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# Visual Preferences for Grades of Retail Beef Cuts

A STUDY CONDUCTED IN METROPOLITAN  
ST. LOUIS, 1954

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# Visual Preferences for Grades of Retail Beef Cuts

## INTRODUCTION

Interest is growing in the study of the degree to which meat products are satisfying the desires or "preferences" of consumers. One researcher estimated that only one-fifth of the variation in per capita expenditures on meat in a New York city was explained by variation in per capita income while two-fifths to three-fifths was explained by the likes and dislikes of consumers (1).\* In 1912 a pioneer Illinois study reported on the variations in prices of various cuts of beef and attributed most of these to "considerations other than their food value, such as tenderness, grain, color, general appearance, and convenience of cooking" (2).

For a long time there have also been differences in the prices of various "qualities" of several of the important cuts. The principal factor in long-run price differentials among different retail cuts is the preferences of consumers, since the cuts are produced in a quite inflexible common supply. The long-run price differentials among "qualities" of a given cut are influenced to a lesser degree by consumer preferences.

Grading of live cattle and carcasses was developed by the industry and other interested groups in the early part of this century to facilitate trading by classifying beef in homogeneous quality groups. There is now a renewed interest in discovering how effectively these grade classifications contribute to the satisfaction of consumer preferences. There is some reason to doubt that consumers agree with each other or with some interpretations of the grading standards about the relative desirability of various quality attributes in beef. Moreover, most consumers probably know little about the meaning of the various federal grades.

## PURPOSE OF STUDY

This investigation concerned preferences of consumers for loin steaks and chuck roasts from carcasses of the four top federal grades. In addition, a preliminary investigation was made of preferences for beef from different sizes of carcasses as reflected in size of retail cuts.

The specific objectives of this study were:

(1) To determine preferences among a set of similar retail cuts from the four federal wholesale carcass grades.

(2) To determine preferences for beef from various sizes of animals as reflected among various sizes of retail cuts within grade.

(3) To determine the attributes of the various grades and sizes of retail cuts concerning which there are preferences and to determine the relative influence of each attribute upon over-all preferences.

\*Numbers refer to Bibliography, page 67.

(4) To determine the degree with which consumers associate certain physical attributes and certain organoleptic characteristics of beef.

(5) To determine the degree of and reasons for dissatisfaction with beef presently being consumed.

(6) To determine the eating qualities desired and the cooking methods used and their relationship to the degree of satisfaction attained and to the grade of beef preferred.

(7) To relate preferences and organoleptic knowledge of beef to the social and economic characteristics of consumers.

The primary purpose was to obtain basic information which would be useful in solving practical problems relating to beef production, processing, and merchandising.

### PREVIOUS WORK

Several consumer preference studies have attacked these problems with some success (3, 4, 5, 6, 7, 8, 9, 10). The visual preferences of several groups of consumers at equal and at realistic market prices for several grades of beef were shown to differ with one particular assumption regarding federal grade standards. This is the assumption that Prime is preferred by everyone until it becomes considerably more expensive than the other grades and that no one prefers Commercial unless it is cheaper than the three "higher" grades.

The leaner grades have often been more popular than the more finished grades at equal prices. It is not clear how many of the consumers preferring one of the leaner grades were cognizant of the possibility that it might be somewhat less juicy or tender than a more finished grade. The Missouri study (10) did follow up the purchases and showed that most of them—including the leaner grades—possessed satisfactory eating qualities. Of course, a "satisfactory" grade might not be *the preferred* grade. It is presumed that many consumers do not obtain their preferred grade consistently but the evidence is not conclusive.

Only a small amount of fat in steaks and roasts was generally popular, though some consumers desired fatter cuts. Several shades of color of the lean and fat were found to be about equally popular. The Missouri study (10) raises serious questions about the individual consistency over time of color responses expressed subjectively, and concerning the consistency among individuals of the color chart ratings indicated by subjective responses. The sales results of Washington State (9) on these color preference problems may conceal many no-preference purchases. Amount of fat appeared to be the most important attribute influencing meat selection, though color and physical appearance also had some importance. The surveys found general ignorance about the names and meanings of the federal grades. Most consumers are price conscious but probably have little technical knowledge about meats.

## MATERIALS AND METHODS

The general approach of the study was experimental in design. Because little was known about consumer preferences for grades and weights of beef, an approach probing several problems with several experimental techniques seemed advisable. Consequently, three distinct yet complementary sub-studies were carried on simultaneously. The sub-studies were:

- (1) To estimate by a rating technique, preferences for beef steaks from various grades of carcasses and to estimate by multiple correlation the relationship of preferences for steak attributes to over-all preferences.
- (2) To estimate by a ranking technique preferences for beef roasts from various grades of carcasses and to estimate by cross-tabulation the relationship of preferences for roast attributes to over-all preferences.
- (3) To estimate preferences for beef steaks from different sizes of carcasses and to estimate inter-relations between grade and size preferences.

Displays of the cuts were used to obtain preferences of the consumer samples. In addition, general information about attitudes, meat preparation methods, household characteristics and income of each respondent was obtained through interviews. Interviews were conducted in stores for several reasons. Store interviewing made possible the relating of preferences to grade probably bought by respondents. Store interviewing also appeared to be a cheaper method of interviewing than house to house. Moreover, extensive experimentation with sizeable displays was possible in stores. Such displays could not be feasibly carried house to house.

The sampling problem was a complex one. The object was to obtain a representative sample of the adult human population of Metropolitan St. Louis. This area includes St. Louis City, St. Louis, and St. Charles counties, Mo.; and Madison and St. Clair counties, Ill. Because of transportation problems, the outlying St. Charles county was arbitrarily omitted from the sample, as were a few stores in outlying rural areas of the other counties.

The sampling method used was two-stage sampling with primary units of unequal size. Each store's clientele was considered a primary unit to be subsampled. One method of assuring every person an equal chance of being sampled would be to require; (1) that he shop at only one store once (or the same number of times as does everyone else) during the interviewing period; (2) that the probability of his store being selected be proportional to the size of its population relative to the total population; (3) and that an equal number of people be sampled in each store.

The attempt to obtain an equal probability of sampling for every person fell short in several ways, but a fair approximation of the probability of

selection for those sampled was obtained. First, there was a range of once a month to over seven times a week in the frequency of grocery shopping of the respondents. Some adult consumers probably rarely entered a grocery store. The more frequently a person shopped the greater chance he would have had of being interviewed. To measure and meet this problem, data on the frequency of shopping of each respondent was obtained, so that weights might be given, if necessary. Second, it was impossible to obtain a completely accurate list of all the stores in the area or the size of their "populations." Third, some of the stores in the survey had a very small traffic flow while others had a large one, and so the same size of sample was not obtained in every store. However, a sizeable bias was not introduced, it was felt, because of the modifications that were made to meet the sampling problems and because in the analysis of the results, little relationship was found between shopping frequency and other variables.

Standard deviations for the hundreds of proportions given in the results were not computed because of the large computational effort which would have been required by the appropriate formula for two-stage sampling with clusters of unequal size. The samples in almost all cases were quite large, and a large amount of stability in the estimates of the various parameters can be assumed. Moreover, the amount of variation in results due to a minor variation in schedule wording was likely to be greater than one sampling standard deviation. However, the calculation of the standard deviation of the proportion of people preferring Choice in the specially trimmed display was made in order to have one quantitative estimate. Many other proportions probably would have similar standard deviations since there were many four-way divisions of the sample into proportions of approximately equal size.

This estimate of the variance of the proportion uses a specially weighted estimate of the proportion (see footnote\*\*). Cochran has shown that the

\*\*Formula from William G. Cochran, *Sampling Techniques*, N. Y.: John Wiley and Sons, 1953, p. 261.

$$V(\hat{R}) = \frac{1}{n(n-1)\bar{X}^2} \sum_{i=1}^n \left\{ \frac{M_i}{z_i m_i} (y_i - \hat{R}x_i) \right\}^2$$

where

$z_i$  = probability of store being chosen

$M_i$  = number of persons eligible for interview in store during the interviewing period

$m_i$  = number of respondents of a particular schedule

$n$  = number of subsamples

$$\hat{X} = \frac{1}{n} \sum_{i=1}^n \frac{M_i \bar{x}_i}{z_i}$$

non-weighted estimates of proportions such as those used throughout this analysis are biased. However, the bias is reasonably small if there is no correlation between the size of the primary sampling units and the proportion concerned, and if the sample is large. This lack of correlation is important because the biased estimate weights the smaller units too heavily.† Generally, both conditions have been met in this sample. Thus the terrific computational labor of weighted estimates of the proportions has been avoided without serious loss of accuracy in results.

The non-weighted estimate of the proportion of preferences for specially trimmed Choice was 31.40 percent, while the unbiased weighted estimate was 32.83 percent. This small difference of 1.43 percent was anticipated because of the reasons just given. The standard deviation of this weighted proportion was 2.21 percent. The use of the weighted estimates of both the proportion and its variance required estimates of the subpopulation size of each primary sampling unit. These estimates had to be based on inadequate data, but the influence of errors in these estimates upon the estimated standard deviation would not be large.

Thus, the samples were large enough to give a fairly satisfactory degree of stability to results from simple tabulated breakdowns of four parts or less. This stability is lessened, of course, by cross tabulations and more numerous subgroupings. For example, the number of Negroes was so small that any estimate of characteristics for Negroes alone was certain to have a high standard deviation. Consequently, very few inferences from the sample to the population were made for Negroes or for similar small subgroups. Many chi square calculations were reported. Several weak relationships were specified to exist in the sample and were not inferred to the population. The manner in which this sample failed to fit the sampling model has been described. While the authors' judgment is fairly optimistic concerning the representativeness of the results with a large N, an attempt is made to describe completely the application of the techniques so that each reader may judge for himself.

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$\bar{x}_i$  = average proportion of respondents expressing a preference.

$y_i$  = number of respondents preferring a specific grade

$\bar{y}_i$  = proportion of all respondents preferring a specific grade

$$\hat{R} = \frac{\sum_{i=1}^n \frac{M_i}{z_i} \bar{y}_i}{\sum_{i=1}^n \frac{M_i}{z_i} \bar{x}_i}$$

†Cochran, Ch. 11, pp. 234-267.

Two listings of grocery stores were obtained from the two major St. Louis newspapers. One master list was compiled from these, which included 3304 stores and was fairly accurate as far as could be determined. There is a rather high rate of turnover in the ownership of small stores, but often the store continues to be operated at the same location and thus belongs in the sample listing. The stores were classified by volume of sales in one listing. This classification was used to weight the probability of selecting each store according to its estimated weekly customer traffic.

The metropolitan area was then stratified into 5 areas of nearly equal population on the bases of income and geographical contiguity. The first stratum included all the wealthy western suburban section. The second stratum area was made up of poor downtown areas and included a considerable Negro population. The third and fourth strata consisted of average to high income areas and the fifth was composed of average to low income areas. A total sample of 15 stores was estimated to give suitable sampling results without exceeding budgetary and supervisory limitations. Three stores were selected from each area. This stratification insured considerable variation in incomes and in geographical location. It was assumed that these factors might be important in relation to preference.

Stratification limits by size of store were then put upon each area before drawing the three stores. For example, AA stores (the largest volume class) obtained about 56 percent of sales in the high income area 1, so the restriction was imposed that of the first two stores chosen in that area one must be an AA and one must not, and the third store could be any size. In the second area, AA stores were less important, so the restrictions were that one store be an AA, one an A (second in size), and one a B or C (third and fourth, respectively, in size). These restrictions were the dominant control in drawing the stores and insured a more accurate representation of large and small stores than did the simple weighting by random numbers previously referred to.

In anticipation of store refusals to cooperate or other difficulties, an alternate sample was drawn under the same restrictions. The final summary of contacts was as follows: of 30 store contact attempts, 15 stores cooperated, 6 refused, 6 were not usable (5 were too small and 1 was a market stall), and 3 either were out of existence or were at a different and unknown address. Ten of the cooperating stores were in the first sample of 15. One of the cooperating stores ceased cooperation at the end of the fifth day. Almost all the refusals and failures to locate involved very small stores. The list accuracy for medium and large stores was apparently good.

It was hoped that some sort of mechanical randomness could be introduced into the selection of respondents but no inexpensive, feasible method was found. Interviewers were given instructions to contact any person over 18 years of age who was not an employee of the store. They were warned not



to be selective in any other way. The refusal rate of respondents varied from store to store and through the day. Near meal times the refusal rate was highest. The smaller the store the smaller the refusal rate tended to be. The schedules were thought to be quite long—average time was 11½ minutes—but only 16 of 1475 interviews were so incomplete as to be useless.

Interviewing was conducted during the week of February 1 to 6, 1954. Interviewers were kept in the stores most of the period they were open. In two stores, two shifts of interviewers were necessary. The 17 interviewers were St. Louis housewives who were trained and supervised by the staff of the Agricultural Economics Department.

Loin steaks were chosen for the grade and size experiments because of their good representation of the carcass grades. They also were found easier to handle in displays than round steaks. They were not a particularly well known cut, however. The "loin steaks" were the Porterhouse, T-bone, and Club steaks of the short loin with the tip trimmed and the tenderloin muscle removed so that they were uniform in appearance.

Another very important reason for their use in the tests was the fact that the range in market prices of short loins of the various grades indicates that consumer preferences vary more for this cut than for any other wholesale cut. The large divergence in carcass values can be attributed largely to a few wholesale cuts and especially to the short loin and not to differences in consumer attitudes toward less popular cuts. Therefore, the short loin was considered the most relevant cut for the preference tests.



Fig. 1—Respondent answering questions on a display of four grades of steak in one of the 15 stores sampled.

It was desired to use roasts as well as steaks since several of the roast cuts vary in value by grade. The chuck roast was selected as a popular cut that was representative of the forequarter as it varies by grade.

The short loins and chucks were purchased from a major packer in Kansas City. The carcasses from which they were selected by the representative of the University meats section were of the Federal grades, Prime, Choice, Good, and Commercial. Most of the carcasses for the grade experiment fell in the weight range 475 pounds plus or minus 50 pounds. Despite every effort to buy within the specified range, loins and chucks of two cattle weighing 587 pounds and eight others weighing more than 50 pounds over the 475 pounds weight were selected. The average weight of large samples of the loin cuts showed a range in grade averages of only 0.05 pounds, and a range in samples of 0.1 pound. The range in sampled roast weights was slightly over 1 pound. Average roast weight was about 4½ pounds and the average loin weight was slightly less than ½ pound. The carcasses from which loins were selected for the size experiment were Choice grade and were three weights—375 pounds  $\pm$  25 pounds, 525 pounds  $\pm$  25 pounds, and 675 pounds  $\pm$  25 pounds. A total of 84 loins and 48 chucks were purchased. Carcasses selected were, in most cases, representative of the middle of the respective grades.

Cutting was done with a power saw. The steaks were cut ¾ inch thick and all roasts were cut 2 inches thick. Cuts were placed on bleached backing boards and wrapped with 300 MSAT 80 Cellophane. Previous to wrapping they were bloomed for 20-24 hours with oxygenic paper at 36 to 38° F. The packaged cuts were attached to plywood trays and were kept in specially constructed cooler boxes except during the short intervals when on display. Samples including the four grades or the three sizes were placed on an individual tray by a special randomization design.

Six of the 24 different permutations of the four grades were selected by random numbers and these six designs were used in two and a half replications of a "Latin square" design of days of week versus stores. The three sizes of steaks were placed in a line; e.g., small, medium, large. The order was different each day and was randomly assigned. Every cut was placed on the tray with the fat edge nearest the respondent. Each cut was designated by a double-letter code that was non-ordering in the case of grades. Nowhere in the display or interview was any hint given that the differences were *grade* differences until after all preferences had been expressed.

To acquire more evidence about the importance of the amount of outside fat as a factor influencing preference among grades, two differently trimmed displays of steaks were used. The first tray had the "regular trim" of a maximum of ½ inch thick fat covering. This generally required some trimming of the Prime and Choice grades. The second tray had a "special trim" of a maximum of ¼ inch thick fat which generally required trimming

of all four grades. In this case outside fat was eliminated as a variable by the trimming. The grade schedule was based on the regular trim display and was obtained from 506 respondents. The rankings of the four grades on the special tray were made by a parallel sample of 503 respondents and were recorded as a part of the size schedule. Thus, the preferences of a sample of consumers for grades where amount of external fat was not a variable among grades can be compared with preferences of a parallel sample where it was a variable.

Another experimental control was the randomization of cuts of a particular position on the loin by days and stores so that the same store never received a cut from a given position on the loin more than one day and every store had received a full range of positions by the end of the experiment. At the same time there was matching so that the relative position of the steak or roast within the wholesale cut for all four grades was the same on each display. There were 15 stores in the experiment and, with one exception, the two steak grade displays, the steak size display, and the roast grade display were in every store. Since only seven roasts could be obtained per chuck, roast displays were limited to 14 stores in order to avoid increasing chuck requirements. The non-roast store was chosen arbitrarily and was quite small. This randomization of cuts by store and by position in display may appear too complicated to be workable but it was accomplished without undue labor.

Schedules and displays were designed to coordinate closely on most preference questions. Since the opinions and preferences of all consumers were desired, most questions were of the closed-end type. While the use of check lists and multiple-choice answers risked omission of important answers, this risk was minimized by the extensive open-end questioning performed by researchers at this Station in two previous studies (1) (2), and by pre-testing of the schedules.

Three different schedules were used. The two grade schedules differed little except that the one for roasts obtained ranked preferences and the one for steaks obtained rated preferences. Thus, some of the relative merits of ranking and rating methods were tested. The size schedule obtained replies based upon two separate displays and also certain other information not covered on the grade schedules. The three schedules were used alternately throughout each day. A given respondent answered only one schedule.

The total number of usable schedules per day was: 194, 222, 227, 240, 299, and 287, respectively, Monday through Saturday. The total number of schedules per store was in ascending order: 19, 39, 40, 62, 62, 67, 68, 71, 105, 127, 140, 146, 155, 172, and 196, making a total of 1469. The middle frequencies of stores from 60 to 130 had been anticipated. The three smallest frequencies were in stores with surprisingly low volume in relation to floor area of store. The three largest frequencies were in stores with traffic con-

siderably above the average AA and probably did not over-compensate greatly for their less than proportional chance of being sampled. Frequencies by days, to a considerable extent, were proportional to daily traffic volume, though the weekend traffic was still undersampled. Sampling frequency variations by day and by store were largely associated with traffic variations, as the interviewers at all times obtained as many interviews as possible.

The frequency with which respondents shopped was not associated strongly with any of several variables with which it was tabulated. Therefore, results were not weighted by this variable. While shopping frequency was not related to roast grade preferences, it was slightly related to steak grade preferences.

Weekend (Friday and Saturday) shoppers were found on the average to be slightly younger, have slightly higher incomes, and slightly larger families than weekday shoppers. None of the results would have been changed much by weighting by day of week to compensate for the under-sampling of weekend shoppers. The Choice and Good grades of steak and the Prime grade of roast would have been slightly (a maximum of 2 percent) more popular if weighting had been done.

### PREFERENCES FOR GRADES

This analysis concerns preferences of respondents for grades of roasts and steaks both on their over-all preferences for the grades and on their preferences for particular physical characteristics or attributes. Rating and ranking techniques were both used to determine their relative effectiveness in the analysis of over-all preferences and in the determination of the association of over-all and attribute preferences.

Expressions of respondent preferences were recorded after the respondents had inspected the display of fresh steaks or roasts.

All respondents were asked to give ranks to all four grades of roasts. The schedule questions on over-all preference were: "Now let's think about each roast as a whole. Which roast do you like best?" "How would you rank the others?" Each of the four grades was ranked first by a sizeable proportion of the sample. The percentages of the sample giving first and last choice to the various grades are shown in Table 1. Full tabulations of the ranks allotted for each grade are in the Appendix.

TABLE 1 -- DISTRIBUTION OF FIRST AND FOURTH PREFERENCE RANKINGS OF ROASTS BY GRADES

Grade	First Rank	Adjusted First Preferences	Fourth Rank
	%	%	%
Commercial	18.6	16.7	32.1
Good	30.9	27.7	19.5
Choice	22.3	19.9	30.3
Prime	28.1	26.8	18.2
No Preference	----	8.9	----

These unadjusted percentages are based on 462 "first choices" and 440 "fourth ranks." Tie ranking by several respondents caused the lower number of fourth ranks. Those who gave a tied third rank to two grades had no fourth rank in the data tabulation. These few ties affect the results only minutely. The lack of "no preferences" was rather surprising and was partly due to the use of the ranking method and its assumption that a respondent had preferences. In anticipation of that result, a method of measuring the "monetary strength" of preferences was used experimentally. Respondents, immediately after ranking the roasts, were asked: "How much more would you be willing to pay per pound for the roast you chose as best than for the roast you liked least of all? List No. 1 on your guide sheet has some suggestions." Prices on the list ranged from 0 to 30 cents in five cent units. The alternatives, "Would never buy the poorer piece" and "Don't know," were also listed. The assumption was that those who stated an unwillingness to pay any more for the most preferred roast than for the least preferred had "no preferences" at equal prices. The adjusted distribution of preferences shown in Table 1 was adjusted to account for those unwilling to pay a price differential for the grade most preferred over that least preferred.

This adjustment made no important change in the relative popularity of the grades but did point out the existence of "no preferences." It may well be that the proportion of "no preference" response in reality should be larger, but there is no way of knowing how many, if any, respondents indicated a nonexistent willingness to pay a price differential for the preferred grade.

The question might be raised whether or not the percentage preferring Commercial was significantly different from chance. On further consideration, the question will be seen to have little meaning. When four unlike products are presented to a group of people presumably possessing rather heterogeneous preferences, there is no theoretical guide as to the "expected distribution due to chance." If all respondents were assumed to be unable to distinguish among the four grades, then a division into four equal groups would be expected by chance, but such an assumption appears extremely unrealistic. What can be said about sampling variation is that in the present case, it is possible that the sample percentage, 19.9, for Choice is larger than the percentage, 16.7, for Commercial solely because of sampling variation.

Information about preferences for steaks from various grades of carcasses was obtained by the same procedures as for roasts except that the answers were obtained in terms of ratings rather than ranks. Respondents were told, "Now let's think about each steak as a whole," and asked: "Which steak is the most satisfactory and how satisfactory is it?" "How satisfactory are the other steaks?" Ratings were given in terms of a cardinal rating scale ranging from 0 to 100 with associated descriptive terms. The ratings given were later

coded into relative ranks, i.e., the highest rating became first rank, the next highest became second, etc. The percentages of the first and last ranks given to the various grades were from ratings given by a sample of 506 respondents (Table 2). The unadjusted percentages, however, were based on 583 first

TABLE 2 -- PERCENTAGE DISTRIBUTION OF FIRST AND FOURTH PREFERENCE RANKINGS OF STEAKS, BY GRADE

Grade	First Rank	Adjusted	Fourth Rank
	%	First Preferences	%
Commercial	16.3	15.4	43.8
Good	23.3	21.9	24.1
Choice	26.8	24.3	7.2
Prime	33.6	31.7	24.9
No Preference	----	6.7	----

ranks and 349 fourth ranks because of tie ratings. The large number of ties stemmed from the use of ratings and the permissibility of similar ratings. The distribution of first ranks that did not separate the ties was used in the analysis because its slight inaccuracy seemed less important than its greater ease of computation for cross-tabulation purposes. The tie of two grades for first rank cannot be construed as "no preference" among the four grades, of course, but rather as "no preference" between the particular pair.

The percentage distribution, omitting entirely the first rank ties, was as follows: Commercial 16.0 percent, Good 25.0 percent, Choice 24.5 percent, and Prime 34.5 percent. Identical ratings resulting in first rank ties were given by 72 respondents or 14.2 percent of the sample, while 14 respondents or 2.8 percent of the sample gave don't know answers. Most of the ties were given to adjacent grades, though there were a few ties of Commercial and Prime and of other non-adjacent grades. Ties of all four grades, indicating no preference among the four, were given by 1.8 percent of the sample (Table 3).

TABLE 3 -- RESPONDENTS GIVING TIE RANKS OF FIRST PREFERENCES FOR STEAKS

Grades Tied	Percentage of Total Respondents
Commercial-Good	1.4
Commercial-Choice	1.4
Commercial-Prime	1.0
Good-Choice	1.4
Good-Prime	1.4
Choice-Prime	5.7
Good-Choice-Prime	0.2
Commercial-Good-Choice-Prime	1.8

A tabulation of grades ranked first and second by each respondent was made to determine the extent to which these grades were adjacent on the grading scale. A majority of those ranking Prime first, ranked Choice second;

a majority of those ranking Choice first, ranked Prime second, and of the remaining second ranks many more were allotted to Good than to Commercial. However, the second ranks of those ranking either Good or Commercial first were distributed rather evenly across the other three grades with very little clustering at the adjacent grades. Thus, the distribution of second ranks about adjacent grades and the distribution of tie ranks about adjacent grades show that the preference rankings of those preferring one or other of the higher grades were more "consistent" than those preferring one or other of the lower grades, especially Commercial. The assigning of first and second ranks to *adjacent* grades is "consistent" in the sense that adjacent grades are commonly believed by meat experts to be more alike in physical and eating qualities than are non-adjacent grades.

The same method of obtaining the price differential among preferences was used for steaks as for roasts. The adjusted distribution of preferences for steaks is shown in Table 2.

The proportions of expressed, over-all preferences for each grade in the steak sample were similar to those for the roast sample except that the Commercial and Good grades of roasts were preferred by greater proportions of people than was the case for steaks.

Replies to the question of price differential between the best and poorest grade should be interpreted cautiously since it was a hypothetical question, but the distribution is suggestive. Probably some of those indicating a willingness to pay a particular price differential would not actually pay that much, if anything, in an actual purchase situation. For steaks 6.7 percent of the group indicated they would pay no more and another 15.9 percent would pay only 5 cents more. This group of weak or no preferences was distributed quite evenly as far as indicated first preferences among grades were concerned. If their answers could be considered as reliable, then Commercial, which is the cheapest of the four grades in the market, would be preferred by a larger proportion of respondents at realistic market prices, than the 15.4 percent preferring Commercial at equal prices for all grades.

For roasts, 8.9 percent would pay no differential between the most and least desired, while 26.4 percent would pay only 5 cents. Again, preferences would likely be greater for the "lower grades" and less for the more expensive ones at realistic market prices. However, the price range among grades of roasts in the market is narrower than in the case of steaks, so that the preferences at equal prices would be quite indicative of preferences under realistic pricing.

The obtaining of steak preferences in terms of rating permitted additional analysis of preferences. The ratings provided a powerful analytic basis for relating attribute preferences to over-all preferences, and were of some interest in analyzing group preferences over-all by grade. Average scores for each grade were computed for the whole sample and for selected segments.

The averages were: Commercial 57.4, Good 60.3, Choice 70.9, and Prime 68.0. Thus, on the average, Choice was the most highly rated grade by the sample and Commercial was rated lowest. The extremes in average rating scores per grade between the group ranking it first and the group ranking it last were: Commercial, 41.1 and 81.5; Good, 35.9 and 77.7; Choice, 45.6 and 85.1; and Prime, 42.4 and 83.3. The range was very similar for each grade. Those who disliked Prime rated it about the same as those who disliked Commercial grade steak. Despite the ready acceptance that these average ratings may find in some quarters, it is believed that, for meat, "style" is not the most important determinant of the preferences of most individuals, and therefore individual rankings are more informative than group averages, though the latter have some value. If beef were a style product, then that grade most popular to the group as shown by the average ratings might well be said to be the most preferred because group opinion about such goods strongly affects individual preferences.

Some evidence is available concerning the distribution of preferences that would have been found if only three grades had been displayed rather than four. Preferences among the grades Commercial, Good, and Choice were expressed by 216 respondents interviewed in five stores with a display of those three grades. Table 4 shows the distribution of preferences based upon the three-grade display compared with those based upon four-grade display for those five stores.

TABLE 4 -- COMPARISON OF PREFERENCES WITH THREE- AND FOUR-GRADE DISPLAYS

Steak Grades	Three-Grade Display	Four-Grade Display
	%	%
Commercial	13.0	13.6
Good	29.6	16.7
Choice	57.4	28.3
Prime	----	41.4

The removal of Prime as an alternative greatly increased the proportion preferring Choice, increased somewhat the proportion preferring Good, and had no effect upon the proportion preferring Commercial. This is evidence of some continuity of grade preference selection in the sense that most of those that would prefer Prime preferred Choice when Prime was not available. The special sample may not be representative of the whole population of Metropolitan St. Louis, but it is large enough for the results to be interesting from the methodological point of view.

At least four groups of consumers were found with regard to preferences for grades of roasts and steaks, since each grade was preferred by a group of respondents. Perhaps more than four groups existed but other groups could not be determined by the offer of only four products. Since the four products were offered at equal prices, the "lower grades" were not preferred just be-



cause they were cheaper, as has sometimes been alleged in the market.

It is impossible to construct indifference maps with this empirical data corresponding to theoretical ones for reasons that will be detailed later. The construction of Figure 2 has illustrative value as long as its hypothetical nature is kept clearly in mind. Four grades of beef (four degrees of fat/lean composition) roasts and steaks were offered respondents, at equal prices, represented by the line PP in Figure 2. Each grade was preferred by some respondents so four points of tangency of the price line and the four indifference curves are shown.

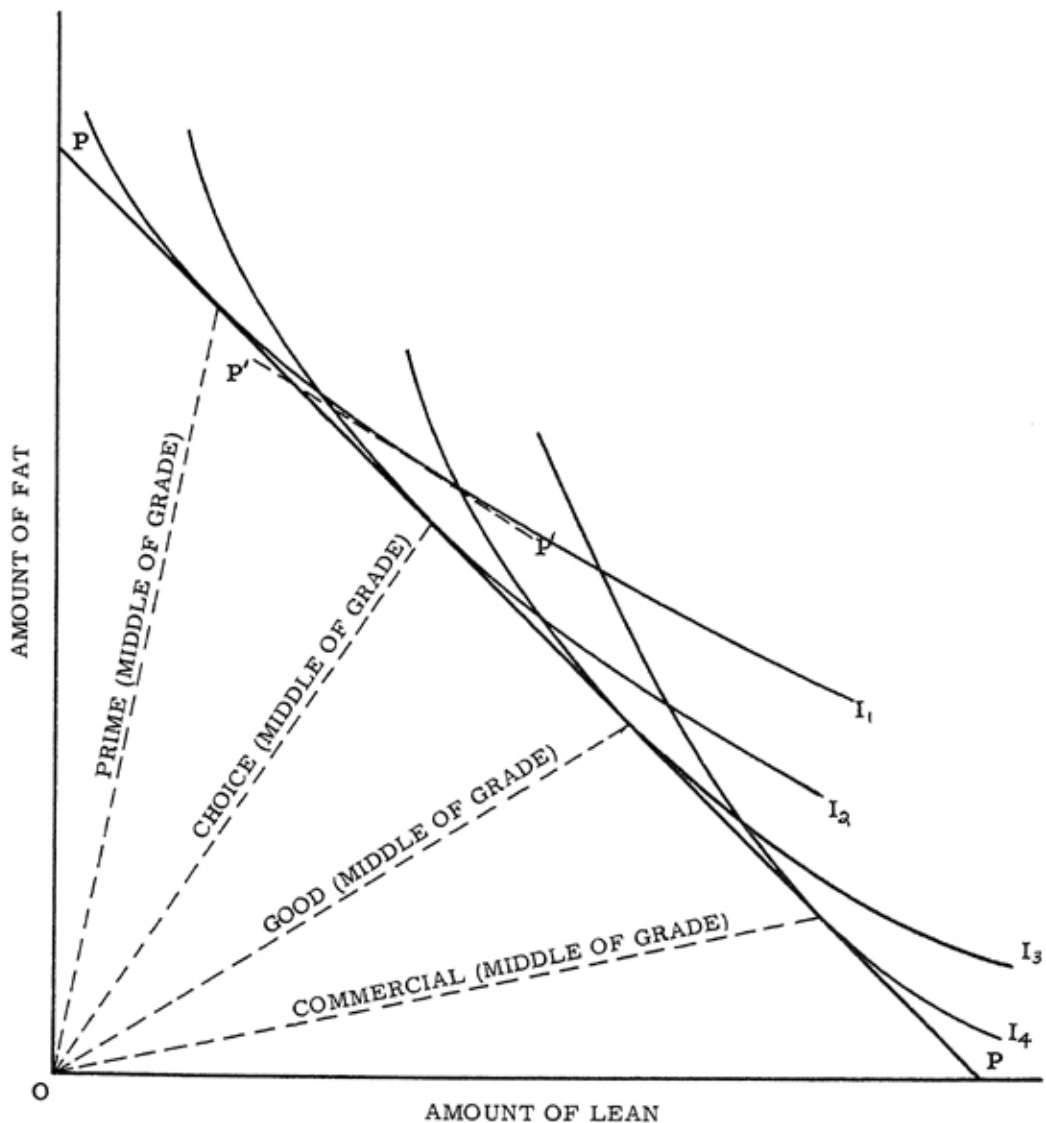


Fig. 2—Hypothetical preferences for beef grades.

No attempt is made to depict the relative sizes of the groups preferring the grades. There were also some consumers expressing no preferences, who might be represented by indifference curves superimposed on the price line PP between grades Prime and Choice, Prime and Commercial, etc. The representation of all respondents by these curves is not realistic, except for the no preference curves and the points of tangency of the other preference curves.

The preference curves of individuals range from an L-shape ("I would not buy any other grade at any price") to almost a straight line ("I would pay only 5 cents a pound more for the grade I ranked first than for the grade I ranked last"). In general, the hypothetical indifference curves shown in Figure 2 probably have more curvature than would be justified by the answers of the "average" consumers. There were some consumers who did not rank the grade adjacent to the preferred grade as the next best. The representation of those preferences in terms of the elements involved in the indifference map of Figure 2 would require a peculiar shaped indifference curve. Such preferences may represent consumer ignorance or the forming of preferences on another basis than degree of finish.

It is not necessarily true that these four grades of beef should continue to be merchandised in order to get maximum consumer satisfaction. First, the *eating* preferences of consumers may indicate more or less discrimination or different discriminations than the *visual* preferences. Second, the preferences of most consumers may not be intense enough to justify the handling of four grades. When the costs and "consumer confusion" of marketing more than two grades are considered, it is possible that the division of beef carcasses into two grades and the handling of both of these by most large food retailers would better satisfy consumer preferences than the present system.

The offering of four grades at a price ratio that made the higher grades more expensive than the lower would shift some consumer preferences down a grade or more. It is unlikely, however, that this price ratio would cause a whole group of consumers to shift preferences, if the ratio was at all realistic in terms of existing market prices. However, one or more groups might be so small that it might not be economic to continue the separating out of their preferred grade from the adjacent grade.

Third, the survey has emphasized the importance of tenderness as an eating characteristic. Many consumers complained of disappointments with tenderness. Some physical and organoleptic tests have indicated that present grades may not differentiate very well among varying degrees of tenderness (15) (16). Therefore, it is possible that the present grading does not provide *the series* of products that would give maximum consumer satisfaction even if everyone obtained the grade he preferred.

## PREFERENCES FOR PHYSICAL ATTRIBUTES OF BEEF ROASTS AND STEAKS

The respondents were asked for ratings or rankings on each of several physical attributes of steak and roasts. For example, on steak one question was: "Do you like the *color of the lean meat* of any of these steaks better than others?" If the answer was yes, then: "Which steak has the best color of lean? How high on your thermometer would you rate it? How would you rate the others?" This rather laborious multiple-questioning was necessary to obtain the ratings and to emphasize the possibility of expressing "no preference" where it existed. The roast schedule questions used ranks and were phrased: "As far as the *color of lean* is concerned, is there a roast that you like best? Which one? How would you rank the other three on *color of lean*?"

There were some respondents who either ignored certain of the physical attributes, or could see no difference in that attribute among the four grades and, consequently, expressed no preference among the grades concerning it. One measure of the relation of an attribute to preferences over-all is the percentage of respondents actually having a preference for a certain variation of that attribute. Another measure is the intensity of preference concerning that attribute. To obtain the former measure for the various attributes, the calculations shown in Table 5 were made. The question on the attribute

TABLE 5 -- PERCENTAGES OF RESPONDENTS EXPRESSING A PREFERENCE AMONG GRADES CONCERNING EACH ATTRIBUTE

Attributes	Steaks	Roasts
	%	%
Amount External Fat	90.1	88.5
Amount Marbling	82.4	86.7
Color of Lean	81.8	87.8
Color of Fat	72.7	69.8
Amount of Bone	66.8	54.1
Texture	72.9	----
Gobs Internal Fat	----	88.5

"gobs internal fat" was a replacement in the roast schedule for a similar question on "texture" in the steak schedule because the former attribute appeared more important for roasts and it was felt that the schedule could not be lengthened further.

The difference between each of these percentages and 100 is the percentage of the sample expressing "no preference." These percentages of first preferences are not a direct measure of the relative importance of these attributes to a given individual. They do indicate for the sample, however, that certain attributes were considered to be relevant variables by larger proportions of respondents than were some others. Caution should be exercised in the interpretation of these percentages. Quite probably the percentage of "no preference" was larger for each attribute than these figures indicate, because the questioning process could have focused the attention of the

respondent upon attributes not previously considered. However, this overstatement of preference may be lessened by the fact that attributes not previously considered explicitly may have affected the over-all impression obtained by the respondent in his visual inspection. It was presumed that the display of similar sized steaks nearly eliminated amount of bone as a real variable, but it was still considered a variable by more than one-half the sample. This suggests the importance of the amount of bone as a relevant factor in choice. Many respondents were observed to examine carefully each steak (or roast) to determine which had the least bone. On the other hand, there was a perceptible difference in the color of fat between the Commercial and Prime grades, but only a few more respondents indicated a preference for color of fat than had for bone.

Any study of the preferences for physical attributes must be interpreted in terms of the amount of displayed variation in them. To meet the problem in the most meaningful way, this study was designed to determine preferences among the variations of physical attributes as these normally occur among the four top federal grades. For example, instead of asking for preference among "bright red, medium red, or dark red" colors of lean, preference was sought among the colors of lean of the four grades in the displays.

Preferences among grades of roasts for various attributes are shown in Table 6. Those persons with no preference concerning a particular attribute

TABLE 6 -- PERCENTAGE DISTRIBUTION OF FIRST PREFERENCE RANKS  
AMONG GRADES OF ROASTS FOR EACH ATTRIBUTE

Attribute	Commercial	Good	Choice	Prime	Totals
	%	%	%	%	%
External fat	16.0	33.5	20.9	29.6	100
Gobs Internal fat	20.4	27.5	23.1	29.0	100
Marbling	19.7	30.2	22.2	27.9	100
Color of Lean	22.1	25.6	22.1	30.2	100
Color of Fat	8.3	20.7	31.2	39.8	100
Amount of Bone	18.9	31.5	23.6	26.0	100

are excluded. The table reveals the popular and unpopular attributes of the various grades of roasts. The most unpopular grade attribute was the color of fat of Commercial. While a few people preferred Commercial's color of fat, the proportion of preferences increased up the grade. Color of lean was the most popular attribute of the Commercial grade; amount of external fat was the most popular attribute of Good; color of fat was the most popular attribute of Choice and Prime. It may be surprising to some that a far greater proportion did not prefer Commercial's amount of fat. Amount of fat apparently was not an "evil" to be avoided completely for most people. This is of particular interest because amount of fat was rather obvious, visually, to respondents. Amounts of inter-muscular and external fat actually varied within a fairly limited range among grades of this particular roast cut, while marbling varied considerably.

The possibility of "halo influence" upon respondents exists. That is, over-all attitude may have considerably influenced ratings of specific attributes by some respondents. It would have been a very loose and irregular halo that would allow for the differences in percentages of preferences on different attributes shown in Table 6. However, small differences in percentages may have little meaning. For example, Good grade was more popular than the other grades on amount of bone, but it is to be doubted that there was much real difference in amount of bone. It should be remembered that almost one-half of the sample saw no differences in amount of bone and these percentages of preferences for bone were based on only 254 first ranks.

A different type of analysis was used in determining the relative popularity of the various attributes of grades of steak since preferences had been registered cardinally. Respondents were asked to rate every attribute of every grade and most of them did so. The average rating of each attribute was determined and represents the "average opinion" of the group concerning the desirability of each attribute (Table 7). The averages were derived from

TABLE 7 -- AVERAGE RATINGS OF STEAK GRADE ATTRIBUTES

Attribute	Commercial	Good	Choice	Prime
	%	%	%	%
Amount external fat	59.2	61.1	68.5	65.9
Color of lean	60.4	64.2	71.3	69.6
Marbling	61.3	66.8	69.9	66.1
Texture	64.1	67.0	71.0	68.9
Color of fat	57.2	63.7	72.4	73.4
Amount of bone	67.6	69.4	70.8	70.7

diverse scores, since some respondents rated a given grade highest on a particular attribute while other respondents rated it lowest.

Choice grade steak had the most popular amount of outside fat and Commercial the least popular amount. Commercial steak was rated low on color of fat. The only Prime attribute that received a higher average rating than a Choice attribute was color of fat. The amount of marbling of Good grade was as popular as that of Prime grade, while the marbling of Choice was the most popular and that of Commercial least popular.

The fact that every attribute average score on Commercial is lower than every score on Good and that every Good score is lower than every Choice score raises two important questions. First, one might conclude that everyone prefers Choice to Good and Commercial on every attribute, but that is not true; these scores are an average opinion of the group that obscures variations in ratings of individuals. Second, one might conclude that any given respondent rated all attributes alike because he failed to separate his attitude about individual attributes from his over-all attitude toward the cut. Probably there was some halo effect, but many individuals rated one attribute of a steak grade high and another attribute low, while just as many ranked one

attribute of a roast grade high and another attribute low. The halo, if it existed, was very irregular, or was of minor importance in over-all effect. For example, Good excelled Commercial on amount of bone by only 1.8 points but on color of fat by 6.5 points. Amount of bone appeared to be the attribute most likely to record "halo," since the actual physical variation was held to a minimum, yet the scores on it did not differ materially by grades and were not very highly related to other attribute scores of a particular grade.

A comparison of grade attributes of steaks and roasts shows that the only attribute in which a given grade was most popular for both steaks and roasts was color of fat in which Prime was most popular. Differences arising from sampling, differences in preferences for the two cuts, and differences in the methods of recording preferences account for the dissimilarities of steak and roast results. These dissimilarities should not be over emphasized for the general result was one of somewhat similar popularity of every grade of roasts or steaks with Commercial generally the least popular grade. Commercial's color of fat was the lowest rated and ranked attribute of all attributes.

In summary, for some segment of the population, each of the particular variations of each of several physical attributes associated with a particular grade of roast or steak was "the preferred" variation. This segment varied in size from a minimum of 8.3 percent preferring Commercial's color of fat to a maximum of 39.8 percent preferring the Prime color of fat for roast. The attributes of the Prime roast grade were considered "better" than those of "lower" grades by less than 40 percent of the sample. It was found that Commercial roasts were preferred not only for their leanness, but also for their color of lean, for example. This picture of diverse preferences and of some segment of the population preferring every displayed variation in the various physical attributes hardly corresponds with the technical evaluation of those grades and their relative desirability. The fact that important segments of the sample expressed no preference among the four grades upon each of several physical attributes is another indication of the extent to which consumer evaluations fail to be equivalent to those of "experts."

Some other likes and dislikes in terms of popularity of grades may be seen in the tables, though there was enough chance or unexplained variation in the scores and percentages to require cautious interpretation. The failure of this analysis to point out several other large disparities in the popularity of the various grades on various attributes was due either to the "real" situation being a lack of such differences, or to mistakes in the experiment. However, the techniques appear sound and other evidence suggests a fairly correct though simplified picture of reality.

The general picture is one of considerable differences in preferences among the St. Louis population. With a few exceptions, the particular de-

gree of variation of the attributes of a given grade was preferred by approximately the same proportion of people as preferred that grade over-all.

### THE INTER-RELATIONS OF PREFERENCES

The determination of the product attributes which influence preference over-all is a very important part of consumer preference research. If color of fat has an important relation to acceptance of roasts, then the avoidance of an unpopular color of fat has important merchandising benefits.

This section is concerned with the relationship between the preferences of individuals for particular attributes of steak or roast and their preferences over-all. This attempt to measure relationship is somewhat akin to attempts of Vail and others to relate panel palatability scores to chemical or physical measurements (11). Rather simple cross tabulation techniques were used in the case of roasts while multiple correlation was used for the steaks to determine these inter-relations.

Obtaining the relative percentages of respondents expressing no preference among grades concerning the various attributes is the first step to determining the relative importance of those attributes to over-all preferences. An indication of "no preference" is considered virtually an indication that the particular attribute had no influence upon over-all preferences in this experimental situation. The extent of attribute "no preferences" can be calculated from Table 5.

Table 8 presents some evidence about those respondents who did have a preference among grades of roasts on particular attributes. The fact that one-

TABLE 8 -- PERCENTAGE DISTRIBUTION OF RESPONDENTS WHO RANKED A GIVEN GRADE FIRST, OVER-ALL, WHO ALSO RANKED THAT SAME GRADE FIRST ON A GIVEN ATTRIBUTE

Attribute	Commercial %	Good %	Choice %	Prime %
Amount external fat	41.0	64.7	64.8	65.0
Amount internal fat	63.6	62.7	68.9	72.8
Marbling	52.1	64.9	63.4	64.2
Color of lean	67.1	61.5	59.1	61.5
Color of fat	23.7	43.6	61.8	66.3
Amount of bone	49.0	58.8	62.2	54.3

third of the respondents had no preference on color of fat implies nothing directly about its importance to over-all preference for the other two-thirds. It may or may not be true that the greater the proportion of "no preference" attitudes on an attribute the less the importance of the preferences to those who did hold them.

Replies of respondents were sorted into four groups according to the grade they preferred over-all. Then the percentage of each group which ranked the grade first on a specific attribute was determined. It is assumed that the lower the percentage of agreement of first ranks, the less the rela-

tion. While this is a rather crude measure, it is logical and deals with probably the most important indicators of preference, i.e., first ranks.

The preference for amount of internal fat was most consistently related to preference over-all. The "gobs" or large streaks of internal fat did vary considerably from grade to grade. Color of lean, marbling, and amount of external fat were next in order in degree of consistent relation to over-all preference with little real difference among them. The relation of over-all preference to amount of bone was more consistent for all grades than the relation to color of fat but was not much higher on the average. Examination of the table leads to the conclusion that color of fat was not an important determinant of preference over-all for Commercial roast because a very low percentage is shown. However, the percentages for Choice and Prime in relation to color of fat were much higher. It can be assumed either that color of fat was not an important determinant of over-all preference for any grade, or that color of fat was an important criterion only for those preferring Prime and Choice. The latter alternative might be reasoned as follows: If it is logical to assume that different people have different preferences over-all, then it is also logical to assume that the determinants of those diverse preferences not only *could* be different but are even *likely* to be different. Unfortunately, there is no evidence of a conclusive nature for either hypothesis. It can only be said that most of these ranking either Commercial or Good first over-all did so in spite of their attitude toward the color of its fat. Surprisingly enough, the same conclusion can be made for Commercial in regard to amount of external fat.

A tabulation of those who ranked a given grade first over-all and yet ranked it fourth on specific attributes was made. In general, the evidence was consistent with the relations found above. A study of the table relating first and fourth ranks and of the table relating first ranks emphasizes that either the consumer's over-all choice is often the result of considerable compromise, or that only a few attributes have any importance in his choice.

In summary, supported by the data presented in Tables 5 and 8, the importance of each attribute of roasts was:

- (1) Amount of external fat was not considered (preference-wise) by 11.5 percent of the sample. Of the remainder, almost 35 percent of those preferring over-all grades Good, Choice, or Prime did not rank that grade first on amount of external fat, and 59 percent of those preferring Commercial over-all did not rank Commercial first on amount of external fat.

- (2) Amount of internal fat was not considered by 11.5 percent of the sample. Of the remainder, from 27 to 37 percent of those who ranked a given grade first on over-all preference did not rank that grade first on amount of internal fat. The greatest consistency of preferences was for the Prime grade and the least for the Good grade.



(3) Amount of marbling was not considered by 13.3 percent of the sample. Of the remainder, from 36 to 48 percent of those who ranked a given grade first on over-all preferences did not rank that grade first on amount of marbling.

(4) Color of lean was not considered by 12.2 percent. Of the remainder, from 33 to 41 percent of those who ranked a given grade first over-all did not rank it first on color of lean.

(5) Color of fat was not considered by 30.2 percent of the sample. Of the remainder from 34 to 76 percent of those who ranked a given grade first over-all did not rank it first on color of fat. Thus, less than one-half of the respondents gave any evidence of an important relation of their preference for color of fat to their over-all preference.

(6) Amount of bone was not considered by 45.9 percent of the sample. Of the remainder, from 38 to 51 percent of those who ranked a given grade first over-all did not rank it first on amount of bone. Thus, only about one-fourth of the respondents gave evidence that amount of bone may have influenced their over-all preference in this situation.

The order in importance of the various attribute preferences as influences upon over-all preferences for roasts on the basis of the preceding evidence was (1) amount of internal fat, (2) color of lean, (3) amount of marbling, (4) amount of external fat, (5) color of fat, (6) amount of bone.

These factors were relative to the given display situation, it must be remembered. At the same time, the situation was designed to be as realistic as possible, consistent with grade being the only variable. The amount of trimming affected the amount of external fat, of course, so its relative position in importance may have been more subject to experimental bias than any other attribute. The ambiguity of amount of bone as a variable has already been discussed.

Multiple correlation analysis was performed on the steak preference rating scores to determine the inter-relations between attributes and over-all preferences. This analysis was based on the method of preference analysis used by Banks and Brown (12) (13). Ratings were obtained from all respondents on all four grades as to their preferences over-all and on the following attributes; amount of external fat, color of lean, amount of marbling, texture, color of fat, and amount of bone. The order of obtaining attribute preferences was as listed above with one exception: to prevent a position bias, the questions on amount of fat and marbling each occupied first place on half the schedules and occupied third place on the other half. Ratings on tenderness and juiciness were also obtained, but were not used in the multiple correlation because they were attributes that were not directly observable in the same way as the other attributes. A linear equation was obtained relating preferences for the whole sample. On theoretical grounds some sort of

joint functional relation appeared more logical than a linear one, but the computational simplicity of the latter caused it to be used.

EQUATION I:

$$X_1 = .2319 X_2 + .1900 X_3 + .1775 X_4 + .1614 X_5 + .1576 X_6 + .0998 X_7 + E$$

where  $X_1$  = over-all preference rating

$X_2$  = amount of external fat rating

$X_3$  = color of lean rating

$X_4$  = marbling rating

$X_5$  = texture rating

$X_6$  = color of fat rating

$X_7$  = amount of bone rating

E = Random variable assumed to be normally and independently distributed from the explanatory variables

The Beta coefficients show the average change in the dependent variable,  $X_1$ , associated with a unit change in the given explanatory variable when the remaining variables are kept constant or when changes in these variables are allowed for insofar as this is possible with a linear equation. It was found that there was considerable correlation among the explanatory variables; therefore, the equation needs to be considered as a whole. In interpreting these results it should be realized that they hold only for the group and thus cannot be applied to single individuals. The "average consumer" considered all attributes in the way shown by the above equation, but it has been shown that many individual consumers had no preference whatsoever among the grades as to one or more attributes. The loss of important detail by such aggregation into an "average consumer" concept has been commented upon but it is felt that there is some value in these results as long as they are interpreted cautiously. The problem of showing the relative importance of preferences for the physical attributes to over-all choice requires some type of aggregation, if anything more is to be said than that different individuals weighted the various attributes differently.

The equation when only 4 explanatory variables were used was:

EQUATION II:

$$X_1 = .2660 X_2 + .2376 X_3 + .2118 X_4 + .2046 X_5 + E$$

The addition of two more explanatory variables in the first equation had the expected result of decreasing the Betas of the first four explanatory

variables. However, the relative size-order of these four variables was not changed by the addition of the other two variables.

Both equations have quite stable parameters. All Betas differed significantly from zero at the 1 percent level.†† The multiple R for four explanatory variables was .7672 and for six was .7741. The standard deviation of  $R_1$  <sup>234567</sup> was .011. The net, direct, and indirect effects of each explanatory variable could be determined fairly accurately by a method used by Schultz (14). The percentage contribution of each variable to total *explained* variance is shown in Table 9.

TABLE 9 -- PERCENTAGE CONTRIBUTION OF ATTRIBUTE RATINGS TO TOTAL EXPLAINED VARIANCE OF OVER-ALL RATINGS OF STEAKS

Attributes	Explained Variance
	%
External fat	24.7
Color lean	19.9
Marbling	18.0
Texture	15.0
Color fat	15.2
Amount bone	7.2

The similarity in contributions of the first five variables, and especially of the first three, is striking. At the same time, the order of importance is the same as the order deduced from the simple tabulated range of scores on steak grade presented above. It must be cautioned that about 41.1 percent of the total variation was not explained. Perhaps complicating factors such as respondent awkwardness in using the rating system and differences in respondent ideas as to what constituted a particular attribute may have accounted for the failure to explain a greater share of the variation. Probably there is an over-all impression obtained visually in inspecting grades that cannot be summarized completely by a breakdown into preferences for all the particular attributes recognized by meat researchers.

It should be pointed out that these Betas show the relative importance of physical attributes as determinants of over-all preferences with all other things equal. Among the important determinants impounded in *certeris paribus* are price, labeling, and store environment. Moreover, the reduction of the percentage of unexplained variation by better measurement or more accurate regression estimation might affect the relative contribution of the various explanatory variables. There is no reason to think that the importance of the examined factors relative to each other will change when price is no longer held constant but certainly price will become a determinant relative to the factors as a group.

The same things may be said for releasing labeling and "store environment" from *certeris paribus*, but with the added qualification that such release might affect the relative importance of some examined attributes more than others. For example, a difference between stores in lighting or in the advice

††The standard errors of the Betas measure variation in the observed data; no inference is made to the population.

of the butcher might cause customers to ignore differences in one attribute and examine more closely differences in another. Or the preferences of many customers may have been determined over a long period of beef consumption so that beef is bought only at a certain store, or stores, where it is known to be "good." These customers would give physical attributes only a brief glance.

In interpreting these equations and percentages of explained variance, it must be recognized that they relate to a given experimental situation. The relative importance of preferences for physical attributes of a grade like Commercial was related obviously to the number and type of other alternative grades being rated at the same time. It would be expected that the relative importance of the attributes would be only approximately the same if only Choice and Good grades had been in the display rather than all four grades, but this is not necessarily true.

In this experimental situation the conclusion is that respondent preference ratings indicated that external fat was the most important determinant of choice for loin steaks but that color of lean and marbling were each nearly as important, with texture and color of fat tied for fourth place in importance. Color of fat seemed to be peculiarly important as far as over-all preference for Commercial grade was concerned. Amount of bone did not actually vary much among grades, though enough respondents thought it did to cause it to account for a small, but significant, amount of the variance.

### PREFERENCES FOR SPECIALLY TRIMMED STEAKS

The amount of external fat left upon retail steaks has been shown to influence consumer preferences. To investigate that influence more fully than was done by the rating and multiple regression analysis, a special experiment was devised.

A display of steak grades was set up, identical in every respect to the steak grades display already described except for one difference. In the regular steak display, a maximum of  $\frac{1}{2}$  inch of external fat covering was allowed. Since the Commercial and Good grades ordinarily have less than that amount of external fat, there was a noticeable difference among the grades as to amount of external fat in the regular display. This variation in amount of external fat among grades was removed in the special experiment by trimming all fat coverings to a  $\frac{1}{4}$ -inch width. This display was shown to a sample of respondents parallel to the regular steak grade sample, so that a direct comparison of preferences could be made.

The question asked was: "If you were to be given one of these four steaks, which one would you choose?" Since the four steaks were the same size, the preference, or lack of preference, of the respondents depended upon their evaluation of the relative desirability of the steaks. The distribution of

the visual preferences for specially trimmed grades as compared with the preferences of the regular grade experiment is shown in Table 10.

TABLE 10 -- DISTRIBUTION OF FIRST PREFERENCE RANKINGS OF GRADES OF STEAKS IN REGULAR AND SPECIAL DISPLAYS

Grade Preferred	Special Display	Regular Display
	%	%
Commercial	13.5	16.3
Good	18.7	23.3
Choice	31.5	26.8
Prime	36.3	33.6

As expected, the proportion of people preferring each of the two higher grades increased with the removal of the extra fat covering of the higher grades. It should be noted, however, that external fat of upper grades was not the all-important hindrance to preference for those grades. The combined group preferring Prime or Choice included only 7.4 percent more of the total respondents after the external fat variable had been eliminated. This is evidence to support the thesis stated previously that other physical attributes besides external fat are quite important determinants of preference. No method of estimating the extent of "no preference" in the sample results is possible because the price differential question was not used. There seems to be no reason to think the extent or distribution of no preference would be much different than for the other two experiments, although it is possible.

Probably the first ranks are the most meaningful set of ranks for analysis of preferences, but the *fourth* ranks provide some basis for appraising the unpopularity of the various grades. Note that in both experiments the Commercial grade was the least popular (Table 11). The Prime grade was more

TABLE 11 -- DISTRIBUTION OF FOURTH RANKS OF GRADES OF STEAK IN REGULAR AND SPECIAL DISPLAYS

Steak Grade	Special Display	Regular Display
	%	%
Commercial	36.4	43.8
Good	27.5	24.1
Choice	9.7	7.2
Prime	26.4	24.9

popular than the Choice grade in terms of first ranks in both experiments but had more fourth ranks. This is explainable. Probably almost all those who greatly disliked fat ranked Prime fourth rather than Choice, while those who ranked Prime first probably ranked Good or Commercial last. Removing the excess external fat of the Prime grade in the special experiment did not reduce its unpopularity in terms of fourth ranks as compared with Choice because the greater amount of internal fat probably was still objectionable to many respondents. The similarity of the two distributions of preferences show, again, the limited influence of the special trimming of the external fat.

## RELATIONSHIP OF PREFERENCES TO SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

An important phase of a sampling study of preferences of a human population is obtaining information that enables a determination of the degree of relationship of various socio-economic characteristics of the sample with the characteristics under investigation. Schedules were designed to obtain information concerning the stores in which the respondents were shopping and various characteristics of the respondents such as their family income, family size, family employment, sex, race, age, and education. The relationships of these characteristics to over-all preferences and to the degrees of the inter-relationships of attributes and over-all preferences are summarized in this section.

The sample stores were widely dispersed over the Metropolitan St. Louis area and varied considerably with respect to the incomes and occupations of the customers. Despite the differences among stores, every grade of roast was preferred by one or more respondents in nearly every store. However, there was considerable variation in the proportion of respondents preferring each grade. The highest percentage of a store subsample preferring one given grade was 55.6 percent, and that was in a small subsample. The percentage preferring Prime roast ranged from 9.1 percent to 50.0 percent, while the range for Choice was 0.0 percent to 43.5 percent; for Good, 7.2 percent to 55.6 percent, and for Commercial, 0.0 percent to 45.5 percent (Table 12).

There was only a weak relation of grade preference to the grade handled by the store in which the interview was taken. While the highest percentage of preference for Prime was in a store selling Prime grade beef, and for Good was in a store selling Good, the highest percentages for Choice and Commercial were also in stores selling Good grade.

The relations of stores to both the special and regular preferences were analyzed. Every grade of regular steak was preferred by one or more respondents in every store. As in roasts, there was considerable variation among stores in the proportion of respondents preferring each grade. A similar pattern of variation was found for preferences based upon the special display of steak.

The relation between the modal preference of a subsample and the grade of steak sold was weak. Modal preference for Good was in a store selling Good grade. The modal preference for each of the other grades was not in a store selling that particular grade. No relation of grade of steak sold to preference for grade was found in the special experiment.

A classification of stores by size showed both Prime and Commercial roasts and Prime steaks to be more popular in the larger stores.

It is well known that there is some relation between incomes and the grade of beef consumed by people. A retailer in a low-income neighborhood

TABLE 12 -- DISTRIBUTION OF FIRST PREFERENCES FOR GRADES OF ROASTS AND STEAKS BY STORES

Store No.	Grade Sold by Store*	Commercial %	Good %	Choice %	Prime %	Total %
Roasts						
1	Prime	0.0	7.2	42.8	50.0	100
2	Choice	18.2	27.3	36.3	18.2	100
3	Commercial	37.2	23.2	14.0	25.6	100
4	Commercial	40.0	40.0	0.0	20.0	100
5	Good	45.5	31.8	13.6	9.1	100
6	Good	13.0	39.2	26.1	21.7	100
7	Choice	4.1	32.6	20.4	42.9	100
8	Ch.-G.-Com.	31.0	12.1	29.3	27.6	100
9	Good	0.0	52.2	21.7	26.1	100
10	Choice	23.5	31.2	14.1	31.2	100
11	Good	0.0	55.6	11.1	33.3	100
12	Good	15.2	30.4	43.5	10.9	100
13	Good	10.0	44.0	4.0	42.0	100
14	Good	8.7	39.1	26.1	26.1	100
15	Good	-----	-----	-----	-----	-----
Steaks						
1	Prime	13.3	33.3	20.0	33.4	100
2	Choice	15.6	22.2	26.7	35.5	100
3	Commercial	27.3	27.3	18.1	27.3	100
4	Commercial	25.0	25.0	12.5	37.5	100
5	Good	11.5	23.1	42.3	23.1	100
6	Good	22.7	27.3	22.7	27.3	100
7	Choice	11.4	32.9	27.1	28.6	100
8	Ch.-G.-Com.	8.1	14.5	29.0	48.4	100
9	Good	22.2	51.9	18.5	7.4	100
10	Choice	14.8	11.4	27.3	46.5	100
11	Good	4.8	28.6	23.8	42.8	100
12	Good	14.0	27.9	37.2	20.9	100
13	Good	16.7	18.8	33.3	31.2	100
14	Good	39.2	17.4	21.7	21.7	100
15	Good	16.7	16.7	20.0	46.6	100

\*These were the grades comprising the principal part of sales at the stores during the interview week. Probably there were slight variations into an adjacent grade at times.

is likely to sell low priced Commercial or Good, while the retailer in the high-income neighborhood is likely to handle Choice, and a few retailers will handle Prime. It might be expected that grade preference would therefore be related rather closely to income if people tend to prefer the grade usually purchased.

Income, defined as "take-home pay" after tax deductions, was obtained on a per family per week basis. Information on income was given and was coded into 7 income classes with No. 1 class being less than \$25.00 and each of the others covering a \$25 range except the last, Class 7, which was "over \$150 a week." Since data was also obtained on the number of members of the family and the number employed, it was possible to calculate incomes on a per family member and per worker basis. The income per family member may be a somewhat better indicator of the economic capacity to consume

meat than family income. The income per worker measure distinguishes the highly-paid occupations from lower-paid jobs in a manner superior to the other measures in which number of workers is a variable.

Family income was not related significantly to preference for roast grade. Neither was income per worker related to preference for roasts. However, there was some positive association of store income groups and grade preference.

The stores were divided into three groups of five on the basis of the average and median incomes of the customers interviewed in them. The distribution of preferences indicates more of a positive relation between income and *roast* grade than was found by direct tabulation but no greater relation between income and *steak* grade (Table 13). Of course, there are educa-

TABLE 13 -- PERCENTAGE DISTRIBUTION OF FIRST PREFERENCE RANKINGS OF GRADES OF ROASTS AND STEAKS BY INCOME GROUPS OF STORES

Grade	Upper Income	Middle Income	Lower Income
	%	%	%
		<b>Roasts</b>	
Commercial	14.4	17.4	23.2
Good	28.8	37.2	28.7
Choice	23.0	19.8	23.2
Prime	33.8	25.6	24.9
		<b>Steaks</b>	
Commercial	14.1	24.3	12.8
Good	21.4	30.4	20.3
Choice	25.8	20.3	33.2
Prime	38.7	25.0	33.7

tional and other social variables associated with the income differences by stores.

Income per worker was significantly related to steak grade preference (chi square, 1 percent). The higher the income the greater were the proportions of higher grades preferred. Income per family member had only a weak relation, if any, to steak preference; no significance test was made. There was no relation of grade preference in the special experiment to either income per family or income per worker.

Education was measured by the length of formal schooling. Greater education was associated with fewer preferences for Commercial roast and slightly more for Prime with no changes in the proportions preferring Good and Choice. The relationship of education to steak preference was largely hidden until a double-tabulation was used to separate income and education. As shown by Table 14, education level was associated to some extent with preference, though not in the simple positive manner which might have been expected. It is likely that the income effects cited above were appreciably affected by education level.



TABLE 14 -- PERCENTAGE DISTRIBUTION OF FIRST PREFERENCE RANKINGS OF GRADES OF STEAK BY 250 MIDDLE INCOME RESPONDENTS OF THREE EDUCATIONAL LEVELS

Years of Schooling	Commercial	Good	Choice	Prime	Total
	%	%	%	%	%
8 years or less	16.2	16.2	26.6	41.0	100
9 to 12 years	13.7	20.4	34.8	31.1	100
13 years or more	10.0	27.5	27.5	35.0	100

Data was obtained on the employment status of the housewife (the wife or the woman of the home). Employment was defined as full-time work for remuneration outside the home. It was felt that employed housewives might have different preferences both because of the demands of employment on their time and because of the possible differences in income and social status. However, no relationship of roast grade preference to employment or non-employment of the housewife was found. The same proportions of employed and unemployed housewives preferred the two lower grades of steak but Prime was more popular than Choice for the non-employed group as compared with the employed group. The same relation was found for the special trimmed grades.

The sex of the respondents was significantly related to first preference for roasts. A tendency for male respondents to indicate a preference for higher grades than did female respondents was found in both races (Table 15).

TABLE 15 -- PERCENTAGE DISTRIBUTION OF FIRST PREFERENCE RANKINGS OF ROAST GRADES BY SEX OF RESPONDENT

Sex	Commercial	Good	Choice	Prime	Total
	%	%	%	%	%
Female	21.2	32.6	20.0	26.2	100
Male	10.5	27.2	28.9	33.3	100

Commercial and Good regularly trimmed steaks were *rated* slightly higher and grades Choice and Prime were rated slightly lower by women than men. Commercial, specially trimmed steaks were more popular among men while Choice and Prime were less popular.

The sample was designed to be representative of the Metropolitan St. Louis population so Negro as well as white shoppers were interviewed. However, the Negro sample was so small (about 60 per experiment) that any inference of relations from that sample to the Negro population involves considerable risk.

The proportion of Negroes in the sample preferring Commercial grade roasts was slightly higher than for the white group, but the difference was not significant. Total percentage of Negroes preferring Commercial or Good regular steak was 49.2 as contrasted with 38.5 for whites. The differences in the special grade sample between races were very small.

In general, age of respondent was not consistently associated with grade preference. Prime and Commercial roasts were slightly more popular with

the older group (40 years of age and older). Prime regular steaks and Prime and Choice special steaks were slightly more popular with the older group.

No relation of grade preference to family size was found.

In summary, cross-tabulation of preferences with various socio-economic characteristics indicated some relationship in most cases. However, the relationships were generally so weak and unsystematic that extreme caution must be used in inferring them to the population of Metropolitan St. Louis.

Multiple correlation analysis of the relation of attribute preferences to preferences over-all was extended to two income classes for all grades. The percentages of total *explained* variance contributed by the scores of each attribute in the two income classes as compared with the whole sample disclosed some differences in relative contributions among the classes (Table 16). The number of respondents in each sample was 338 for the whole sample, 143 for the high income class and 159 for the low income class.

TABLE 16 -- PERCENTAGE CONTRIBUTION OF ATTRIBUTE RATINGS TO TOTAL EXPLAINED VARIANCE OF OVER-ALL RATINGS OF STEAKS BY TWO INCOME CLASSES AND BY THE WHOLE SAMPLE\*

Attribute	High Income Class	Low Income Class	Whole Sample
	%	%	%
External fat	30.2	21.4	24.7
Color of lean	18.3	23.1	19.9
Marbling	12.8	22.6	18.0
Texture	15.0	13.6	15.0
Color of fat	18.6	11.2	15.2
Amount of bone	5.1	8.1	7.2

\*Low income was up to \$74.99 per week and high income was more than that amount.

The 3.0 percent difference in percentages between the two income classes on amount of bone indicates the danger of undue emphasis on differences of that magnitude, since attitude toward amount of bone was probably affected somewhat by chance or by imperfect visual perception. The large differences between the income classes related to amount of external fat and amount of marbling. The high income class apparently placed much more emphasis upon external fat than upon marbling in making their over-all selections. The low income class gave equal emphasis to external fat, color of lean, and marbling; thus, they emphasized marbling more than the high income class while emphasizing external fat less. The high income class emphasized color of fat slightly more than the low income class and color of lean slightly less. Perhaps these differences by income class reflected differences in the attributes of the beef customarily purchased. High income groups were probably more accustomed to associating a large amount of external fat with quality than were low income groups. Perhaps, low income groups emphasized color of lean more because of a greater concern about the freshness of the beef they bought. The data do not provide information about the inner motivations of respondents. Therefore, the speculations

about the reasons for differences in the attitudes of the two income samples cannot be substantiated in this study. The results of this technique must be interpreted cautiously because of their abstract and aggregative nature and because of the present lack of experience with the technique.

### STEAK SIZE PREFERENCES

An experiment to determine the preferences of consumers for various areal sizes and thicknesses of steaks was another part of this study. Steaks that were cut from carcasses weighing 375, 525, or 675 pounds were used. The steaks were cut  $\frac{3}{4}$  inch thick.

In ten stores the three sizes of Choice loin steak were displayed alone. A special variation of the above experiment accompanied by a special variation of the regular size schedule was used in the other five stores. A display of three sizes of each of grades Choice, Good, and Commercial was used. After a respondent had chosen the preferred size from the Choice trio, she was then asked to indicate her preference for one of the grade trio of that size. Certain other preferences were obtained. The tray design is shown in Figure 3. The size schedule was answered by 503 respondents.

The first question about size was asked as the three displayed sizes were pointed out. "If you were going to buy one of these steaks and they were the same price per pound, which one would you take?" The small size was preferred by 18.1 percent, the medium by 36.4, and the large by 45.1, while 0.4 percent gave no answer.

Respondents were asked: "Do you think that there is any difference in flavor or tenderness between these three sizes of steak?" "Yes," replied 51.1 percent of the respondents, while 30.2 percent said, "no" and 18.7 percent gave no answer. Only about 44 percent of those who preferred either the small or the medium size answered, "yes," while 60 percent of those preferring the larger size said, "yes."

White women and white men had about the same proportions preferring the large steak, while a somewhat smaller proportion of women than men preferred the smaller size and a larger proportion of women preferred the medium size. No relation of size preferences to income or education or

	Small	Medium	Large
Commercial			
Good			
Choice			

Front of Display Tray

Fig. 3—Display tray arrangement.

age was found. There was a slight negative association between the areal size preference and the size of the respondents family.

On all size schedules the respondents ranked four grades of similar sized steaks of a special trim as to preferences, as described elsewhere. There was a significant association of preference for Commercial grade and the small size, Good grade and medium size, Prime and Choice grades with the medium size and to some extent with the large size.

At ten stores 287 respondents were asked: "Why do you like that size best?" The verbalized reasons for preferring a certain areal size of steak reflected more the visual appearance as to quality of steak and relative quantity of fat than they reflected the appropriateness of a certain size for providing the individual or the family with a pleasing serving at an acceptable cost. Quantitative comparisons of this nature from an open-end question must be made cautiously, of course.

The question was asked, "Which one of these is more important in helping you to choose the best size of a steak when you are shopping; (1) the total weight and total cost of that size, or (2) the eating qualities of that size?" This question proved to be too direct an approach to the problem. "Cost" and "quality" seemed to be the comparison in the minds of most respondents and the prestige-raising "quality" was claimed by most of them, and certainly by a far greater group than showed any real awareness of quality differences in steak. Alternative one was answered by 9.9 percent, alternative two by 86.5 percent, and 3.6 percent gave no answer. However, only 51.1 percent of the respondents on a later question said that they thought the three sizes had *any differences* in flavor or tenderness.

As mentioned above, the special nine-steak display was the basis for certain special experiments. The respondent first chose the size preferred out of the Choice grade row. Then out of that size column, he selected the grade preferred. The respondent was then asked to choose the preferred steak from among the *other* two steaks of the grade row and the *other* two steaks of the size column. The interviewer said, "From among these four steaks that I am going to point out to you, please pick the one you would take, if these four were all the same price per pound." This choice forced the respondent to give up either his preferred grade or his preferred size of steak. By this means it was hoped to learn which preference—grade or size—was the stronger. It must be remembered that the differences in grades were not referred to explicitly. Therefore the respondents' attitudes on the three grades were based largely upon their visual appearance. This experiment was frankly of a very exploratory nature and was made in only five stores with 201 respondents participating. Therefore, these results are not inferred to the population.

The over-all percentages showed that 47.8 percent of the respondents changed their grade choice while 52.2 percent changed their size choice. If these figures are taken at face value, one-half the respondents had stronger

size than grade preferences and the other half had the converse. Probably a number of respondents had no real basis for their choices and made them rather randomly.

The results from the next question are tentative evidence that preferences for size and grade of steak were weak for many people, but that grade preference was stronger than size preference for slightly more people. The interviewer asked as she pointed out a trio of steaks, "If you were to be given one of these three steaks which one would you take?" This trio was the small Choice, the medium Good, and the large Commercial *if* the original preference of the respondent was for Choice; otherwise, the trio was small Commercial, medium Good, and large Choice.

Size was changed more readily than grade by this group of respondents, but both size and grade were changed with surprising readiness (Table 17.)

TABLE 17 -- SHIFTS IN GRADE AND/OR SIZE BY RESPONDENTS BETWEEN ORIGINAL SIZE SELECTIONS AND "GIFT" SELECTIONS

Decision	Number of Respondents
Changed grade but not size	27
Changed size but not grade	46
Changed both size and grade	79
Changed neither size nor grade	22
Total	174

One caution in interpretation is that 132 of the 174 gift choices were for medium sized Good, which was the middle steak in the trio offered. Perhaps the middle choice seemed "safer" to the uncertain. Even though the changes of *both* size and grade may have been often motivated by a desire to move toward the "safe" middle choice, the changes still appear to reflect a lack of *strong* preference for either size or grade.

Another question was put in this way: "The steaks on this tray happen to be  $\frac{3}{4}$  inch thick. How thick do you want loin steaks?" Two observations need to be made. First, the question and the results apply to *loin* steaks. Second, the reference to the  $\frac{3}{4}$  inch thickness in the display probably increased the "preference" for that thickness in spite of the casualness of the reference. This risk of bias was taken in order to furnish a reference point for estimating thickness. The distribution of replies was considerably different from that reported in a previous Missouri study (7) as far as particular thicknesses are concerned, but both studies found that most respondents wanted steaks within a range of  $\frac{1}{2}$  and 1 inch in thickness (Table 18).

TABLE 18 -- DISTRIBUTION OF LOIN STEAK THICKNESSES DESIRED BY RESPONDENTS

Thickness Desired	Percentage of Respondents
1/4 inch	1.4
1/2 inch	12.5
3/4 inch	46.3
1 inch	16.1
over 1 inch	4.8
no answer	18.9

There was a slightly greater proportion of preference for the "higher" grades of steaks among those desiring the thicker steaks. The highest proportion of broiling as the customary method of cooking steaks was found among respondents who desired steaks one inch or more in thickness. Frying exceeded broiling in popularity only among respondents who desired steaks of  $\frac{1}{2}$  inch or less in thickness. Those preferring one or the other of the two lesser degrees of doneness gave less "don't know" answers about thickness and, on the average, preferred thicker steaks than those preferring a great degree of doneness. Only a slight positive association of desire for thicker steaks and larger areal size preferences was found.

Socio-economic influences upon individual taste in regard to thickness of steak are apparently very small. White men desired slightly greater thicknesses than white women in the sample. Older people desired thicker steaks, on the average, than younger people, although there was a wide range of desires at each age level. There was a slight association with income and education, but the relation was neither systematic nor strong.

## PREFERENCE VS. IGNORANCE

(an appraisal)

Frequently, the question is raised as to whether or not visual preference indicates the grade which is actually preferred after eating. This is a question crucial to the interpretation of much of the results of this and other preference studies. The problem could be attacked directly by allowing respondents to eat the grades under test and obtaining their preferences visually before eating and then again after eating. A variation of such a direct approach was made on the pilot study at Missouri (10). Resources were not adequate for such a procedure on the scale necessary for this study, but considerable evidence indirectly bearing upon the problem was obtained. Related problems concerning the strength of eating preferences and the extent of consuming experience upon which preferences were based were not attacked.

The problem is to determine the degree of association between visual and eating preferences. What proportion of the respondents can identify visually the grade they prefer for eating? "Ignorance" is here defined as the inability to perform successfully, most of the time, visual identification of the grade that best satisfies eating preference. However, this term must be interpreted strictly as defined. Ignorance, as defined, may result from an absence of need for that kind of knowledge. That is, many people may be satisfied customers of a certain store or set of stores that consistently sell the desired grade and, therefore, have no need to inspect their beef purchases to obtain the preferred quality. Consequently, an ignorant consumer, as here defined, may still be obtaining the grade of beef that satisfies him and that he prefers at the dinner table.

There are other minor facets to this problem. For example, the person who pressure-cooks his roast or steak need have little knowledge of the variation of tenderness in those cuts, for tenderness is probably guaranteed by the cooking method. It seems likely, however, that visual preference is sometimes relied upon by many people and often relied upon by some; therefore, it is of importance to the market researcher to estimate the degree of accuracy with which this coincides with eating preference. Moreover, such discovery is extremely important in evaluating the area of application of results of the research determination of visual preferences.

Respondents were asked, "Which one of these four (roasts, steaks) is most like the type of (roasts, steaks) that this store sells?" The percentage of respondents making a correct identification was 19.2 percent for steaks and 16.4 percent for roasts. (One sample store sold more than one grade of beef, so the percentages are based only upon the total of respondents in the other sample stores.) Since about one-fourth of the respondents ordinarily purchased no beef in the store where interviewed, they, perhaps, should not have been expected to recognize the grade, or "type," of beef sold, and the percentages might well be increased by one-third to adjust them to the total of buyers of beef. "Type" was used instead of "grade" to avoid influences upon responses which the later term might arouse and may have been ambiguous to a few respondents though "grade" would have had little meaning to others. The adjusted percentages were so small that they could be explained by chance alone, even if there were complete ignorance of the grades sold. It should be recognized that from the standpoint of the respondent the test was not an easy one and, therefore, it did not obtain whole-hearted cooperation. Since these questions were near the end of a long schedule and did give the respondent the feeling of being "tested," an ideal interviewing situation was not attained.

A special display containing three grades of loin steak—Commercial, Good, and Choice—of the same areal size and thickness was shown to a total of 216 respondents in five stores. After having selected the grade preferred of four specially trimmed steaks, these respondents selected the grade preferred of the three regularly trimmed grades of steak. The difference in trimming would probably make some difference in the selections and other intra-grade differences in appearance might have a small effect in a sample of this size. There were 141 respondents who selected one of the three lower grades in the first display and, therefore, had an opportunity to select the same grade the second time. Only 60 respondents, or 42.6 percent of the group, did select the same grade again. Since 33 percent of the grade selections might be expected to be consistent solely due to chance, this percentage implies a rather high proportion of "uninformed" respondents.

A large share of those preferring Prime selected Choice the second time. The higher the grade originally selected the greater the proportion of con-

sistent second selections. It appears that more than one-third of the respondents made a second choice quite inconsistent with their first preference. Possibly the preference of these individuals was not for one grade but for a range including two or more grades, but it is also possible that most of these respondents were "ignorant" in the expression of their preferences.

The special sample of respondents, after having been shown the three grades of loin steaks — Commercial, Good, and Choice—of the same areal size and thickness and regular trim, were asked: "Do you think that there is any difference in flavor or tenderness between these three steaks?" Those who said, "yes," were asked, "Which one do you think is the tenderest?" Only 62.5 percent answered the first question in the affirmative while 30.6 percent said, "no," and 6.9 percent gave no answer. Even more striking was the failure of most of the first group to identify Choice as the tenderest grade. A range of 2.9 to 18.1 percent of those in the four preference groups identified Choice as the tenderest. Those preferring Prime did better on identification than any other group but even they did poorly. Good was most often selected as the tenderest, and Commercial was selected more often than was Choice. The grade preferences were expressed considerably earlier in the interview on a different grade display than the one in which identification of the tenderest steak was sought so there was little chance of carrying over expressed preference to the identification question.

The belief in quality difference in grades was rather definitely related to family income with greater proportions of the higher income groups indicating that belief. But this belief was not related to education except as the latter was associated with income. A higher proportion of whites than non-whites and of the 30- to 39-year-old group than other groups said there were inter-grade quality variations.

Two other tests of "consumer ignorance" were based on *the assumption that the higher the carcass grade the more tender and juicy, on the average, are the cuts from them*. It has already been indicated that available data is inadequate to show the strength of the relationship of federal grade to tenderness and juiciness. If the relationship should be proven weak, these tests of consumer ignorance are of little value. If the assumption is true, then a large proportion of St. Louis consumers were ignorant concerning visual indicators of quality. The juiciness identification question read: "Let's look at the meat again. Which (roast, steak) is the juiciest? How would you rank the other three?" The tenderness question for roasts was: "As far as tenderness is concerned, is there a roast that you like best? Which one? How would you rank the other three on tenderness?"

"Errors" of respondents were defined somewhat arbitrarily. Each grade was assigned a rank on tenderness and juiciness as follows: Prime, 1; Choice, 2; Good, 3; and Commercial, 4. Each respondent's ranking was then com-



pared to this ranking and the differences between the two were calculated. For example, if a respondent ranked Prime 3, Choice 1, Good 2, and Commercial 4, then his total number of "errors" was  $|(1-3) + (2-1) + (3-2) + (4-4)| = 4$ . There are 24 possible permutations of these four grades, and the probability of occurrence by chance alone of a certain number of errors was calculated.

The computations for steaks on tenderness were modified by the fact that ratings were used and equal ratings sometimes occurred. These equal ratings necessitated the assignment of tie-ranks which produced uneven numbers of errors ranging from one to nine as well as the even numbered errors ranging from zero to eight. The probability distribution would be strictly valid only for an even-numbered distribution of errors, but there were so few odd-numbered error frequencies for roasts and for steak juiciness as to have a negligible effect. However, there were so many odd-numbered errors on steak tenderness that the probability distribution is only approximately valid.

The computed error distributions on tenderness and juiciness for both steaks and roasts were skewed upward toward the smaller error frequencies sufficiently to infer that they differed from chance (Table 19). That is, a small segment (15 or 20 percent, perhaps) of the sample knew enough about tenderness and juiciness and their association with grade to skew the distribution upward. Although the proportions of "don't know" answers on both tenderness and juiciness were higher for steaks than roasts, the proportions of informed answers (0 to 3 errors) were also higher. That the degree of ignorance should be greater for roasts than steaks can probably be explained by the greater physical similarity of four grades of roasts than of steaks.

The proportions of "don't knows" were much higher on tenderness than on juiciness for both roasts and steaks. However, the distribution of errors for roasts and steaks indicated little, if any, more accuracy in identifying juiciness than tenderness among those who did attempt the identification. But it should be noted that there were no uneven-numbered errors on juiciness of steaks so a distribution terminating in 2, 5, and 9 rather than 3, 6, and 9 errors shows only 47.0 percent making 0 to 2 errors on steak tenderness as contrasted with 53.5 percent on steak juiciness and 25.7 percent making 6 to 9 errors on tenderness as contrasted with 24.9 percent on juiciness. It is concluded that more respondents were informed about juiciness than tenderness in roasts and steaks, but large proportions were informed about neither. There was a fairly high degree of association between number of errors by respondents on juiciness and tenderness.

As might be expected there was considerable correlation between the ratings or rankings of steaks and roasts as to tenderness and juiciness and the ratings or rankings on over-all preference. As long as the former ratings

TABLE 19 -- COMPARISON OF ERROR DISTRIBUTIONS OF RESPONDENTS CONCERNING THE TENDERNESS AND JUICINESS OF ROASTS AND STEAKS

Frequency of Errors	Actual Error Distribution (Percent of Respondents)*				Theoretical Probability Distribution of Errors Assuming Ignorance of Respondents But Excluding "Don't Know" Answers
	Tenderness		Juiciness		
	Sample	Sample Excluding "Don't Know"	Sample	Sample Excluding "Don't Know"	
			<u>Roasts</u>		
0-3	22.1	31.5	27.3	32.4	16.7
4-6	32.6	46.6	42.4	50.4	66.7
7-8	15.4	21.9	14.5	17.2	16.7
Don't Know	29.9	----	15.8	----	----
			<u>Steaks</u>		
0-3	30.4	56.3	43.8	53.6	16.7
4-6	16.0	29.7	17.6	21.5	66.7
7-8	7.6	14.0	20.4	24.9	16.7
Don't Know	46.0	----	18.2	----	----

\*Number of respondents was 460 for roasts and 506 for steaks.

are assumed to explain, or help explain, the latter ratings there is no difficulty of interpretation. To the extent that a "halo" developed for some respondents so that they simply ranked the grades on these two eating attributes the same way that they felt about them on over-all preference, the number of errors was influenced by that extraneous factor. There were only a few people who preferred either Good or Commercial and yet made two errors or less on tenderness.

Probably the percentage of those preferring each grade who answered "don't know" concerning tenderness is the best measure of the relation of degree of knowledge of tenderness to preferences. These percentages ranged from 57.9 percent for Commercial, to 55.9 percent for Good, to 46.2 percent for Choice, to 40.3 percent for Prime grade steak. This is evidence that the groups preferring one or other of the lower grades contained more poorly informed consumers than the groups preferring one or other of the higher grades. The fact that 22.1 percent of those preferring Commercial steak could rank the grades correctly, or nearly so, on juiciness as contrasted with 6.3 percent in the same category for tenderness is other evidence that juiciness identification can be done accurately by more people than can tenderness identification.

Much larger proportions of "higher" grades were preferred by those making few errors. It was difficult for respondents to indicate that the juiciness or tenderness degrees were in any different order than the order of their over-all preferences; consequently, the higher the grade preferred over-all the greater the probability of the respondent making few or no "errors." Thus, the differences in the grade preferences of the informed and uninformed are probably over-estimated by these calculations and the error distributions are biased somewhat. The preference and error distributions cannot be separated with complete accuracy.

The percentages of grade preferences in the special sample of those who realized the possibility of flavor or tenderness differences in grades of steak as contrasted with the percentages for those not aware of the differences were somewhat similar (Table 20).

TABLE 20 -- COMPARISON OF SPECIALLY TRIMMED STEAK GRADE PREFERENCES OF INFORMED AND UNINFORMED RESPONDENTS

Grade Preferred	"Informed"	"Uninformed"
	%	%
Commercial	13.3	17.6
Good	14.1	21.6
Choice	36.3	31.1
Prime	36.3	29.7
Total	100.0	100.0

The available evidence suggests that higher grades were somewhat more popular among the informed respondents than the uninformed. It seems

quite possible that *some* of the uninformed respondents' visual preferences for lower grades were determined by color, or lack of fat, or other characteristics without realization of the possible sacrifice in tenderness and juiciness. However, important segments of the *informed* group preferred Commercial or Good even at equal prices in relation to the other two grades.

Socio-economic and other associations with number of errors were investigated for tenderness. White men made slightly fewer errors on tenderness than white women, while whites as a group made fewer errors than non-whites on both roasts and steaks. The proportion of informed increased only slightly as education increased. Age had little or no effect. Higher income respondents made slightly fewer errors on steaks and roasts. The strongest association with "income" was with income computed on a family member basis.

The number of errors varied quite widely from store to store but was much the same for roasts and steaks within stores with two or three exceptions.

Those who did not depend upon a butcher's advice about steaks and roasts were slightly better informed than those who did. It is interesting that there was no relation between errors and respondents' attitudes concerning the desirability of informative labeling of beef. Apparently, some of the "ignorant" either failed to recognize their own ignorance or felt that they had a better remedy than labeling. There was no relation between those who were sometimes disappointed in the quality of steak and roast consumed and the degree of ignorance about tenderness. That the more ignorant were no more frequently disappointed than the well informed respondents suggests that the bulk of consumers use other means besides visual inspection to obtain the quality of beef desired.

In summary, this section is an attempt to determine the proportion of respondents who could identify in a visual preference experiment the grade they actually preferred—at the dinner table. The following evidence is relevant to the question:

(1) The proportion of respondents in the two large samples who could identify the grade of steak or roast in the display that was sold in that store was only about one-fourth, or no larger than chance could explain if complete ignorance were assumed.

(2) Only 62.5 percent of a sample of 216 were even aware that flavor and/or tenderness probably varied among the grades of steak—Commercial, Good, and Choice—displayed before them.

(3) Only 10.2 percent of that sample of 216 indicated that Choice was the tenderest grade.

(4) Only 42.6 percent of 141 respondents who had the opportunity to express preferences for the same grade of loin steak in two consecutive dis-

play situations actually did so. While there were other reasons for this happening besides the inability of respondents to make the same visual selection twice, it was concluded that more than one-third of them probably made inconsistent selections because of such inability.

(5) The identification tests of two eating characteristics for the two large samples showed that at least one-third of the respondents knew very little about the grade variations in juiciness of steaks and roasts, while one-half were in that same category as regards tenderness. Accurate knowledge about those grade variations was probably possessed by a maximum of one-fourth of the respondents for tenderness and one-third for juiciness.

However, the difference in satisfaction between the grade preferred and the grade next preferred is probably considerably smaller for roasts than for steaks, so as many or even more respondents likely would be "satisfied" with the roasts they selected as with steaks. If those differences in satisfaction between the preferred and the next preferred grade are small for a sizeable segment of people, then larger fractions of respondents can be expected to obtain satisfactory purchases by visual inspection than is indicated by the above data. The possibility of intra-grade differences being large enough that only a part of the grade or only certain carcasses within a grade are preferred by some people cannot be overlooked, but appears unlikely for most retail cuts.

Even after allowing for considerable quantitative inaccuracies in the estimates, an important implication for preference research can be drawn from them. *The implication is that the discovery of visual preferences is probably not a very accurate indicator of actual eating preferences of consumers.* When only one-half, or less, of the respondents can recognize the eating characteristics of the grade, it is obvious that the resulting distribution of visual preferences may be only a rough guide as to the distribution of actual eating preferences. Moreover, such a distribution is not a completely accurate indicator of purely visual preferences (in the sense of what respondents think they prefer), since these are not consistent from time to time for a large segment of the group.

This large element of consumer ignorance must be interpreted carefully. Consumer ignorance apparently makes impossible the accurate discovery of actual eating preferences by any test depending upon visual selection. The methods used in this study and in several recent studies determined *visual* preferences. Many sales tests also depend upon visual selection. Other methods should be explored for determining the actual eating preferences of individuals. While it is important to determine visual preferences, it is very important that they not be confused with eating preferences, and the discovery of the latter is a necessary part of the evaluation of "consumer preferences" for beef.

## RELATIONSHIP OF CONSUMER DESIRES AND HABITS TO PREFERENCES

An important part of this study was an attempt to obtain information about desires and habits of consumers which bear upon their preferences and acceptance of steaks and roasts. Socio-economic characteristics were also related to consumer habits and desires. A rather extensive set of questions was asked, and considerable cross tabulation was performed to get as complete a picture as possible of this aspect of the problem.

### CONSUMER DESIRES CONCERNING BEEF

The experimental investigation of preferences was limited to preferences among four grades of loin steaks or chuck roasts and to three areal sizes of a given grade of loin steaks. This limitation, though required by the resources available for the research, excluded the comparison of consumer preferences of many possible beef "products." Moreover, it is possible that the beef "product" that would be most preferred by a large group of consumers is not even being produced today. In recognition of these experimental limitations, a portion of the schedule was designed to investigate certain consumer desires concerning roasts and steaks and other beef products. For example, the importance of tenderness as an eating characteristic was investigated from several points of view so that a comprehensive picture could be obtained. Consistent evidence from several different sources is probably more reliable since the composite results have less chance of being biased materially by poor schedule wording or improper interviewing techniques. Considerable evidence was obtained for several important conclusions and a more adequate fund of knowledge was developed as a basis for further research.

#### Relative Importance of Eating Characteristics

Respondents were questioned: "Let's think about *eating* characteristics for a moment. List No. 2 on your guide sheet is a list of four eating characteristics that we often think about when we talk about (steak, roast). Which one of these seems most important to you? How would you rank the other three?" The four characteristics were flavor, tenderness, amount of fat, and juiciness, which had been selected from answers to open end questions of previous studies. There was at the time, and still is, some question about placing "amount of fat" in the list. A few people explicitly reasoned that the "right" amount of fat gave the preferred flavor, tenderness, and juiciness and, therefore, ranked fat first, though they had little interest in fat, itself. It was hoped that those who were willing to sacrifice some juiciness and tenderness for leanness would rank amount of fat first, but this apparently occurred infrequently.

TABLE 21 -- EATING CHARACTERISTIC RANKED FIRST IN ROASTS AND IN STEAKS BY RESPONDENTS

Eating Characteristic Ranked First	Roasts	Steaks
	%	%
Tenderness	54.7	56.7
Flavor	33.6	30.1
Juiciness	6.5	8.5
Amount of fat	5.2	4.7

The similarity of the distributions of first ranks of the four eating characteristics for roasts and for steaks was striking. (Table 21). Again, the differences in first ranks emphasize the differences among consumers and, perhaps, help to explain differences in preferences for grades.

The striking importance of tenderness emphasizes that that characteristic needs to be present in beef roasts and steaks if consumers are to purchase them at a high rate. Further evidence on quality disappointment and on the extent of use of tenderizers is given later. "Appearance" was mentioned once or twice as an important eating characteristic.

Cross tabulations of these eating desires by various social characteristics did not, in general, reveal very significant associations. Non-white respondents ranked tenderness or juiciness first slightly more frequently than did whites in the case of both roasts and steaks. There was little difference between the sexes except that men emphasized tenderness slightly less than women for both roasts and steaks.

Respondents with 8 years or less of education emphasized tenderness less and juiciness more than did others for roasts and steaks. This relation to education was tested by chi square for steaks and found extremely significant. The higher the family income, the less emphasis was placed upon juiciness for both roasts and steaks. This relation may reflect differences in cooking and in the grade consumed at different income levels. Flavor of roasts was more often ranked first by those with high family incomes, while the middle family income group emphasized tenderness more than did other groups. Flavor of steak was more often ranked first as both family income and worker income rates increased but the relations were not statistically significant.

Flavor was emphasized more and tenderness less by those people under 30 years of age or over 60 than by the middle age group.

There was a significant relation between the eating characteristic ranked first and the eating characteristic with which a consumer had been disappointed at sometime. For example, a greater proportion of the respondents who complained of disappointment with tenderness in their steaks ranked tenderness first as a desired eating characteristic. Presumably the relation may work either way or both, i.e., a desire for tenderness causes one to be more likely to be disappointed on that score and, conversely, disappointment with tenderness serves to emphasize the importance of that characteristic.

### Desired Degree of Juiciness

The schedule question read: "Please tell me what degree of juiciness of the five on list No. 3 that you most prefer in (steak, roast)?"

It was recognized that there was some ambiguity inherent in the question since Mrs. A's concept of "very juicy" may well differ from Mrs. B's concept and from the concept of the interviewer. But, it was thought the answers would help shed some light on consumer preferences for juiciness. The results have supported that hypothesis.

Not all consumers agreed as to the degree of juiciness desired in steaks and roasts but the distributions for the two cuts were similar (Table 22). The

TABLE 22 -- DEGREE OF JUICINESS DESIRED IN ROASTS AND STEAKS  
BY RESPONDENTS

Degree of Juiciness Desired	Roasts	Steaks
	%	%
Very juicy	21.5	21.2
Juicy	52.0	55.3
Neither dry nor juicy	24.9	22.2
Dry	0.2	0.8
Very dry	0.0	0.0
Other replies or no reply	1.3	0.4

modal preference for "juicy" steaks and roasts is an important indication of the degree of juiciness desired by one-half the population, but it should not obscure the fact that the other half had differing views. It is generally believed by experienced market researchers that the extremes on a check list are avoided by respondents and so the "very juicy" category may, perhaps, have been even larger in the population than the sample percentages indicated. It would be interesting to know which grades and which cooking methods and which combinations of those produce sufficient juiciness to satisfy those desiring the two greater degrees of juiciness. A previous discussion indicated, however, that tenderness was a more important characteristic to most consumers. Therefore, improvement in tenderness should be a more important means of increasing consumer acceptability of roasts and steaks than improvement in juiciness, though the latter should not be ignored.

A highly significant relation was found between the degree of juiciness desired and the degree of doneness desired in steaks (chi square, 1 percent). The greater the degree of juiciness desired, the less the degree of doneness wanted. About one-half of those preferring "rare" steak like it "very juicy" as contrasted with only 17 percent of those liking it "well done." The same type of relationship, though perhaps less strong, exists for roasts between degree of juiciness desired and degree of doneness. These relations indicate that some people adapt their cooking time to the other eating characteristics desired. Improper cooking could obstruct the satisfaction of preferences for a given degree of juiciness whatever the original degree of juiciness of the cut. A majority of respondents preferred a degree of doneness in roasts con-



sistent with the degree of juiciness desired. There appears to be no way of completely satisfying the preferences of those who want a "very juicy," well-done steak.

"Very juicy" roasts and steaks were more popular among Negro respondents than whites. There was no apparent relation of juiciness desired to sex of whites for either roasts or steaks. "Very juicy" steak was desired by 11.2 percent of the group under 30 years of age, by 24.5 percent of those 40 to 59 years of age, and by 39.9 percent of those 60 years old and older.

### Amount of Fat Desired

This section treats mainly the answers to a schedule question on this subject. The question was used in conjunction with a check list and read as follows: "Please tell me what amount of fat of the five described on list No. 1 you like best in steaks?"

Any verbalization of desires of this type must be interpreted cautiously but these generalizations can be made on the basis of the replies. A surprisingly large proportion of respondents indicated no desire for marbling (Table 23). One out of 20 respondents said they wanted *no* fat. Approxi-

TABLE 23 -- DEGREE OF FAT DESIRED BY RESPONDENTS

Degree of Fat	Percentage of Respondents
1) No fat anywhere	5.2
2) A little outside fat, but no specks nor streaks of fat in the lean	27.6
3) Little specks and streaks of fat in the lean but no outside fat	7.6
4) Little specks and streaks of fat and a small amount of outside fat	26.6
5) Little specks and streaks of fat and a moderate amount of outside fat	31.6
No answer	1.4

mately two-thirds of the sample wanted a small amount of outside fat. This certainly bears out the oft-repeated statements of butchers that most consumers want closely trimmed steaks. However, one-third of the respondents desired a moderate amount of fat. While it is evident that almost everyone wanted *some* outside fat on their steak, there may have been two or more reasons for this desire. Some respondents may like fat while others may dislike it, in itself, but consider it necessary for "good" steak.

Certain relations of amount of fat desired to attitudes and habits were found. In terms of the degrees of fatness in Table 23, there were associations of preference for Commercial and degree 2 of fat, Good and 1 to 3, Choice and 4 to 5, and Prime and 3 to 5. Those wanting the greatest degree of fat wanted a little thicker steak on the average. A larger proportion of those desiring the greater degrees of fatness said that there was a difference in the flavor and tenderness of three grades of steak displayed than of those desir-

ing less fatness. Those purchasing higher grades on the average chose a slightly higher degree of fatness.

Family income was positively related to amount of fat desired. Amount of education appeared to have a positive, though rather irregular, relation to fat desired on the basis of simple cross-tabulation, but separation of the income effect removed almost all the systematic influence of education. Relations to age, sex, and race are shown in Table 24.

TABLE 24 -- PERCENTAGE DISTRIBUTION OF DEGREE OF FAT IN STEAKS DESIRED BY RESPONDENTS, CLASSIFIED BY AGE, RACE, AND SEX

Social Background	Degree of Fat Desired*					Total
	(1)	(2)	(3)	(4)	(5)	
Young** white women	6.4	26.2	8.5	31.9	27.0	100.0
Older white women	4.2	24.9	9.0	28.0	33.9	100.0
Young white men	4.7	30.2	4.7	20.9	39.5	100.0
Older white men	7.8	32.8	4.7	20.3	34.4	100.0
Young negroes	5.6	44.4	0.0	22.2	27.8	100.0
Older negroes	2.7	35.2	10.8	21.6	29.7	100.0

\*Degrees of fat are numbered as in Table 23.

\*\*"Young" included ages 18 to 39, and "Older" included ages 40 and over.

### Degree of Doneness Desired

Information concerning the degree of doneness desired by consumers was obtained on all three schedules. The respondents were not given a check list because in pretests it was found that virtually all answers fell into one of four categories; therefore, an open-end approach involved no classification problem. The problem of meaningfulness of these subjective answers parallels the problem for degree of juiciness as previously discussed.

The question on the roast and steak grade schedule was: "How well done do you like (roasts, steaks)?" The wording on the steak size schedule was: "How well do you like a steak to be cooked?" The distributions of the replies as to degree of doneness desired in steaks and roasts, as found on the three schedules, are shown in Table 25 (data from the two steak schedules are averaged together).

TABLE 25 -- PERCENTAGE DISTRIBUTION OF DEGREE OF DORENESS IN ROASTS AND STEAKS DESIRED BY RESPONDENTS

Doneness Desired	Roasts	Steaks
	%	%
Well done	55.9	43.2
Medium	31.1	32.1
Medium rare	9.1	14.4
Rare	2.4	8.6
Other or no answer	1.5	1.7

A greater proportion of people in the samples wanted well done roasts than wanted well done steaks. In fact, a rather high degree of doneness was desired by most respondents. The degree of doneness affects, considerably, the eating qualities of the meat cut and the degree of consumer satisfaction.

Since cooking vitally influences the eating qualities of meat, the discovery of the extent to which this influence is favorable or unfavorable and the discovery of remedies for unfavorable results assume an important role in the over-all beef marketing problem. More extensive research in this area appears desirable.

The relation of doneness desired to method of cooking used, eating characteristics desired, and degree of doneness desired is shown in Table 26.

TABLE 26 -- DEGREE OF DONENESS DESIRED IN STEAKS COMPARED WITH THE METHOD OF COOKING USED, EATING CHARACTERISTIC RANKED FIRST, AND DEGREE OF JUICINESS DESIRED BY RESPONDENTS\*

Method of Cooking	Well	Medium	Medium- Rare	Rare	Total Percentage of Respondents in Sub-Group
Broil	36.5	35.7	16.6	11.2	100.0
Fry	59.6	26.9	7.7	5.8	100.0
Eating Characteristic Ranked First					
Flavor	30.5	40.9	15.6	13.0	100.0
Tenderness	42.2	32.7	19.9	5.2	100.0
Desired Degree of Juiciness					
Very juicy	31.1	35.8	14.2	18.9	100.0
Juicy	38.9	35.3	19.9	5.9	100.0
Neither dry nor juicy	47.3	32.7	16.4	3.6	100.0

\*Comparisons are made using data obtained from the regular steak schedule except for cooking methods which were obtained from the special steak schedule.

There was a strong inverse relationship between the doneness desired and the thickness of steak desired.

The question was asked on the steak size schedule: "Does the rest of your family prefer the same degree of doneness as you do?" To this, 76.3 answered, yes; 22.3 percent, no; and 1.4 percent gave no answer.

White women preferred a significantly greater degree of doneness in roasts than white men. The same relation was noted for steaks but it was not quite strong enough to be statistically significant. Simple cross tabulations of desired doneness by family income and by education showed no relation to income and an inverse relation to number of years schooling. Subclassification to obtain three educational groups of the same middle income again revealed an inverse relation of degree of doneness to education. No systematic relation of desired doneness to income per worker was found. Age was not a significant explanatory variable for either steaks or roasts with respect to degree of doneness desired.

### Disappointment With Eating Characteristics

Evidence of inability of consumers to recognize quality variations in these steaks and roasts, plus the probability of intra-grade and inter-grade variations in the eating characteristics of these cuts, suggest that some cus-

tomers might sometimes be disappointed in them. The extent of disappointment, its causes, and its association with the grades consumed are important in evaluating this aspect of marketing resistance.

The schedule question used to gather information on this problem was, "Do you ever find when you serve (roast, steak), that it is a different *quality* than you thought it was when you bought it?" If the answer was yes, the following two questions were asked: (1) Does this occur—more than  $\frac{1}{4}$  of the time or less than  $\frac{1}{4}$  of the time?" (2) "Is this difference from what you expected in—flavor, or tenderness, or juiciness?" These *differences* were all, or almost all, *disappointments* the authors believed, and were so interpreted.

More than 70 percent of the respondents said that they were disappointed sometimes in the eating quality of the roasts and steaks they consumed (Table 27). The large proportion of complaints does not mean that most people were *usually* dissatisfied with the beef they buy, but rather that they did recall one or more times when they were dissatisfied.

TABLE 27 -- PERCENTAGE OF RESPONDENTS SOMETIMES DISAPPOINTED IN THE EATING QUALITY OF ROASTS AND STEAKS CONSUMED

	Roasts	Steaks
	%	%
Yes	71.1	72.5
No	25.9	25.5
No answer	3.0	2.0

The 367 people who complained about steak quality made 447 specific complaints and the 310 people who complained about roast quality made 380 complaints, distributed as shown in Table 28.

TABLE 28 -- PERCENTAGES OF TOTAL RESPONDENTS MAKING SPECIFIED COMPLAINTS ABOUT ROAST AND STEAK QUALITY

Type of Complaint	Roasts	Steaks
	%*	%*
Tenderness	55.2	61.9
Flavor	17.4	15.6
Juiciness	10.0	8.5
Other	----	0.6

\*These percentages cannot be meaningfully totaled as some respondents made more than one complaint.

Just as tenderness was the outstandingly important eating characteristic desired in beef, so it was the characteristic in which most consumers had at one time or another been disappointed. The figure of 62 percent disappointed with steak tenderness may be lower than it would be if the recollections of respondents about the past were better.

But its relative size compared with the 15.6 percent of the total sample complaining about flavor should give an accurate appraisal of the comparative extent of consumers' satisfaction with each characteristic. Tenderness was the eating characteristic most often lacking in steaks and roasts con-

sumed by the population of Metropolitan St. Louis. A few other complaints were ventured concerning tenderness such as "grain," "texture (did not cut right)," and "stringy."

While deficiency in recollection may have biased the percentage of disappointment downward somewhat, there was a small bias the other way caused by a more than proportionate degree of disappointment among the group that shopped most frequently and thereby were sampled most heavily.

The estimates of the frequency of quality disappointment must be taken as a rough approximation since the question calls for both recollection and generalization by the respondent. There were 20.9 percent of those disappointed who reported a disappointment frequency of one-fourth or more of the time for roasts; 77.3 percent reported less than one-fourth and 1.8 percent giving no answer. Thus, most respondents were disappointed only occasionally but a significant minority were disappointed more than one-fourth of the time.

Type of quality disappointment in steaks was related significantly (chi square, 5 percent) to the eating characteristic ranked first.

There was not a significant relation between the number of "errors" on tenderness identification by individual respondents and the degree of quality disappointment. If steak purchases were determined solely by visual inspection, then the ability to identify tenderness in steak would be expected to have an inverse relation to the degree of disappointment with tenderness. The budgetary factor is one reason why this association might not be perfect. Then there may be some people who knowingly sacrifice tenderness to avoid fat. But it seems unlikely that these factors explain away *any* relation at all between the ability to identify tenderness and the presence or absence of quality disappointment. This lack of relationship is further evidence that many consumers cannot detect much about the eating characteristics of meat by visual inspection. It is reasonable to believe that many of them use other means of ascertaining the eating characteristics of the meat they buy.

The lowest frequency of steak disappointment was 38.7 percent in a store selling young Commercial beef, and the highest frequency was in a store selling Good beef. The average (unweighted) percent of disappointment per store was 74.9 percent. The stores with lesser degrees of disappointment by grade sold were: 1 Prime, 2 Choice, 3 Good, and 2 Commercial, while the stores with greater frequencies were: 1 Choice, 1 Choice through Commercial, and 3 Good. There is, therefore, some relation between grades and the frequency of quality disappointment of their buyers, but it is not a simple relationship of the higher the grade the less the disappointment. That relation is probably partially obscured by the fact that only about 40 percent of the respondents bought almost all, or all, of their beef at the store where interviewed, while about 26 percent, on the average, bought no meat

at the store where interviewed. It is likely that other variables than grade sold, such as the particular cuts purchased, the age of the animals, the skill of the meat retailer, the cooking methods used, and individual tastes also influenced the degree of satisfaction with quality.

The mean and median of the respondents' family incomes at each store were used to divide the stores into three groups of five stores each. The percentages of quality disappointment with steaks or roasts were then computed for each group (Table 29). There is evidence that customers in the middle

TABLE 29 -- PERCENTAGE OF RESPONDENTS COMPLAINING ABOUT QUALITY OF STEAKS OR ROASTS CONSUMED AS CLASSIFIED BY INCOME GROUPS SERVED BY THE STORES

Income Group	No	Complaints Concerning:		
	Complaints	Tenderness	Flavor	Juiciness
	%	%	%	%
Upper 1/3	24.0	60.0	9.9	4.3
Middle 1/3	31.7	45.9	2.6	3.0
Lower 1/3	24.9	45.9	7.3	3.0

family income bracket had less complaints about quality and particularly about tenderness than did those in the upper and the lower brackets. Perhaps those in the upper income group had higher expectations or were more inclined to complain to interviewers, but it is rather surprising that they were not achieving more satisfaction than those with lower incomes. The stores catering to high income customers may form an important area for the improvement of marketing. The grades sold in these store groups were: (1) Upper third—1 Prime, 3 Choice, and 1 Good; (2) middle third—4 Good and 1 Commercial; and (3) lower third—1 Choice through Commercial, 3 Good, and 1 Commercial. Some respondents were not buying beef in the store where interviewed but most were. It thus appears that Choice and Prime were not as satisfactory to as high a proportion of upper income respondents as Good was to middle incomes.

Disappointment is a psychological attitude and, consequently, the methods used here of measuring it must be recognized as crude approximations. It does seem obvious that the great majority of people had occasional complaints about the eating characteristics of the beef they consumed and mostly about its tenderness. A cheap and satisfactory method of tenderizing beef in the carcass or in the cut appears to be an important problem for those concerned with its production and merchandising. This is an area in which further experimentation and research could possibly increase consumer satisfaction and demand for beef.

### Desire for Informative Labeling

The possibilities of improving quality satisfaction through informative labeling of beef cuts seemed important enough to warrant investigation.

This was done by a pair of questions in each schedule. The first question was identical on both schedules: "Do you think that there is enough variation in the quality of the beef that you buy that it would often be helpful to you to have the recommended cooking method and time printed on the label of every package of beef?" This was followed by a second question on the roast schedule which read: "Would such instructions often be helpful to most people?" The steak schedule question read: "Do you think such instructions would be helpful to most people?"

Since the identical first questions were asked by the same interviewers of parallel samples, the differences in percentages between schedules arose from sampling alone (Table 30). A small majority of consumers thought that

TABLE 30 -- PERCENTAGE DISTRIBUTION OF REPLIES AS TO USEFULNESS OF LABELING TO RESPONDENTS AND TO OTHERS

Replies	Useful to Respondents:		Useful to Others:	
	Roasts %	Steaks %	Roasts %	Steaks %
Yes	53.2	56.1	75.6	74.3
Yes, for inexperienced	----	----	2.2	2.0
No	42.9	40.3	14.5	15.4
Don't know or no answer	3.9	3.6	7.7	8.3

such labeling would help them. Since it is hardly likely that the negative responses mean opposition to the proposed practice, many meat prepackagers might find it worth the cost to label because of the probable increase in consumer satisfaction of some customers.

The answers to the second question show the acceptability of labeling as it was felt useful for others (Table 30). On some types of questions, and, perhaps, on this one, it can be argued that the answer "for others" reflects the real feelings of the respondent projected into others in the interviewing situation. The slight difference in wording of this question in the steak and roast schedules had little effect. These figures reinforce the conclusion above that informative labeling would be accepted by the population. The data do not indicate how many people would consistently use the labels or prove that labeling would necessarily increase meat sales but they indicate a general interest in and acceptance of the idea. One respondent commented: "Lots of people do not buy because they do not know how to prepare." Perhaps there is some truth in the comment.

There was 67.3 percent acceptance of labeling for themselves in the group who tenderized their steak and 52.0 percent acceptance in the group who did not. It seems natural that those who were already actively trying to improve the eating qualities of steak would be more receptive to the provision of information on that subject. Attitude toward labeling was not related to whether or not the butcher's advice was depended upon. No relation of attitude toward labeling to methods of cooking was found. Of the 227 steak

schedule respondents desiring labeling, 75.8 percent made complaints about quality, while only 49.6 percent of those 133 people who said labeling would not be helpful to them made complaints about quality. Dissatisfaction with quality was clearly a positive factor in the acceptance of labeling.

The average (unweighted) acceptance rates as indicated by both schedules were: white women 55.0 percent, white men 54.9 percent, and Negroes 70.5 percent. The greater the education of respondents the greater the acceptance of labeling. The younger the respondents the greater the acceptance of labeling. No consistent relation of attitude toward labeling to income rates per worker were found.

On the size schedule the labeling acceptance question was followed by "Why (or why not)?" Quite a group of respondents thought that informative labeling would improve cooking methods and time and, thereby, the eating qualities of meat, and its nutritional value—especially for the neighbors. Those not accepting labeling indicated that they already had an established way of cooking.

### CONSUMER HABITS CONCERNING BEEF

Meat consumption is probably greatly conditioned by habit patterns of consumers. A few habits which were believed to be related closely to the problem under investigation were selected for study. Questions were developed concerning use of tenderizing techniques, methods of cooking, and degree of dependence upon the butcher's advice about the quality of beef purchased. Certain other "habits" were investigated which were less directly related to the general purpose of the study.

#### Use of Tenderizing

The extent to which consumers attempted the tenderizing of beef reflected the extent to which lack of tenderness was an important enough problem to motivate a specific attempt at solution. A question was worded: "Do you attempt to make more tender the (steak, roast) you ordinarily buy?" If, yes, was the answer the respondent was asked: "What do you do?"

The fact that two out of every five respondents attempted to tenderize their steaks and one out of four attempted to tenderize roasts shows that lack of tenderness in those cuts was an important problem for a significant portion of the population of Metropolitan St. Louis (Table 31). More than half

TABLE 31 -- PERCENTAGE OF RESPONDENTS ATTEMPTING THE TENDERIZING OF ROASTS AND STEAKS

Replies	Roasts	Steaks
	%	%
Yes	24.8	40.1
No	72.4	57.9
No answer	2.8	2.0



of those who made complaints about the lack of tenderness in beef were concerned enough to attempt a solution.

The percentages of total respondents using a given method for tenderizing roasts were: Commercial enzyme, 8.5 percent; pressure cooking, 6.4 percent; home remedies (vinegar, etc.), 3.8 percent; mechanical (pounding, etc.), 3.2 percent; and combined methods, 3.1 percent. The percentages of the whole sample of respondents using a given method for steak were: Mechanical, 26.0 percent; commercial enzyme tenderizers, 8.9 percent; special cooking, 2.8 percent; home remedies, 2.4 percent; and other 1.2 percent.

Thus mechanical means, mainly pounding with instruments, were the most important method of tenderizing steaks, while commercial preparations were most used for roasts. The special cooking included a variety of methods and probably varied considerably in the degree to which tenderness was promoted. The fact that some of these attempts were probably inadequate only intensifies the need for modifying the product so that tenderness is assured.

The percentages using tenderizers on steak in a given store sample ranged from 0.0 percent in a store selling only Prime to 58.3 percent in a store in a low income section of the city selling Good grade beef. However, the over-all relation of tenderizing to grade of beef sold was not as strong as is implied by the above examples. The percentages of respondents tenderizing roasts in a given store sample ranged from 4.5 percent to 45.4 percent. The two stores at opposite extremes both sold Good grade beef. Again, there was no clear relationship of tenderizing to grade sold.

Use of tenderizing was related to the socio-economic status of respondents. Larger families tended to use tenderizing more than small families. There did not seem to be a consistent relation of tenderizing use to age or education of respondents. Use of tenderizing was related inversely to income rate per worker on the steak schedule. A slightly higher proportion of Negroes used a tenderizer than whites.

### Cooking Methods

The cooked steak on the dinner plate is the "consumer product" which is, or is not, satisfactory to the household. The cooking time and method can materially affect the flavor, tenderness, juiciness, and texture of the consumer product. While it would be virtually impossible to determine for every household how well the cooking of steaks and roasts was being done, a question was included to try to expand knowledge about cooking habits: "What method of cookery do you ordinarily use for (roasts, steaks)?"

While the method "ordinarily used" was sought, more than one answer was sometimes given (Table 32). More than one method may have been used by some of those giving only one method, but 71.7 percent of respondents said they used a single method all, or almost all, the time. Dry roasting

TABLE 32 -- USUAL METHOD OF COOKING ROASTS AND STEAKS

Method	Roasts	Method	Steaks
	%		%
Dry roast	46.4	Broil	48.7
Pot roast	31.6	Pan-fry	31.1
Pressure	6.4	Braise	4.6
Other methods	2.3	Other	1.8
Two or more methods	13.3	Two or more	12.8

was the most popular single method of cooking roasts but moist heat was used by slightly more than one-half of the respondents. Broiling was the most popular method of cooking steaks. For both roasts and steaks, dry-heat cooking and moist-heat cooking were about equally popular. From the responses of several housewives it was presumed that loin or T-bone steak was often cooked differently than other steak cuts. While the previous schedule questions had concerned only loin steak, it is possible that some respondents did not often cook loin steak and therefore, gave their method of cooking some other steak cut. Consequently, these percentages for steak must be interpreted accordingly.

Respondents who used dry heat for roasts generally desired less doneness and more juiciness than those who used moist heat. Those who broiled steaks generally desired less doneness but apparently no more juiciness than those who fried steaks.

No systematic relation between method of cookery and grade preference was found for either the regularly or specially trimmed steaks. Larger areal size and thinner steaks were more popular among those who fried rather than broiled steaks.

No significant differences as to methods of cooking were found between whites and non-whites. No relation to the size of family was found. Popularity of broiling was highly and positively related to income rate per worker, while popularity of frying, braising, and other methods was negatively related. This was probably partly due to the accepted method of cooking in those socio-economic groups and partly due to long-time adaptation to the quality of meat consumed. There was a strong positive association between broiling steak and family income and education, even after the effects of the latter two variables were separated. Likewise there was negative association of frying with family income and with education of respondents. Broiling was most popular with ages 30-49, but this may be partly an indirect income effect.

### Dependence Upon Butcher's Advice

Since visual inspection, alone, was apparently not a very satisfactory method of obtaining preferences for many respondents the use made of the butcher's advice was studied. Fourteen of the 15 stores were service type stores in which butcher advice was available to respondents.

On the roast and steak grade schedules, the question read: "Do you depend on a butcher's advice for getting the right quality of beef?" The question on the steak size schedule was: "Do you depend on your butcher's advice about the quality of beef?" Replies indicated 61.9 percent of the respondents depended on the butcher's advice, 34.6 percent did not, and 3.5 percent gave no answer. Thus, a large proportion of consumers did utilize the advice of the butcher when purchasing beef.

Certain relations of this dependence or non-dependence to other consumer attributes were investigated. There was no evidence that those who were advised by butchers were more satisfied with quality than those who were not. Those depending upon the butcher's advice made significantly more errors in the tenderness identification test on steaks than those who did not. The same relation was found for roasts. Dependence on butcher, by stores, ranged from 87.2 percent to 44.0 percent. While the three highest proportions of dependence upon the butcher were in small neighborhood stores, there were a few of these stores where dependence was quite low.

Dependence upon butcher was slightly greater among white women than among white men, and among those with 9 to 12 years of education than those with more. Income had little or no effect upon the proportion of respondents depending upon the butchers' advice.

### Percentage of Beef Purchased at Store Where Interviewed

Respondents were asked the percentage of beef purchased at the store where being interviewed. Since the grade sold in that store was known, it was possible to identify the grade consumed by respondents who were regular customers of that store. Some interesting data about this matter can be presented here as a by product.

The question on all three schedules read: "About what percentage of your total purchases of beef was bought at this store last month?" The distribution of purchasing regularity as based on 1,469 interviews, is shown in Table 33.

TABLE 33 -- PROPORTION OF BEEF PURCHASED AT THE STORE WHERE RESPONDENTS WERE INTERVIEWED

Proportion Purchased	Percentage of Respondents
None	25.1
Up to 39%	12.7
40% to 59%	11.0
60% to 79%	5.7
80% and over	39.8
No answer	5.6

Roughly 50 percent of the shoppers were regular beef purchasers at the store where interviewed and 40 percent of the respondents purchased 80 percent or more of their beef at that store. However, 25 percent bought no beef

there. If it is assumed that 40 percent of the group of respondents who bought no beef *at the store where interviewed* did buy 80 percent or more of their beef at *one* other store, then it can be surmised that a total of one-half of the population purchased most of their beef in a *single* store, while the other one-half shopped in two or more stores. Since most stores merchandised beef within a single grade range, it appeared that at least one-half of the meat customers were not customarily in a shopping situation where more than one grade of beef was sold. And it is possible that many of those who shopped around did so only in stores carrying the same grade.

Many important unsolved problems are raised by these facts. What are the factors that cause customers to buy a given proportion of their beef at a certain store? How much influence does satisfaction with a store's beef have in motivating a customer to buy all (or most) of his beef at that store? How many customers will buy at an attractive display of beef even though they either have had no experience with that store's beef or else have had more favorable experience elsewhere? What factors motivate some customers to do most of their total grocery shopping at a given store?

Explicit recognition needs to be made of the possibility that a good many other factors besides the comparative visual appearance of the various grades of beef or even the comparative eating characteristics of those grades influence the grade of beef purchased by a given consumer. This study is obviously based on the premise that visual appearance and eating characteristics of the various federal grades are sufficiently important to warrant extended investigation, but recognition is still made of the probable influence of other factors of importance. The fact that some (many?) customers will patronize a retailer whether he sells their "preferred" grade of beef or not is an important reason why consumer "preferences" for beef may not be satisfied.

No strong relations of proportion of beef purchased at that store to income, education, or sex of respondent were found. The proportion of those who bought no beef at the store where interviewed did increase somewhat as income and education increased in the sample.

### Frequency of Shopping

The frequency of shopping was obtained for sampling reasons. Highlights of that data have some interest. The question on all three schedules was: "How often per week on an average does someone in your household, including yourself, shop in a grocery store?" The average distribution from the three schedules showed a wide variation in shopping frequencies among consumers (Table 34).

The frequency with which a family shopped appeared to be related to several socio-economic characteristics of the family with none of them being

TABLE 34 -- FREQUENCY OF SHOPPING IN A GROCERY STORE

Frequency per Week	Percentage of Respondents
Once or less	25.9
2	22.8
3-4	25.9
5-9	23.9
No answer	1.5

very important singly. Shopping frequency did not appear to be independent of either education or income, but income did not have a systematic relation, while the inverse relation to education was weak. There was a small positive association in the sample of shopping frequency with family size and also with the age of the respondent. Families with employed women (ordinarily the housewife) shopped slightly less frequently than families without employed women. In general, the larger stores had slightly smaller shopping frequencies reported by their customers, though this association was not strong.

### Purchases of Frozen Beef

New methods of processing meats, such as freezing and sterilization by radiation, have been the subject of some interest in the industry. Only a few aspects of this problem were explored in this study.

This question was asked on one schedule: "Do you ever buy frozen beef of any kind?" Frozen beef was occasionally purchased by only 16.7 percent, while 3.8 percent said they purchased fresh beef for freezing, 78.7 percent did not buy frozen beef, and 0.8 percent gave no answer. Most of those who did buy frozen beef bought no more than one-third of their beef in that form. By stores, the percentages of respondents who occasionally purchased frozen beef, or purchased fresh beef for freezing, ranged from 28.5 percent to 5.4 percent. Within the sample, there was some direct association between purchase of frozen beef (or fresh for freezing) and higher income and education levels—especially the latter.

Persons who did not buy frozen beef were asked, "Why don't you buy it?" The responses are valuable more for their range than for the comparative number of people making each one, because of the general exploratory nature of the question (Table 35). Most of the responses reveal a direct comparison of frozen beef with fresh, emphasizing that those respondents were thinking of frozen beef as a direct substitute for (or competitor of) fresh. Some of the innovating sales of frozen beef avoided this direct competition. A sandwich-type product, for example, was conveniently made up for a quick meal, but the buying of fresh wholesale and retail cuts for the freezer has probably emphasized the direct competition of fresh and frozen in the public mind. No outstanding deficiency of frozen in competition with fresh beef was revealed, but many people seemed to doubt that frozen was "better" than fresh. It is not known how many respondents had ever consumed the

TABLE 35 -- REASONS WHY RESPONDENTS DID NOT BUY FROZEN BEEF

Response	No. of Respondents
No answer or don't know	171
Like fresh better or don't like frozen (no specific reason)	127
Don't like frozen as well as fresh as far as flavor or "taste"	41
Frozen not available	37
No storage space	24
Never have tried it	18
Cannot tell what you are getting when buy frozen	11
Frozen is not as convenient as fresh	9
Appearance of fresh is better than frozen	6
Buy meat only for immediate use	5
Frozen more expensive	4
Like fresh better for various other reasons	4
Frozen is not Kosher style	2
Miscellaneous and unclassifiable	15
Do buy fresh for freezing*	28

\*The 28 replies here give 5.6 percent of the total sample in that category as contrasted with 3.8 percent reported above. This likely resulted from some of these on the former questions failing to mention that they bought fresh to freeze, and the discrepancies were not noticed in the coding.

frozen product. Thus the extent of experience possessed as a basis for expressing dislike is also unknown. Such experience may be presumed to be quite limited.

### Consumer Knowledge of Grade Names

Federal grades have sometimes been assumed to be the "consumer's best guide" for their beef purchasing. However, it has been suspected by some people that most consumers do not even know the names of federal grades and certainly not the content of each grade. Certainly it is impossible for American consumers to possess technical knowledge about all the huge array of products from which they make their purchases today. There is no particular reason why beef would be an exception.

The following comments were made to respondents. "As you may know, beef is often graded by government grades. I wonder if you would happen to remember the names of any of the four grades." Interviewers were instructed to list all responses. Replies were given by 51.7 percent of the respondents, while 43.9 percent gave don't know answers, and 4.4 percent gave no answer. The 260 respondents who answered gave 548 "grade names" which included the names of five federal grades and many private brands (Table 36).

About 26 percent of the sample could give the name "Choice," although it is the grade of largest poundage volume in retail trade and is probably the most featured and advertised grade name. Many respondents confused brand names or letters with federal grades. Only 20.3 percent of the respondents gave no incorrect answers while giving one or more correct answers.

TABLE 36 -- "NAMES" OF FEDERAL GRADES GIVEN BY 260 RESPONDENTS

"Federal Grade Names"	Percentage of Total Respondents (503) Giving That Response
Prime	12.3
Choice	25.8
Good	18.3
Commercial	14.3
Utility	4.0
Letters	23.7
Other names (mostly brands)	10.5

White men and women were very much alike in the names they gave to the grade question. There was a strong association between the giving of correct grade name and education and income (Table 37). The fact that the more educated more often confused a brand name or letter with federal grades than did the less educated is interesting, and probably reflects a greater acquaintance with stores handling and advertising branded beef. It could also reflect a greater willingness to "risk" an incorrect answer in the interviewing situation.

TABLE 37 -- DISTRIBUTION OF GRADE QUESTION ANSWERS BY INCOME AND EDUCATION

Respondent Class	No Answer or Don't Know	Incorrect Names	Prime	Choice	Good
<b>Education</b>					
0-8 years	66.9	24.9		10.5	7.2
9-12 years	38.5	42.4		31.2	21.5
13 and over	31.7	38.5		42.3	28.8
<b>Family Income</b>					
Under \$50.00 week	67.6		2.9		
50.00 to 99.99	53.2		8.3		
100.00 and over	28.2		25.2		

## SUMMARY AND CONCLUSIONS

The likes and dislikes of American consumers for beef, in general, and for specific federal grades of beef, in particular, influence the total dollar sales of that important farm product and the relative profitability of producing the various grades. The problems of ascertaining the preferences of a large group of consumers for grades and sizes of beef and reasons for their likes and dislikes were the subject of this investigation.

Almost 1500 respondents were interviewed in a multi-stage sampling of the adult consumer population of Metropolitan St. Louis. Preferences for the four top federal grades of loin steaks and chuck roasts were obtained by the use of carefully controlled fresh-beef displays.

Additional information about the preferences of the respondents for physical attributes of the displayed cuts was obtained. Each grade of steak or roast was preferred by a certain portion of the sample as far as over-all preference was concerned. Moreover, the color of fat, amount of marbling, color

of lean, amount of external fat, texture, and amount of bone of each grade was preferred by some segment of the sample, though some grades were more popular on some characteristics than others.

The percentage distribution of first preferences for steaks was: Prime, 31.7; Choice, 24.3; Good, 21.9; Commercial, 15.4; and no preference (at equal prices), 6.7. These were visual preferences. There is evidence to support the hypothesis that less than one-half, and perhaps only one-third, of the respondents were cognizant of the eating qualities of the various grades. Several means of gathering that evidence were used and the evidence from each was consistent. The major obstacle to appraising consumer "ignorance" was the lack of knowledge that even the expert has concerning the eating characteristics of grades. The preferences of the "informed" were not greatly different from those of the "uninformed," however.

At least four groups (a group preferring each grade) of consumer preferences were revealed by the data. The differences in the intensity of preferences of consumers within the groups were pointed out and the limitations upon interpreting these findings were discussed.

The order in importance of preferences for the various physical attributes of roasts as influences upon the over-all grade preferences was (1) amount of internal fat (other than marbling), (2) color of lean, (3) amount of marbling, (4) amount of external fat, (5) color of fat, (6) amount of bone. The order in importance of the attributes of steaks was (1) amount of external fat, (2) color of lean, (3) marbling, (4) texture, (5) color of fat, and (6) amount of bone.

These orders were determined by cross-tabulation of ranks for roasts and by multiple-correlation of rating scores for steaks. All respondents ranked or rated every characteristic, so these relations represent the central tendencies for the group; however, many individuals deviated from them.

An experiment with a specially trimmed display of steaks indicated that very close trimming of the external fat of the upper grades increased their popularity but only to a very limited extent. Most consumers appeared to be much more interested in the attributes *per se* than as indicators of tenderness or other non-visible eating qualities. That is, not too much fat, a good color of lean (indicating freshness), and a small amount of bone were generally desired, though consumers often had different opinions as to which grade had those characteristics.

No strong socio-economic relationships to preferences were found, though some were significant. Income had surprisingly little relation to preferences, considering the relation it has to grades consumed.

Preferences for various areal sizes of steaks were obtained along with reasons for the preferences. The reasons indicated that consumers considered the visual appearance of the various sizes of steak that pertained to quality and relative amount of fat more than they considered the appropriateness of



the various sizes for providing their family with a pleasing serving at an acceptable cost. A special size-versus-grade preference experiment showed that about one-half the respondents seemed to lack *strong* preference for any particular size or grade of steak.

Answers to questions concerning consumer desires showed that tenderness was the eating characteristic of steaks and roasts most desired by a majority of people. Tenderness was most often named as the characteristic found lacking in roasts and steaks. Almost 25 percent of the respondents tenderized roasts and 40 percent tenderized steaks. Few respondents liked rare roasts or steaks. Dry heat methods were the most popular methods of cooking roasts and steaks, though 31.6 percent of the respondents pot roasted their roasts, and 35.7 percent fried or braised steaks.

Few St. Louis respondents were well-acquainted with frozen beef. No outstanding faults were found with frozen beef but many people failed to see any superiority of frozen beef.

Only about one-third of the respondents could recall the name of one or more federal grades. Choice was the best-recalled name and was given by 25.8 percent of the respondents. Knowledge of grade names was strongly associated with income and education.

Certain major implications for the livestock and meat industry and also for further research can be stated.

Consumer dissatisfaction with beef—especially regarding tenderness—is an important problem. The problem is complicated by an aversion of many consumers to fat. Meat retailers have sometimes described the consumer as wanting an impossible combination of leanness, juiciness, tenderness, and flavor. The emphasis for a majority of the respondents was on tenderness and leanness, which is not an impossible combination for certain cuts.

Perhaps, this combination can be obtained from lean carcasses of young cattle and by tenderizing the lean carcasses of older cattle. The solution of this preference problem by production or processing, or both, should increase consumer satisfaction with beef and thereby increase returns to producers. A grading system that is more concerned with consumer preferences would probably help solve this problem and aid consumers in obtaining their preferences.

The need for effective tenderization of the less tender beef at some level in the marketing system is apparent. Just how much tenderizing should be done and what changes in flavor or texture would be acceptable (if the process necessarily involves such changes) are problems for future research. Many respondents indicated readiness to use instructive labeling of beef as to cooking, so improvements in tenderness of certain cuts and qualities might be obtained by package labeling.

Consumers are different as far as preferences are concerned. Each of the four grades was preferred by some consumers. A majority of consumers said

tenderness was the most important eating characteristic of beef but a significant minority said flavor was most important. The marketing system appears inadequate to satisfy these differing preferences. Grading may not differentiate satisfactorily concerning eating characteristics. Most retail stores handle only one grade of beef. It is possible that changes in grading and in the number of grades handled by stores would facilitate satisfaction of the differing preferences. There are many problems involved here. Many retail stores are obviously too small to handle more than one grade profitably.

Further research concerning the nature and economic significance of eating preferences and concerning consumer ignorance is needed. Changes in the grading system, changes in the retail outlets for the various grades, and better education of consumers as to how to obtain *their* preferences would affect the relative prices of the various grades of cattle in the market and thereby affect production patterns to some degree.

Eating preferences of consumers for various "types" of the more popular cuts of beef need to be investigated. Inferring eating quality of beef from its visual appearance is difficult for the expert and almost impossible for most consumers. Therefore, the study of visual preferences, alone, is insufficient for solving the over-all problem of maximum consumer satisfaction. Since there is probably much intra-grade heterogeneity of eating quality, the eating preference tests might be improved by using "types of product" that have other boundaries in addition to, or instead of, grade boundaries.

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APPENDIX: PREFERENCE RANKS  
COMPLETE PREFERENCE RANKINGS OF GRADES

Rank	Commercial	Good	Choice	Prime
		<u>Regular Steak Grades</u>		
First	95	136	156	196
Second	71	101	180	91
Third	171	172	128	113
Fourth	153	84	25	87
Don't Know	16	13	17	19
Total	<u>506</u>	<u>506</u>	<u>506</u>	<u>506</u>
		<u>Special Steak Grades</u>		
First	67	93	156	180
Second	90	120	197	86
Third	150	144	89	97
Fourth	177	132	47	128
Don't Know	19	14	14	12
Total	<u>503</u>	<u>503</u>	<u>503</u>	<u>503</u>
		<u>Roast Grades</u>		
First	86	143	103	130
Second	106	95	121	115
Third	116	126	97	126
Fourth	143	87	129	81
Don't Know	9	9	10	8
Total	<u>460</u>	<u>460</u>	<u>460</u>	<u>460</u>