An Empirical Investigation of Importance Ratings of Meat Attributes by Louisiana and Texas Consumers

Jianguo Hui, Patricia E. McLean-Meyinsse and Dewitt Jones*

Abstract

This study provides an empirical investigation of how consumers rate meat attributes. Results show an importance order for 12 selected meat attributes and reveal some relationships between the importance ratings and consumer's demographic or socioeconomic characteristics. The findings suggest that (1) the meat marketing strategy should focus on freshness, taste, and appearance; (2) nutritional attributes have become important factors in the meat purchasing decision of female, educated, and married consumers; (3) older, married, low-income, or non-white consumers still remain price conscious; and (4) USDA label has become an important symbol of meat quality and safety to older, female, Baptist, and high-income consumers.

Key words: meat attributes, importance ratings, meat marketing, socioeconomic characteristics, Kruskal-Wallis test, ordered-probit model

Introduction

Declining red meat consumption, rising health-nutrition consciousness, and increasing competition in food marketing have made having an understanding of consumer concerns imperative for successful meat marketing. Over the last two decades, changes in the demographic composition of the population, lifestyles, incomes, and attitudes toward meat have significantly shaped how consumers rate meat attributes in meat consumption (Manchester; Senauer, et al.). Therefore, knowledge of the relationship between consumer characteristics and importance ratings for different meat attributes may provide substantial marketing opportunities for farmers, processors, wholesalers, and retailers in the meat industry.

Many studies have suggested that (a) meat prices have become a less sensitive factor in meat consumption; (b) dietary excesses of some meat attributes such as saturated fat, cholesterol, and sodium are highly associated with heart disease, cancer, stroke, and obesity; and (c) meat attributes related to food safety, nutrition, and preference have been important factors influencing the purchasing behavior of consumers (Briggs and Schweigert; Capps and Schmitz; Frazao, 1994; Jordan and Elnagheeb; Frazao and Cleveland; Menkhaus, et al.; Pehanich; Smallwood, et al.; Schutz, et al.; Senauer, et al.; Tippett and Goldman; Wohlgenant, et al.) Studies have also found that geographic, demographic, and socioeconomic factors play important roles in consumer attitudes toward meat, meat purchases, and meat consumption (Adrian and Daniel; Frazao, 1993; Frazao and Cleveland;

*Jianguo Hui, Patricia E. McLean-Meyinsse and Dewitt Jones are assistant professor, associate professor and professor, respectively, in the Department of Agricultural Economics, Southern University, Baton Rouge, LA 70813. Funding for this research was provided to College of Agriculture and Home Economics by the Cooperative State Research Service, USDA.

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Manchester; Popkin, et al.; Putnam; Senauer, et al.; Steven, et al.; Steven, et al., 1993).

However, most of the studies focused on meat attributes individually. To our knowledge, no studies has empirically examined the relationship among meat attributes and the linkage between consumers' importance ratings of meat attributes and their geographic, demographic, and socioeconomic (GDS) characteristics. This study endeavors to investigate how consumers simultaneously evaluate the importance of 12 selected meat attributes and what relationship exists between importance ratings of meat attributes and consumer GDS characteristics. The information generated from this study should enhance the marketing ability of meat producers, processors, wholesalers, and retailers by providing some bases for market segmentation and developing niche markets for different types of meats.

The procedure of this paper is threefold. First, we examine how consumers simultaneously rank importance ratings for 12 selected meat attributes when purchasing meat. Second, we estimate the empirical effects of consumer GDS factors on the importance ratings of the meat attributes. Finally, we generate some marketing implications for the meat industry.

Data and Empirical Models

Data for the study were obtained from a telephone survey of 1,002 randomly selected households in Louisiana and Texas during February 1993. Respondents in the survey were the persons who did the grocery shopping for their households. A survey questionnaire was used to identify consumer important ratings for 12 selected meat attributes and their GDS characteristics. Respondents were asked the following question: "I am going to mention several attributes of meats which may or may not be of importance to you. Please tell me if you feel each following meat attribute is extremely important, very important, somewhat important, not very important, or not at all important in your purchasing of meats. How important is: being low in saturated fat; the price per pound; being low in cholesterol; being free from chemical additives; the taste of the meat; being a red meat; the appearance of the meat; being low in salt/sodium; the freshness of the meat; having a USDA label; being a white meat; the tenderness of the meat?" Information about respondents' GDS characteristics was also collected during the interview.

The Kruskal-Wallis test was used to test whether respondents differentiated importance ratings among the selected meat attributes. The Kruskal-Wallis test statistic is defined as

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{[R_j - n_j(N+1)/2]^2}{n_j}, \tag{1}$$

Where H is the statistical value that is approximated by the chi-square distribution with k-1 degree of freedom, k is number of samples, R_j is sum of the ranks in the jth sample, n_j is number of observations in the jth sample, and N is total number of observations. A simultaneous multiple comparison (SMC) method was then employed to test the difference between the mean ranks of the meat attributes in order to identify an importance order for the meat attributes if there was a difference among the meat attributes. The SMC computes the smallest difference that would be declared statistically significant for multiple-mean-rank comparisons. The test criterion for the SMC is as follows (Gibbons):

$$|\bar{R}_i - \bar{R}_j| \le z_{\alpha/2} \left[\frac{N(N+1)}{12}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)\right]^{1/2}. \tag{2}$$

Where $\bar{R}_i$ and $\bar{R}_j$ denote the mean rank for the ith and jth sample, respectively, and $z_{\alpha/2}$ is the z critical value at α level of significance for the multiple comparisons of the mean ranks for k samples.

Finally, an ordered-probit model was used to estimate the influence of consumer's GDS characteristics on the importance ratings for the meat attributes. The model is based on the following specification:

$$U = \beta' X + \varepsilon, \quad \varepsilon \sim N[0, 1] \tag{3}$$

$$\begin{aligned} y_i &= 0 \text{ if } U \le \mu_0, \\ &= 1 \text{ if } \mu_0 < U_1 \le \mu_1, \\ &= 2 \text{ if } \mu_1 < U_2 \le \mu_2 \\ &\cdots \\ &= J \text{ if } U_i > \mu_{J-1}. \end{aligned}$$

A consumer's personal utility function (U) for a special event (important ratings for selected meat attributes in this study) is determined by a vector of his/her GDS factors. The utility function (U) is not observable, but assumed to match an observed y_i vector which is obtained from the survey. The vector y_i comprises the responses of each survey participant (the grocery shopper for the household in this study) and is expressed as an ordinal rank toward the special event based on his/her personal utility function. Thus, a respondent's rank choice (y_i) coincides with a range of his/her personal utility (U). By this assumption, the ordinal ranking scale (y_i) is categorized into U_i between cutoff utility parameter μ_i. In terms of the probability distribution of the respondent's rank choice (y_i) within U_i, the probability density function is established. That is:

$$\begin{aligned} &Prob[y_i = 0] = \Phi(-\beta'X), \\ &Prob[y_i = 1] = \Phi(\mu_1 - \beta'X) - \Phi(-\beta'X), \\ &Prob[y_i = 2] = \Phi(\mu_2 - \beta'X) - \Phi(\mu_1 - \beta'X), \\ &\quad \ldots \\ &Prob[y_i = J] = 1 - \Phi(\mu_{J-1} - \beta'X). \end{aligned} \tag{4}$$

Where $\Phi(\cdot)$ is the probability density function (PDF) with a normal distribution at the special range of consumers' utility, ß is the vector of parameters to be estimated, and X is the vector of the GDS characteristics (independent variables) (Greene; Beggs, et al.) To estimate the parameters, the maximum likelihood technique was employed and the log-likelihood function becomes:

$$LnL = \Sigma_i \, Ln \, L_i = \Sigma_i \, Ln \, Prob[y_i = j]. \tag{5}$$

Table 1. Variables, Codes, and Statistics for the Survey Data

Dependent Variables	Definitions & Codes
Selected Meat Attributes	(1) Low in Fat, (2) Low in Sodium, (3) Low in Cholesterol, (4) No Chemical Additives, (5) Taste, (6) Red Meat, (7) White Meat, (8) Appearance, (9) Prices, (10) Freshness, (11) USDA Label, (12) Tenderness.
Importance Ratings	not at all important = 1, not very important = 2, somewhat important = 3, very important= 4, extremely important= 5.

Independent Variables	Definitions & Codes	Means (Standard Deviations)
Area	Louisiana = 1, Texas = 0	0.795 (0.404)
Gender	female = 1, male = 0	0.746 (0.435)
Age	Age(1): 18-39 = 1, otherwise = 0;	0.386 (0.487)
	Age(2): 40-59 = 1, otherwise = 0;	0.358 (0.479)
	Age(3): 60-65 & older = 1, otherwise = 0.	0.237 (0.425)
Household Size	one = 1, two = 2, three = 3, four = 4, five = 5, six = 6, seven & more = 7	2.869 (1.469)
Education	above high school =1, high school & below = 0	0.480 (0.500)
Marital Status	married = 1, not married = 0	0.677 (0.468)
Religion	Baptist = 1, otherwise = 0	0.288 (0.453)
	Catholic = 1, otherwise = 0	0.366 (0.482)
	other Protestant = 1, otherwise = 0	0.206 (0.405)
Employment Status	white collar = 1, otherwise = 0	0.475 (0.500)
	blue collar = 1, otherwise = 0	0.178 (0.383)
	retired = 1, otherwise = 0	0.198 (0.399)
Race	white = 1, otherwise = 0	0.795 (0.404)
Household Incomes	under $10,000-$34,999=1, otherwise=0	0.514 (0.500)
	$35,000 - $74,999 = 1, otherwise=0	0.266 (0.442)
	$75,000 and over = 1, otherwise = 0	0.064 (0.245)

Source: Survey Data.

This log-likelihood function can be estimated by the LIMDEP computer package with adjustment of the heteroscedasticity in the data (Greene). Table 1 presents variables, codes, and basic statistics for the survey data.

Empirical Results

The Kruskal-Wallis test (table 2) rejects the null hypothesis that the importance ratings of the 12 selected meat attributes are identical, and indicates that respondents differentiated the importance of the meat attributes. By the SMC test, table 2 presents an importance order for the meat attributes. The multiple comparison results reveal that freshness and taste are the most important attributes consumers consider when purchasing meat. The appearance of the meat stands as the third most important attribute among the selected attributes, though it is not statistically significantly different from the taste of the meat. USDA label, tenderness, and no chemical additives are ranked as the fourth important group of meat attributes. Low in fat, low in sodium, and low in cholesterol rank as the fifth important group of attributes. Price, white meat, and red meat are ranked as the sixth, seventh, and eighth important attribute, respectively, when consumers purchase meat.

Table 3 details how the GDS characteristics influence respondents' importance ratings for each of the meat attributes. The coefficients of independent variables (x_i) in table 3 can be considered as the effects of shifting the entire PDF of y_i for each of the meat attributes. An increase in one variable in the X vector, which has a positive coefficient while holding β and μ constant, is equivalent to shifting the PDF to the right (higher ratings), and vice versa. In the general case, only the signs of the coefficients are unambiguous, because of the uneven densities of the PDF (Greene).

From the results in table 3, as gender changes from male to female, the coefficients indicate that the importance ratings for all meat attributes are increasing except for taste and red meat. Female respondents are more concerned than males about fat, sodium, cholesterol, chemical additives, prices, appearance, freshness, tenderness, USDA label, and white meat when making purchase decisions. Younger respondents (age 18-39) are concerned about freshness. Both middle-aged (age 40-59) and older (above 60 years old) respondents are more concerned about freshness, appearance, USDA label, and tenderness of the meat than respondents of other age groups. In addition, older respondents consider red meat as an important factor in making meat purchasing decisions.

Respondents in larger households appear more concerned about sodium and chemical additives than those from smaller households. Respondents with education above high school appear less concerned about sodium, red meat, and appearance of meat than those with high school or lower education. Married respondents are more concerned about fat, cholesterol, red meat, and prices than those unmarried.

Baptists tend to be more concerned about taste, appearance, USDA label, and tenderness than other religious groups. Catholics are more concerned about fat, taste, white meat, appearance, and tenderness than other religious groups. Other Protestants seem more concerned about fat than other meat attributes. White collar workers are less concerned about red meat and tenderness than other employees. Blue collar workers are less concerned about fat, cholesterol, red meat, price, and USDA label than other workers. Retirees are less concerned about USDA label and tenderness than non-retirees.

Respondents from high income households are less concerned about fat, cholesterol, and prices but more worried about sodium and USDA label than those from low and middle income households. Respondents in middle income households are also less concerned about fat and cholesterol than others. Low income respondents are more concerned about sodium and red meat than others. Non-white respondents are more concerned about fat, cholesterol, and prices than white respondents.

Summary and Implications

This study provided an empirical investigation of how consumers in Louisiana and Texas rated meat attributes when purchasing meat. The statistical results for importance ratings indicated that consumers ranked freshness and taste

Table 2. The Kruskal-Wallis Test and Multiple Comparisons of Importance Ranks for the Selected Meat Attributes

Ho: the importance ratings of the 12 selected meat attributes are identical.
Ha: the importance ratings of the meat attributes are different.

$H = 3{,}462.17$, $\chi^2_{\alpha=0.01} = 28.30$.

$H > 28.30$ and reject Ho:.

Meat Attributes	Mean Ranks for Meat Attributes	Multiple Comparisons of k Sample Mean Ranks (α=0.01)	
Freshness of Meat	7,751.50[a]	A[b]	(1)[c]
Taste of Meat	7,321.96	A B	(2)
Appearance of Meat	7,225.63	B	(3)
USDA Label	6,638.58	C	(4)
No Chemical Additives	6,405.33	C D	(4)
Tenderness of Meat	6,335.93	C D	(4)
Low in Fat	6,006.45	D	(5)
Low in Sodium	5,725.22	D	(5)
Low in Cholesterol	5,642.36	D	(5)
Price of Meat	4,987.77	E	(6)
White Meat	4,057.58	F	(7)
Red Meat	3,440.45	G	(8)

Source: survey data.

[a] the mean of the ranks corresponding to the ith sample ($\bar{R}_i = R_i/n_i$);

[b] based on the multiple comparison test ($|\bar{R}_i - \bar{R}_j| = 463.40$, $\alpha = 0.01$), the different letters suggest that there is a significant difference between the meat attributes, vice versa;

[c] The numbers in parentheses are the order of importance ranks for the meat attributes.

Table 3. The Effects of the GDS Factors on Importance Ratings for Selected Meat Characteristics

GDS Characteristics (x_i)	(1)[a]	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	----------The Model of Importance Ratings for Meat Attributes----------											
Constant	1.3636***[b]	1.7572***	1.4880***	1 3172***	1.8837***	1 0152***	0.7060***	1.7663***	0.6860***	-1.7161**	0.9440***	1.3224***
Area	0.1197	0.0096	0.0507	0.0608	-0.0003	-0.0609	0.0884	-0.1155	0.0119	0.0239*	-0.0162	0.0512
Gender	0.3401***	0.1843**	0.3609***	0 3559***	0.0820	-0 0749	0.2397***	0.2991***	0.3738***	0.3932***	0.3483***	0.2117***
Age(18-39)	0.0022	-0.0919	-0.0498	0 0807	0.2352	0 1526	0.2543	0.3512	0.3774	0.4737**	0.3628	0 3782
Age(40-59)	0.2026	0.1244	0.1754	0.1129	0.2288	0.2880	0.3874*	0.4481*	0.6352***	0.5170**	0.4226**	0.5835**
Age(>60)	0 3000	0.0265	0.2141	0.1195	0 2005	0 3212*	0.3971*	0.3566*	0.7803***	0.3865*	0.6300***	0.8375***
Household Size	0.0151	0.0706**	-0.0089	0 0654**	0.0311	0 0119	-0.0277	0.0039	0.0323	0.0184	0.0264	0.0268
Education	0.0789	-0.1942***	-0.0041	-0 0451	0.0680	-0 1147*	0.4211	-0.1368*	0.0365	0.0801	-0.0785	0.0102
Marital Status	0 3140***	0.0400	0 2438***	0.0477	0.0474	0 2490***	0.3283***	0.0396	0.1207*	-0.0071	0.0928	0.1268
Baptist	0 1218	0.1186	0.1243	0 1062	0 2849**	0 1060	0 0241	0.3017***	0.0364	0.0548	0 3045***	0.2747**
Catholic	0.2577**	-0.0872	0.1217	-0.0418	0 2040*	0 1079	0.2092**	0.2328**	0.1221	0.0608	0.1474	0.2165*
Other Protestant	0 2169*	0.0793	0 1558	0 0029	0 1820	-0 0231	0.0316	0.1548	0.0122	-0.0436	0.0543	0.1145
White Collar	-0 0584	-0 0834	-0 1294	0 0172	-0.0843	-0 2469***	-0.1033	-0.1468	-0.0370	-0.0085	-0.1595	-0.1782*
Blue Collar	-0.2647**	-0 1547	-0.2264**	-0.0458	-0 0172	-0.2339**	-0.0202	-0.1270	-0.1916*	-0.0579	-0.2024*	-0.1594
Retiree	-0 0870	-0.1205	-0.0211	0 0472	0.0380	-0 0781	0.0375	0.0440	-0.0263	0.0858	-0.2862**	-0.3396**
Race	0.1627*	0.0568	0.2087**	0.1323	-0.1352	0 0391	0.0605	0.0258	0.2278***	-0.0317	0.0349	0.1290
Low Income	-0.1914*	0.3297***	-0.1111	0.0399	0.1065	0 2217**	0.0964	0.0294	0.0054	-0.0137	0.1598	-0.0954
Middle Income	-0.3441***	0.0314	-0.1852*	0.0571	0.0156	0 0919	-0.0390	0 0566	-0.1335	-0.1462	0.1312	0 0143
High Income	-0.3269***	0 2209**	-0.2085*	-0.0756	0 0051	0 0824	-0.0065	0.1440	-0.2130*	-0.0770	0.1972*	0 0927
Model Chi-Squares	78.6726***	85.7380***	68.9968***	41.8940***	15.4189	48.2077***	49.9515***	42.6723***	79.3923***	29.3602**	58.6843***	46.7544***

[a] (1) Low in Fat, (2) Low in Sodium, (3) Low in Cholesterol, (4) No Chemical Additives, (5) Taste, (6) Red Meat, (7) White Meat, (8) Appearance, (9) Prices, (10) Freshness, (11) USDA Label, (12) Tenderness.

[b] * statistical significance at the 0 10 level of probability, ** at the 0.05 level, and *** at 0.01 level.

as the most important attributes among the selected meat attributes. Appearance of meat was ranked as the second important attribute. USDA label, tenderness, and no chemical additives are the third most important group of attributes, while low in fat, low in sodium, and low in cholesterol follow next. The importance order for the rest of the meat attributes is price, white meat, and red meat.

The empirical results from the ordered-probit model suggested that consumers' demographic and socioeconomic characteristics influenced the importance ratings for the meat attributes. Females gave higher importance ratings than males to all selected meat attributes except taste and red meat. Older consumers cared about prices, red meat, appearance of meat, USDA label, and tenderness of meat. Larger households considered low in sodium and no chemical additives as important attributes. Low income households ranked low in sodium and red meat as important attributes when purchasing meat. Educated respondents gave lower importance ratings to sodium, red meat, and appearance of meat. Married respondents graded higher importance ratings to low in fat, low in cholesterol, and prices. Both Baptists and Catholics were concerned about taste, appearance, and tenderness, but Baptists gave USDA label high importance ratings and Catholics did so to low in fat. Blue collar workers did not care much about fat, cholesterol, red meat, price, and USDA label. Consumers from high income households were not concerned much about low in fat, low in cholesterol, and prices but worried about sodium and USDA label. Non-white respondents were often concerned about low in fat, low in cholesterol, and prices.

The following marketing implications seem appropriate. First, for processors, wholesalers, and retailers in the meat industry (including restaurants), the marketing strategy should focus on freshness, taste, and appearance of meat. The marketing plan may emphasize on developing novelty and tasty meat products and recipes, shortening the marketing channel (directly to purchase the meat stock from processors and producers and to eliminate excess middlemen) for freshness of meat, and promoting appetizing and healthy image of meat. Any of these efforts, which most satisfy consumers, may tremendously increase the marketing value and sales of meat.

Second, the nutritional attributes, such as low in fat, sodium, and cholesterol have become sensitive or important factors in the market segment of female, educated, and married consumers. Female consumers, a dominant group in grocery shopping, have been drifting away from red meat consumption to white meat. These imply that the market for the poultry industry such as chicken and turkey will continue to increase. This market trend may also provide the marketing opportunities for specialty meat enterprises such as rabbit, ostrich, and quail. In addition, any marketing promotion of new meat products related to nutritional attributes should aim at the target market of female, educated, and married consumers.

Third, meat price has been a less sensitive factor during meat shopping, but older, married, low income, or non-white consumers still remain as price conscious market segments. These market segments are sizeable. Therefore, efforts to reduce production and marketing costs for cheap prices of meat continue to be one of the keys for meat marketing.

Fourth, older, married, low income, and low educated consumers have been an important market segment for red meat. Although red meat consumption is declining, the marketing mix (product, distribution, promotion and price) focusing on these target markets could considerably increase the market volume of red meat. These market segments have the greatest potentials for red meat consumption (Smallwood, et al.) And finally, the USDA label has become an increasing important factor for older, female, Baptist, and high income consumers in making meat purchasing decisions. Any public policies strengthening the USDA's labeling and management in meat market should increase consumer utility and social welfare of the meat market.

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