.07	.08
Modest	Average Choice	7.00[b]	.08	7.02	.07	7.08	.07	7.02	.08	7.07	.08	6.97	.08
Small	Low Choice	7.07[b]	.07	6.92	.08	7.08	.08	6.92	.07	7.02	.07	7.10	.07
Upper Slight	High Good	7.04[b]	.07	6.95	.07	7.05	.06	6.90	.06	7.00	.07	7.00	.07
Lower Slight	Low Good	6.92[bc]	.07	6.80	.07	6.97	.07	6.76	.08	6.90	.08	6.89	.07
Traces	High Standard	6.76[c]	.07	6.72	.07	6.80	.08	6.69	.07	6.77	.07	6.74	.08

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95% confidence level

Table 28. Comparison Among Sensory Factor Ratings Associated With Overall Steak Ratings - Four City Combined

Marbling Level	USDA Quality Grade	Overall Desirability		Juiciness		Juiciness Desirability		Tenderness		Tenderness Desirability		Flavor	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		- - - - - - - - - - - - Ratings[1] - - - - - - - - - - - -											
Slightly Abundant	Low Prime	7.24[a2]	.03	7.20	.03	7.29	.03	7.24	.03	7.24	.04	7.21	.04
Moderate	High Choice	7.15[b]	.03	7.05	.03	7.21	.03	7.08	.04	7.18	.04	7.18	.04
Modest	Average Choice	7.00[c]	.04	6.89	.03	7.04	.04	6.91	.04	6.96	.04	7.01	.04
Small	Low Choice	7.05[c]	.03	6.89	.03	7.06	.04	6.90	.04	6.97	.04	7.09	.03
Upper Slight	High Good	6.90[d]	.04	6.81	.04	6.96	.04	6.80	.04	6.90	.04	6.94	.04
Lower Slight	Low Good	6.81[de]	.04	6.65	.04	6.87	.04	6.69	.04	6.76	.04	6.85	.04
Traces	High Standard	6.77[e]	.04	6.63	.04	6.78	.04	6.67	.04	6.76	.04	6.78	.04

[1] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[2] Means followed by same letter superscript are not significantly different at the 95% confidence level

found five levels of differentiation, but considerable overlapping, Table 38. The mean shear test values found three classifications, Table 39.

Profile of Consumer's Food Selection Criteria

The majority of the three-city test panel selected foods primarily on the basis of what they like to eat, Table 40. However, 44 percent replied positively when asked if they felt it was important to avoid animal fats. That reflects consumer concerns from the adverse nutritional publicity regarding animal fats. Nonetheless, when these same panelists rated the beef top loin steaks, they too found eating quality differences among the U.S.. Prime down the Standard grade steaks. Small differences, if any, were noted between the Choice and Good grades. Therefore, these consumers are a market segment toward which "leaner" beef marketing should be targeted. However, both the Low Good and Standard grades were rated below the critical rating of seven, which suggests desirable eating qualities in steaks are less certain within those lower grade levels.

As found in previous consumer beef research, most shoppers have a preference for outside fat thickness on steaks to be 3/8 inch to 1/4 inch or less on loin and round steaks.

Conclusions

What beef consumers are saying to beef producers and marketers in this four-city research may be briefly summarized in the following statements.

1. For the majority of consumers beef eating quality, or palatability, is positively associated with increases in beef marbling. That is, the higher the beef grade, in the High Standard to Low Prime grade range, the higher the consumer rates the eating quality of the beef.

2. There is a group os consumers that rate Good grade beef as being equal to Choice grade beef. These consumers are a separate segment of the market.

3. Beef retailing demand should profit from making the U.S. Choice and a leaner grade (U.S. Good) both available generally to consumers in the retail stores.

4. Between one-third and one-half of the beef consumers report that animal fat consumption is a consieration in their food buying selections.

5. Outside fat thickness of T-bone steaks is preferred to be from 1/4 and 3/8 of an inch. For oin and round steaks, a 1/4 inch or less is desired.

6. It is clear that the mixed signals from some of the previous consumer panel tests of beef are the result of research that has used inadvertently too small a test panel to adequately separate significant quality differences among beef grades.

7. There may be some differences in regional preferences among beef marbling levels, since the Houston and San Francisco markets showed somewhat more acceptance of the High Good grade. One national meat products firm, however, reports that these city differences from panel tests may or may not prove to be of substantial importance to product marketing.

8. It is recommended that a series of retail store tests be conducted to test the strategy of marketing two grades of beef.

Table 29. Correlation Among Sensory Test Factors in Beef Leanness Ratings by Houston Panel

HOUSTON - TOTAL PANELISTS 14:39 TUESDAY, APRIL 1, 1986 1
OD MEANS=JUICINESS DESIRABILITY, TENDERNESS DESIRABILITY AND FLAVOR MEANS

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: OD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	3	0.15500261	0.05166754	41.13	0.0062	0.976263	0.5125
ERROR	3	0.00376882	0.00125627		ROOT MSE		OD MEAN
CORRECTED TOTAL	6	0.15877143			0.03544393		6.91571429

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
JUICYDES	1	0.15303028	121.81	0.0016	1	0.00351683	2.80	0.1929
TENDRDES	1	0.00190596	1.52	0.3058	1	0.00180988	1.44	0.3162
FLAVOR	1	0.00006637	0.05	0.8330	1	0.00006637	0.05	0.8330

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	0.45328526	0.56	0.6144	0.80913863
JUICYDES	0.55963192	1.67	0.1929	0.33447904
TENDRDES	0.29785878	1.20	0.3162	0.24815775
FLAVOR	0.06078740	0.23	0.8330	0.26446193

Table 30. Correlation Among Sensory Test Factors in Beef Leanness Ratings by Philadelphia Panel

PHILADELPHIA - TOTAL PANELISTS 15:23 TUESDAY, APRIL 1, 1986 1
OD MEANS=JUICINESS DESIRABILITY, TENDERNESS DESIRABILITY AND FLAVOR MEANS

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: OD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	3	0.48013581	0.16004527	30.32	0.0096	0.968072	1.0462
ERROR	3	0.01583562	0.00527854		ROOT MSE		OD MEAN
CORRECTED TOTAL	6	0.49597143			0.07265355		6.94428571

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
JUICYDES	1	0.45471878	86.14	0.0026	1	0.00160047	0.30	0.6202
TENDRDES	1	0.01693279	3.21	0.1712	1	0.00049006	0.09	0.7805
FLAVOR	1	0.00848424	1.61	0.2943	1	0.00848424	1.61	0.2943

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-0.52314828	-0.56	0.6154	0.93644363
JUICYDES	0.24350793	0.55	0.6202	0.44222752
TENDRDES	0.13001598	0.30	0.7805	0.42670458
FLAVOR	0.71005831	1.27	0.2943	0.56007270

Table 31. Correlation Among Sensory Test Factors in Beef Leanness Ratings by Kansas City Panel

KANSAS CITY - TOTAL PANELISTS 14:29 TUESDAY, APRIL 1, 1986 1
OD MEANS=JUICINESS DESIRABILITY, TENDERNESS DESIRABILITY AND FLAVOR MEANS

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: OD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	3	0.16667086	0.05555695	191.14	0.0006	0.994795	0.2407
ERROR	3	0.00087199	0.00029066		ROOT MSE		OD MEAN
CORRECTED TOTAL	6	0.16754286			0.01704888		7.08285714

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
JUICYDES	1	0.16050209	552.19	0.0002	1	0.00260467	8.96	0.0580
TENDRDES	1	0.00461153	15.87	0.0283	1	0.00000871	0.03	0.8736
FLAVOR	1	0.00155725	5.36	0.1036	1	0.00155725	5.36	0.1036

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	0.72122811	1.44	0.2444	0.49932019
JUICYDES	0.54710292	2.99	0.0580	0.18276297
TENDRDES	-0.06712231	-0.17	0.8736	0.38774679
FLAVOR	0.42044330	2.31	0.1036	0.18164557

Table 32. Correlation Among Sensory Test Factors in Beef Leanness Ratings by San Francisco Panel.

SAN FRANCISCO - TOTAL PANELISTS 15:24 TUESDAY, APRIL 1, 1986 1
OD MEANS=JUICINESS DESIRABILITY, TENDERNESS DESIRABILITY
AND FLAVOR MEANS

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: OD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	3	0.13498564	0.04499521	10.22	0.0440	0.910834	0.9468
ERROR	3	0.01321436	0.00440479		ROOT MSE		OD MEAN
CORRECTED TOTAL	6	0.14820000			0.06636856		7.01000000

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
JUICYDES	1	0.13138482	29.83	0.0121	1	0.00003493	0.01	0.9346
TENDRDES	1	0.00007722	0.02	0.9030	1	0.00021677	0.05	0.8387
FLAVOR	1	0.00352360	0.80	0.4370	1	0.00352360	0.80	0.4370

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	0.15338407	0.11	0.9226	1.45264770
JUICYDES	0.14679940	0.09	0.9346	1.64837672
TENDRDES	0.32287429	0.22	0.8387	1.45543131
FLAVOR	0.50765466	0.89	0.4370	0.56759366

Table 33. Mean Ratings of Beef Loin Steaks by Level of Consumer Usage - Three Cities Combined[1]

Marbling Level	USDA Quality Grade	Light Users (1-3 steaks / month)		Medium Users (4-6 steaks / month)		Heavy Users (7 + steaks / month)	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
		Ratings[2]					
Slightly Abundant	Low Prime	7.28[a3]	.07	7.31[a]	.08	7.29[a]	.07
Moderate	High Choice	7.24[ab]	.08	7.20[ab]	.07	7.10[bc]	.09
Modest	Average Choice	7.11[b]	.07	7.07[bc]	.08	7.02[bc]	.10
Small	Low Choice	7.10[b]	.08	7.20[ab]	.07	7.08[bc]	.10
Upper Slight	High Good	6.76[c]	.09	7.03[bc]	.08	7.14[ab]	.09
Lower Slight	Low Good	6.65[c]	.09	6.95[c]	.08	6.89[c]	.10
Traces	High Standard	6.71[c]	.09	6.69[d]	.08	7.07[bc]	.10
Ratings Range		0.63		0.62		0.40	
Correlation and Coefficient of Determination							
r		.9458		.9043		.6124	
r^2		.8946		.8177		.3750	
Number of Panelists		263		279		162	

[1] Three Cities include Philadelphia, Kansas City and San Francisco, panelists who rated all 7 steaks

[2] Based on nine-point, five centered, hedonic scale with 9.0 as highest rating

[3] Means followed by same letter superscript are not significantly different at the 95 percent confidence level

Table 34. Overall Flavor Values for Strip Loin Steaks Evaluated by a Trained Sensory Panel, Three-City Beef Supply Sample

USDA Grade	Mean	Significance Tests		Standard Error	Percentage of Steaks Scored	
		Duncans	"z"		≤ 4	≥ 6
Low Prime	5.99	A	A	.05	14.17	69.55
High Choice	5.93	A	AB	.05	15.04	69.11
Average Choice	5.88	A	B	.04	13.62	67.78
Low Choice	5.68	B	C	.05	16.84	60.35
High Good	5.54	C	D	.05	18.09	63.62
Low Good	5.52	C	D	.04	17.24	51.83
High Standard	5.47	C	D	.05	20.59	50.91

[1] Based on eight point scale with eight being extremely flavorful and one being extremely unflavorful

[2] Duncans multiple range (two-tail) test at 95% probability and "z" single-tail test at same confidence level

Table 35. Juiciness Values for Strip Loin Steaks Evaluated by a Trained Sensory Panel, Three-City Beef Supply Sample

USDA Grade	Mean	Significance Tests		Standard Error	Percentage of Steaks Scored	
		Duncans	"z"		≤ 4	≥ 6
Low Prime	5.63	A	A	.08	16.99	56.58
High Choice	5.52	AB	AB	.09	22.26	52.03
Average Choice	5.34	BC	B	.10	26.61	48.13
Low Choice	5.10	CD	C	.09	30.02	39.35
High Good	4.87	DE	D	.09	37.81	32.11
Low Good	4.83	E	D	.10	40.57	31.34
High Standard	4.75	E	D	.09	39.66	28.60

[1] Based on eight point scale with eight being extremely juicy and one being extremely dry

[2] Duncans multiple range (two-tail) test at 95% probability and "z" single-tail test at same confidence level

Table 36. Mean Connective Tissue for Strip Loin Steaks Evaluated by a Trained Sensory Panel

USDA Grade	Mean	Signficance Tests		Standard Error	Percentage of Steaks Scored	
		Duncans	"z"		≤ 4	≥ 6
Low Prime	6.52	A	A	.06	6.33	81.31
High Choice	6.47	A	A	.06	6.40	79.88
Average Choice	6.50	A	A	.06	6.65	80.77
Low Choice	6.46	A	A	.06	6.29	80.43
High Good	6.47	A	A	.07	8.23	80.18
Low Good	6.42	A	A	.07	9.94	78.20
High Standard	6.39	A	A	.07	10.35	77.99

[1] Based on eight point scale with eight being none and one being abundant

[2] Duncans multiple range (two-tail) test at 95% probability and "z" single-tail test at same confidence level

Table 37. Mean Muscle Fiber Tenderness for Strip Loin Steaks Evaluated by a Trained Sensory Panel

USDA Grade	Mean	Significance Tests		Standard Error	Percentage of Steaks Scored	
		Duncans	"z"		≤ 4	≥ 6
Low Prime	6.51	A	A	.08	7.24	80.80
High Choice	6.36	AB	A	.08	8.64	77.95
Average Choice	6.33	AB	A	.08	10.19	77.86
Low Choice	6.14	BC	B	.08	11.25	73.73
High Good	6.02	CD	BC	.09	14.53	70.12
Low Good	5.88	D	CD	.09	18.56	65.21
High Standard	5.79	D	D	.10	20.89	61.87

[1] Based on eight point scale with eight being extremely tender and one being extremely tough

[2] Duncans multiple range (two-tail) test at 95% probability and "z" single-tail test at same confidence level

Table 38. Mean Overall Tenderness for Strip Loin Steaks Evaluated by a Trained Sensory Panel

USDA Grade	Mean	Significance Tests		Standard Error	Percentage of Steaks Scored	
		Duncans	"z"		≤ 4	≥ 6
Low Prime	6.27	A	A	.08	9.45	73.67
High Choice	6.11	AB	AB	.08	11.79	71.55
Average Choice	6.05	AB	BC	.08	13.31	69.34
Low Choice	5.89	BC	CD	.08	15.52	67.24
High Good	5.79	CD	DE	.10	18.09	63.62
Low Good	5.65	CD	E	.10	22.31	58.42
High Standard	5.56	D	E	.11	23.63	54.97

[1] Based on eight point scale with eight being extremely tender and one being extremely tough

[2] Duncans multiple range (two-tail) test at 95% probability and "z" single-tail test at same confidence level

Table 39. Mean Shear Force Values (KG) for Strip Loin Steaks Evaluated by a Trained Sensory Panel

USDA Grade	Mean	Significance Tests		Standard Error	Percentage of Steaks			
		Duncans	"z"		0 - 2.99 kg	3.0 - 3.99 kg	4.0 - 4.99 kg	≥ 5.00 kg
Low Prime	3.06	A	A	.08	53.93	34.83	8.99	2.25
High Choice	3.25	AB	B	.07	39.33	47.19	13.48	---
Average Choice	3.29	B	BC	.07	31.11	54.44	12.22	2.22
Low Choice	3.42	B	C	.06	31.46	50.56	16.85	1.12
High Good	3.68	C	D	.06	11.36	60.22	26.14	2.27
Low Good	3.78	C	D	.08	13.95	51.16	31.40	3.49
High Standard	3.94	C	D	.16	15.39	49.45	24.18	10.99

[1] Duncans multiple range (two-tail) test at 95% probability and "z" single-tail test at same confidence level

Table 40. Replies to Food Selection Factors, Three City Panel

Question	Reply		
	Important	Medium Importance	Low Importance
Select only foods really like	69.9	25.0	5.1
Select foods mostly for nutrition content	60.4	30.7	8.9
Select foods to avoid fats and oils	37.4	37.4	15.2
Avoid animal fats	44.3	35.9	19.7
Avoid vegetable fats	17.2	25.9	56.9

n = 720 panelists

Table 41. Average Ratings of Beef Grades by Panelists Desiring to Avoid Animal Fats, Three-City

Grade	Mean[1]	Standard Error
Low Prime	7.43[a]	.07
High Choice	7.15[b]	.08
Average Choice	7.04[b]	.07
Low Choice	7.12[b]	.08
High Good	7.11[b]	.07
Low Good	6.81[c]	.08
Standard	6.86[c]	.08

n = 280

[1] Means with the same letter designation are not significantly different

A P P E N D I X I

Normalization of Ratings

The Likert scale was used to measure rating differences among the beef grades, not people response differences to the scale, (Tull and Hawkins, Menezes and Elbert). Ratings normalization seeks to eliminate the latter effect. Normalized scores were determined by expressing each panelist's steak ratings in relation to their ratings average over all of the steaks in the test set, and that in turn to the grand mean of all ratings by all panelists. Normalized ratings are determined by the following series of equations.

The first equation computes the grand mean of all panelists ratings over all seven beef grades.

$$\bar{G}_{xp} = \sum_{i=1}^{n} R_n \; / \; NP$$

Where: $\bar{G}_{xp}$ = grand mean over all panelists and products

$\sum_{i=1}^{n} R_n$ = summation of ratings of all products by all panelists

N = number of panelists

P = number of kinds of the product (beef grades) tested

The second equation computes the mean rating over all products (beef grades) for each panel member.

$$I_{j\bar{x}} = \frac{\sum_{i=1}^{n} R_{jn}}{n}$$

Where: $I_{j\bar{x}}$ = panelists j's average rating over all products

R_j = individual product ratings by j

n = number of products rated by j

The final equation provides the set of normalized ratings when applied to each successive product's ratings by each successive panelist.

$$NOD_{jk} = G_{\bar{x}\bar{p}} - I_{j\bar{x}} + R_{jk}$$

Where: R_{jk} = rating by panelist "j" of product "k"

NOD_{jk} = normalized rating by panelist "j" of product "k"

REGRESSION: FOUR CITY MEAN RATINGS OF BEEF GRADES

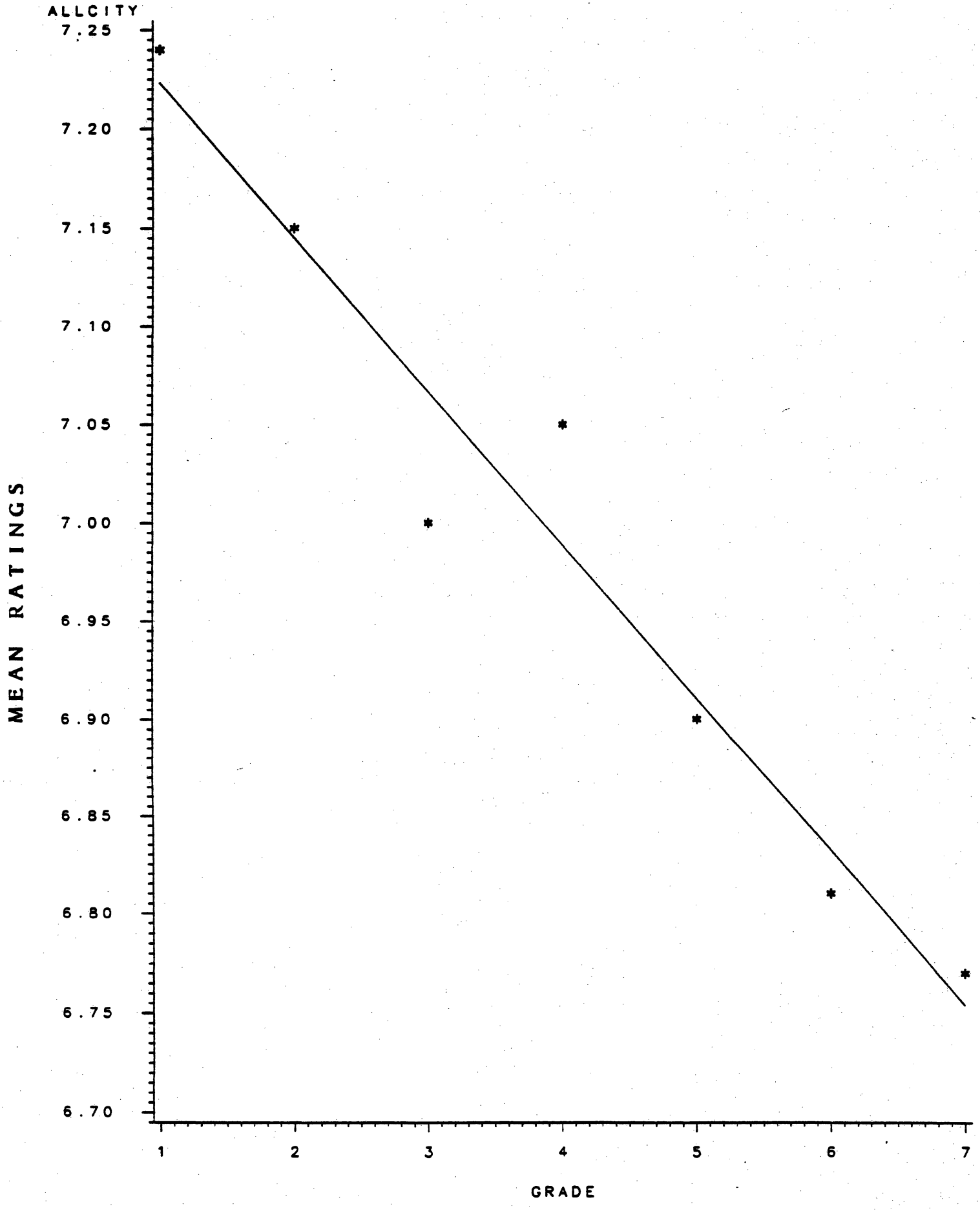


FIGURE A1-2

DEP VARIABLE: ALLCITY

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	1	0.171289	0.171289	91.146	0.0002
ERROR	5	0.009396429	0.001879286		
C TOTAL	6	0.180686			

ROOT MSE	0.043351	R-SQUARE	0.9480
DEP MEAN	6.988571	ADJ R-SQ	0.9376
C.V.	0.6203089		

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
INTERCEP	1	7.301429	0.036638	199.285	0.0001
GRADE	1	-0.078214	0.008192518	-9.547	0.0002

REGRESSION: HOUSTON MEAN RATINGS OF BEEF GRADES

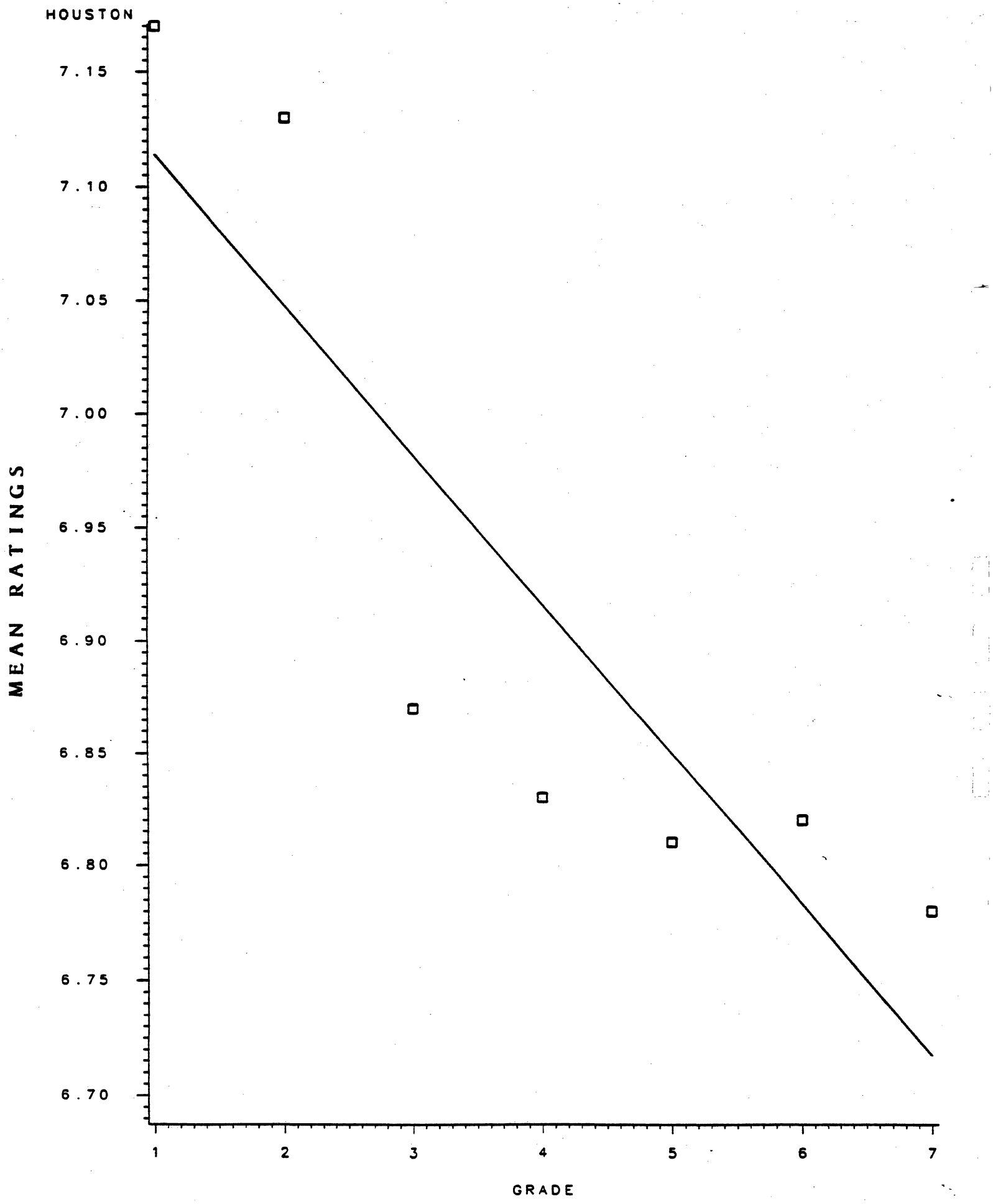


FIGURE A1-3

DEP VARIABLE: HOUSTON

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	1	0.122232	0.122232	16.726	0.0094
ERROR	5	0.036539	0.007307857		
C TOTAL	6	0.158771			

ROOT MSE	0.085486	R-SQUARE	0.7699
DEP MEAN	6.915714	ADJ R-SQ	0.7238
C.V.	1.236112		

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
INTERCEP	1	7.180000	0.072249	99.379	0.0001
GRADE	1	-0.066071	0.016155	-4.090	0.0094

REGRESSION: PHILADELPHIA MEAN RATINGS OF BEEF GRADES

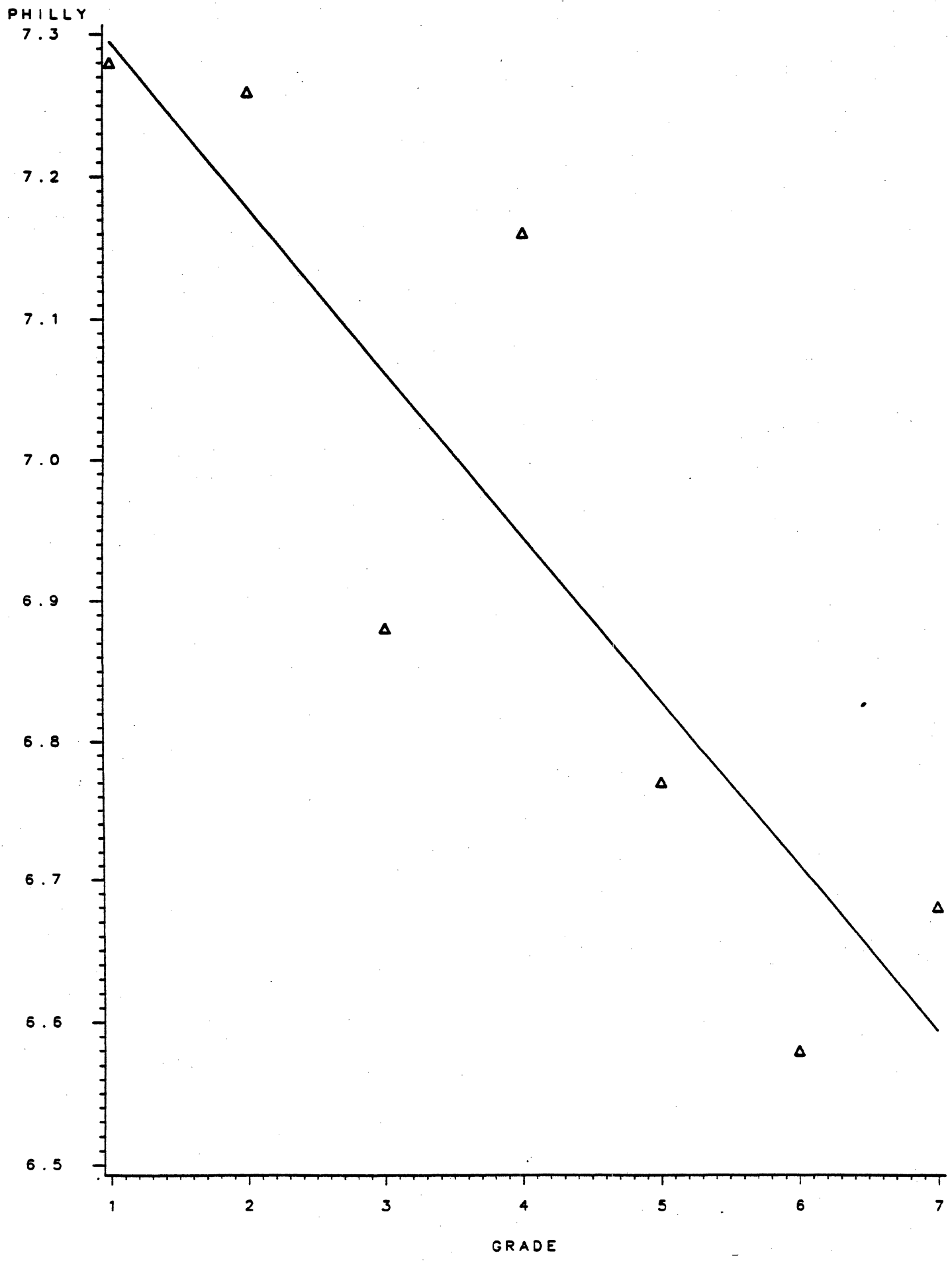


FIGURE A1-4

DEP VARIABLE: PHILLY

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	1	0.381889	0.381889	16.737	0.0094
ERROR	5	0.114082	0.022816		
C TOTAL	6	0.495971			

ROOT MSE	0.151051	R-SQUARE	0.7700
DEP MEAN	6.944286	ADJ R-SQ	0.7240
C.V.	2.175185		

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
INTERCEP	1	7.411429	0.127661	58.055	0.0001
GRADE	1	-0.116786	0.028546	-4.091	0.0094

REGRESSION: KANSAS CITY MEAN RATINGS OF BEEF GRADES

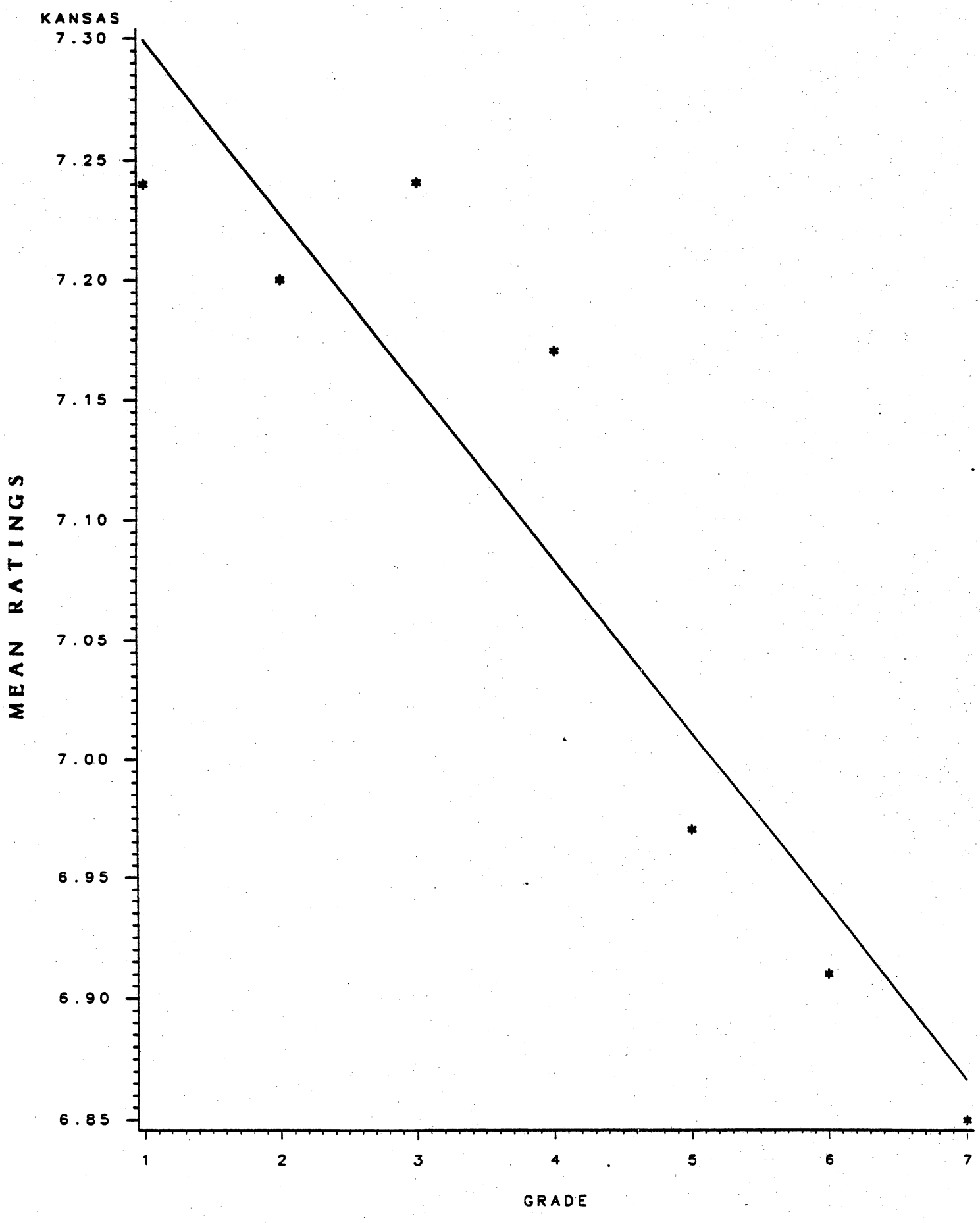


FIGURE A1-5

DEP VARIABLE: KANSAS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	1	0.145729	0.145729	33.402	0.0022
ERROR	5	0.021814	0.004362857		
C TOTAL	6	0.167543			

ROOT MSE	0.066052	R-SQUARE	0.8698
DEP MEAN	7.082857	ADJ R-SQ	0.8438
C.V.	0.9325605		

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
INTERCEP	1	7.371429	0.055824	132.047	0.0001
GRADE	1	-0.072143	0.012483	-5.779	0.0022

REGRESSION: SAN FRANCISCO MEAN RATINGS OF BEEF GRADES

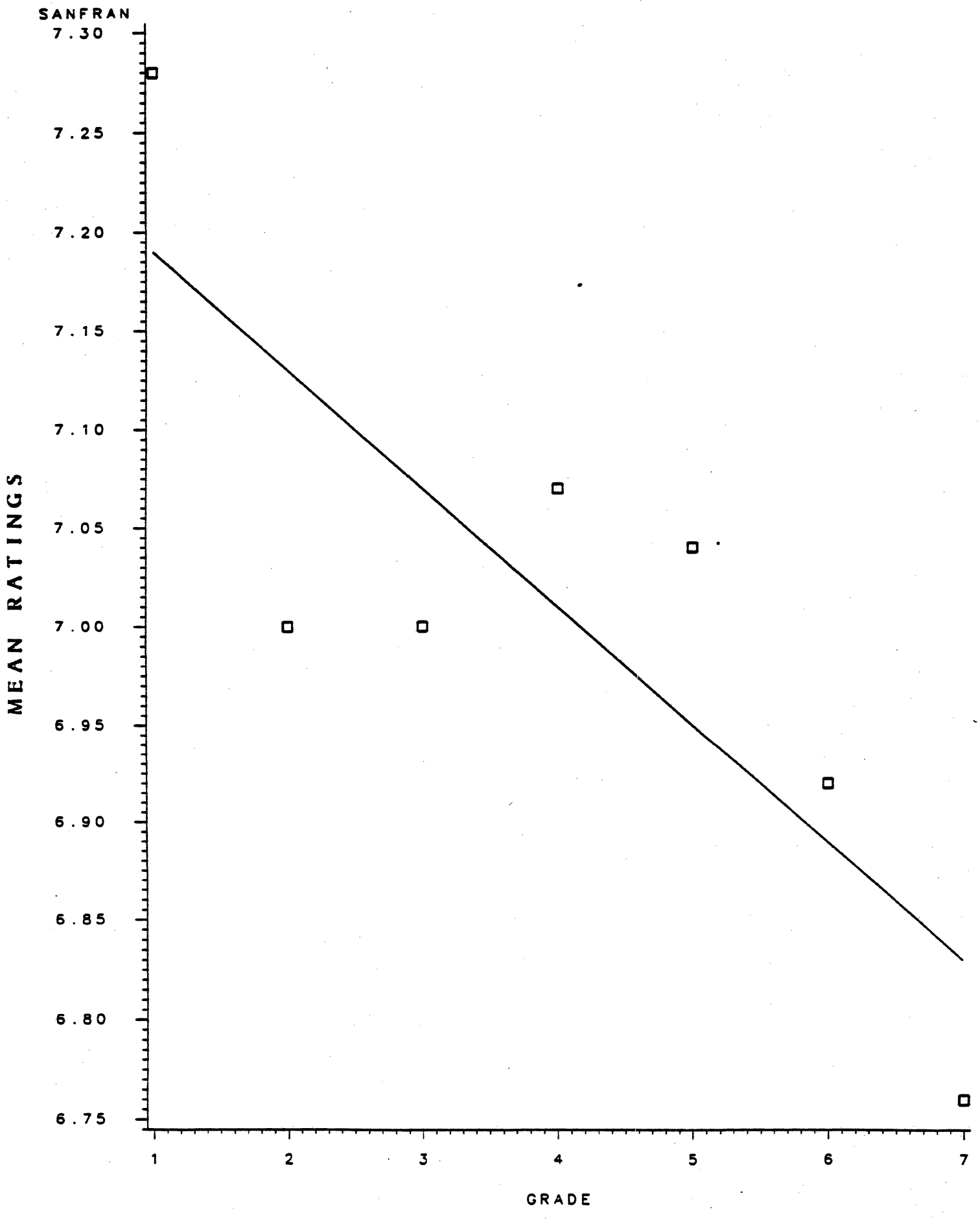


FIGURE A1-6

DEP VARIABLE: SANFRAN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	1	0.100800	0.100800	10.633	0.0224
ERROR	5	0.047400	0.00948		
C TOTAL	6	0.148200			

ROOT MSE	0.097365	R-SQUARE	0.6802
DEP MEAN	7.010000	ADJ R-SQ	0.6162
C.V.	1.388949		

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
INTERCEP	1	7.250000	0.082289	88.104	0.0001
GRADE	1	-0.060000	0.018400	-3.261	0.0224

A P P E N D I X I I

TEXAS A&M UNIVERSITY

COLLEGE OF AGRICULTURE

COLLEGE STATION, TEXAS 77843-2124

Texas Agricultural Market Research and Development Center

City Philadelphia

Beef Study 0191
Form A (2 Pages)

TEXAS A&M UNIVERSITY

BEEF STEAK COOKING AND RATING INSTRUCTIONS

STORING INSTRUCTIONS

The sirloin steak you have received was frozen to protect its freshness. Keep it in the freezer until the day before you wish to cook it. Put it in the refrigerator section one day before you cook it so that it will be fully thawed and ready for cooking.

COOKING INSTRUCTIONS

Cook this steak the same way you usually cook sirloin steaks. If two adults are sharing this steak and like different degrees of doneness, cut the steak in half before cooking according to the attached instruction sheet. Most people broil steaks on a grill or in the broiler section of the stove, but use the cooking method you prefer. The meat must be served as a steak, and not used in any type of meat dish such as a casserole or stew. Cook the steak to the level of doneness that you like for your steaks.

SERVING INSTRUCTIONS

THE SAME ADULTS MUST EAT AND RATE THE STEAK EACH WEEK. Each adult should eat a serving of the steak and, at the same time, fill out the rating form. If there is one adult in the household, then that adult should eat the steak and complete the rating form. Do not ask children to eat and rate the steak.

The steak should be served while it is still warm.

FILLING OUT THE RATING FORM

Please fill out the steak rating forms as you are eating the meat. Also, complete the form on the method of cooking.

****
* Keep this set of instructions and the rating forms. The rating form *
* for each steak will be picked up by the JJ&L Research delivery per- *
* son when the steak for the next week is brought to you. *
****

If you have any questions about these instructions or the rating forms, call:

Dina Britton
JJ&L Research Co.
2383 Cottman Ave.
Philadelphia, PA 19149
(215) 332-7040

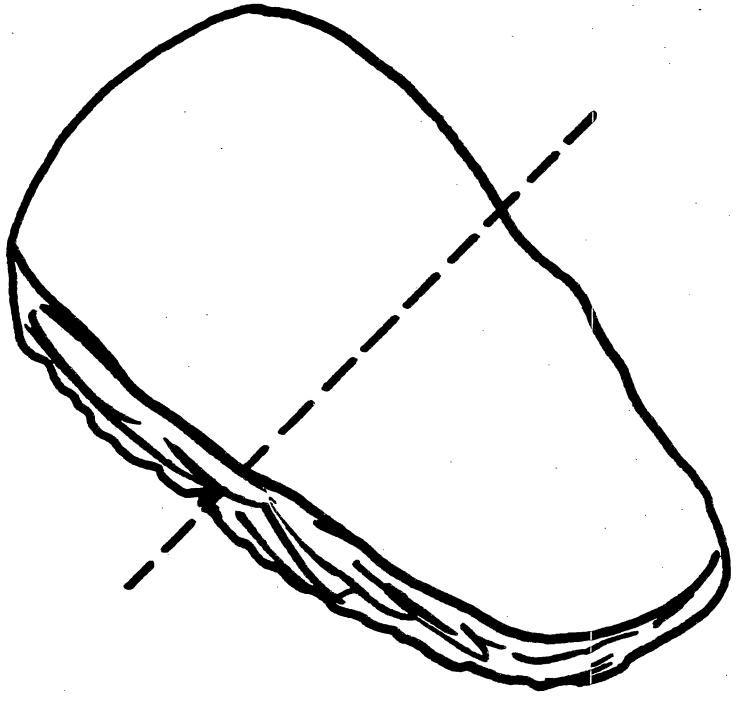
- or -

Lorraine Weisman
JJ&L Research Co.
2383 Cottman Ave.
Philadelphia, PA 19149
(215) 332-7040

****
* ONLY TO BE USED IF YOU NEED TO COOK TWO PARTS *
* OF THE STEAK TO DIFFERENT LEVELS OF DONENESS. *
****

INSTRUCTIONS FOR DIVIDING STEAK INTO TWO PIECES

If two persons will be rating the steak, and if each person likes a different degree of steak doneness, then the steak should be cut in half across the narrow width of the steak before cooking.



FOR TWO SMALLER STEAKS, CUT STEAK AS DOTTED LINE INDICATES.

USE THE SAME COOKING METHOD FOR EACH OF THE SMALL STEAKS

COOK THE SMALL STEAK TO THE DEGREE OF DONENESS PREFERRED BY THE PERSON WHO WILL EAT AND RATE THE STEAK.

To be filled in by the field person delivering the steak:

City

Household Number

Week Number

Steak Number

Delivery Date

Beef Study 0191
Form B (1 Page)

Field Representative _____

* * * * * * * * * * * * * * * * *

METHOD OF COOKING AND
ESTIMATED STEAK DONENESS

Panelist's first Name _____

To be completed by panelist who cooks the steak:

Cooked by (method):

_____ Broiling on a grill in the house

_____ Broiling on a charcoal grill outside

_____ Cooked in broiler section of kitchen oven

_____ Pan broiled or fried in skillet on top of the stove

Degree of doneness: (Refer to Beef Steak Color Guide)

_____ Very Rare (Mostly red inside color)

_____ Rare (Very pink inside color)

_____ Medium Rare (Considerable pink inside color)

_____ Medium (Moderately pink inside color)

_____ Well done (Slightly pink inside color)

_____ Very well done (No pink inside color)

City Kansas City

Household Number _____

Week Number _____

Male _____

Female _____

Panelist's First Name _____

Market Research Center
Texas A&M University
College Station, Texas

Beef Study 0191
Form C
Field Representative _____

Make your judgement of this steak on its eating quality only and not on steak size or thickness.

Steak Rating Report

Do not let ratings given the product by any other member of the family (or household) influence your own ratings.

OVERALL DESIRABILITY

(Considering the total qualities of this steak, how would you rate your satisfaction with it?)

_____ 9 Extremely desirable
_____ 8 Very desirable
_____ 7 Moderately desirable
_____ 6 Slightly desirable
_____ 5 Neither desirable nor undesirable
_____ 4 Slightly undesirable
_____ 3 Moderately undesirable
_____ 2 Very undesirable
_____ 1 Extremely undesirable

JUICYNESS

(The amount of juicyness noticed during the first three or four chews on a bite of the steak.)

_____ 9 Extremely juicy
_____ 8 Very juicy
_____ 7 Moderately juicy
_____ 6 Slightly juicy
_____ 5 Neither juicy nor dry
_____ 4 Slightly dry
_____ 3 Moderately dry
_____ 2 Very dry
_____ 1 Extremely dry

JUICYNESS DESIRABILITY

(The purpose of this rating is to show how well the juicyness of this steak suits your own preferences.)

_____ 9 Extremely desirable
_____ 8 Very desirable
_____ 7 Moderately desirable
_____ 6 Slightly desirable
_____ 5 Neither desirable nor undesirable
_____ 4 Slightly undesirable
_____ 3 Moderately undesirable
_____ 2 Very undesirable
_____ 1 Extremely undesirable

PLACE A CHECKMARK BY THE RATING YOU SELECT.

City _____

Household Number _____

Week Number _____

Market Research Center
Texas A&M University
College Station, Texas

Beef Study 0191

Form C

TENDERNESS

(The purpose of this rating is to determine how tender you feel this steak is.)

_____ 9 Extremely tender
_____ 8 Very tender
_____ 7 Moderately tender
_____ 6 Slightly tender
_____ 5 Neither tender nor tough
_____ 4 Slightly tough
_____ 3 Moderately tough
_____ 2 Very tough
_____ 1 Extremely tough

TENDERNESS DESIRABILITY

(This rating is to show how well the tenderness of this steak meets with your satisfaction. For example, your may like your steak either very tender, moderately tender or somewhat chewy.)

_____ 9 Extremely desirable
_____ 8 Very desirable
_____ 7 Moderately desirable
_____ 6 Slightly desirable
_____ 5 Neither desirable nor undesirable
_____ 4 Slightly undesirable
_____ 3 Moderately undesirable
_____ 2 Very undesirable
_____ 1 Extremely undesirable

FLAVOR DESIRABILITY

(Indicate your opinion of the desirability of this steak's flavor.)

_____ 9 Extremely desirable
_____ 8 Very desirable
_____ 7 Moderately desirable
_____ 6 Slightly desirable
_____ 5 Neither desirable nor undesirable
_____ 4 Slightly undesirable
_____ 3 Moderately undesirab
_____ 2 Very undesirable
_____ 1 Extremely undesirabl

Thank You For Rating This Steak.

KEEP THIS RATING FORM UNTIL THE NEXT STEAK IS DELIVERED.

GIVE IT TO PERSON DELIVERING THE STEAK.

City _____

Household Number _____

Week Number _____

Steak Number _____

Delivery Date _____

Field Representative _____

Panelist's First Name _____

Sex _____

Market Research Center
Texas A&M University
College Station, Texas

Beef Study 0191

Form D

TO BE FILLED OUT BY THE PERSON WHO BUYS MEAT FOR THE HOUSEHOLD

Please answer the following questions about the steak you have just eaten. This information will help us to tell the beef industry what kind of beef consumers really want to buy.

WE ARE NOT GOING TO BE SELLING ANY STEAKS

We simply want to find out what kind of meat you are most interested in purchasing. Think only of the eating quality of this steak. Do not consider size, thickness, or any other factor. Consider eating quality only.

1. Thinking only of the steak you have just eaten, what would youmost likely do if you had the opportunity to purchase a steak of the same quality in your store?

CHECK THE LINE THAT CORRESPONDS TO YOUR ACTIONS:

a. Would buy _____
b. Would probably buy _____
c. Somewhat undecided _____
d. Would buy only at reduced price _____
e. Would not buy at any price _____

2. If you needed to buy a steak at the store for your household, what price difference if any, would you be willing to pay for a steak of the same overall desirability as the one you have just eaten? (CHECK ONLY ONE)

Would pay an added price of:
- +30¢ per pound . . . . . _____
- +15¢ per pound . . . . . _____

Would buy only at the regular price . . . . . _____

Would buy only if price were reduced by:
- -15¢ per pound . . . . . _____
- -30¢ per pound . . . . . _____
- -45¢ per pound . . . . . _____
- -60¢ per pound . . . . . _____
- -75¢ per pound . . . . . _____

Would not buy at any price . . . . . _____

City San Francisco Bay Area

Household Number _____

Panelist's First Name _____

Beef Study 0191

Form E

TEXAS A&M BEEF STUDY

SAN FRANCISCO BAY AREA HOUSEHOLD PANEL

TO BE ANSWERED BY FOOD BUYER ONLY

PLACE IN ENVELOPE AND SEAL THE ENVELOPE

This information, like all of the rest, is entirely confidential. Its only purpose is to help us determine the representativeness of our San Francisco Bay Area sample in the Beef Household Panel as to age, education and general level of income.

Please check the response that applies to you:

1. Age level (check the one that includes your age):

Under 20	_____	50 - 59	_____
20 - 29	_____	60 - 69	_____
30 - 39	_____	70 +	_____
40 - 49	_____		

2. Highest school level attended:

Grammar school	_____	Technical school	_____
High school	_____	College or university	_____

3. Approximate total combined family income level for your household per year:

Under $5,000	_____	20,000 to 24,999	_____
5,000 to 7,999	_____	25,000 to 34,999	_____
8,000 to 9,999	_____	35,000 to 49,999	_____
10,000 to 14,999	_____	50,000 to 74,999	_____
15,000 to 19,999	_____	75,000 or more	_____

4. Kind of work or occupation of each adult in your household:

1.	_____	3.	_____
2.	_____	4.	_____

City _____ Beef Study 0191

Household Number _____ Form F

Panelist's First Name _____

Sex _____

TEXAS A&M BEEF STUDY

SAN FRANCISCO BAY AREA HOUSEHOLD PANEL

TO BE FILLED OUT BY THE PERSON WHO BUYS MEAT FOR THE HOUSEHOLD

Thank you for being a member of our consumer beef test group. In order to help us interpret the ratings reported for the steaks which we are providing to you absolutely free, please take a few minutes and answer the four following questions for us.

1. About how many of each of the following steaks do you recall having bought for your household during the past three months?

Steak	Approximate Number Bought in Last Three Months	Approximate Number Bought in Last Month
T - Bone	_____	_____
Sirloin Steak	_____	_____
Club Steak	_____	_____
Filet Mignon	_____	_____
KC Steak	_____	_____
Rib Steak	_____	_____

2. Indicate which one of the following ratings you feel best describes your overall satisfaction with most of the above kinds of steaks you have bought during the last six months.

CHECK ONLY ONE

_____ 9 Extremely desirable

_____ 8 Very desirable

_____ 7 Moderately desirable

_____ 6 Slightly desirable

_____ 5 Neither desirable nor undesirable

_____ 4 Slightly undesirable

_____ 3 Moderately undesirable

_____ 2 Very undesirable

_____ 1 Extremely undesirable

Enter the rating number selected on the previous question on the line below.

_____

3. Keeping the above overall steak desirability rating number in mind, what would you most likely do if you knew beforehand that a steak had the following rating? Please check your answers for each of the following ratings.

CHECK THE LINE THAT CORRESPONDS TO YOUR ACTIONS:

	Steak Rating	Would Buy	Would Probably Buy	Somewhat Undecided	Would Buy Only at a Reduced Price	Would Not Buy at Any Price
9	Extremely desirable	_____	_____	_____	_____	_____
8	Very desirable	_____	_____	_____	_____	_____
7	Moderately desirable	_____	_____	_____	_____	_____
6	Slightly desirable	_____	_____	_____	_____	_____
5	Neither desirable nor undesirable	_____	_____	_____	_____	_____
4	Slightly undesirable	_____	_____	_____	_____	_____
3	Moderately undesirable	_____	_____	_____	_____	_____
2	Very undesirable	_____	_____	_____	_____	_____
1	Extremely undesirable	_____	_____	_____	_____	_____

Beef Study 0191

Form F

4. For each of the steak ratings, indicate below your estimate of the price per pound difference you think you would be willing to pay.

	STeak Rating	Would Buy at Price Premium of +30¢	Would Buy at Price Premium of +15¢	Would Buy At Present Prices	Would Buy Only at Indicated Price Discount -15¢	-30¢	-45¢	-60¢	-75¢	Would Not Buy at Any Price
9	Extremely desirable	____	____	____	____	____	____	____	____	____
8	Very desirable	____	____	____	____	____	____	____	____	____
7	Moderately desirable	____	____	____	____	____	____	____	____	____
6	Slightly desirable	____	____	____	____	____	____	____	____	____
5	Neither desirable nor undesirable	____	____	____	____	____	____	____	____	____
4	Slightly undesirable	____	____	____	____	____	____	____	____	____
3	Moderately undesirable	____	____	____	____	____	____	____	____	____
2	Very undesirable	____	____	____	____	____	____	____	____	____
1	Extremely undesirable	____	____	____	____	____	____	____	____	____

Be sure you have answered the above questions for each of the nine rating numbers.

WE ARE NOT GOING TO BE SELLING ANY STEAKS. WE SIMPLY WANT TO RELATE THESE ANSWERS TO YOUR STEAK RATINGS.

City Philadelphia

Household Number _____

Male _____

Female _____

Beef Study 0191

Form G

TEXAS A&M BEEF STUDY

PHILADELPHIA HOUSEHOLD PANEL

TO BE ANSWERED BY EACH BEEF PANEL PERSON

Individuals differ in age, sex, occupation, height, and weight. These differences, plus many others, affect attitudes toward the foods we decide to eat. The following few questions that require only a checkmark (/) to answer will help us relate consumer likes regarding levels of quality in beef to the factors consumers consider in selecting other foods.

FOR EACH STATEMENT, CHECK ONLY ONE ANSWER

I Think This Food Selection Factor Is:	Extremely Important	Highly Important	Medium Importance	Low Importance	Do Not Consider
Select only foods you really like to eat	_____	_____	_____	_____	_____
Select foods mostly according to their vitamin and nutriional content	_____	_____	_____	_____	_____
Select those foods having little or no fats or oils	_____	_____	_____	_____	_____
Select foods with little or no animal fats	_____	_____	_____	_____	_____
Avoid eating highly processed foods	_____	_____	_____	_____	_____
Avoid foods that contain food additives	_____	_____	_____	_____	_____

Beef Study 0191
Form G
Page 2

Food Selection Factor	Extremely Important	Highly Important	Medium Importance	Low Importance	Do Not Consider
Select foods that help you control your weight	_____	_____	_____	_____	_____
Select foods that help you gain weight	_____	_____	_____	_____	_____
Select foods that help you lose weight	_____	_____	_____	_____	_____
Select foods with high roughage (fiber) content	_____	_____	_____	_____	_____
Take vitamins to cover any missed in the food you eat	_____	_____	_____	_____	_____
Select a vegetarian diet (beans, peas, cereals or grains, and fruits and vegetables)	_____	_____	_____	_____	_____
Select foods to avoid any vegetable oils and fats (for example, nuts, peanut butter, margarine, and/or vegetable cooking oils, such as corn oil, olive oil and vegetable shortenings)	_____	_____	_____	_____	_____

City _____

Household Number _____

Panelist's First Name _____

Sex _____

Beef Study 0191

Form H

TEXAS A&M BEEF STUDY

KANSAS CITY HOUSEHOLD PANEL

TO BE FILLED OUT BY THER PERSON WHO BUYS MEAT FOR THE HOUSEHOLD

Please answer the following questions regarding the things you look for in selecting a T-Bone or loin steak at the retail meat counter.

Do you consider the amount of fat on the outside of the steak to be:

_____ Extremely Important
_____ Highly Important
_____ Medium Importance (CHECK ONE)
_____ Low Importance
_____ Do Not Consider

On T-bone and loin steaks, do you prefer the beef color to be:

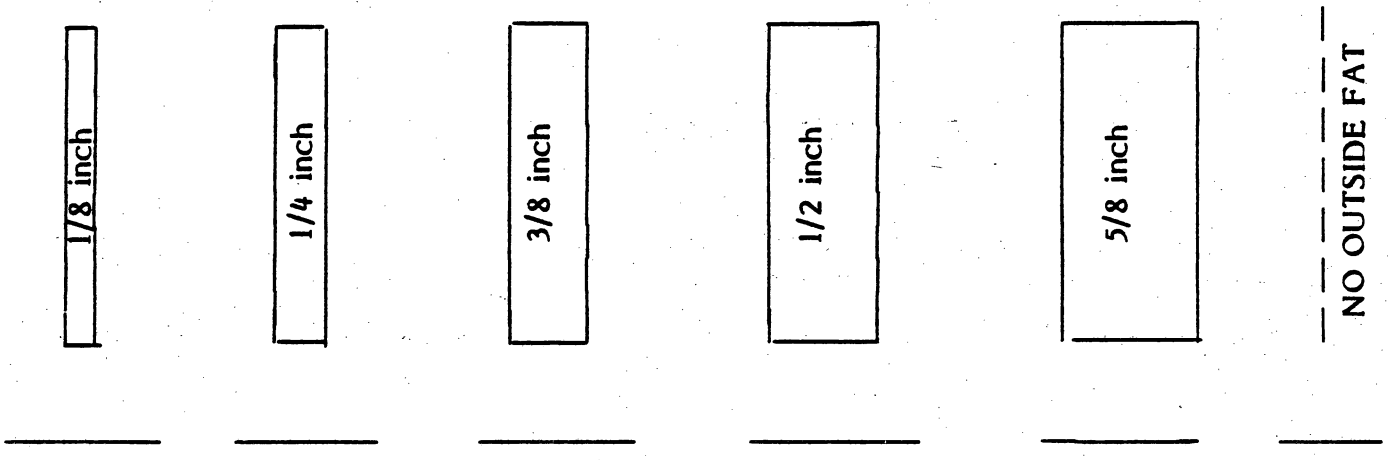
_____ Light Pink
_____ Pink
_____ Light Red (CHECK ONE)
_____ Medium Red
_____ Dark Red

Do you consider the amount of fat on the outside of the steak to be:

_____ Extremely Important
_____ Highly Important
_____ Medium Importance (CHECK ONE)
_____ Low Importance
_____ Do Not Consider

Beef Study 0191
Form H
Page 2

What outside fat thickness to you prefer on T-bone, loin or rib steaks?
(CHECK ONE)



Beef Study 0191
Form H
Page 3

What thickness of steak do you prefer in T-bone, loin or rib steaks?

(C H E C K O N E)

_____ 1/4 inch

_____ 3/8 inch

_____ 1/2 inch

_____ 3/4 inch

_____ 1 inch

_____ 1 1/4 inches

Beef Study 0191
Form H
Page 4

Frequency of Beef Use Survey

Some individuals like and eat beef less frequently or more frequently than others because of personal tastes and preferences or because of dietary reasons or due to the costs of eating beef. It will be helpful to us if you will have each person or persons participating in this beef test indicate the usual frequency with which they normally eat the following kinds of beef. Do not use only the last six weeks, but think in terms of the usual meals you eat.

Part-I

First name of first panel member _____

Beef Kind:			No. of times beef eaten at meals		
			Per week	or	Per month
1.	Beef Steaks (sirloin, T-bone rib steaks, etc.)	At home	_____		_____
		Eating out	_____		_____
2.	Beef Steaks (round steak)	At home	_____		_____
		Eating out	_____		_____
3.	Roasts	At home	_____		_____
		Eating out	_____		_____
4.	Ground beef or hamburger meat	At home	_____		_____
		Eating out	_____		_____

If two people are eating the panel steaks, have second person fill out Part II.

Part II

First name of second panel member _____

Beef kind:			No. of times beef eaten at meals		
			Per week	or	Per month
1.	Beef steaks (sirloin, T-bone, rib steaks, etc.)	At home	_____		_____
		Eating out	_____		_____
2.	Beef Steaks (round steak)	At home	_____		_____
		Eating out	_____		_____
3.	Roasts	At home	_____		_____
		Eating out	_____		_____
4.	Ground beef or hamburger meat	At home	_____		_____
		Eating out	_____		_____

APPENDIX III

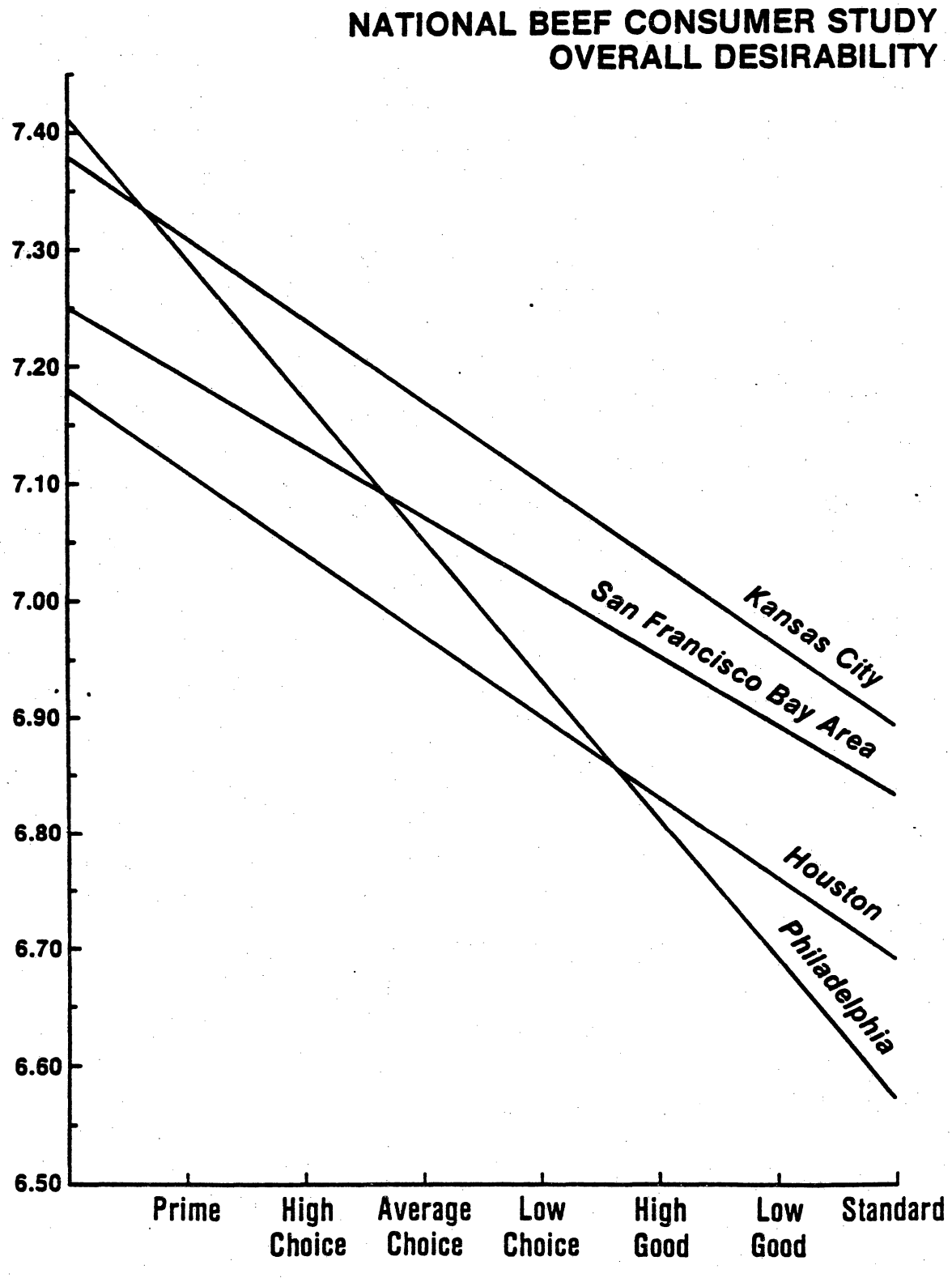

NATIONAL BEEF CONSUMER STUDY
OVERALL DESIRABILITY
7.40
7.30
7.20
7.10
7.00
6.90
6.80
6.70
6.60
6.50
Kansas City
San Francisco Bay Area
Houston
Philadelphia
Prime
High Choice
Average Choice
Low Choice
High Good
Low Good
Standard

Figure A3-1

Table A3-2. Ancova Analysis of Panelists' Ratings of beef steak, by Grade, Houston, Kansas City & San Francisco - Panelists who rated all steaks

Source	D.F.	F-Value	Probability *
City	2	0.42	.6563
Beef Grade	1	6.77	.0093
Panelists			
Income	9	0.29	.9761
Age	6	0.34	.9170
Education	3	0.07	.9718
Beef			
Cooking Method	4	1.10	.3529
Degree of Doneness	3	1.80	.1436
Interactions			
City*Grade	2	0.61	.5431
Grade*Cooking	4	0.91	.4588
Grade*Degree of Doneness	3	0.18	.9102
Total	4912	R^2 = 0.020	

* With grade as a continuous variable

Table A3-3. Chi-square analysis of differences in ratings among the three cities, by beef grade

Category	χ^2	Probability
Low Prime	15.754	0.4703
High Choice	21.453	0.1618
Medium Choice	23.340	0.1049
Low Choice 1st	21.442	0.0908
Low Choice 2nd	19.989	0.2207
High Good	22.724	0.1213
Low Good	23.570	0.0993
Standard	11.661	0.7670

Source: Phase I, 3-City Consumer Household Panel - Rated All Seven Steaks