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# Use of the Nutrition Facts Label in Chronic Disease Management: Results from the National Health and Nutrition Examination Survey

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**ABSTRACT**

Dietary modifications are common treatment strategies for patients with various chronic diseases, but it is unclear how often these individuals read food labels. The objective of this study was to determine whether patients with chronic disease who are advised to change their eating habits read nutrition labels more than patients who have not been so advised, and whether that impacts their energy and nutrient intake. Analysis of the 2005-2006 National Health and Nutrition Examination Survey, a nationally representative, cross-sectional survey of the United States population, was performed. Adults (20 years of age or older) who participated in the 2005-2006 National Health and Nutrition Examination Survey and who had type 2 diabetes, hypertension, and/or hyperlipidemia were included for analysis. There were 3,748 unweighted participants, which represents 170,958,166 in the US population. Proportions of patients with chronic disease who read nutrition labels were compared by $\chi^2$ analysis, mean values of various components of their diet were compared by the two-sample independent $t$ test, and odds ratios and 95% confidence intervals were determined by logistic regression. Among patients with chronic disease, the odds of reading food labels when told by their doctor or another health professional to reduce calories or weight was 50% higher than in those without physician intervention (odds ratio=1.50, 95% confidence interval: 1.12 to 2.00). Those who read food labels consumed less energy, saturated fat, carbohydrates, and sugar, and more fiber than those who did not. These findings point to the value of dietary counseling in chronic disease management.

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Patient education has long been considered an important part of treatment for conditions where lifestyle modifications improve disease control. In particular, dietary modifications have been shown to be beneficial for chronic diseases, such as type 2 diabetes, hypertension, and hyperlipidemia (1,2). One strategy to help with making appropriate dietary choices is to know what is in the food one is eating. Nutrition labels in the United States were revised in May 1994 to be easier to read and easier to extract information from, and they are available on >90% of processed food packages (3). The appropriate use of food labels allows one to know how much energy, fat, sodium, and carbohydrates are in a certain food before eating the product.

Several studies have tried to evaluate how well patients understand food labels and whether patient education can help patients understand them better (4-7). However, these interventions have been more focused on patients with type 2 diabetes than those with other chronic diseases (3,8). Also, these studies have examined specific populations, such as Latinas (6-8). They have shown that education can increase food label knowledge (6,7,9,10). However, no large-scale study has demonstrated whether patients actually implement the education they receive about food labels once they are advised to modify their dietary intake. Thus, the guiding hypothesis of this study is that patients with chronic disease who are advised by a health professional to change their diet read nutrition labels more frequently than patients who have not been so advised and that these participants have a more healthful diet as well.

## METHODS

### Design

Cross-sectional analysis of the 2005-2006 National Health and Nutrition Examination Survey (NHANES) was conducted. NHANES is a continuous national survey that represents a stratified multistage probability sample of the noninstitutionalized US population. NHANES combines questionnaires with physical examinations and laboratory samples obtained from participants. The data are weighted to allow for computation of appropriate population estimates.

### Sample

The participants in this study are adults 20 years of age and older who participated in NHANES in 2005-2006. There were 3,748 participants, which represents 170,958,166 in the US population.

### Measures

**Chronic Disease Status.** This study focused on individuals with at least one of three chronic conditions, ie, type 2 diabetes, hypertension, and hyperlipidemia. Diabetes was operationalized as the response to the question: "Have you ever been told by a health professional that you had diabetes or sugar diabetes?" For women, the qualifier "Other than during pregnancy" was added to the beginning of the question. Patients who answered "yes" were considered to have a known diagnosis of type 2 diabetes. Patients who answered "no" or "borderline" were considered not to have a known diagnosis of type 2 diabetes.

Participants were considered to have a known diagnosis of hypertension if they answered "yes" to the question: "Have you ever been told by a doctor or other health care professional that you had hypertension, also called high blood pressure?" and "yes" to the follow-up question: "Were you told on two or more visits that you had hypertension, also called high blood pressure?" Patients were considered to have a known diagnosis of hyperlipidemia if they answered "yes" to the question: "Have you ever been told by a doctor or other health care professional that your blood cholesterol level was high?"

**Patient Education Intervention.** Participants were considered to have had nutritional advice from a health care professional if they answered "yes" to the question: "To lower your risk for certain diseases, during the past 12 months, have you ever been told by a doctor or health professional to reduce the amount of fat or calories in your diet?"

**Nutritional Label Status.** The following question was asked of participants: "How often do you use the Nutrition Facts label when deciding to buy a food product? Would you say always, most of the time, sometimes, rarely, or never?" Patients who answered "always," "most of the time," or "sometimes" were considered to read food labels, and participants who answered "rarely" or "never" were not considered to read food labels.

**Food Intake.** Calories, total fat, cholesterol, carbohydrate, and sodium content were all measured using the 24-hour dietary recall from NHANES 2005-2006. NHANES quantifies dietary intake in the calendar day from midnight to midnight prior to the interview via dietary recall interviews that were conducted in person by trained dietary interviewers fluent in Spanish and English. If necessary, translators were available for respondents who spoke other languages. A multiple-pass method was used to obtain dietary information. This entailed obtaining an initial list of foods consumed, after which respondents were asked about the time and place of consumption. A list of frequently forgotten foods was then displayed, and a complete description of the foods eaten obtained. Finally, the foods were reviewed in chronological order with amendments made as appropriate (11). A standard set of measuring guides, tools used to help the respondent report the volume and dimensions of the food items consumed, was available during interviewing to aid portion-size estimation.

**Demographic Characteristics.** The following demographic characteristics of respondents were included: sex, age, race (non-Hispanic white, non-Hispanic black, Mexican American, other Hispanic, and other race/multiracial), family income as indicated by poverty-income ratio (<1.0 indicates poverty), marital status (married/living with partner, divorced/separated, never married), education (less than high school graduate, high school graduate or more), body mass index (BMI; calculated as $kg/m^2$), and the number of prescription medicines taken.

### Statistical Analysis

Because NHANES has a complex sampling design that makes the resulting sample representative of the noninstitutionalized US population, nationally representative estimates were made. Analyses were performed using SUDAAN (version 10.0, 2008, RTI International, Research Triangle Park, NC) to account for the weighting and complex sampling design. $\chi^2$ tests were performed to evaluate bivariate relationships between use of food labels and chronic disease and nutritional advice categories, and results are presented as proportions. To compare diets among patients with disease who do or do not read labels, a two-sample independent $t$ test was used to compare mean energy (in kilocalories), fat (in grams), cholesterol (in milligrams), carbohydrate (in grams), protein (in grams), and sodium (in milligrams) intakes. Conditional marginals were calculated to adjust these means for age, sex, race, BMI, poverty-income ratio, education level (high school graduate vs not), marital status (married/living with partner vs divorced/separated vs never married), and number of prescription medicines taken.

Logistic regression analyses were performed to determine odds ratios for individuals with type 2 diabetes, hypertension, hyperlipidemia, or any combination of these diseases reading food labels more frequently when told to change their diet by a health professional. Logistic regression was also performed to determine odds ratios that these same patients adhere to the energy, carbohydrate, protein, total fat, saturated fat, cholesterol, fiber, and sodium contents of the Dietary Approaches to Stop Hypertension (DASH) diet, a well-known eating plan featured in the 2005 Dietary Guidelines for Americans (12). Potential confounding variables were controlled for. Age, poverty-income ratio, BMI, and the number of prescription medicines taken were treated as continuous variables. Sex, race, education level, and marital status were treated as categorical variables.

## RESULTS AND DISCUSSION

### Demographics

Individuals with type 2 diabetes, hypertension, hyperlipidemia, or any combination of these three diseases were similar to those without any of these diseases in respect to sex distribution (52.4% vs 50.7% female, respectively, $P=0.40$) and education level (83.9% vs 83.5% finished high school or higher, $P=0.75$). All other demographic factors were statistically different. Patients with disease were older (mean age 54.7 years, standard deviation

[SD]=0.41 vs 39.9 years, SD=0.41), more likely to have had a doctor or health professional advise them to change their diet or lose weight (47.1% vs 11.7%), took more prescription medicines (mean 3.2, SD=0.09 vs 0.8, SD=0.04), and had a higher mean BMI (mean 30.2, SD=0.20 vs 27.4, SD=0.17).

### Reading Nutritional Labels

Overall, individuals with type 2 diabetes, hypertension, hyperlipidemia, or any combination of these three diseases read food labels more than patients without any of these diseases (71.2% vs 59.9%; $P \leq 0.0001$). Among those with disease, those who had been advised by a doctor or other health professional to reduce their caloric intake or weight were significantly more likely to use the Nutrition Facts label than those who had not been so advised (75.4% vs 67.6%; $P<0.001$). What is concerning is that patients without disease read food labels only about 60% of the time. The risk of developing type 2 diabetes, hypertension, and hyperlipidemia are all increased with obesity and poor dietary choices (13-15). Development of methods to encourage the appropriate use of food labels in those without disease may lead to interventions that prevent obesity and obesity-related conditions.

In multivariate analyses, the odds of reading food labels among those with disease when advised to reduce calories or weight is about 50% higher than in those not so advised (odds ratio [OR]=1.50, 95% confidence interval [CI]: 1.12 to 2.00) when controlling for all other regression variables. Also, when controlling for all other regression variables, women were more than three times more likely to read food labels (OR=3.39, 95% CI: 2.55 to 4.51), those with less than a high school education were about half as likely to read food labels (OR=0.46, 95% CI: 0.33 to 0.65), and for every 1-unit increase in poverty-income ratio, patients were 26% more likely to read food labels (OR=1.26, 95% CI: 1.14 to 1.38). Divorced/separated patients were about 30% less likely to read food labels than married patients (OR=0.69, 95% CI: 0.50 to 0.96). The other covariates examined did not influence how frequently participants with chronic disease read food labels (Table 1). These results regarding sex, education, and income support similar findings in other literature (16).

**Table 1.** Multiple logistic regression for reading the Nutrition Facts panel among 2005-2006 National Health and Nutrition Examination Survey participants with type 2 diabetes, hypertension, hyperlipidemia, or any combination of these three diseases

| | Odds ratio | 95% Confidence interval | *P* value |
|---|---|---|---|
| Age | 1.00 | 0.99-1.01 | 0.68 |
| Sex | | | |
| Female | 3.39 | 2.55-4.51 | <0.01 |
| Male | 1.00 | | |
| Race/ethnicity | | | |
| Non-Hispanic black | 1.00 | 0.71-1.41 | 1.00 |
| Mexican American | 0.71 | 0.47-1.07 | 0.10 |
| Other Hispanic | 1.04 | 0.46-2.35 | 0.92 |
| Other race | 0.96 | 0.48-1.91 | 0.91 |
| White | 1.00 | | |
| Family poverty-income ratio | 1.26 | 1.14-1.38 | <0.01 |
| Education | | | |
| Less than high school | 0.46 | 0.33-0.65 | <0.01 |
| High school graduate or more | 1.00 | | |
| Marital status | | | |
| Never married | 1.31 | 0.77-2.23 | 0.32 |
| Divorced/separated | 0.69 | 0.50-0.96 | 0.03 |
| Married/living with partner | 1.00 | | |
| No. of prescription medicines taken | 1.03 | 0.98-1.09 | 0.20 |
| Body mass index[a] | 1.00 | 0.97-1.02 | 0.91 |
| Advised to change diet by doctor or other health professional | | | |
| Yes | 1.50 | 1.12-2.00 | 0.01 |
| No | 1.00 | | |

[a]Calculated as kg/m$^2$.

### Comparison of Energy and Nutrient Intake

Further analysis was performed investigating the diets of individuals with disease who read food labels vs those who do not. In the unadjusted model, those who read food labels consumed less energy, less saturated fat, fewer carbohydrates, less total sugar, and more fiber than those who do not. However, in the model adjusted for age, sex, race, BMI, education level, poverty-income ratio, marital status, and number of prescription medicines taken, only fiber and total sugar content showed a statistically significant difference (Table 2). Controlling sugar intake is an important aspect of dietary control for type 2 diabetes (17), and fiber intake has been shown to reduce inflammation (18). This difference between the adjusted and unadjusted models suggests that there may be some confounding involved when comparing the nutrient and energy intakes of those with disease.

In those patients with chronic disease who read food labels more frequently, their adherence to any of the aspects of the DASH diet was not statistically significantly different than in those patients with chronic disease who do not read food labels (*P* values ranging from 0.42 to 0.96). The DASH diet was chosen as the comparison diet because it has been shown to be helpful in treating or preventing all three of the diseases addressed in this study (19-21). Reading nutritional labels did not have an effect on adherence to the DASH diet in participants in this study. However, it is only known whether patients were advised to make a change in diet, not if they were told to follow a specific diet, such as the DASH diet.

### Limitations

First, even though it is known that some patients in this study were advised to change their diet by their doctor or another health professional, it is not known whether part of that intervention included specific teaching about nutritional labels. Furthermore, patient recollection of provider advice was evaluated, not whether they actually received the advice or not. However, because this study

**Table 2.** Mean nutrient and energy intake among among 2005-2006 National Health and Nutrition Examination Survey participants with type 2 diabetes, hypertension, hyperlipidemia, or any combination of these three diseases

| | Unadjusted Means | | |
|---|---|---|---|
| | Read nutritional labels | Do not read nutritional labels | *P* value |
| | ← *mean± standard error* → | | |
| Energy (kcal) | 2,058±33 | 2,251±57 | 0.006 |
| Total fat (g) | 80.4±1.6 | 85.6±2.4 | 0.09 |
| Saturated fatty acids (g) | 26.8±0.6 | 29.2±0.9 | 0.04 |
| Monounsaturated fatty acids (g) | 29.5±0.6 | 31.5±0.9 | 0.09 |
| Polyunsaturated fatty acids (g) | 17.3±0.4 | 17.5±0.6 | 0.74 |
| Total sugars (g) | 105.4±2.5 | 126.4±5.2 | 0.001 |
| Dietary fiber (g) | 16.0±0.3 | 14.5±0.4 | 0.01 |
| Cholesterol (mg) | 280.7±7.8 | 309.6±12.6 | 0.06 |
| Carbohydrates (g) | 240.1±4.1 | 267.2±7.7 | 0.003 |
| Sodium (mg) | 3,392±60 | 3,550±95 | 0.17 |
| Protein (g) | 81.7±1.4 | 84.1±2.3 | 0.38 |
| | ← *adjusted means*[a] → | | |
| Energy (kcal) | 2,096±30 | 2,158±51 | 0.32 |
| Total fat (g) | 81.3±1.5 | 83.4±2.4 | 0.47 |
| Saturated fatty acids (g) | 27.1±0.6 | 28.6±0.9 | 0.2 |
| Monounsaturated fatty acids (g) | 29.8±0.6 | 30.6±0.9 | 0.49 |
| Polyunsaturated fatty acids (g) | 17.5±0.4 | 17.1±0.6 | 0.6 |
| Total sugars (g) | 107.9±2.5 | 120.5±5.2 | 0.04 |
| Dietary fiber (g) | 16.2±0.3 | 14.1±0.5 | <0.001 |
| Cholesterol (mg) | 286.0±7.6 | 296.5±13.3 | 0.51 |
| Carbohydrates (g) | 244.9±3.9 | 255.5±7.3 | 0.23 |
| Sodium (mg) | 3,430±55 | 3,455±90 | 0.82 |
| Protein (g) | 83.0±1.3 | 80.9±2.2 | 0.42 |

[a]Adjusted for age, sex, race, body mass index, education level, poverty-income ratio, marital status, and number of prescription medicines taken.

evaluates an outcome of the provider advice, reading the Nutrition Facts panel, the patient's recollection and understanding is relevant. Also, the extent or type of counseling the patient received cannot be determined, and thus the approaches that were most successful cannot be determined. Patients may have also received dietary advice from various sources other than their health providers. However, it is unlikely this would lead to a systematic bias that would affect these results. Although whether or not participants read food labels could be assessed, evaluating how accurate they are in reading the labels was not possible. Comparing those who read labels accurately vs those who do not read labels might demonstrate larger differences than those seen in this study.

## CONCLUSIONS

Advising patients with type 2 diabetes, hypertension, or hyperlipidemia to make a change in their dietary habits appears to pay dividends in patient behavior regarding the reading of food labels. A modification of diet was found as a reduction of total sugar intake and an increase in fiber intake. These findings suggest a potential value of dietary counseling in management of type 2 diabetes, hypertension, and hyperlipidemia. Further studies investigating food label use and disease control are needed as well as studies that demonstrate the best ways to help patients understand and use food labels.

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