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Nutrition label use partially mediates the relationship between attitude toward healthy eating and overall dietary quality among college students

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Abstract

Individuals who frequently read nutrition labels tend to both value healthy eating and engage in healthy dietary practices more than individuals who read labels infrequently. However, the relationship between label use, attitude toward healthy eating, and dietary quality remains unclear, particularly among young adults, about whom little is known with regard to nutrition label use. The present study investigated whether nutrition label use mediates the relationship between eating-related attitudes and dietary behaviors among young adult college students. Using cross-sectional online survey data collected in 2010 from a convenience sample in Minneapolis/St. Paul, MN (598 attending a 2-year community college; 603 attending a public 4-year university; mean age = 21.5 years; 53.4% non-white; 52.5% female), study findings indicate that students who reported frequently reading nutrition labels were more likely to have healthier dietary intakes (e.g., less fast food and added sugar; more fiber, fruits and vegetables), compared to those who read labels sometimes or rarely ($p < 0.001$). Further, frequent nutrition label use was a significant partial mediator of the relationship between eating-related attitude (i.e., feeling that it is important to prepare healthy meals) and dietary quality, indicating that label use may be one means by which individuals who value healthy eating translate their attitude into healthy eating behaviors. Even among those who did not believe it was important to prepare healthy meals, frequent nutrition label use was significantly associated with healthier dietary intake, suggesting that label use may operate independently of nutrition-related attitude in contributing to healthful diet.

Keywords

nutrition label; young adult; dietary quality

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Introduction

Previous research has revealed health-relevant differences between individuals who report frequently reading nutrition labels on food packages and those who do not (1-3). Some of these differences are attitudinal (e.g., individuals who frequently read labels tend to perceive health and healthy eating as more important than those who do not) (1); other differences are behavioral (individuals who frequently read labels tend to eat more healthfully compared with those who read labels infrequently or never) (2-3). Despite these differences, and although nutrition label use has been identified as a mediator of the relationship between income and dietary quality (3), no published research has yet examined nutrition label use as a potential mediator between health/diet-relevant attitudes and corresponding behaviors.

Young adulthood is a time when individuals, having only recently left the family home, are beginning to make more independent choices about food and a time when many individuals adopt unhealthy dietary behaviors and gain excess weight (4). It is important not only to achieve a better understanding of nutrition label use among this age group, but also the extent to which it may act as a mediator between individual-level psychosocial factors (such as attitudes about healthy foods) and dietary outcomes. However, with a few recent exceptions (5-6), existing research examining nutrition label use has focused on the general adult population, with participant ages averaging in the 40s and 50s (7-8), while label use among younger individuals has been studied far less. Indeed, a recent review of nutrition label use reports that, of the 129 extant papers addressing this topic, “most studies used convenience samples of the general adult population... [and only] one study looked at adolescents” (9, p.23). Despite being traditionally overlooked in diet research, the eating-related behaviors of individuals exiting adolescence and entering adulthood are important to understand.

The present study examined dietary attitudes, behaviors, and nutrition label use among a diverse sample of college students. It was hypothesized that those who reported reading nutrition labels frequently would be more likely to engage in healthy dietary practices and would demonstrate greater nutrition knowledge than would those who read labels less frequently. In addition, it was hypothesized that self-reported nutrition label use would mediate the relationship between healthy eating attitude and healthy dietary behavior, such that reading labels would be a mechanism by which individuals holding healthy attitudes toward eating translate their beliefs into healthy eating behaviors.

Methods

Recruitment

In the spring of 2010, a sample of 1201 college students (598 attending a 2-year community college; 603 attending a public 4-year university; mean age = 21.5; 53.4% non-white; 52.5% female) in the Twin Cities area of Minnesota participated in a study of nutrition- and weight-related issues. Data collectors approached students on campus, inviting them to participate. Students were given a weblink and access code to enter an online survey. The survey took approximately 30-35 minutes to complete, after which participants had their height, weight, and body composition measured on campus and received a \$50 gift card for their participation. Participants were also entered in a lottery to win an Apple iTouch™ device. All study procedures were approved by the University of Minnesota Institutional Review Board.

Assessments of Attitude and Behavior

Nutrition Label Use—Participants completed a survey item, adapted from previous research (10), in which they self-reported the frequency with which they read the nutrition information on food labels before purchasing foods/beverages (i.e., “How often do you read the nutrition labels on food labels before purchasing foods or beverages?”) with response options including “never or rarely,” “sometimes,” “often,” and “always or almost always.” Students who selected often and always or almost always were categorized as frequent label users.

Importance of Preparing Healthy Meals—Participants also self-reported their agreement with the following statement: “It is important to me to prepare healthy meals,” by endorsing a response option ranging from 1 (strongly disagree) to 5 (strongly agree). One-week test-retest reliability for importance of preparing healthy meals was 0.64 ($p < 0.0001$).

Dietary Assessment—Participants self-reported dietary behaviors for the previous 30 days using the Five Factor Screener from the 2005 NHIS Cancer Control Supplement, the Percentage Energy from Fat Screener, and the All-Day Fruit and Vegetable Screeners from the Eating at America’s Table Study (all available at <http://riskfactor.cancer.gov/diet/screeners/>; for validity results, see references 11-13). The Percentage Energy from Fat Screener was modified slightly due to the inadvertent omission of one of the items, mayonnaise, included on the original instrument. From these dietary screeners, summary variables (i.e., percent of calories from fat, and dietary fiber (grams), calcium (mg), added sugar (teaspoons), fruits and vegetables (servings), and dairy (servings)) were calculated. Participants also self-reported whether or not they followed a vegetarian diet (14) and how many times per week they consumed fast food (including any restaurant where food is ordered at a counter or drive-through window; (15)).

For these analyses, a healthy eating behavior composite score was computed as a sum (0 – 8) of the number of these eight eating practices the individual followed, with higher scores indicating more of the healthy eating practices were followed. Each of the 8 behaviors has been previously linked to positive health outcomes, and include: consuming <35% of daily calories from fat (16); fiber intake of between 21 and 38 grams/day, based on age and sex (17); calcium intake between 1000 and 1300 mg/day, based on age and sex (18); dairy intake of 3 servings per day (19); added sugar intake of between 3 and 18 tsp/day, based on age, sex, and physical activity level (20); fruit and vegetable intake between 7 and 13 servings/day, based on age, sex, and physical activity level (17); < 3 times per week eating fast food (21-22); and following a vegetarian diet (23-24).

In addition, participants reported the number of fruits, vegetables, and calories they believed they should consume per day in order to be healthy. Actual recommended levels of intake (for calories, fruit and vegetable servings) were calculated for each participant individually based on age, sex, and physical activity level (17).

Demographic Information—Participants self reported age, sex, race and ethnicity.

Statistical Analyses

Analyses investigating dietary differences between those individuals who reported frequently reading nutrition labels and those who did not included independent samples *t*-tests comparing the percent of participants in each group who followed each of the eight healthy dietary practices assessed.

The differences between participant estimates of the number of calories, servings of fruits, and servings of vegetables they should consume daily to meet public health guidelines and actual recommended levels of intake were compared for frequent label readers and infrequent label readers with the hypothesis that frequent label readers would provide more accurate estimates.

Analyses testing for mediation included linear regression models fit to test whether self-reported nutrition label use mediated the relationship between attitude toward healthy eating and healthy eating behavior. Three linear regression models were fit in accordance with the recommendations of Baron and Kenny (25) and MacKinnon (26): 1) a model in which attitude toward healthy meals predicted healthy eating behavior; 2) a model in which attitude toward healthy meals predicted nutrition label use; and 3) a model in which nutrition label use predicted healthy eating behavior in the presence of attitude toward healthy meals. All regression analyses included gender, race/ethnicity, and age as covariates.

Additional regression analyses were conducted to test whether nutrition label use predicted the healthy dietary practices composite score among those individuals reporting agreement with the statement “It is important to me to prepare healthy meals,” as well as among those who did not agree with the statement. All analyses were conducted using SPSS 19.0.0.1, release date January 21, 2011, IBM SPSS (Chicago, Illinois).

Results and Discussion

Participants in the study sample were more likely to represent racial and ethnic minorities and were younger than the total student population at the two schools. At the 2-year community college, 18%, 61%, and 21% of study participants were under 19 years old, 19 – 24, and over 24, respectively, compared with 6%, 54%, and 41% of all enrolled students. Study participants from the 2-year college represented more racial/ethnic minorities (41% white, 34% African-American, 22% Asian, 12% other), compared to all enrolled students (62% white, 20% African-American, 12% Asian, 4% other). Gender did not differ appreciably (53% participants were female vs. 55% of all students). At the 4-year public university, 11%, 85%, and 4% of study participants were under 19 years old, 19 – 24, and over 24, respectively compared with 10%, 79%, and 11% for all enrolled undergraduate students. Study participants from the 4-year university represented more racial/ethnic minorities (52% white, 8% African-American, 36% Asian, 10% other), compared to all enrolled students (70% white, 4% African-American, 8% Asian, 18% other). Gender did not differ (52% participants were female vs. 52% of all students).

Thirty-five percent of participants were classified as frequent label readers (reporting nutrition label viewing “always or almost always” or “often”). This percentage is on the low end of the range of self-reported rates of label use (typically about 40-60%) presented in other studies (see reference 27 for review). However, the mean response to the label use question in the present study was 2.3 on a 1-4 scale, which is similar to the mean of 3.3 on a 5 point scale (1=never, 5=always) reported by Misra and colleagues in their 2007 study of label use among college students in Texas (5), both of which suggest that the average college student uses nutrition labels sometimes. In that participants in our study tended to be somewhat younger than those included in most previous nutrition-label research, the slightly lower rate of frequent label use reported here relative to the rates summarized in the Grunert and Wills review (27) is consistent with evidence that label use increases with age (27).

Consistent with our a priori hypotheses, independent samples *t*-tests revealed that frequent nutrition label readers showed higher rates of engaging in each of the 8 healthy dietary behaviors (significantly higher for eating fruits/vegetables, fiber, and a vegetarian diet, as well as limiting fast food and added sugar; $p<0.001$) compared with the infrequent label

readers (see Table 1). In addition, consistent with our hypotheses and with previous research (5,28), frequent label readers demonstrated greater nutrition knowledge than infrequent label readers. Estimates of how many calories and fruit and vegetable servings they needed in order to be healthy provided by frequent label readers were significantly nearer to the true recommendations (by more than 200 calories and approximately half of a serving each of fruits and vegetables; all p 's < 0.001) compared to the estimates provided by infrequent label readers.

Linear regression analyses (see Figure 1) revealed that 1) attitude toward preparing healthy meals was a statistically significant predictor of the healthy eating composite score; 2) attitude toward preparing healthy meals significantly predicted nutrition label use; and 3) when included in a regression model together, both attitude and nutrition label use significantly predicted the healthy eating composite score, suggesting possible partial mediation by nutrition label use of the relationship between attitude toward healthy eating and healthy dietary practices.

A Sobel's test of partial mediation (25): $Z = \frac{ab}{\sqrt{(S_a^2 S_b^2 + a^2 S_b^2 + b^2 S_a^2)}}$ produced a z-score of 4.80, indicating that nutrition label use was indeed a significant partial mediator of the relationship between attitude toward healthy eating and healthy dietary practices.

In addition, nutrition label use significantly predicted the healthy eating composite among both attitude-based groups of participants (i.e., those who agreed that it was important to prepare healthy meals [$b(se) = 0.27(0.05)$, $\beta = 0.20$, $p < 0.001$ and those who did not ($b(se) = 0.16(0.07)$, $\beta = 0.12$, $p = 0.02$)).

The role of nutrition label use as a partial mediator between attitude toward preparing healthy meals and healthy dietary practices indicates that consumers with an inclination to make healthy dietary choices may be utilizing nutrition labels as one way of putting their health preferences into action – a possibility supported by previous research demonstrating that health concerns predicted frequent label use among college students (29). The present analyses indicated that higher levels of label use were related to greater engagement in healthy eating behaviors not only among those participants with healthy eating attitudes, but also among those who *did not* believe it was important to prepare healthy meals. Although provision of nutrition information on its own has not been shown to be highly successful in changing dietary behaviors (30-31), accurately understanding nutrition information may be one of the many contributors to dietary intake, and may operate independently of nutrition-related attitude. These findings underscore the need for accurate, readily accessible, and understandable nutrition labeling on foods in the US.

Although the present study is the first of its kind to indicate that nutrition label use partially mediates the relationship between attitude and diet among young adults, there are important limitations to address. Participants comprised a diverse sample of both traditional and non-traditional college students; however, college students may differ in numerous ways from the larger population of young adults. Thus, these results may not generalize to young adults beyond 2- and 4-year college students. The participants were also recruited via convenience sampling, and responders were more likely to represent racial and ethnic minorities and were younger than the total student population at their respective colleges; although not assessed, it is possible that responders differed from non-responders in additional ways. It is also important to note that this analysis is limited by a cross-sectional design; thus, it is not possible to determine from these data whether attitude toward healthy meals preceded nutrition label use and dietary behavior. Longitudinal research could help to clarify this temporal ordering, and a prime opportunity for prospective research in this area is emerging

as new nutrition labels are beginning to appear on the front of food packages in the United States (32). Measuring consumers' health-related attitudes before front-of-pack labels are ubiquitous and assessing attitudes again after a period of naturalistic exposure to the new labels could facilitate a clearer temporal understanding of the role of label use in linking attitudes to behavior.

Conclusions

Reading nutrition labels appears to be a mechanism through which college students who value healthy meal preparation make healthy dietary decisions. Even among those who do not believe it is important to prepare healthy meals, nutrition label use is linked with healthier dietary intake, suggesting that label use among college students relates to healthful dietary intake independently of attitude toward healthy meals.

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A. Attitude toward Healthy Eating → Overall Dietary Quality

$$\beta(\text{Attitude toward Healthy Eating}) = 0.33; b(se) = 0.32(0.03); p < 0.001$$

B. Attitude toward Healthy Eating → Nutrition Label Use

$$\beta(\text{Attitude toward Healthy Eating}) = 0.22; b(se) = 0.27(0.04); p < 0.001$$

C. Nutrition Label Use → Overall Dietary Quality

$$\beta(\text{Nutrition Label Use}) = 0.17; b(se) = 0.22(0.04); p < 0.001$$

Attitude toward Healthy Eating (controlling for Nutrition Label Use) → Dietary Quality

$$\beta(\text{Attitude toward Healthy Eating}) = 0.16; b(se) = 0.20(0.04); p < 0.001$$

Figure 1. Test of Mediation of the Relationship between Attitude toward Healthy Eating and Overall Dietary Quality by Nutrition Label Use

Note: All regression analyses included the following covariates: gender, race/ethnicity, and age

^a Overall Dietary Quality ranged from 0 to 8 with 1 point for each of the following:

- met dairy recommendation (3 servings/day);
- met fat recommendation (<35% calories from fat)
- met fruit/vegetable recommendation (based on gender, age, and physical activity)
- met calcium recommendation (based on gender, age)
- met added sugar recommendation (based on gender, age, and physical activity)
- met fiber recommendation (based on gender, age)
- ate fast food <3 times per week
- ate a vegetarian diet

Table 1

Comparison of demographic and dietary variables among frequent and infrequent label readers

	Frequent Label Readers (often, always/almost always)	Infrequent Label Readers (never/rarely, sometimes)
N ^a	418	775
DEMOGRAPHIC VARIABLE		
Age (years)	22.0 (N=418)	21.3 (N=773)
BMI (kg/m ²)	24.7 (N=418)	24.7 (N=775)
Female	64% * (N=418)	47% (N=773)
White	58% * (N=418)	41% (N=775)
DIETARY VARIABLE		
Added Sugar (recommendation met) ^[20]	41.1% * (N=399)	24.7% (N=716)
Calcium (recommendation met) ^[18]	24.0% (N=371)	20.2% (N=664)
Dairy (3 servings/day) ^[19]	16.3% (N=412)	14.9% (N=759)
Fast Food (<3 times/week) ^[21-22]	39.5% * (N=418)	26.6% (N=775)
Fat (<35% of calories) ^[16]	93.0% (N=415)	90.4% (N=762)
Fiber (recommendation met) ^[17]	15.6% * (N=392)	6.1% (N=707)
Fruit/Vegetable (recommendation met) ^[17]	5.3% * (N=400)	2.1% (N=721)
Vegetarian ^[23-24]	9.0% * (N=415)	4.0% (N=765)
Total Healthy Dietary Practices ^b (mean)	2.5 * (n=417)	1.9 (N=754)
Absolute differences between participant estimated need and recommended intake		
Calories	636.0 * (N=407)	868.5 (N=735)
Fruit (servings)	1.5 * (N=404)	1.8 (N=710)
Vegetables (servings)	2.8 * (N=404)	3.3 (N=714)
Importance of preparing healthy meals ^c	4.3 * (N=417)	3.6 (N=769)

*
p<0.001^aVariations in sample size for dietary variables due to removal of outliers 3 standard deviations above the mean.^bTotal Healthy Dietary Practices was calculated as the total number of the 8 dietary recommendations the participant met; for those participants who were missing up to 3 dietary variables, this variable was calculated as the percentage of recommendations met for all valid variables multiplied by 8 (participants missing more than 3 dietary variables were also coded as missing the composite variable.)^cThis item, "It's important to me to prepare healthy meals," had response options ranging from 1 ("strongly disagree") to 5 ("strongly agree.")