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# Nutrition considerations in food selection

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**Abstract**

The importance of nutrition consideration to households in food selection is instrumental in the development of information programs to promote public health and to market healthy food. Using a national telephone survey of 2880 U.S. households, this study examines the role and influence of socio-economic characteristics and lifestyle on a household meal planner's consideration of four dietary components in food selection. Household income, children in households, geographic location, and gender, age, education, and lifestyle of meal planners affected the consideration of dietary components in food selection. The results provide a basis for developing education programs that focus on the particular dietary consideration of identified demographic subgroups. 

## 1. Introduction

Americans have access to one of the world's most nutritious and plentiful food supplies. However, this access does not imply that Americans are consuming a well-balanced diet. The data from the healthy eating index (HEI) show that although dietary quality has improved over the past years, the diets of most Americans need improvements in several aspects (Kennedy et al.,1999). Many experts in the health and nutrition area have generally agreed that consumers can reduce the risk of chronic disease such as heart disease, stroke, and cancer by monitoring the intakes of foods and by maintaining a healthy lifestyle including regular exercise. Regular physical activity can be helpful in delaying development of heart disease, adult-onset diabetes, obesity, osteoporosis, and perhaps certain cancers (Anon, 1989).

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Information about nutrition can be found through public as well as private sources. Public sources of information provide generic information about the effects of diet on disease risks. Examples of public nutrition information include the Food Guide Pyramid, Recommended Daily Allowances, and the Dietary Guidelines for Americans. Private information sources typically include producer-provided information about particular brands of food items and health information by health professionals. Increased availability of nutrition information has been successful in enhancing public awareness of the importance of healthy diet and lifestyles. The important issue is whether enhanced nutrition and health awareness have any significant impact on consumers' actual dietary behavior. Studies evaluating the relationship between nutrition knowledge and dietary behavior have found no direct correlation between the two (Putler and Frazao, 1994; Sapp, 1991). Another study concentrating on fat and cholesterol (Ippolito and Mathios, 1994) found that despite abundant information regarding the adverse health effects of fat and cholesterol, the decline in fat consumption among men and women has been considerably small since 1977. Many other studies have determined that perceptions about product attributes, including nutrition attributes, are better indicators of consumer dietary behavior than the level of health awareness (Shepherd and Towler, 1992; Tuorila,1987). Weirenga (1983) proposed that socio-demographic characteristics of individuals can influence their perception of various food attributes. Nayga (1997) evaluated the impact of socio-demographic factors on perceived importance of nutrition in food shopping using data available in the 1991 Diet and Health Knowledge Survey (DHKS). The study indicated that individuals belonging to a demographic subgroup, for example Black, female, and higher educated, perceived nutrition as more important than individuals in other subgroups. The analysis, however, used nutrition in general without delineating various dietary components of nutrition such as cholesterol, vitamins, and calories.

The other aspect of healthy living is the lifestyle of individuals. In a study by Morrow et al. (1999), knowledge of the relationship between physical inactivity and specific chronic disease among American adults varied with age, ethnicity and educational level. However, scant information in the literature is available showing the relationship between consumers' nutrition perception and their lifestyle. A1997 Nutritional Trends Survey by the American Dietetic Association reported that 43% of the Americans surveyed said they made an effort to get regular physical exercise. In addition, 81% said exercise was as important as a nutritious eating plan to good health. However, it is not known whether those who considered exercise to be important for healthy living also were concerned about nutritional components when selecting food items.

The purpose of this study was to examine how a household meal planner's consideration of various dietary components in selecting food items is influenced by the person's or the household's sociodemographic factors and lifestyle. Information about the relationship between demographics and perception of specific dietary components is useful when designing information programs targeted to a specific demographic subgroup. For example, the food decisions consumers make are influenced by food habits, an important component of culture (Asp, 1999). Similarly, dietary excess of calories, sugar, fat, cholesterol, and sodium common among many teenagers may continue into adulthood (Story, 1989). Thus, some demographic subgroups are likely to consume a specific dietary component at much higher levels than recommended from a nutritional standpoint. The health intervention program

targeted to that demographic subgroup can be made more effective if the information regarding their perception of the specific component while making food selection is available.

## 2. Methods

### *2.1. Empirical model*

The notion of the relationship between product attribute and consumer utility (Lancaster, 1966) can be extended to establish the link between nutrition consideration in food selection and sociodemographic characteristics of individuals. In this model, let $U_j$ represent utility for an individual $j$. This utility is hypothesized to be a function of various factors, $z$, which includes nutritional attributes of products. Following Lancaster's Linear Characteristics Model (Lin, 1995), the amount of the nutritional attribute an individual derives is the sum of each food's level of a specific nutritional attribute, say vitamin, times the corresponding quantity of consumption. This amount can be expressed using the following notations: $z_k = \sum_i \delta_{ki}\, x_i$ where $z_k$ is the amount of the kth nutritional attribute z (e.g., vitamin), $\delta_{ki}$, unit of $z_k$ (e.g., vitamins per serving) in food i, $x_i$, quantity of food i consumed. If $\delta_{ki}$ is mentioned in the labels of the products, and a consumer considers the particular nutrition attribute in the products to be important while making food selections, he or she is likely to select the most satisfactory combination of foods that provide the desired level of the specific nutrition. In that case, a consumer's attitude toward nutrition attributes is directly reflected in the maximized utility function, $U_j$. Here, the empirical model posits that a consumer's nutritional consideration is a function of various socioeconomic characteristics of individuals. The decision maker's theoretical utility model, therefore, can be formally written as:

$$U_j = \beta' Z_j + \varepsilon_j, \tag{1}$$

where $U_j$ is the utility level attained by the jth household and $Z_j$ is a vector of explanatory variables including household decision makers' profiles. Although $U_j$ is unobserved, what is observed is the indicated frequency of consideration of nutritional attributes while making food selection decisions represented by the rank-ordered dependent variables, $R$, where:

$$\begin{aligned} R &= 0 \ \text{ if } U_j \le 0 \\ R &= 1 \ \text{ if } 0 < U_j \le \mu_1 \\ R &= 2 \ \text{ if } \mu_1 < U_j \le \mu_2 \\ R &= w \ \text{ if } \mu_{w-2} < U_j \end{aligned} \tag{2}$$

where the $\mu$'s are the threshold variables or cutoff points that provide the ratings of alternative product attributes. The lowest ranked outcome, $R = 0$, represents the situation when the specific nutritional attribute is considered "almost never" while selecting a food item; highest ranked outcome, $R = w$, represents the situation when the consumer considers the specific attribute "nearly all the time" while selecting a food item.

Although there is lack of any theoretical basis for selecting explanatory variables in the models, results of previous studies provide valuable guidelines in this regard. Putler and Frazao (1994) reported a positive relationship between an individual's awareness of the link between dietary fat and chronic disease and household income. They also postulated a variation in nutrition concern based on race, urbanization, and region due to differences in media exposures among these demographic subgroups.

Household meal planners with different characteristic profiles are likely to have different levels of consideration of dietary components when making food selections. Grossman and Kaestner (1997) reported a positive relationship between education and health. A person with more education is better able to maintain a healthy life than a person with less education. Better education enhances the access to nutrition information, thus increasing the likelihood of nutritional considerations while making food selections. Nayga (1997) also found a significant positive relationship between education and a main meal planner's perceived importance of nutrition in food shopping. Among the other characteristics of the household meal planners, a female household meal planner (Food Marketing Institute, 1990; Nayga, 1997; Putler and Frazao, 1994; Moon et al., 1999) is more likely to consider nutrition while making food selections; an older household meal planner is more likely to consider nutrition while shopping for food than a younger household meal planner (Frazao and Cleveland, 1994; Grossman, 1972; Ott and Maligaya, 1989). Race may be another individual characteristic associated with the variation in nutrition consideration. Flynn et al. (1994) found that non-Whites were more concerned about contamination in food than Whites. Nayga (1997) reported that Black meal planners perceived nutrition as more important than did White meal planners.

Empirical evidence showing interrelationships between lifestyles and health attitudes is limited. Johnson et al. (1998) reported a statistically significant relationship between indices of physical activity and eating habits of university men and women. The indices measured leisure-time moderate and vigorous activities, flexibility, and strengthening activities. A random cross-sectional study (Woodward et al., 1994) of men and women comparing their health knowledge, behavior, and lifestyles reported that smokers had poorer dietary knowledge, lower intake of vitamins and fiber, and higher intake of dietary cholesterol and alcohol than nonsmokers. The assessment of nutritional habits in population studies has demonstrated that selection of food by a smoker is different from that by a nonsmoker (Midgette et al., 1993; Preston, 1991). Empirical evidence regarding lifestyle and consideration of nutrition when selecting food items is not available. Although lifestyles include many aspects of daily life of individuals, in this study the household meal planner's exercise habit is chosen to represent her or his lifestyle. It is hypothesized that those household meal planners who exercise regularly are likely to consider nutrition issues more often when selecting food than nonexercisers.

The empirical models in this study posit that the importance of the nutrition consideration to a household meal planner when selecting food is influenced by the following factors: household income, presence of young children in the family, geographic location, race, education, age, sex, marital status, employment status, and lifestyle of household meal planners represented by their exercise habits.

### 2.2. Data and econometric model

The data set used in this study is a part of a nationwide telephone survey of 2880 U.S. households by the Gallup organization in December 1996. All survey respondents were at least 18 years of age. They were household meal planners making food purchase decisions for the households. A multiple call back method was used for the telephone interview. Up to five call backs were made to the same telephone number to eliminate bias in favor of those easy to reach by telephone. Survey questionnaires included consideration of four nutritional components in making food choices, respondents' lifestyle represented by their exercise habits, and demographic background. Four market regions (west, midwest, northeast, and south) were identified based on telephone area codes used for interviews. In the survey, respondents were asked: "when you choose the foods you eat, please tell me how frequently you consider the following components, using a 10-point scale, where "10" means you consider it nearly all the time (NAT), and "1" means you almost never (AN) consider it." Four nutritional components of consideration were read, starting with a randomly chosen component for each household: vitamins and minerals, cholesterol, fat, and sugar. The responses to nutrition consideration when selecting food items were measured using an ordinal scale of 1 to 10.

The frequency distribution of lowest to highest levels of nutritional consideration among the sample households is reported in Table 1. Although 1,5, and 10 ratings were selected more often than the others, the distribution is not excessively skewed. In contrast, previous studies on nutritional and safety attributes of food have reported extreme skewness in the distribution of responses. Lin (1995) used an ordinal scale to evaluate the importance of food safety. Using a scale of 1 to 6, where 1 represented "not important" and 6 represented "very important", he found out that two thirds of the respondents gave a rating of 6. Nayga (1997) evaluated the perceived importance of nutrition in food shopping using an ordinal scale of 1 to 6 as Lin (1995) did and reported a mean of 5.20 with the standard deviation of 1.04. Such distribution parameters suggest an extreme skewness of the data that may be attributed to the wordings bias in the ranking questions (Sterngold et al., 1994) and/or social desirability bias (Fisher, 1993). As recognized by Lin (1995), use of highly skewed dependent variables in an ordered probit model hinders the model's ability to discern more clearly the effects of independent variables as their variations are not always observed in the ratings.

Table 2 reports the specific variables used in the models and their description. The explanatory variables were grouped into three classes namely, household characteristics, geographic location of households, and household meal planners' characteristics including lifestyle. Only 39% of the households had children in the family. More than 50% of the respondents were female. Four in five respondents were White. The sample included all four U.S. regions with the South representing more than 33% of the total sample. The sample means compared well with the population averages. For example, whereas 85% of the U.S. population are White, 83% of the sample households were White. The gender composition of the U.S. is approximately 51% female as compared to 56% female meal planners in the sample. The regional distribution in the sample is nearly identical to the regional distribution of the U.S. population among four regions.

Table 1
Distribution of the lowest and highest levels of nutritional consideration of U.S. households in making food purchase decisions ($n$ = 2505)

| Consideration in Food Selection | Vitamins (% of Sample Households) | Cholesterol (% of Sample Households) | Sugar (% of Sample Households) | Fat (% of Sample Households) |
|---|---|---|---|---|
| 1 = Almost Never | 22.0 | 21.5 | 22.0 | 13.1 |
| 2 | 6.2 | 6.5 | 5.8 | 3.3 |
| 3 | 6.8 | 5.0 | 7.5 | 4.5 |
| 4 | 5.7 | 4.3 | 5.8 | 3.4 |
| 5 | 18.0 | 14.3 | 18.3 | 11.9 |
| 6 | 7.2 | 4.6 | 6.3 | 4.3 |
| 7 | 7.5 | 6.2 | 6.9 | 6.0 |
| 8 | 11.8 | 11.7 | 9.7 | 13.9 |
| 9 | 3.1 | 6.1 | 3.8 | 10.7 |
| 10 = Nearly all the time | 11.7 | 19.9 | 13.8 | 28.7 |

The dependent variable was measured using ordinal measures (1,2,..,10). Hence, an ordered probit model (Long, 1997; Godfrey, 1988; Davidson and MacKinnon, 1993; Greene, 1993) was used in the analysis to investigate the impact of demographic and socio-economic factors on nutrition consideration when the consumers shopped for food items. The objective of the model was to determine the probability that household meal planners will select one level of perceived importance of nutrition components over the several levels defined above. The econometric model is defined as:

$$Y_i^* = \beta' x_i + \varepsilon_i \tag{3}$$

Values for Y* are 1,2, 3,4,5,6,7,8,9,10. Value of 1 indicates household meal planners "almost never" considered nutrition components when making food selection decisions, whereas 10 indicates the highest level of nutrition consideration. $\beta$ is the vector of unknown parameters and $\epsilon_i$ is the independently and identically normally distributed error term. In limited dependent variable models, heteroskedastic errors lead to inconsistency of the parameter estimates (Arabmazar and Schmidt, 1981). To correct for the potential inconsistency caused by heteroskedasticity, the standard deviations, $\sigma_i$, can be specified as:

$$\sigma_i = \exp(\gamma' z_t) \tag{4}$$

where $z_t$ is a vector of exogenous variables,[1] and $\gamma$ is a conformable parameter vector. The unknown parameters including $\beta$ (Equation 3) and $\gamma$ (Equation 4) for the models were estimated using maximum likelihood estimation (Greene, 1995). The only reported are those corresponding to $\beta$ due to space limitation. The parameter estimates for $\gamma$ are available from the authors upon request. Test of heteroscedasticity was conducted using a likelihood ratio test. The $\chi^2$ values were 130.02, 100.77, 77.85, 106.38 for vitamin and minerals, cholesterol, fat, and sugar, respectively. These values are sufficiently high to reject the null hypothesis, at the 0.01 significance level, that the models were homoscedastic.

Table 2
Names of the variables and their descriptions ($n$ = 2505)

| Variable Name | Description | Mean | SD |
|---|---|---|---|
| Vitamins and minerals | Nutrition ingredient considered by household meal | 5.02 | 3.04 |
| Fat | planners while making food selection: 1 = Almost | 6.69 | 3.18 |
| Cholesterol | never, 2=, 3=, 4=, 5=, 6=, 7=, 8=, 9=, 10= | 5.56 | 3.37 |
| Sugar | Nearly all the time. | 5.07 | 3.12 |
| **Household characteristics** | | | |
| High income[a] | 1 = Gross household income more than $75,000 per year; 0 otherwise | 0.123 | 0.328 |
| Low income[a] | 1 = Gross household income less than $35,000 per year; 0 otherwise | 0.396 | 0.489 |
| Children in the household | = 1 if children in the household; =0 otherwise | 0.387 | 0.487 |
| **Geographic location[b]** | | | |
| Northeast | New England and Mid Atlantic States | 0.189 | 0.392 |
| Midwest | East North Central and West North Central States | 0.258 | 0.438 |
| South | South Atlantic, East South Atlantic, and West South Atlantic | 0.335 | 0.472 |
| **Household meal planner's characteristics[c]** | | | |
| Race | 1 if household meal planner is white, 0 otherwise | 0.851 | 0.356 |
| Less educated[d] | 1 if education level of household meal planner is high school graduate or less; 0 otherwise | 0.356 | 0.479 |
| Highly educated[d] | 1 if education level of household meal planner is college graduate or more; 0 otherwise | 0.361 | 0.480 |
| Age | Mid points in the age groups of household meal planners | 45.08 | 15.43 |
| Female | 1 if household meal planner is female, 0 otherwise | 0.565 | 0.495 |
| Marital status | 1 if household meal planner is married, 0 otherwise | 0.574 | 0.494 |
| Employed | 1 if household meal planner is employed, 0 otherwise | 0.646 | 0.478 |
| No exercise[e] | = 1 if a household meal planner does not exercise; 0 otherwise | 0.449 | 0.391 |
| Regular exercise[e] | = 1 if a household meal planner exercises 4 to 7 days per week; 0 otherwise | 0.349 | 0.476 |

[a]Omitted category for this group of dummy variable is middle income households.
[b]Omitted category for this group of dummy variable is households located in the midwest.
[c]The respondent is assumed to be the household meal planner who makes food purchase decisions.
[d]Omitted category for this group of dummy variable is meal planners who are moderately educated.
[e]Omitted category for this group of dummy variable is meal planners who exercise 1 to 3 days per week.

## 3. Results and discussion

Due to incomplete information, only 2550 out of 2880 observations were included in the models. Such deletion of observations due to incomplete socio-demographic information could result in potential self-selection problems. In this study the deletion did not lead to problems because the mean and standard deviation of the full data set compared well with the usable data set. Ordered probit models for the four nutritional components considered by the household meal planners in making food choices were estimated and reported in Tables 3 through 6. For all four models the null hypotheses that all parameters were jointly equal to zero were rejected using $\chi^2$ statistics at the 0.01 significance level. Based on collinearity

Table 3
Maximum likelihood estimates of the ordered probit models for vitamin and minerals concern

| Variables | Coefficient[a] | *p*-value | Marginal Effect on ''Nearly all the time''[b] |
|---|---|---|---|
| Low income | 0.1052* | 0.0219 | 0.0206 |
| High income | −0.1157* | 0.0489 | −0.0235 |
| Children in the household | 0.1021* | 0.0286 | 0.0200 |
| Northeast | 0.1151* | 0.0625 | 0.0222 |
| Midwest | 0.0015 | 0.9793 | — |
| South | 0.0236 | 0.6635 | — |
| Regular exercise | 0.1995* | 0.0000 | 0.0385 |
| No exercise | −0.2486* | 0.0006 | −0.0513 |
| Race | −0.2050* | 0.0020 | −0.0381 |
| Highly educated | 0.1101* | 0.0185 | 0.0215 |
| Less educated | −0.0891* | 0.0990 | −0.0178 |
| Female | 0.2515* | 0.0000 | 0.0501 |
| Marital status | −0.0204 | 0.6427 | — |
| Age | 0.0044* | 0.0078 | 0.0013 |
| Employed | −0.0630 | 0.2162 | — |
| Constant | 0.5214* | 0.0000 | |
| $\mu_1$ | 0.1933* | 0.0000 | |
| $\mu_2$ | 0.3814* | 0.0000 | |
| $\mu_3$ | 0.5273* | 0.0000 | |
| $\mu_4$ | 0.9752* | 0.0000 | |
| $\mu_5$ | 1.1644* | 0.0000 | |
| $\mu_6$ | 1.3841* | 0.0000 | |
| $\mu_7$ | 1.8240* | 0.0000 | |
| $\mu_8$ | 1.9818* | 0.0000 | |
| Value of log-likelihood function | −5258.7530 | | |
| $\chi^2$ Statistics (df = 21) | 270.3685 | | |
| McFadden $R^2$ | 0.0251 | | |

[a]Estimated Parameters and *p*-values for the exogenous variables used to correct for the heteroscedasticity are not shown.

[b]the marginal effects are shown for the statistically significant variables only. Marginal effects on response categories other than ''nearly all the time'' are not shown.

*Indicates significance at $\alpha = 0.10$.

diagnostics (Belsley et al., 1980), no collinearity problems were detected in the analyses. As reported in Tables 3 to 6, many socioeconomic and demographic variables significantly affected household consideration of four nutritional components in making food purchase decisions. Marginal effects on the highest level of response category, "nearly all the time," are reported for significant variables only.

### *3.1. Household characteristics and nutrition concern*

Annual household income affected vitamins and minerals, and fat considerations significantly but did not make any impact on the consideration of cholesterol and sugar when consumers selected food items. Also, note that the signs for fat and vitamins are opposite for the high income category. This result implies that as income level increases, household meal

Table 4
Maximum likelihood estimates of the ordered probit models cholesterol concern

| Variables | Coefficient[a] | *p*-value | Marginal Effect on ''Nearly all the time''[b] |
|---|---|---|---|
| Low income | 0.0136 | 0.8576 | — |
| High income | 0.0997 | 0.3215 | — |
| Children in the household | 0.0461 | 0.5353 | — |
| Northeast | 0.3153* | 0.0022 | 0.0607 |
| Midwest | 0.1489* | 0.0917 | 0.0322 |
| South | 0.2370* | 0.0084 | 0.0509 |
| Regular exercise | 0.1769* | 0.0174 | 0.0388 |
| No exercise | -0.5570* | 0.0000 | −0.1515 |
| Race | −0.1184 | 0.1961 | — |
| Highly educated | 0.1323 | 0.1178 | — |
| Less educated | −0.2261* | 0.0134 | −0.0539 |
| Female | 0.2738* | 0.0001 | 0.0639 |
| Marital status | 0.0610 | 0.4033 | — |
| Age | 0.0254* | 0.0000 | 0.0139 |
| Employed | 0.0252 | 0.7482 | — |
| Constant | −0.0594 | 0.7451 | |
| $\mu_1$ | 0.3377* | 0.0000 | |
| $\mu_2$ | 0.5716* | 0.0000 | |
| $\mu_3$ | 0.7616* | 0.0000 | |
| $\mu_4$ | 1.3581* | 0.0000 | |
| $\mu_5$ | 1.5488* | 0.0000 | |
| $\mu_6$ | 1.8144* | 0.0000 | |
| $\mu_7$ | 2.3796* | 0.0000 | |
| $\mu_8$ | 2.7304* | 0.0000 | |
| Value of log-likelihood function | −5331.211 | | |
| $\chi^2$ Statistics (df = 21) | 293.6551 | | |
| McFadden $R^2$ | 0.0275 | | |

[a]Estimated Parameters and *p*-values for the exogenous variables used to correct for the heteroscedasticity are not shown.

[b]the marginal effects are shown for the statistically significant variables only. Marginal effects on response categories other than ''nearly all the time'' are not shown.

*Indicates significance at $\alpha = 0.10$.

planners are less likely to be concerned about vitamins and more likely to be concerned about fat. Nayga (1996) reported that income affected significantly and positively on consumer use of information regarding undesirable nutrition factors such as fat, calories and cholesterol. Moon et al. (1999) showed that concern about fat content in food items among Bulgarian households was positively related with income.

Children had a positive impact on household meal planners' consideration of vitamin and mineral content when selecting food items. The probability of considering vitamins and minerals "nearly all the time" was 0.02 higher for households with children than those without children holding all other variables at their means. This result implies that existing nutrition information programs have been able to enhance awareness among parents regarding the importance of vitamins and minerals in growth and development of children. Presence of children in the households, however, did not have any impact on consideration of nutritional components such as cholesterol, fat, and sugar.

Table 5
Maximum likelihood estimates of the ordered probit models for fat concern

| Variables | Coefficient[a] | *p*-value | Marginal Effect on ''Nearly all the time''[b] |
|---|---|---|---|
| Low income | −0.0554 | 0.3899 | — |
| High income | 0.1360* | 0.0938 | 0.0023 |
| Children in the household | −0.0306 | 0.6223 | — |
| Northeast | 0.0785 | 0.3657 | — |
| Midwest | −0.0108 | 0.8930 | — |
| South | 0.0441 | 0.5592 | — |
| Regular exercise | 0.2260* | 0.0012 | 0.0057 |
| No exercise | −0.4199* | 0.0000 | −0.0394 |
| Race | 0.1803* | 0.0342 | 0.0121 |
| Highly educated | 0.1745* | 0.0144 | 0.0051 |
| Less educated | −0.2820* | 0.0003 | −0.0161 |
| Female | 0.6326* | 0.0000 | 0.0350 |
| Marital status | 0.1130* | 0.0795 | 0.0049 |
| Age | 0.0054* | 0.0198 | 0.0028 |
| Employed | 0.0019 | 0.9772 | — |
| Constant | 0.8208 | 0.0000 | |
| $\mu_1$ | 0.2098* | 0.0000 | |
| $\mu_2$ | 0.4571* | 0.0000 | |
| $\mu_3$ | 0.6225* | 0.0000 | |
| $\mu_4$ | 1.1205* | 0.0000 | |
| $\mu_5$ | 1.2833* | 0.0000 | |
| $\mu_6$ | 1.5022* | 0.0000 | |
| $\mu_7$ | 1.9951* | 0.0000 | |
| $\mu_8$ | 2.4039* | 0.0000 | |
| Value of log-likelihood function | −5002.2390 | | |
| $\chi^2$ Statistics (df = 22) | 342.9628 | | |
| McFadden $R^2$ | 0.0332 | | |

[a]Estimated Parameters and *p*-values for the exogenous variables used to correct for the heteroscedasticity are not shown.

[b]the marginal effects are shown for the statistically significant variables only. Marginal effects on response categories other than ''nearly all the time'' are not shown.

*Indicates significance at $\alpha = 0.10$.

It was found that households located in the northeastern U.S. had stronger concern about vitamins and minerals in food items than those in the midwest and south. Geographical disparity was also found for cholesterol concern. Households in the northeast U.S. were likely to be the most concerned about cholesterol followed by those in the south and the midwest. This result is similar to the results reported by Nayga (1996; 1997) that indicated differences among nutritional concerns based on geographic location. No significant differences were found regarding the consideration of fat and sugar in terms of geographic location of households.

### *3.2. Characteristics of household meal planners and nutrition concern*

Many variables representing the characteristics of household meal planners had a significant impact on the consideration of all four nutritional factors in making food selection

Table 6
Maximum likelihood estimates of the ordered probit models for sugar concern

| Variables | Coefficient[a] | *p*-value | Marginal Effect on ''Nearly all the time''[b] |
|---|---|---|---|
| Low income | −0.0373 | 0.6119 | — |
| High income | −0.1288 | 0.1988 | — |
| Children in the household | 0.0974 | 0.1825 | — |
| Northeast | 0.0763 | 0.4625 | — |
| Midwest | −0.1148 | 0.2135 | — |
| South | −0.0303 | 0.7402 | — |
| Regular exercise | 0.2177* | 0.0040 | 0.0643 |
| No exercise | −0.4089* | 0.0001 | −0.1340 |
| Race | −0.1809* | 0.0376 | −0.0520 |
| Highly educated | 0.1216 | 0.1129 | 0.0051 |
| Less educated | −0.1732* | 0.0437 | −0.0537 |
| Female | 0.3796* | 0.0000 | 0.1167 |
| Marital status | 0.0409 | 0.5684 | — |
| Age | 0.0200* | 0.0000 | 0.0113 |
| Employed | 0.0929 | 0.2325 | — |
| Constant | 0.2543 | 0.1564 | |
| $\mu_1$ | 0.2982* | 0.0000 | |
| $\mu_2$ | 0.6358* | 0.0000 | |
| $\mu_3$ | 0.8805* | 0.0000 | |
| $\mu_4$ | 1.6247* | 0.0000 | |
| $\mu_5$ | 1.8968* | 0.0000 | |
| $\mu_6$ | 2.2201* | 0.0000 | |
| $\mu_7$ | 2.7691* | 0.0000 | |
| $\mu_8$ | 3.0487* | 0.0000 | |
| Value of log-likelihood function | −5267.0490 | | |
| $\chi^2$ Statistics (df = 20) | 255.2423 | | |
| McFadden $R^2$ | 0.0237 | | |

[a]Estimated Parameters and *p*-values for the exogenous variables used to correct for the heteroscedasticity are not shown.

[b]the marginal effects are shown for the statistically significant variables only. Marginal effects on response categories other than ''nearly all the time'' are not shown.

*Indicates significance at $\alpha = 0.10$.

decisions. White household meal planners were more likely to be concerned about fat than those belonging to other ethnic groups. The probability that a White household meal planner considered fat "nearly all the time" when making food selections was 0.01 higher than those from other ethnic groups. However, they were less likely to consider vitamins and minerals, and sugar in making food selections.

Education attainment of household meal planners had significant and positive impacts on nutritional concerns in selecting food items. This result implies that more educated household meal planners are more likely to read about nutrition information and connect it with diet-disease relationships than less educated meal planners (Putler and Frazao, 1994; Nayga and Capps, 1999) and thus consider nutritional components "nearly all the time" when shopping for food. Results from this study show a consistent pattern across all four nutrition components.

The influence of household meal planners' gender on their consideration of nutritional

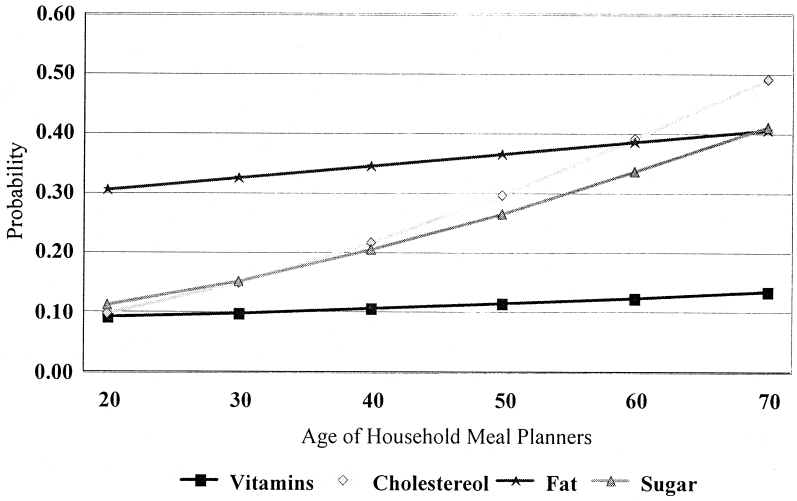


Fig. 1. Age of household meal planners and the probability of considering nutritional components "nearly all the time" in making food selection.

factors was statistically significant for all four nutrition components. Female household meal planners were more likely to consider all four nutritional components when making food selection decisions than were males. The difference between male and female meal planners was highest for sugar followed by cholesterol, vitamins and minerals, and fat. The probability of considering sugar content in food "nearly all the time" was 0.11 higher for a female than a male meal planner. This result confirms other findings about the relationship between gender and nutritional concerns (Frazao and Cleveland, 1994; Nayga and Capps, 1994). This result also agrees with the general findings that men are less concerned about health issues than are women. Lin (1995) noted that females were more likely to believe food safety was very important in food shopping than were males. Guthrie et al. (1995) reported that females were more likely to use nutritional labels than men in making food selections.

Older household meal planners were more likely to consider all four nutrition components when making food selections than their younger counterparts. Positive relationships between age and general health concern were reported in previous studies. Older meal planners were more likely to be concerned about food safety (Lin, 1995) and more likely to use nutritional information about health benefits, fat, and cholesterol content on food packages than younger meal planners (Nayga, 1996). The magnitude of the effect of age is evaluated by simulating the probabilities of considering nutritional factors "nearly all the time" when age of household meal planners varied (Fig. 1). It is peculiar that the influence of age on fat consideration was at the highest level between ages 50 and 60 in terms of absolute probabilities of considering fat content "nearly all the time" over the range of household meal planners' age. In contrast, household meal planners were less concerned about vitamins and minerals, cholesterol, and sugar when they were relatively young. Concern for cholesterol increased at the fastest rate and surpassed that for fat above 60 years of age. It is important, therefore, to place emphasis on fat in developing nutrition education programs for younger populations.

For the older population, information about cholesterol should be at the forefront followed by sugar, fat, and vitamins and minerals.

Employment status had no impact on nutrition considerations when selecting food among the sample households. Previous studies (Lin, 1995; Nayga, 1997) reported a negative relationship between safety and nutrition attributes of food and employment status. There is no clear explanation for such negative relationship. However, for the sample households in this study, other factors were more important than employment status when consumers decided about the nutrition consideration in food selection.

### *3.3. Lifestyle and nutrition consideration*

Lifestyle of household meal planners represented by their exercise habits had a significant effect on the nutrition concern. Although it is important to acknowledge that the "exercise" variable may have simultaneity effects with the dependent variables, the focus of this study is to investigate the effects of exercise habits on nutrition consideration in making food selection. Those meal planners who did not exercise were less likely to be concerned about nutritional components. For example, the probability of considering sugar and cholesterol "nearly all the time" was 0.13 and 0.15 lower for those household meal planners who did not exercise compared to those who did. Similar effects, but with lesser magnitude than for fat, were found for other nutrition factors. Johansson et al. (1999) reported that regular physical leisure exercise was positively associated with indicators for healthy dietary habits such as consumption of fruits and vegetables, fiber, and fat.

## 4. Conclusions and implications

This study addressed consumer consideration of four nutritional components in selecting food, using U.S. household survey data collected in 1996. The survey evaluated the attitude of household meal planners towards vitamins and minerals, cholesterol, fat, and sugar. Consumer attitudes were found to vary in accordance with the several socioeconomic and demographic factors, suggesting a need to tailor intervention strategies to various population subgroups so that nutrition concern of a particular group are addressed.

Ordered probit models were developed to determine socio-demographic characteristics and lifestyle of household meal planners influencing nutritional consideration of U.S. households when selecting food items. Household income, presence of children in the family, geographic location, race, education attainment level, gender, age, and exercise habit were significant in explaining consumer consideration of four nutritional components. The results provide a basis for developing nutrition programs that focus on the particular need of identified demographic subgroups. Targeted consumer information programs are more efficient than generic programs in improving the general health of the nation (Lin, 1995). For example, household meal planners of different age groups are concerned about different dietary components when selecting food. Fat consideration is most important until ages 50 to 60. Contrary to that, cholesterol is less important at early age but its importance increases at the fastest rate and surpasses that for fat. It is important, therefore, to place emphasis on

fat in developing nutrition education programs for the younger population. For the older population, information about cholesterol should be at the forefront followed by the overall contribution of food, sugar, fat, and vitamins.

A food marketing program is another area that can utilize the findings of this study. For example, high income households consider fat in food items more frequently, while consideration of vitamins tends to be more important for low income households. Thus, food advertising campaigns designed for different income groups can be more effective if the different nutritional considerations of these groups are also taken into account.

This study attempts to evaluate the effect of lifestyle on the attitude of consumers towards various nutritional attributes. Lifestyle factors have become important in describing how consumers make food decisions (Johansson et al.,1999). Although there are many variables that could represent individual lifestyles, this study considered only the exercise habits of the household meal planners. Nevertheless, the results showed a positive correlation between nutrition consideration and exercise habits. Those who exercised more frequently were more likely to consider all four nutritional components when selecting food. Nutrition programs often emphasize that individuals should not only monitor what they eat but also develop a healthy lifestyle such as regular exercise habits. A similar sentiment is found among the sample households in this study.

## Notes

1. The exogenous variables to adjust for heteroskedasticity were selected in two steps. First, all of the independent variables in the models were included in the vector of exogenous variables, $z_t$. Finally, only statistically significant variables were selected. The selected exogenous variables for cholesterol were Northeast, South, Regular Exercise, No Exercise, Highly Educated and Age; for fat were Regular Exercise, No Exercise, Race, Highly Educated, Less Educated, Marital Status, and Age; for vitamin and minerals were Regular Exercise, No Exercise, Race, Less Educated, Female, and Employed; and for sugar were Midwest, South, Regular Exercise, No Exercise, Less Educated, and Age.

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