

**Fourth Minnesota Padova Conference on  
Food, Agriculture, and the Environment**

Proceedings of a Conference Sponsored by  
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**SESSION IV: THE QUALITY OF AGRICULTURAL PRODUCTS  
AND HUMAN HEALTH**

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**PAPER 1: CONSUMER PERCEPTIONS, SAFETY,  
AND HEALTH CONCERNS**

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## Consumer Perceptions, Safety, and Health Concerns

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### ABSTRACT

Consumers' concerns about food attributes related to health, safety and nutrition were ascertained by way of a mailed survey in the metropolitan area of St. Paul/Minneapolis, Minnesota, in 1993.<sup>1</sup> An ordered probit analysis was conducted to determine how these concerns correlated with eating habits - specifically increasing, decreasing or making no change in the consumption of various types of meats. Those who had decreased their beef consumption were concerned about their intake of sodium, fat and cholesterol. They also preferred a variety of foods and tended to be older and better educated. Taste, appearance and guaranteed safety ranked high on a list of food attributes consumers preferred.

### INTRODUCTION

Consumers concerned about health and vitality are demanding higher quality diets. They want diets rich in flavor, variety, convenience and safety. They are increasingly aware of how their consumption affects the environment. Senauer (1992) refers to this change as a "demand for attributes."

In an economy where the quantity of food (or other goods and services) exceeds effective demand, consumer demand for higher quality is expected. Consumers fine tune their choices, differentiating products by increasingly subtle attributes, including those unrelated to direct consumption. For example, preferences for longevity or for the well-being of animals affect consumer choices.

The original objectives of the survey project were to identify those factors that weigh most heavily in the consumer's buying decisions, quantify the relative importance of various meat attributes and the consumer issues surrounding its production and

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<sup>1</sup>Funded by the Minnesota Beef Council and the Agricultural Utilization Research Institute. Presented at the Fourth Minnesota/Padova Conference on Food, Agriculture, and the Environment, September 4 - 10, 1994, University of Minnesota.

consumption. Identifying niche markets and educational opportunities were additional objectives.

### Methodology

In order to assess the impact of changing lifestyles, eating habits, and preferences on the demand for food attributes, a survey was mailed to 800 households in the metropolitan area of St. Paul/Minneapolis in January, 1993. Household members who generally purchased or prepared the food were asked to report on changes in their consumption of various types of meat over the prior year and identify and rank food attributes as to their relative importance. The overall response rate was 68 percent; the sample represented households with somewhat higher education and incomes than the population in general.

Quantifying the relative importance of product attributes and linking it to eating behavior is crucial for firms and public regulatory agencies responsible for delivering the products consumers need and want. This study used an ordered probit technique to analyze the relationship between changes in the consumption of various animal products and consumer preferences for food attributes, health, and the environment.

The percent of consumers who reported changes in beef consumption over a 1 to 3-year period prior to the survey are reported for four U.S. cities over years 1987 through 1993 in Table 1. Although the majority (57 percent) of respondents in the St. Paul/Minneapolis metropolitan area reported no change in their consumption of beef, 37 percent reported a decrease, and 4 percent reported an increase. Similar consumption patterns were reported in the other cities.

**Table 1 Percent of Consumers Who Reported Changes in Beef Consumption over a 1 to 3-Year Period Prior to the Survey — Four U.S. Cities, 1987 - 1993**

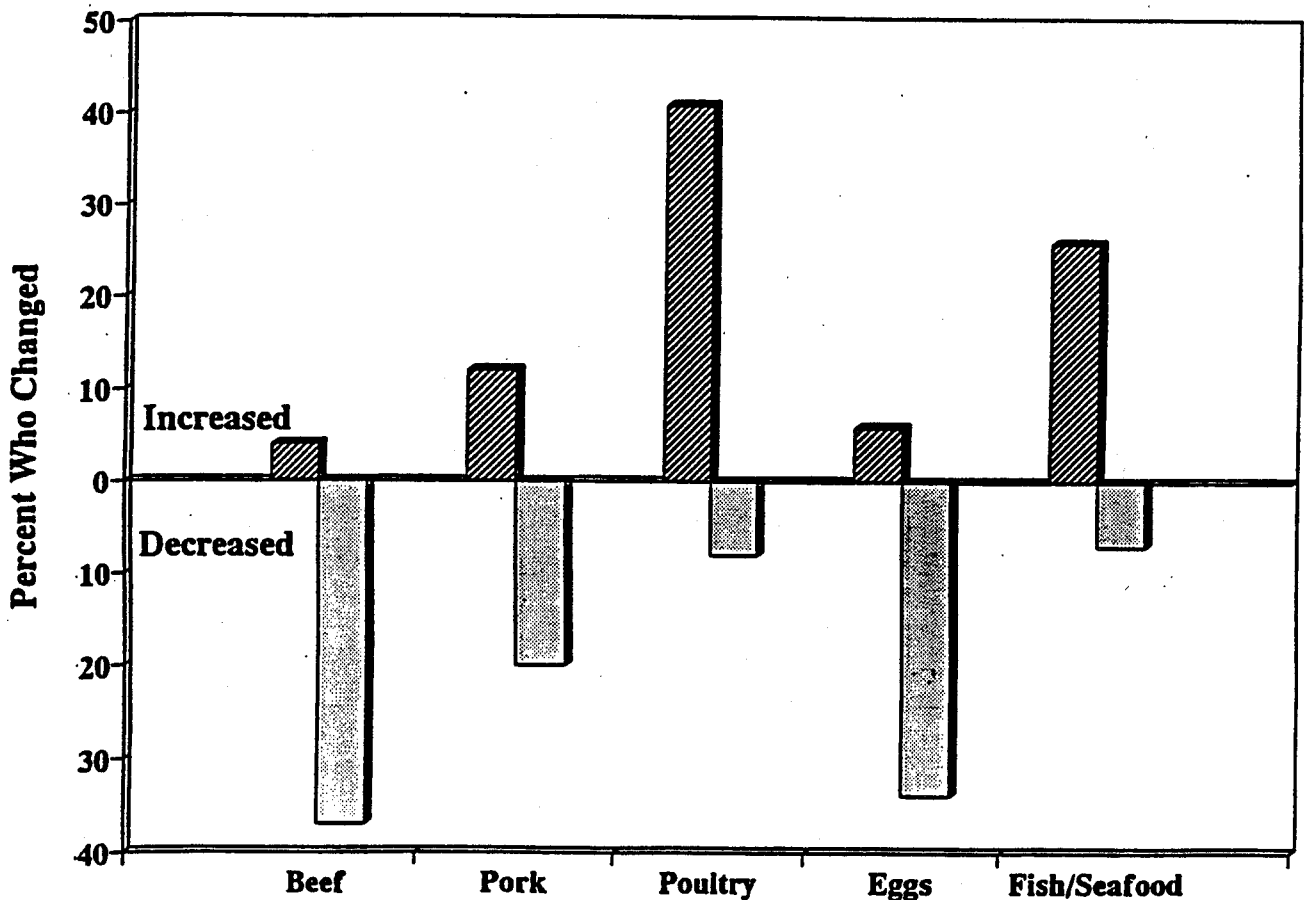
City	Date of Survey	Sample Size	Increased Beef	Decreased Beef	No Change in Beef
Minneapolis/ St. Paul	1993	515	4	37	57
Denver and Los Angeles <sup>1</sup>	1989	716	7	58	35
San Francisco <sup>2</sup>	1987	310	8	43	49

<sup>1</sup> Menkhaus, et al, 1992

<sup>2</sup> Menkhaus, et al, 1990

**Figure 1. Percent Who Increased and Decreased Consumption in the Past Year, 1993**

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The percent of respondents in St. Paul/Minneapolis who increased and decreased their consumption of animal products during 1993 is illustrated in Figure 1. Poultry and fish/seafood saw the greatest increase in consumption (41 percent and 26 percent respectively), suggesting that poultry and fish/seafood were substituting for beef and eggs. This is born out later in the statistical analysis.

In Table 2, opinions or behaviors related to diet and health are given for those who either decreased or increased their consumption of beef. Of those who decreased beef consumption, 75 percent considered it very important to avoid too much saturated fat, compared to 12 percent of those who increased their consumption of beef. Well over the majority of those who had decreased their consumption of beef identified avoiding too much fat (78 percent), cholesterol (65 percent), and sodium (54 percent) as very important. Again, most of those who decreased their consumption of beef also increased their poultry consumption (68 percent), suggesting that poultry was substituting for beef.

Factors influencing overall food choices are shown in Figure 2. Food that appears fresh, is guaranteed safe to eat, and tastes good were very important to the largest proportion of respondents. Appealing to children, having a brand name, and having coupons were not very important to many consumers.

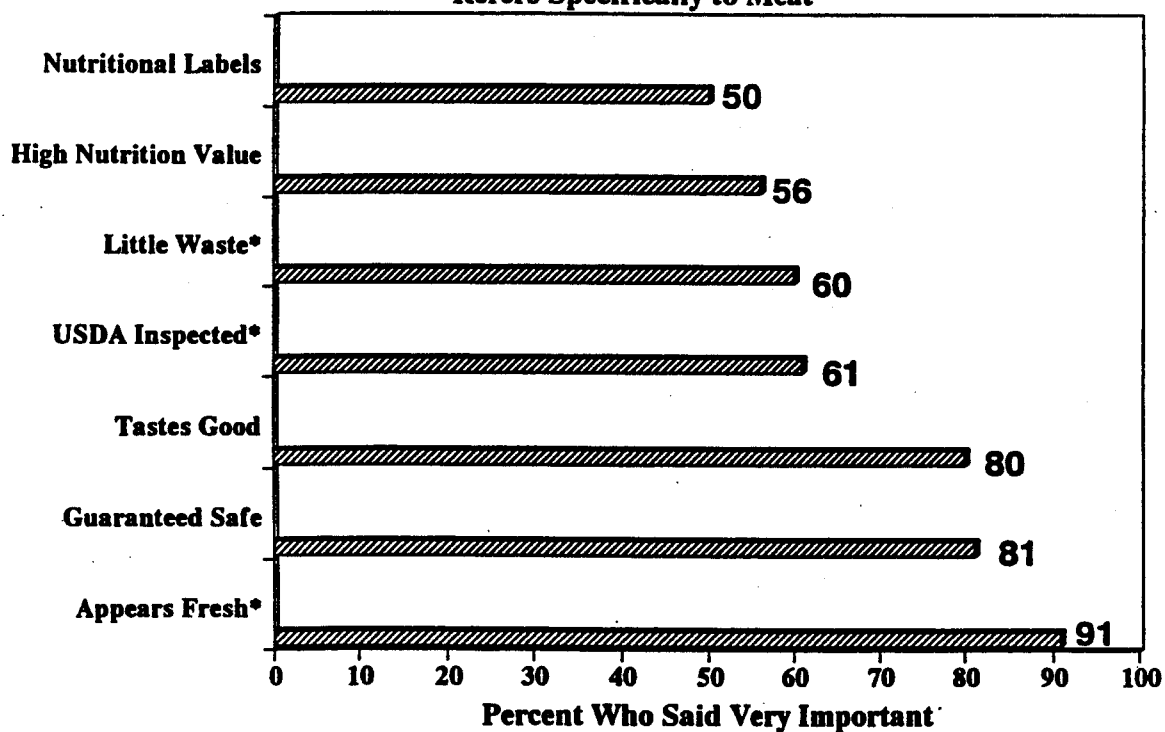
Figure 3 illustrates preferred attributes of animal food products ordered by the percent of respondents who said they agreed or strongly agreed that the attribute was preferred. This set of responses shows that having visible fat trimmed off was the highest priority. Environmental concerns ranked in the middle of this list (organic feed and biodegradable packages). Eighty-seven percent of those who decreased their consumption

**Table 2**                      **Opinion or Behavior Related to Diet and Health**

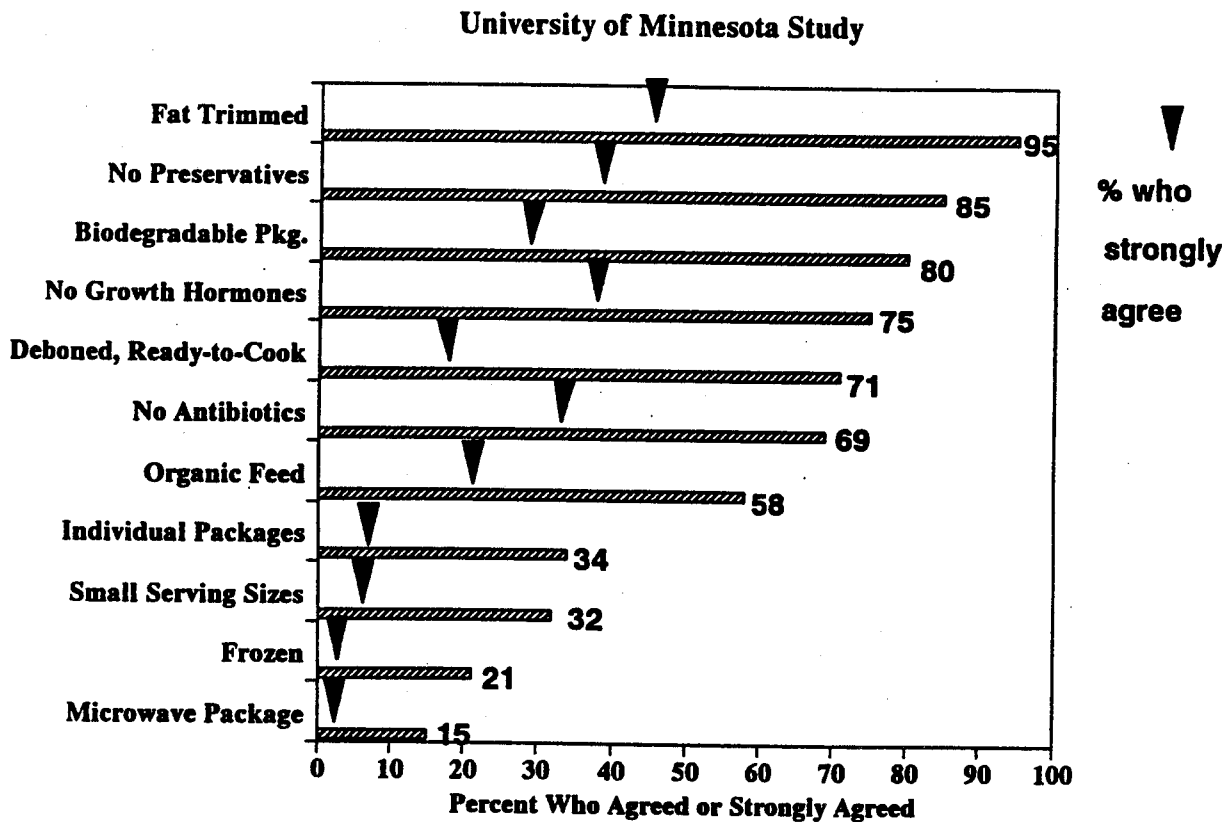
Opinion/Preference Identified as Very Important	<u>Percent of those who:</u>	
	decreased beef consumption	increased beef consumption
1. Avoid too much saturated fat.	75	12
2. Avoid too much fat.	78	37
3. Avoid too much cholesterol.	65	21
4. Avoid too much sodium.	54	21
5. Eat a variety of foods.	73	47
6. Their diet was very good or excellent.	42	21
7. Their diet was poor.	1	11
8. Increased their poultry consumption.	68	42
9. Decreased their egg consumption.	54	26
10. Increased their fish consumption.	39	22
11. Increased their pork consumption.	19	26

**Figure 2.**                      **Food/Meat Characteristics Rated Very Important In Order of Importance**

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**\* Refers Specifically to Meat**



**Figure 3. Percent Who Preferred These Meat Characteristics, In Order**



of beef preferred biodegradable packages while 70 percent of those who increased beef consumption expressed a preference for this type of packaging. Convenience characteristics, including frozen meat or meat in microwaveable packages, were not ranked highly on this list of characteristics.

### Statistical Analysis

In order to quantify the relative importance of meat attributes and the issues surrounding its production and consumption, an econometric analysis of changes in meat consumption was performed using an ordered probit analysis. The methodology is founded

in utility theory. Consumers are assumed to maximize their utility subject to a budget constraint. In this study, food attributes affecting the level of consumer utility derived from consuming food products, specifically meat, poultry, eggs, fish and seafood are identified. Utility for good A ( $U^A$ ) is defined as a function of food attributes  $x$ , household income, demographics, and health:

$$U^A = f^A(x, \text{income}, \text{demographics}, \text{health}) \quad (1)$$

where  $x$  may have both a quantity and quality dimension. As the level of utility is not directly observable, the dependent variable used in the analysis was the change in the consumption of beef, pork, poultry, eggs, fish and seafood over the past year. An ordered ranking of consumer behavior was identified from the reports of increasing, making no change, or decreasing the consumption of each of these foods.

### Ordered Probit

Survey respondents expressed their preferences by an ordinal ranking of alternative consumption behavior. In order to analyze the effect of attitudes, household characteristics, demographics and expenditures on consumption behavior, the statistical model had to account for the ordinal nature of the dependent variable. Since there is no significance attached to the unit distance between the set of observed values of the dependent variable, ordinary linear regression models would have handled the dependent variable incorrectly. The ordinal nature of the dependent variable was accounted for by using the ordered probit model as a framework for analysis.

In order to account for the substitutability of the different types of animal products in consumers' diets, the analysis consisted of a two stage probit. The first stage consisted of

estimating the effect of food attributes  $x$ , demographics, income, and health on the change in the consumption of the animal product in question. Using these estimated (parameter) effects, consumption levels of the substitute meats were predicted and used in the second stage as variables affecting the demand for each of the alternative types of meat products. The resulting model is a simultaneous equation system.

As an illustration, the estimated level of pork consumption derived from the first stage was used as a variable in explaining the probability of decreasing beef consumption. A positive coefficient for the pork consumption variable implies that pork is serving as a substitute for beef.

The underlying response model for the ordered probit can be described as

$$y^* = \beta'x + \varepsilon \quad (2)$$

where  $y^*$  denotes the underlying level of utility achieved. As  $y^*$  is generally unobserved, we observe the coded responses  $y = 0, 1, 2, \dots, J$ , as follows:

$$\begin{aligned} y &= 0 \text{ if } y^* \leq \mu_0, \\ &= 1 \text{ if } \mu_0 < y^* \leq \mu_1, \\ &= 2 \text{ if } \mu_1 < y^* \leq \mu_2, \\ &\vdots \\ &= J \text{ if } \mu_{J-1} \leq y^* \end{aligned} \quad (3)$$

where the  $\mu$ 's are unknown threshold parameters to be estimated with  $\beta$ . These estimates are obtained via maximum-likelihood methods.

Respondents have their own intensity of feelings, i.e. level of utility associated with certain measurable factors,  $x$ , and certain unobservable factors,  $\varepsilon$ . Theoretically, the respondents could have responded to the questions with their own level of utility  $y^*$ , but

given a choice of J possible answers, they chose the response that most closely represented their own feelings on the question. If the characteristics of the food item identified in the dependent variables are sufficiently important to the consumption decision, a threshold level of the index  $\mu$ 's is achieved and a choice is made.

The probabilities which enter the maximum-likelihood estimates can generally be expressed as

$$\text{Prob}(y = j) = \text{Prob}(y^* \text{ is in the } j\text{th range}).$$

In this study, the estimating model was

$$Y = \alpha + \beta_1 X_1 + \beta_2 D_j + \beta_k I_k + \mu + E. \quad (4)$$

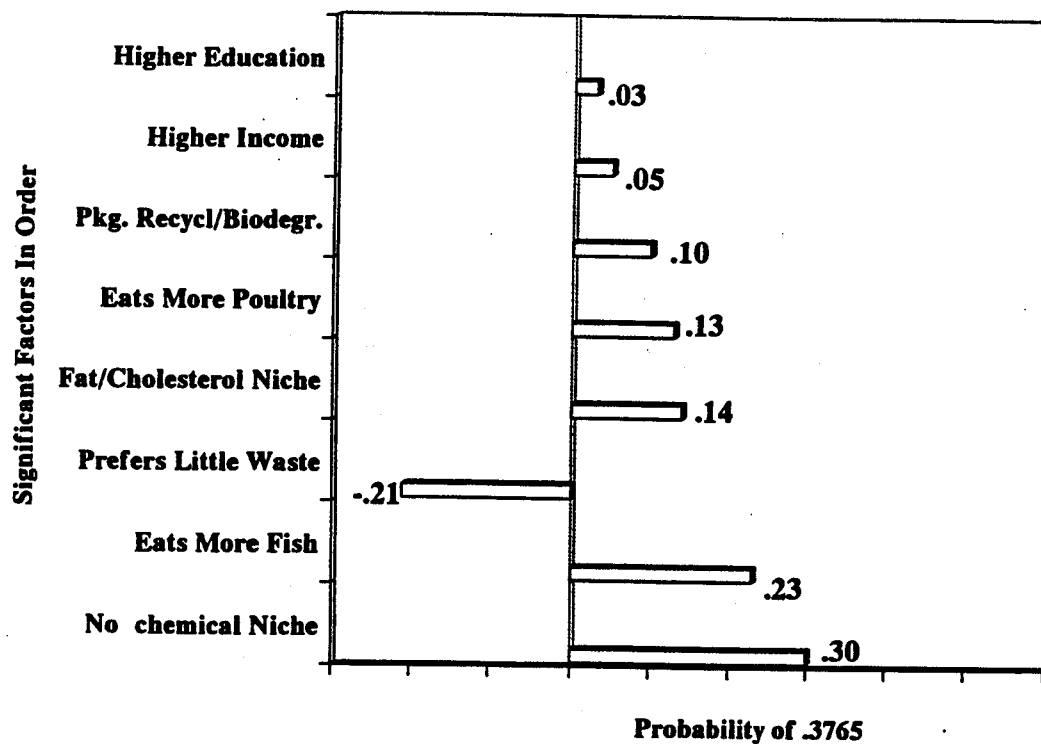
where  $Y = 0$  when consumption decreased,  $Y = 1$  when consumption stayed the same, and  $Y = 2$  when consumption increased.  $X_1$  = food attributes,  $D_j$  = demographic characteristics of the household and  $I_k$  = income and health characteristics of the household.  $Y^*$  is the probability that the household member will have decreased, made no change, or increased their consumption of the meat product in question.

In order to illustrate the results of this study, the probabilities of changing the consumption of beef and poultry were translated into two graphs. The probability of decreasing beef consumption was estimated to be 0.38. Factors that significantly explained consumer preferences for decreasing beef consumption are in Figure 4. They include education, income, and concern for the environment, as acknowledged by a preference for recyclable or biodegradable packaging, poultry and fish consumption, and a preference for little waste on meat products.

As higher levels of education were obtained, the probability of decreasing beef

consumption increased by 0.03. Similarly, as income levels increased, the probability of decreasing beef consumption increased from 0.38 to 0.43, an increase of 0.05. On the other hand, a preference for little food waste indicated a decrease of 0.21 in the probability of decreasing beef consumption. Thus, those people who preferred to buy meat products with little waste associated with meal preparation were less likely to decrease their consumption

**Figure 4.** **Change in the Probability of Decreasing Beef Consumption**  
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of beef. Poultry and fish acted as substitutes for beef; an increase in their consumption increased the probability of decreasing beef consumption by 0.13 and 0.23 respectively. A concern for the use of chemicals in either the production or processing of beef products had

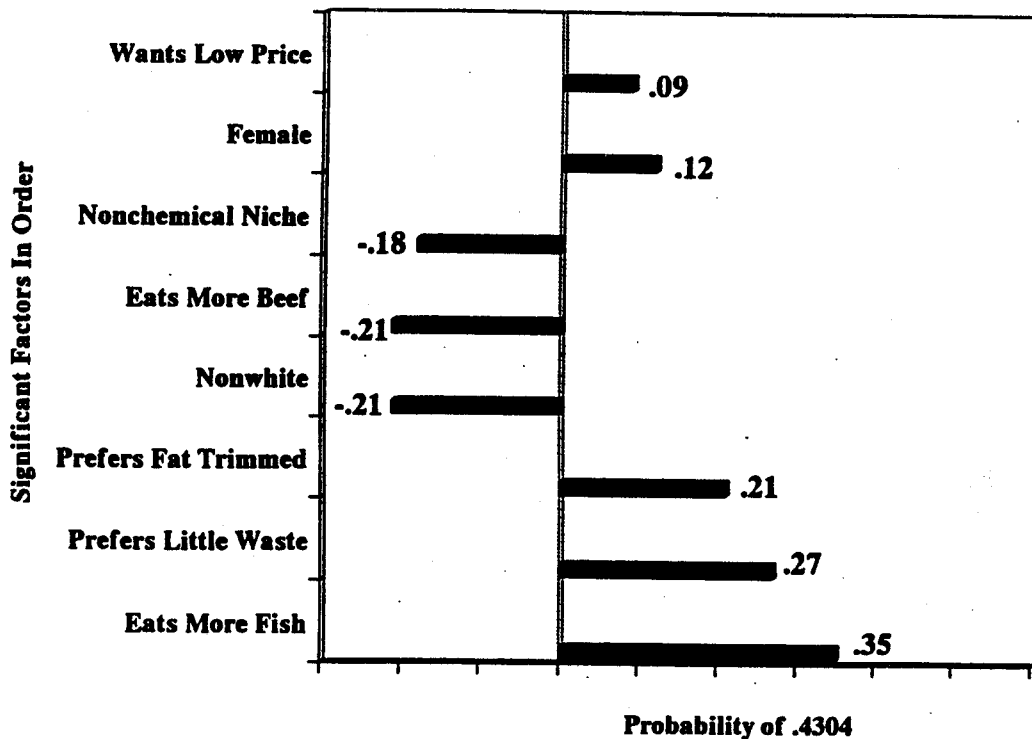
the biggest impact on decreasing beef consumption as indicated by an increased probability of 0.30.

Concern with the use of chemicals, a preference for little waste, and increased fish consumption were significant factors explaining the change in the probability of *increasing* poultry consumption. As illustrated in Figure 5, those who ate more beef were less likely to have increased poultry consumption, while those who ate more fish correlated well with eating more poultry, again suggesting that beef and poultry were substitutes. Other factors that significantly increased the probability of increased poultry consumption included a

**Figure 5.**

**Change in the Probability of Increasing Poultry Consumption**

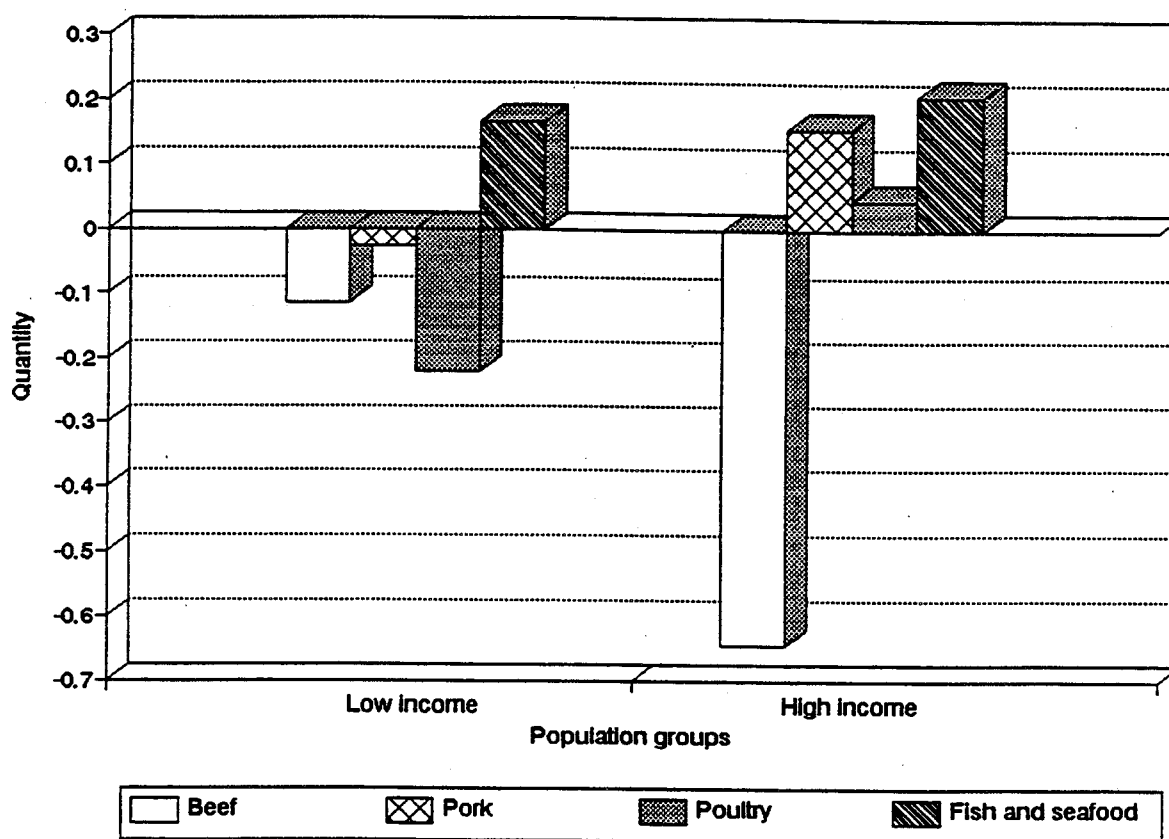
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preference for low prices, being female, and preferring fat trimmed off the meat. Being nonwhite decreased the probability of increasing poultry consumption by 0.21.

Another study by Rafael Cortez and Ben Senauer, using a national data set of household food consumption over a 10 year period, confirms these results. As illustrated in Figure 6, they found that as income increased, beef consumption decreased.

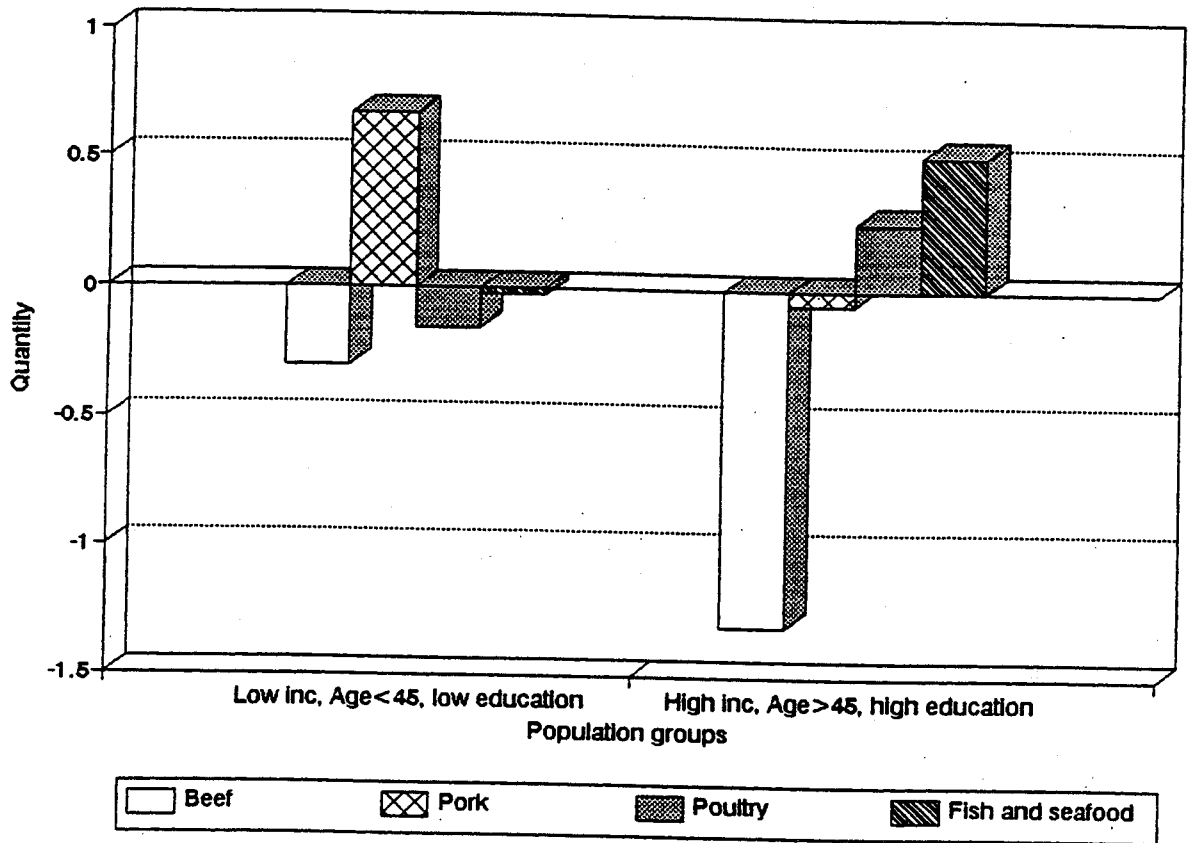
**Figure 6. Cumulative Taste Changes in Meats: 1980-1990 by Class.**



Source: Cortez and Senauer

In Figure 7, moving from a low income, less educated, younger group of consumers to a higher income, more educated, older (over 45) group, the tendency to decrease beef consumption is even more pronounced. Again, this finding by Cortez and Senauer confirms results found in Minnesota. That is, higher education and income significantly increased the probability of decreasing beef consumption.

**Figure 7. Cumulative Taste Changes in Meats: 1980-1990 by Income, Age of Household Head, and Spouse's Education**



Source: Cortez and Senauer

In conclusion, the survey identified consumption patterns for meat products and factors that significantly affected the consumption of meat products in the St. Paul/Minneapolis metro area. Concerns about diet and health were significantly correlated with a decrease in beef consumption. Over 90 percent of those who decreased beef consumption were concerned about sodium, saturated fat and cholesterol, and wanted to eat a variety of foods.

Concerns about diet and health cut across age and educational groups. Concern about fat was greater among females and less among those whose household incomes were between \$35,000 and \$55,000 a year.

In general, the characteristics of food that consumers considered most important were that it tastes good and is guaranteed safe to eat. The most important additional characteristics of meat were that it looks fresh, does not have a lot of waste, is certified as USDA inspected, and is free of chemical residues. There was great concern about chemical residues and about the safety of new processes like irradiation and genetic engineering, but there were also many who confessed they just did not know what to think. Many educational opportunities exist in these areas.

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