A Nonparametric Analysis of Consumer Preferences

For Fresh Meat Products[*]

by

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Abstract

Nonparametric statistical methods (the Kruskal-Wallis test and Dunn's multiple comparison procedure) were used to analyze consumer preferences for fresh meat products (chicken, beef steak, beef roast, fish, ground beef, pork, turkey, and lamb) in a retail food chain in Houston. On a pairwise basis, significant differences in ratings were evident for the majority of the fresh meat products in terms of frequency of purchase as well as taste and quality. In particular, chicken was not only the most frequently purchased fresh meat product but also compared favorably to all meat items in terms of taste and quality.

Introduction

Consumer preferences in the meat department of retail food stores are changing due in part to health concerns and convenience dimensions associated with fresh meat products. To illustrate, Yankelovich, Skelly, and White, Inc. estimate that as many as nine out of ten consumers now exercise care with respect to fat intake, and two out of three consider themselves health conscious. Because of these changes, marketing, merchandising, and promotion are currently buzzwords of the meat industry (American Meat Institute, personal communication). To remain competitive in the market-place, food retailers must respond to the signals of consumers.

To meet consumer demands, the meat industry has taken steps to foster the development of meat products that are not only lean, but also quick, easy, and convenient to prepare. Along this line, certain firms have adopted strategies for product differentiation. For example, Monfort of Colorado has been in the process of developing "high-quality, convenient" products for the past two years (*Wall Street Journal*); Kroger began distribution of 26 different pre-cooked meats from eight packers in early 1986; Randall's Food Markets Inc. of Houston and Giant Foods Inc. of Washington, D.C. began offering consumers a lean house brand in addition to choice grades in 1986. In each of these examples, the respective firms identified attributes (quality, convenience, and leanness) valued by consumers and differentiated their products accordingly to meet those needs. Porter suggests the following: firms that achieve and sustain differentiation will be above average performers in the industry if the price premium exceeds the extra costs incurred of being unique.

Several studies have been conducted recently to examine consumer preferences and attitudes toward beef. The National Consumer Beef Study by Branson et al. examined the effects of different degrees of leanness on con-

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sumer demand. Skaggs et al. analyzed the potential of marketing branded, low fat, fresh beef. In both studies it was apparent that: (1) health concerns were raised in regard to the consumption of animal fats; and (2) consumers were willing to compromise on taste for a product that was perceived to be healthier.

This paper places emphasis on consumer preferences for eight fresh meat products, namely beef steak, beef roast, ground beef, pork, lamb, chicken, turkey, and fish. The purposes of this study are twofold: (1) to compare frequency of purchases for eight fresh meat products by consumers over a four-week period; and (2) to compare taste and quality ratings given to those products. The study was conducted during the second quarter of 1987 and rests on a cross-sectional analysis of 200 shoppers from a retail firm (Randall's Food Markets Inc.) in Houston.

Research Design

This research may be best viewed as a pilot study, an initial effort at a micro level to comprehend consumer preferences so that marketing goals for a firm can be established. Data for the issues raised in this study were obtained from a comprehensive telephone survey. The design of this research embodies descriptive and exploratory elements. A description of the characteristics of shoppers at Randall's permits the construction of demographic profiles. Profiles include information on household size, age, residency, education, and household income.

Frequency of purchase measures were obtained by having respondents recall their fresh meat purchases over the four-week period prior to the interview. They were asked to give an integer response in regard to the number of purchases that were made for each product. Quality and taste ratings were measured using an eleven point scale--zero being the lowest score and ten being the highest score. Respondents were asked to give each meat product a rating.

The justification for the sample size of 200 rests on the simultaneous goals to minimize costs and maintain representativeness of the sample population. The population in this study refers to the totality of shoppers at Randall's. With probability 0.95, the sample size of 200 allows for a margin of error of plus or minus 7 percentage points.[1]

One important caveat is in order. Given the procedures used in developing the sample, representativeness can only be assumed for the totality of shoppers who frequent Randall's stores in Houston. However, with any micro-level study, this limitation is unavoidable. In fact, this issue serves to illustrate the tradeoff between macro-level studies which focus on several markets versus micro-level studies which center attention on market segments. Further, given the local nature of the study, the results may not lend to drawing broad, defensible regional or national inferences. Because of this potential limitation, the results of such local analyses should be used, not on a stand-alone basis, but as buttressing evidence in conjunction with additional research conducted on a broader scale.

Demographic Profile

Because of the uniqueness of the sample, demographic profiles are presented for household size, age, residency, education and household income (Table 1). The average household size for the sample was exactly three persons. Single-person households made up nearly 7 percent of the respondents, two-person households constituted roughly 33 percent, and more-than-two person households made up 54 percent. By and large, this sample relates primarily to two-person, three-person, and four-person households.

The majority of the respondents were between the ages of 30 and 39. Otherwise, there exists a more or less equal distribution of the age brackets. Notably, the sample was very much skewed to the right with respect to residency. Over 60 percent of the respondents have been residents of Texas for 20 or more years.

The overwhelming majority of the respondents were college-educated. Also, shoppers at Randall's were predominantly from higher income groups. Almost 25 percent of the respondents fell into the less than $30,000 income bracket, 29 percent fell into the $30,000 to $59,999 income bracket, and 36 percent fell into the $60,000 and above income bracket. The remaining 10 percent of the respondents failed to report income--a phenomenon not atypical in survey work (Capps and Cheng).

The demographic profiles suggest that the sample is not regionally or nationally representative, especially in regard to household income. However, from the viewpoint of a particular retail firm, it is not necessary for profiles to be regionally or nationally representative. From the viewpoint of this firm, it is crucial to understand preferences of potential customers.

Table 1

Sample Demographics

Household Size:	Percent
One	6.5%
Two	33.5%
Three	23.5%
Four	18.5%
Five	9.0%
Six	2.0%
Seven	1.0%
No Response	6.0%

Age:	Percent
20-29 years	11.0%
30-39 years	40.5%
40-49 years	16.0%
50-59 years	15.5%
60-69 years	15.5%
No Response	1.5%

Residency in Texas:	Percent
Under 5 years	7.0%
5-9 years	14.5%
10-19 years	15.5%
20 or more years	61.5%
No Response	1.5%

Education:	Percent
Part of grade school	0.5%
All of grade school	1.0%
Part of high school	2.0%
All of high school	17.0%
Part of college	25.5%
All of college	51.5%
No Response	2.5%

Household Income:	Percent
Less than $30,000	25.0%
$30,000-$59,999	29.0%
$60,000 and above	36.0%
No Response	10.0%

Total Number of Respondents = 200

Analyses

Because of the non-normality of the data (verification from Kolmogorov-Smirnov tests), the appropriate statistical procedure to analyze equality of either frequency of purchase patterns or taste and quality ratings is the distribution-free Kruskal-Wallis (K-W) test (Hollander and Wolfe, pp. 115-20). The K-W test is in essence a procedure to handle one-way analysis of variance problems. The statistic is calculated using ranks in lieu of original observations. A signifi-

cant K-W test indicates that differences exist among purchase patterns or taste and quality ratings. Further analysis is necessary to determine the nature of differences.

Dunn's multiple comparisons procedure (Hollander and Wolfe, pp. 124-29) for unequal sample sizes is used to detect pairwise differences. In this procedure the user has $k(k-1)/2$ decisions, where k represents the number of product groups. Since k=8 in this study, there are 28 decisions in this analysis that correspond to frequency of purchase and taste and quality ratings. The basis of this procedure rests on absolute differences among the sums of the ranks for the fresh meat products with regard to frequency of purchase as well as taste and quality ratings. Importantly, the procedure is appropriate because the overall experiment-wise error rate is fixed to be equal to the significance level. In essence, this nonparametric multiple comparison procedure is the counterpart to the Duncan, Newman-Keuls, and Tukey (HSD) parametric multiple comparison procedures. The significance level chosen for both the K-W test and Dunn's procedure is .05.

Results

The results of the nonparametric Kruskal-Wallis test and Dunn's multiple comparison procedure are presented in Tables 2 and 3. Kruskal-Wallis test statistics (H) of 352.46 and 126.13 were obtained for the frequency of purchase levels and taste and quality ratings, respectively. Given the critical value of 14.067 (the K-W test is based asymptotically on an X^2 random variable with $k-1$ degrees of freedom), the results of the Kruskal-Wallis test suggest that statistically significant differences exist among fresh meat products with regard to frequency of purchase and taste and quality ratings.

Dunn's multiple comparison procedure revealed that chicken was statistically the most frequently purchased fresh meat product (4 times a month) relative to the other products over the four-week test period. Ground beef was the second most frequently purchased meat product (approximately $2\frac{1}{2}$ times a month) with a higher frequency statistically than either beef steak, pork, beef roast, turkey, or lamb. Fish was the third most frequently purchased meat product (slightly more than twice a month) with a higher frequency statistically than either pork, beef roast, turkey, or lamb. Beef steak and pork were the next most frequently purchased meat products (slightly less than twice a month) with higher frequencies statistically than either beef roast, turkey, or lamb. Finally, beef roast, tur-

key, and lamb were the least frequently purchased meat products. Beef roast and turkey though were purchased with higher frequencies statistically than lamb.

Table 2

Kruskal-Wallis Test and Dunn's Multiple Comparisons Procedure - Frequency of Purchase

Descriptive Statistics of Treatments:

Group	Median	Mean	SD
Chicken	4	4.09	3.23
Ground Beef	3	2.57	1.96
Fish	2	2.33	2.42
Beef Steak	2	1.82	1.86
Pork	1	1.36	1.47
Beef Roast	1	1.13	1.15
Turkey	0	0.94	1.67
Lamb	0	0.46	1.22

Kruskal-Wallis Test Statistic (H) = 352.46

Dunn's Multiple Comparisons Procedure:

Pairwise Comparison	Conclusion
Chicken/Ground Beef	Significantly different
Chicken/Fish	Significantly different
Chicken/Beef Steak	Significantly different
Chicken/Pork	Significantly different
Chicken/Beef Roast	Significantly different
Chicken/Turkey	Significantly different
Chicken/Lamb	Significantly different
Ground Beef/Fish	Not significantly different
Ground Beef/Beef Steak	Significantly different
Ground Beef/Pork	Significantly different
Ground Beef/Beef Roast	Significantly different
Ground Beef/Turkey	Significantly different
Ground Beef/Lamb	Significantly different
Fish/Beef Steak	Not significantly different
Fish/Pork	Significantly different
Fish/Beef Roast	Significantly different
Fish/Turkey	Significantly different
Fish/Lamb	Significantly different
Beef Steak/Pork	Not significantly different
Beef Steak/Beef Roast	Not significantly different
Beef Steak/Turkey	Significantly different
Beef Steak/Lamb	Significantly different
Pork/Beef Roast	Not significantly different
Pork/Turkey	Significantly different
Pork/Lamb	Significantly different
Beef Roast/Turkey	Not significantly different
Beef Roast/Lamb	Significantly different
Turkey/Lamb	Significantly different

Table 3

Kruskal-Wallis Test and Dunn's Multiple Comparisons Procedure - Quality and Taste Ratings

Descriptive Statistics of Treatments - Eleven Point Scale:

Group	Median	Mean	SD
Chicken	8.5	8.23	1.85
Beef Steak	9	8.16	2.13
Fish	8	7.89	2.08
Beef Roast	8	7.63	2.44
Ground Beef	8	7.45	1.92
Turkey	7	6.86	2.45
Pork	7	6.53	2.65
Lamb	5	4.60	3.76

Kruskal-Wallis Test Statistic (H) = 126.13

Dunn's Multiple Comparisons Procedure:

Pairwise Comparison	Comments
Chicken/Beef Steak	Not significantly different
Chicken/Fish	Not significantly different
Chicken/Beef Roast	Not significantly different
Chicken/Ground Beef	Significantly different
Chicken/Turkey	Significantly different
Chicken/Pork	Significantly different
Chicken/Lamb	Significantly different
Beef Steak/Fish	Not significantly different
Beef Steak/Beef Roast	Not significantly different
Beef Steak/Ground Beef	Significantly different
Beef Steak/Turkey	Significantly different
Beef Steak/Pork	Significantly different
Beef Steak/Lamb	Significantly different
Fish/Beef Roast	Not significantly different
Fish/Ground Beef	Not significantly different
Fish/Turkey	Significantly different
Fish/Pork	Significantly different
Fish/Lamb	Significantly different
Beef Roast/Ground Beef	Not significantly different
Beef Roast/Turkey	Significantly different
Beef Roast/Pork	Significantly different
Beef Roast/Lamb	Significantly different
Ground Beef/Turkey	Not significantly different
Ground Beef/Pork	Not significantly different
Ground Beef/Lamb	Significantly different
Turkey/Pork	Not significantly different
Turkey/Lamb	Significantly different
Pork/Lamb	Not significantly different

On a pairwise basis, significant differences in ratings were evident for a majority of the fresh meat products according to Dunn's multiple comparison procedure. Chicken and beef steak were preferred over ground beef, turkey, pork, and lamb. Fish and beef roast were preferred over turkey, pork, and lamb. The results suggest that shoppers at Randall's exhibited no real preference concerning the taste and quality of chicken versus that of fish, beef steak, or beef roast, ceteris paribus. In addition, ratings were not significantly different for ground beef/fish, ground beef/beef roast, ground

beef/turkey, and ground beef/pork. Lamb was unequivocally the lowest rated fresh meat product, with a mean rating that was statistically different from all the other meat products except pork.

Conclusions and Implications

This research documents the increasing importance of chicken in the diet of consumers. In this study, chicken was not only the most frequently purchased fresh meat product but also compared favorably to beef steaks, beef roasts, and fish in terms of taste and quality, *ceteris paribus*.

These findings represent a challenge to the red meat industry. The realization that red meat, and beef in particular, is not as popular as it once was, compels the industry to address the issues of health consciousness and convenience in relation to red meat consumption. The introduction of lean house brands represents a potentially viable differentiation strategy to maintain or ameliorate market share in the growing health conscious niche. However, in order for a strategy of this nature to be effective over the long-run, awareness and acceptance by the consumer must be realized. Programs such as Nutri-Facts and Meat Facts are designed to provide the consumer with objective nutritional information concerning meat products. Another alternative is to focus on uniqueness drivers, i.e. leannness, convenience, and ease of preparation, in advertising campaigns. The goal of these strategies is to provide the consumer with the dimensions that are valued for the selection of fresh meat products.

This study places emphasis on factors that are qualitative in nature. A logical extension of this work centers on incorporating both qualitative and quantitative factors affecting the demand for fresh meat products. Also, given the local nature of the study, further research may be conducted either with additional retail firms (micro level studies) or across retail firms (macro level studies). At any rate, further research, either qualitative or quantitative, at micro or macro levels, will assist in developing marketing goals for the meat industry.

Endnote

[1] Based on the degree of confidence (95%) and the precision level (plus or minus 7 percentage points), the formula given by Churchill (p. 390) for the computation of sample size in survey work yielded 200 as the appropriate number. If instead the margin of error were plus or minus 3 percentage points and if the degree of confidence were 99 percent, the sample size requirement would expand to 1500, more than seven times the original sample size.

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