Evaluating Consumer Usage of Nutritional Labeling: The Influence of Socio-Economic Characteristics

Ramu Govindasamy

John Italia

THE STATE UNIVERSITY OF NEW JERSEY

RUTGERS

Department of Agricultural, Food and Resource Economics
Rutgers Cooperative Extension
New Jersey Agricultural Experiment Station
Cook College
Rutgers, The State University of New Jersey
New Brunswick, New Jersey 08901

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Ramu Govindasamy is an Extension Specialist in Marketing,
John Italia is a Program Associate,
Department of Agricultural, Food and Resource Economics

Correspondence Address:
Ramu Govindasamy, Marketing Specialist and Assistant Professor
Department of Agricultural, Food and Resource Economics,
Cook College
Rutgers, The State University of New Jersey, 55 Dudley Road
New Brunswick, New Jersey 08901-8520
Phone: (732) 932-9171 ext. 25

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Executive Summary

The majority of consumers report making frequent use of nutritional labeling when purchasing food products. However, certain segments appear to place a greater emphasis on food product labels than others. This study empirically evaluates which demographic characteristics encourage consumers to be more likely to take nutritional labels into account when purchasing grocery products. The results indicate that females, older individuals, and those living in suburban and rural areas are the most likely to make use of nutritional labeling. The results also indicate that larger households were less likely to use nutritional labeling.

Introduction

Nutritional labeling has been commonly provided on food products for nearly three decades. For much of this century, nutritional labeling was largely voluntary and only loosely regulated to prevent fallacious and misleading representation. The Nutrition Labeling and Education Act (NLEA), passed in 1990, was intended to ensure the consistency and validity of the information presented in food labeling. Conceptually, improvements in label design and data were anticipated to increase the healthfulness of eating habits and improve consumer diets. However, any modifications in consumer behavior arising from new label policies are intrinsically limited by the existing use of nutritional labels. Examination of food label use is now required to determine the effectiveness of the NLEA and what, if any, changes have occurred that are directly attributable to the NLEA. One necessary step is to ascertain which consumers are most likely to make use of nutritional labeling in actual purchase practice. In addition to aggregate measures of label usage, specific consumer demographic characteristics can be tested for their marginal contributions to label usage. Interest in consumer use of nutritional labeling is held by both health and dietary professionals as well as the food marketing and food processing sectors. In general, the implications of label usage research provide an array of advantages to a wide scope of commercial and health care industries.

Measuring food labeling usage should also be beneficial in selectively targeting segments of the consumer population that would react more favorably toward health-

conscious products. As Jacoby et al. (1977) posited, the act of including or improving nutritional labeling should not be thought of as communicating with the consumer because it presupposes the population will use this information as it was intended. However, those who report using nutritional labels do in fact exhibit a concern about their diet and health. Assumptions can be made about the perceptions and motivations of label users because the act of using and comparing nutritional labels between products requires an investment of time and effort. This investment represents a cost which under assumptions of rational behavior illustrates that healthy eating has a positive value to the consumer. Therefore, those found to regularly consult food labeling may be typically expected to have an above average concern for their health and the well being of those in their care. These individuals may include persons with restrictive diets, those who may be more likely to purchase organically grown produce, and those willing to purchase prepared meals designed for health-conscious consumers.

Since the late 1960's, the United States has undergone a series of dramatic demographic changes which present the challenge of developing and distributing new food products to a dynamic population. Among the major demographic shifts are the changing age distribution, the slowing population growth, changes in the structure of the median family, and the gender make-up of the work force (Senauer, 1991; U.S. Department of Commerce, 1988). In order to successfully market new food products, demographic shifts and differences must be well understood and the needs of specific consumer segments must be considered. Changes in public awareness of food safety

issues and growing interest in healthy eating habits have also affected the demand for food products. Processed foods which are both healthy and which require only minimal preparation have quickly found favor in dual income households. In such cases, because fewer of the primary ingredients are selected by the end use consumer, close attention is often paid to nutritional labeling information. In short, promotion of the current trend of prepared foods, which are both healthful in nature and provide time utility through minimal preparation requirements, may benefit from the identification of consumer characteristics common among users of nutritional labeling. Label usage research may help to identify targetable areas based on socio-economic characteristics where certain food products have the greatest probability of success.

Policy makers may also benefit from the evaluation of current nutritional label usage. To boost the impact of policy tools such as NLEA, educational programs to foster label usage may be necessary. As label usage is not homogeneous across population segments, a program which selectively targets specific groups would maximize the net benefits of an educational campaign.

While numerous studies have established the significance of socio-demographic characteristics (e.g. Nayga, 1996; Klopp and McDonald, 1981; etc.), there is ample justification to warrant further label usage research. In contrast to the majority of relevant studies which have employed national data sets, the data source used in this analysis represents a sample of New Jersey consumers. A localized sample better exemplifies a specific region of the country and may help avoid incongruencies which

are found in the results of existing studies. For instance, Nayga documented statistical differences suggesting label usage differs among national regions. Virtually no label usage research has centered solely on any part of the northeast region, one of the most important consumer markets in the nation. Because of its high population density, its working consumers are among the highest paid in the nation, and for its high number of food manufacturers, New Jersey was an ideal focus for this analysis. Moreover, many existing studies have used old data which may not accurately represent the current behavioral and attitudinal characteristics of the population or public response to the NLEA.

The purpose of this study was to empirically evaluate which socio-economic characteristics encourage consumers to use nutritional labels when making grocery purchases. A logistic framework is used to quantify the effects of several demographic factors on label usage.

Methods

There are no widely accepted theoretical or empirical guidelines for evaluating the impact of socio-demographic factors in the likelihood of nutritional label usage (Nayga, 1996). However, Guthrie et al. (1995) and Nayga (1996) approached the information provided by nutritional labels as a commodity which consumers will continue to make use of as long as the benefits surpass the costs of label usage. This methodology, initially proposed by Stigler (1961), specifically models the consumer's search for information which itself has been shown to be influenced by individual characteristics

(Katona and Mueller, 1955).   Clearly, nutritional information acquisition can be influenced by factors which affect diversified consumer segments and households in different fashions. These factors include time constraints, the perceived role of dietary intake in maintaining individual health, literacy in English, a rudimentary understanding of nutrition, and the perceived benefits of nutritional information.   These factors also vary among distinct demographic segments supporting the use of consumer characteristics in evaluating nutritional label usage.

The logit model was selected for the regression in this analysis because its asymptotic characteristic constrains the predicted probabilities to a range of zero to one. The logit model is also favored for its mathematical simplicity and is often used in a setting where the dependent variable is binary. As the survey utilized in this analysis provided individual rather than aggregate observations, the estimation method of choice was the maximum likelihood estimation (Gujarati, 1992). Among the beneficial characteristics of MLE are that the parameter estimates are consistent and asymptotically efficient (Pindyck and Rubinfeld, 1991).

The model assumes that the probability of being a frequent user of nutrition labels, P_i, is dependent on a vector of independent variables (X_{ij}) associated with consumer i and variable j, and a vector of unknown parameters β. The likelihood of observing the dependent variable was tested as a function of variables which included socio-demographic and consumption characteristics.

$$P_i \quad = \quad F(Z_i) \quad = \quad F(\alpha + \beta X_i) \quad = \quad 1 \; / \; [\; 1 + \exp{(-Z_i)}]$$

Where:

F(Z$_i$) = represents the value of the standard normal density function associated with each possible value of the underlying index Z$_i$.

P$_i$ = the probability that an individual is a frequent user of nutritional labeling given knowledge of the independent variables X$_i$s

e = the base of natural logarithms approximately equal to 2.7182

Z$_i$ = the underlying index number or βX$_i$
α = the intercept

And βX$_i$ is a linear combination of independent variables so that:

Z$_i$ = log [P$_i$/(1- P$_i$)] = β_0 + β_1X$_1$ +β_2X$_2$ + . . . +β_nX$_n$ + ε

Where:

i = 1,2,. . . ,n are observations

Z$_i$ = the unobserved index level or the log odds of choice for the ith observation

X$_n$ = the nth explanatory variable for the ith observation

β = the parameters to be estimated

ε = the error or disturbance term

The dependent variable Z$_i$ in the above equation is the logarithm of the probability that a particular choice will be made. The parameter estimates do not directly represent the effect of the independent variables. To obtain the estimators for continuous explanatory variables in the logit model, the changes in probability that Y$_i$ = 1(P$_i$) brought about by a change in the independent variable, X$_{ij}$ is given by:

$(\partial P_i / \partial X_{ij})$ = [β_j exp $(-\beta X_{ij})$] / [1+ exp $(-\beta X_{ij})$]^2

For qualitative discrete variables, such as the explanatory variables used in this study, $\partial P_i/\partial X_{ij}$ does not exist. Probability changes are then determined by:

$$(\partial P_i / \partial X_{ij}) = P_i(Y_i : X_{ij} = 1) - P_i(Y_i : X_{ij} = 0)$$

The following model was developed to predict the likelihood of making frequent use of nutritional labeling (i.e. those who usually or always consult nutritional labeling on the food products they purchase). The model was tested under the specification:

$Prob = \beta_0 + \beta_1\,Male + \beta_2\,Age1 + \beta_3\,Age2 + \beta_4\,Age3 + \beta_5\,Suburban$
$\quad + \beta_6\,Rural + \beta_7\,Household\_Size + \beta_8\,2Children + \beta_9\,Prime + \beta_{10}\,Organic$
$\quad + \beta_{11}\,Media + \beta_{12}\,Education + \beta_{13}\,Hi\_Income$

Where:

Prob	=	1 if the participant usually or always checked nutritional labeling when purchasing foods and 0 otherwise
Male	=	1 if the individual is male and 0 otherwise
Age1	=	1 if the individual is older than 65 years of age and 0 otherwise
Age2	=	1 if the individual is 51 to 65 years of age and 0 otherwise
Age3	=	1 if the individual is 36 to 50 years of age and 0 otherwise
Suburban	=	1 if the individual resides in a suburban neighborhood and 0 otherwise
Rural	=	1 if the individual resides in a rural neighborhood and 0 otherwise
Household_Size	=	1 if the number of individuals living in the household were 4 or more and 0 otherwise
2Children	=	1 if 2 or more individuals under the age of 17 resided in the household and 0 otherwise

Prime	=	1 if the individual was the primary household shopper and 0 otherwise
Organic	=	1 if the individual frequently purchases organic produce and 0 otherwise
Media	=	1 if the individual made frequent use of food advertisements and coupons in newspapers and 0 otherwise
Education	=	1 if the individual had not completed at least a bachelors degree and 0 otherwise
Hi_Income	=	1 if the household income was at least $70,000 and 0 otherwise

For estimation purposes, one classification was eliminated from each group of variables to prevent perfect collinearity. The base group of individuals and omitted variables are given in Table 1. Based on previous literature, females (Nayga; Bender and Derby, 1992; Guthrie et al.) and households with children (Feick, Harrmann, and Warland, 1986; Guthrie et al.) were initially hypothesized to be most likely to be label users. Older individuals were expected to be less likely to be nutritional label users (Bender and Derby).

Data Description

The data for this analysis was collected from a survey conducted by Rutgers Cooperative Extension. The survey was administered at five grocery retailers

Table 1: Descriptive Statistics for Explanatory Variables

Variable		N	Percentage	Std. Dev.
Gender				
(Male)	Male	100	0.344	0.4757
	Female*	191	0.656	0.4757
Age				
(Age4)	Less than 36 years of age*	68	0.234	0.4239
(Age3)	36 - 50 years of age	103	0.354	0.4790
(Age2)	51 - 65 years of age	69	0.237	0.4260
(Age1)	Over 65 years of age	51	0.175	0.3808
Regional Characteristics				
(Suburban)	Suburban region	229	0.787	0.4102
(Rural)	Rural region	39	0.134	0.3412
(Urban)	Urban region*	23	0.079	0.2702
Household Size				
(Houshold_Size)	Four or more individuals	67	0.770	0.4217
	Less than four individuals*	224	0.230	0.4217
Are there two or more children residing in the household?				
(2Children)	Yes	53	0.182	0.3866
	No*	238	0.818	0.3866
Are you the primary grocery purchaser of the household?				
(Prime)	Yes	244	0.838	0.3686
	No*	47	0.162	0.3686
Do you usually purchase organic produce?				
(Organic)	Yes	99	0.340	0.4746
	No*	192	0.660	0.4746
Do you regularly make use of food advertisements?				
(Media1)	Yes	64	0.220	0.4149
	No*	227	0.780	0.4149
Education				
(Education)	Less than 4 year college degree	98	0.337	0.4734
(Education2)	At least 4 year college degree*	193	0.663	0.4734
Annual Household Income				
(Lo_Income)	Less than $70,000	164	0.564	0.4968
(Hi_Income)	$70,000 or more*	127	0.436	0.4968

* Refers to omitted category in the logit analysis

throughout New Jersey and was completed in 1997. The retail locations included three corporate supermarkets of various sizes, one independent supermarket, and a privately owned direct market establishment. The survey was conducted during both weekend and weekday periods throughout the morning and afternoon hours. Respondents were approached at random while entering the retail establishment. Before distribution, the survey was pre-tested by a group of randomly selected individuals. The pre-tested surveys were not included in the final data set. The survey data was input into a flat text file which was subsequently read by SAS running on a UNIX platform for descriptive and econometric analysis.

The survey contained questions which dealt with the several issues important to food purchasing behavior, food risk perceptions, and the socio-demographic characteristics of the respondents. Overall, 408 surveys were physically distributed to New Jersey shoppers yielding a sample of 291 responses with a response rate of 71 percent.

In the case of the dependent variable, 210 respondents (72%) indicated that nutritional labeling was usually or always used when making decisions about which food products to purchase and 81 (28%) respondents reported that labeling was not often important. These findings were highly consistent with Bender and Derby who reported that 74 percent of consumers were label users and also Guthrie et al. who reported that 72 percent made use of food labels.

Table 1 provides a descriptive tabulation of the explanatory variables used in this analysis. Approximately 66 percent of respondents were female and 83 percent had completed at least some college. About 58 percent of the participants were 49 years of age or below, while approximately 37 percent of the respondents had annual household incomes of less than $39,999. Approximately 33 percent purchased groceries for children who lived in their household. About 13 percent lived in rural areas while 8 percent lived in urban areas and 79 percent lived in suburban areas.

Empirical Results

The maximum likelihood estimates for frequent label usage are displayed in Table 2. A number of previous studies have attempted to identify the household characteristics that increase nutritional label usage among American households. Relatively few demographic variables were found to be significant in more than one study. Males have been reported to be less likely than females to make frequent use of nutritional labeling (Guthrie et al.; Bender and Derby; Nayga). Consistent with these studies, females were found to be 10 percent more likely to make use of food labeling when making grocery-purchasing decisions than males. As the primary function of nutritional labeling is to provide basis for making health and diet-related decisions, comparisons can also be made with gender response to other food health issues. For instance, the analysis results are also consistent with other studies which have demonstrated that females are more concerned about and more knowledgeable of food issues than males. Females have been found to be more risk averse to pesticide residues (Dunlap

Table 2: Maximum Likelihood Estimates of the Logit Model

Variable	Estimate	Standard Error	Change in Probability
Intercept	-0.6511	0.5856	-0.1252
Male*	-0.5174	0.2993	-0.0995
Age1	0.3912	0.4382	0.0752
Age2***	0.9951	0.4236	0.1914
Age3*	0.6106	0.3632	0.1174
Suburb***	1.1973	0.4766	0.2302
Rural*	0.9918	0.5811	0.1908
Household_Size**	-0.9059	0.4609	-0.1742
2Children*	0.9396	0.5132	0.1807
Prime	0.1524	0.3736	0.0293
Organic*	0.5646	0.3084	0.1086
Media	-0.1577	0.3474	-0.0303
Education	-0.0036	0.3291	-0.0007
Hi_Income	0.0764	0.3205	0.0147

Ratio of nonzero observations to the total number of observations: 0.28

*: significant at the .10 level
**: significant at the .05 level
***: significant at the .01 level

Table 3: Prediction Success for the Logit Model

	Predicted	
	Predicted	
	0	1

Actual		0	1
	0	9	72
	1	11	199

Number of correct predictions: 208
Percentage of correct predictions: 72

and Beus, 1992), and exhibit a higher willingness-to-pay for food safety risk reduction (Huang, 1993). Although women have more fully entered the work force, they remain more active in deciding and preparing what American families eat. In the majority of U.S. households, women remain the primary grocery shopper and women do approximately 90% of the cooking (Senaur). Female-headed single parent households also grew by 36 percent between 1980 and 1990 (Waldrop and Exeter, 1990). Conceptually, this fundamental gender difference is consistent with the estimated differential in label usage. Because they are more likely to be frequent food shoppers and because they are more likely to purchase larger quantities of food per supermarket visit, females are generally more frequent users of nutritional labels than males. Conversely, males are more likely to purchase food only for themselves and more likely to purchase only a few items at a time rather than do large weekly shopping.

Guthrie et al., and Feick, Herrmann, and Warland, found that households with more than one inhabitant were more likely to make use of nutritional labeling. Similarly, households with young children were more likely to be label users. Arguments have been made to suggest that those who are responsible for preparing meals for others may be more concerned about food safety issues. This hypothesis is consistent with the findings of previous studies. However, other researchers have proposed that larger household size should lead to diminished availability of time and therefore should be negatively correlated with label usage.

In the present study, households with two or more children were 18 percent more likely to make use of food labeling when making purchase decisions. As with the greater responsibility borne by females in selecting the food which others eat, parents too, have a responsibility and intrinsic interest in providing safe and wholesome meals for their children. This protectionistic motivation may explain why households with several children are more attentive to nutritional labeling.

Household size was found to significantly decrease the importance of nutritional labels. Those with households of 4 or more members were 17 percent less likely to frequently use nutritional labeling. These findings are inconsistent with those of Feick, Herrmann, and Warland and Guthrie et al. A possible reason that large households make less use of nutritional labeling than smaller households may be attributable to the value of scarce time of those responsible for preparing meals for many other people. Intuitively, the estimates for household size also appear to conflict with the finding that households with two or more children are more likely to use nutritional labeling. However, this disparity suggests that the effect of household size is related to the age of household members. In effect, larger households may be less attentive to nutritional labeling if they are primarily made up of adults. In such households, individuals are more likely to purchase food items for themselves rather than for the entire family. Yet large households which also include several individuals under the age of 17, where parents are responsible for selecting food items for children, may in fact be frequent label users.

In previous studies, variables measuring the effects of income and age have generally been less significant in predicting label usage than in other food marketing studies. The results of one study (Bender and Derby) suggest that younger rather than older individuals are more likely to be label users.

In agreement with Bender and Derby, the age variables were estimated with the expected sign and two of the three explanatory age variables were found to be significant. Younger individuals rather than older individuals were more likely to use nutritional labels. Those 51-65 years of age were 19 percent more likely to use nutritional labels than those under the age of 36. Similarly, those 36-50 years of age were 12 percent more likely to make use of nutritional labels than those under 36 years of age. This finding may be a result of older individuals having more restricted diets due to medical advice or health problems whereas younger individuals have less incentive to search for more healthful alternatives.

Of all the included explanatory variables, those who lived in suburban areas had the greatest effect on nutritional label usage. When compared to urban residents, suburban residents were 23 percent more likely to be label users and rural area residents were 20 percent more likely to be label users. Consumers who frequently purchase organic produce were also found to be 11 percent more likely to make use of nutritional labels. This finding is consistent with previous studies which suggest that organic purchasers are more risk averse toward food safety issues than non organic purchasers.

Education was also found to significantly enhance label usage in a number of related studies. Those with higher levels of education were found to be more likely to use nutritional labeling information (Guthrie et al.; Bender and Derby; Feick, Herrmann, and Warland; Klopp and MacDonald; Nayga). Although the variable for education was estimated with a sign consistent to many previous studies, it was statistically insignificant. Other insignificant variables included a dummy variable which denoted the primary household shopper, income, and a variable which captured the effect of households which made frequent usage of food advertisements and coupons for food products.

The logit model chi-square statistic was significant at the 0.003 level clearly rejecting the null hypothesis that the set of explanatory variables were together insignificant in predicting variation in the dependant variable. The tabulation of prediction success is shown in the classification table (Table 3). With a 50-50 classification scheme, approximately 72 percent of the individuals in the sample were correctly classified as those who place a high degree of importance on nutritional labeling when selecting grocery products.

Conclusion

Qualitative choice models are ideal for analysis of many types of consumer behavior. This study illustrates the potential of a logistic framework in decomposing the effects of individual demographic characteristics in decision making. Other applications include

the use of logit models to elicit willingness-to-pay or willingness-to-purchase various products.

From the perspective of food marketing agents, the characteristics of nutritional label users should aid in developing a profile of those willing to purchase food products which appeal to health conscious individuals. As the overwhelming majority of newly introduced food products fail within their year of introduction, as much market segmentation as possible is necessary to increase the chances of product success. New healthful food products can be specifically targeted for nutritional label users such as frequent consumers of organic produce, females, those with children, etc. Marketers can choose to target characteristics such as gender and age through advertisement. Alternatively, other characteristics can be targeted through distribution such as rural and suburban households, household size and households with children by selectively introducing products in regional areas where these characteristics are highly prevalent. The results also show that frequent purchasers of organic produce are more likely to use nutritional labeling suggesting that other healthy foods may have greater likelihood of succeeding if distributed in places where organic produce is sold.

Policy makers can also benefit from gaining insight into nutritional labeling usage. To increase the success of policies such as the NLEA, policy makers might foster increased label usage by males, older individuals and urban households.

Ideally, alterations in nutritional labeling requirements brought about by NLEA would translate into changes in consumer eating habits. Ultimately, the impact of policy regulation on dietary practice is limited by the current usage of nutritional labeling by consumers.

This study attempted to identify the effect of consumer characteristics on the likelihood of being a frequent nutritional label user. While the findings did bring to light several significant variables, some limitations should be noted. Specifically, the small sample size and highly concentrated regional makeup of the participants warrant some caution when extending the outcome of this study to other geographic areas. Furthermore the socio-economic characteristics of sample area indicate the region to be more densely populated than most regions of the country and that local consumers tend to be more highly educated and higher earning than those in most other regions. The results of this study may be useful for health care educators as well as professionals in food marketing and food product development. Research in nutritional labeling usage also facilitates meeting the consumption needs of different demographic segments of the population.

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