Research Article

Nutrition Label Use and Its Association With Dietary Quality Among Latinos: The Roles of Poverty and Acculturation

Machelle D. Wilson, PhD[1]; A. Susana Ramírez, PhD, MPH[2]; Joanne E. Arsenault, PhD, MPH, RD[3]; Lisa M. Soederberg Miller, PhD[4]

ABSTRACT

Objective: To investigate how acculturation and poverty are independently and jointly associated with the use of the Nutrition Facts panel (nutrition label) and to examine the extent to which nutrition label use moderates the association of poverty and acculturation on dietary quality among Latinos.

Design: Cross-sectional analysis of the 2007/2008 and 2009/2010 waves of the National Health and Nutrition Examination Survey.

Participants: A total of 3,696 adults (aged >19 years) self-identified as Latino/Hispanic with food label use data from the most recent Consumer Behavior Phone Follow-Up Modules.

Main Outcome Measure(s): Nutrition label use and dietary quality.

Analysis: Logistic regression.

Results: Acculturation moderated the association of income on the likelihood of using nutrition labels, such that lower-income English-speaking Latinos were half as likely as higher-income English-speakers to use nutrition labels (P = .01, odds ratio [OR] = 0.44, 95% confidence interval [CI], 0.24−0.81); however, Spanish speakers were equally likely to use nutrition labels across income levels (P = .99; OR = 1.00; 95% CI, 0.77−1.31). Nutrition label use moderated the association of acculturation on diet. Among English-speaking Latinos, those who read nutrition labels had less than half the risk for poor diet (P =.001; OR = 0.43; 95% CI, 0.26−0.69); however, label use was not significantly associated with the diet quality of Spanish speakers (P = .07; OR = 0.82; 95% CI, 0.67−1.02). Nutrition label use decreased the risk for poor dietary quality regardless of poverty status.

Conclusions and Implications: Overall, results demonstrated a positive association between the use of the Nutrition Facts panel for Latinos and dietary quality. An important nutrition education strategy among bicultural Latinos at risk for a poor diet as a result of acculturation may include label reading comprehension. This approach may also address the low rates of label use. The study provides evidence of segmented assimilation in which low-income, bicultural Latinos follow an underclass pattern of acculturation demonstrated by a lower likelihood of reading nutrition labels and higher-income, bicultural Latinos follow the more successful selective pattern.

Key Words: dietary intake, Healthy Eating Index, Nutrition Facts panel, poverty, segmented assimilation (*J Nutr Educ Behav.* 2018; 50:876−887.)

Accepted May 29, 2018.

INTRODUCTION

The Nutrition Facts panel (here this term is used interchangeably with *nutrition label*) is a population-level nutrition communication device that provides consumers at the point of purchase with information needed to comply with the Dietary Guidelines for Americans.[1,2] A growing body of evidence suggests that nutrition label use is positively associated with dietary quality;[3-9] however, there are important demographic differences in use. In general, research showed that individuals with lower incomes tend to use labels less frequently than those with higher incomes,[7,10] a pattern mirrored by years of education.[3,4,6,7] Some research also found differences by race and ethnicity, such that Latinos and African Americans were less likely to use food labels compared with non-Latino whites.[7,11,12] In general, these findings are troubling because they suggest that labels are

[1]Department of Public Health Sciences, Division of Biostatistics, University of California, Davis, Davis, CA
[2]Department of Public Health, University of California, Merced, Merced, CA
[3]Program in International and Community Nutrition, Department of Nutrition, University of California, Davis, Davis, CA
[4]Department of Human Ecology, University of California, Davis, Davis, CA
Conflict of Interest Disclosure: The authors have not stated any conflicts of interest.
Address for correspondence: Machelle D. Wilson, PhD, Department of Public Health Sciences, Division of Biostatistics, University of California, Davis, 1 Shields Ave, Davis, CA 95616; Phone: (916) 703-9106; Fax: (916) 703-9124; E-mail: mdwilson@ucdavis.edu

https://doi.org/10.1016/j.jneb.2018.05.019

underused by populations that may be in greatest need of nutrition information.

The current study examined nutrition label use frequency among US Latinos, who are the largest ethnic minority group in the country, with a population of 56.6 million.[13] Latinos have a higher prevalence of being overweight and obese than other ethnic groups[14] and also higher mortality owing to diet-related disease such as diabetes.[15] Latinos may be especially at risk for poor diet and obesity, and therefore in greater need of nutrition guidance, for economic and cultural reasons.[16,17] Latinos have lower incomes and double the rates of food insecurity of non-Latino whites.[18] In addition, studies suggest that as Latinos become more acculturated to mainstream US culture, their diets become less healthful[19] and that they are more likely to have obesity and diet-related illnesses.[20,21] This phenomenon, referred to as the dietary acculturation paradox, is puzzling because the negative shift in diet quality occurs despite gains in income and education that would otherwise suggest a protective effect of acculturation.[18,22] For example, Guendelman and Abrams[23] showed that second-generation (US-born) Mexican American women had a higher risk of poor dietary quality compared with those who were first-generation (foreign-born), with the second generation diet being similar to white non-Latina women. This finding is particularly interesting considering that first-generation Mexican American women are at a higher risk for falling below the poverty line than either second-generation Mexican American or white non-Latina women. Specifically, studies showed that increasing acculturation is associated with decreasing consumption of ethnic foods and increasing consumption of fats and sugars and other unhealthful nutrients.[20,24-27] Ayala and colleagues[28] performed a systematic review of the relationship between dietary intake and acculturation across a variety of measures of acculturation. They found consistent relationships across various acculturation measures: less acculturated individuals consumed more fruit, rice, and beans and less sugar and sugar-sweetened beverages.

Although research showed that nutrition label use is positively associated with dietary quality among the general population,[5-10,29-32] relatively few studies examined this association among Latino populations specifically. Two notable exceptions focused on Latinos with diabetes. The first was an intervention targeted at Latinos with type 2 diabetes that employed community health workers to deliver culturally appropriate training on using the Nutrition Facts panel.[33] Just 2 lessons were enough to increase label use frequency significantly among the intervention group. Moreover, food label use significantly improved diet quality and accounted for 15% of the total effect of the intervention on hemoglobin A1C levels.[33] Second, in an observational study, Fitzgerald and colleagues[34] found that Latinas with diabetes who used food labels were more likely to consume fruits and vegetables and less likely to consume sweets, salty snacks, and sugar-sweetened soft drinks frequently. However, no studies reported whether acculturation moderated the effect of food label use on diet quality. Past research suggested that acculturation influenced the effects of communication interventions,[35,36] which makes it an important factor to consider when evaluating the effectiveness of nutrition labels within this population.

As noted earlier, income is associated with acculturation and is also related to both nutrition label use and diet quality in the general population.[37-39] Therefore, it is particularly important to consider within Latino populations. Latinos have lower average incomes and are more likely to live in poverty compared with non-Latino whites.[14] Sharif and colleagues[40] examined label use among 269 Latino adults in Southern California and found that those below the poverty line were more likely to use nutrition labels than were those at higher income levels. This suggests that poverty may affect the use of nutrition labels among Latinos differently from among other populations, where poverty more clearly has a negative effect on label use.[4,41,42] Such a pattern would be consistent with segmented assimilation theory, a social scientific framework that examines how the trajectories of integration of immigrants and their descendants are influenced by a complex interplay of individual, social, and structural factors.[17,43] Furthermore, label use may be influenced by a combination of income and acculturation. Sharif and colleagues found no significant effects of acculturation on label use, but other work suggested the opposite: that increased acculturation (when measured by language) is associated with increased use of nutrition labels.[7] These findings suggest that the effect of poverty on the frequency of nutrition label use among Latinos could vary with the degree of acculturation.

In general, then, the effects of acculturation and income are important factors to consider when evaluating the effectiveness of nutrition label use among Latinos. Given that higher acculturation is a risk factor for poor diet but is positively associated with education and income,[44] and that income and education are related to reading nutrition labels and better diet in the general populations, their combined effects could be particularly important for understanding how to improve nutrition label use among Latinos.

Thus, the aims of this study were (1) to understand how acculturation and income are independently and jointly associated with the use of nutrition labels, as reflected by self-reported frequency of nutrition label use; and (2) to examine the extent to which acculturation and poverty moderate the associations of nutrition label use on dietary quality among Latinos. The study was guided by the following research questions, which informed the development of the specific hypotheses tested in this study.

First, the researchers hypothesized that low-income Latinos would have lower odds of using nutrition labels compared with higher-income Latinos; and that less acculturated Latinos would have lower odds of using nutrition labels compared with more acculturated Latinos. Second, it was hypothesized that poverty and acculturation would interact to affect nutrition label use, such that poverty

would lower the rate of nutrition label use among Spanish speakers more so than among English speakers. Third, it was hypothesized that acculturation would moderate the association of nutrition label use and diet, such that using nutrition labels would decrease the risk of poor dietary quality more for English speakers than for Spanish speakers. Fourth, it was hypothesized that nutrition label use would decrease the risk of poor dietary quality more for Latinos below the poverty line compared with those above it.

METHODS

Study Design and Participants

The National Health and Nutrition Examination Study (NHANES) is a nationally representative health and nutrition survey of the US population conducted by the National Center for Health Statistics. Data from the 2007–2008 and 2009–2010[45] surveys were used, the most recent years that included food label use items as part of a Consumer Behavior Phone Follow-Up Module focusing on behavior related to the individual's own diet and health. The final size sample of 3,696 consisted of Latino adults aged 18–80 years. Table 1 lists sample demographic factors. The NHANES data were obtained using a complex, multistage, probability sampling design to select participants who were representative of the civilian, noninstitutionalized US population. Oversampling of certain population subgroups was done to increase the reliability and precision of health status indicator estimates for these groups.[46]

Ethical approval for the NHANES survey was obtained from National Center for Health Statistics Research Ethics Review Board (Continuation of Protocol No. 2005-06). University of California, Davis does not consider research involving anonymous or de-identified data to be human subject research. Hence, no institutional review board approval was required for this research.[47]

Outcome Variables

Nutrition Facts panel use. The researchers assessed the frequency of nutrition label use by showing participants a food label sample that was handed to them and asking, *The Nutrition Facts panel of a food label is everything on this page except the list of ingredients in pink. How often do you use the Nutrition Facts panel when deciding to buy a food product?* Responses were made on a 5-point scale (always, most of the time, sometimes, rarely, or never). Label use was dichotomized; label users were defined as using food labels at least sometimes (≤3 on the scale) and nonusers were defined as rarely or never using food labels (4 and 5 on the scale). The proportion of adults in the entire NHANES survey who used nutrition labels at least sometimes was 82.2%.

Dietary quality. Dietary intake data were taken from 2 24-hour dietary recalls. Dietary quality was assessed using an average of the 2 recalls for each individual to calculate a Healthy Eating Index (HEI)-2010 score, which is an overall measure of how well dietary intake conforms to the Dietary Guidelines for Americans.[48] The HEI score is calculated as a summary of 12 components, 9 of which assess adequacy of the diet, including total fruit, whole fruit, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, and fatty acids. The remaining 3 (refined grains, sodium, and empty calories) (ie, energy from solid fats, alcohol, and added sugars) assessed dietary components that should be consumed in moderation. Higher scores reflect better diet quality because lower intakes of the moderation components are scored higher. The scores of the 12 components were summed to yield a total score with a maximum value of 100. The amount of food components consumed by individuals was calculated using data from the food-level dietary intake file from NHANES and the Food Pyramid Equivalent Database from the US Department of Agriculture to convert grams to the number of equivalent servings as expressed in the HEI.[49] The outcome measure used in this study was expressed as a dichotomized variable in which 1 = poor dietary quality, defined as an HEI score below the median score (51.6) of the entire sample of adults in the 2 NHANES survey waves.

Independent Variables

Acculturation. Consistent with previous studies,[50-55] the researchers used a language-based surrogate measure to assess acculturation in the NHANES survey: *Now I'm going to ask you about language use. What language (s) do you usually speak at home?* Responses were made on a 5-point scale: only Spanish, more Spanish than English, both equally, more English than Spanish, or only English. For this study, responses were dichotomized into 2 groups such that if Spanish was spoken at least some of the time (≤4), the language at home was coded as Spanish; otherwise it was coded as English.

Poverty. To assess poverty, the poverty income ratio, which considers household income to be relative to the poverty threshold after accounting for inflation and family size, was used. Poverty was defined to be a poverty income ratio of ≤130%, consistent with the eligibility level for the *Supplemental Nutrition Assistance Program*.[55] In 2008, this level approximated an income of $29,000 for a family of 4, about 13.2% of the US population.[56]

Control Variables

Sex was dichotomized with females as the reference group (female = 0; male = 1). Age was discretized into 3 groups: 18–34, 35–55, and ≥56 years. Participants who self-identified as Mexican American were coded as such regardless of other racial or ethnic identities. Others who self-identified as Latino ethnicity were coded as other Latino. Education was nominalized into 2 groups: those with at least a high school diploma and those without. Body mass index[57] (BMI) was nominalized into 4 groups: underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obese (≥30).

Data Analyses

Summary statistics for the sample demographics were calculated

as means or percentages and 95% confidence intervals (CIs) were calculated using the normal approximation. Univariate logistic regressions were used to test for associations between the covariates and the 2 response variables: dietary quality and nutrition label use. A multivariable logistic regression model was used to predict the odds of using nutrition labels from the interaction between poverty and acculturation while controlling for education, sex, BMI, country of origin, and age. A second logistic regression model was used to predict the odds of poor dietary quality from nutrition label use and its interaction with poverty and the interaction between nutrition label use and acculturation, while controlling for education, sex, BMI, country of origin, and age, as defined previously. Individuals with missing values for a particular analysis were dropped from that analysis. SAS software (version 9.4, SURVEY Procedures for Windows, SAS Institute, Cary, NC; 2015) was used for all analyses to correct for the sampling design using the cluster, strata, and weight variables provided by NHANES.

RESULTS

Demographic Characteristics

About 49% of Latinos in the survey fell below the poverty line and about 49% spoke at least some Spanish at home. Notably, 80% reported using nutrition labels at least sometimes. Table 1 lists sample characteristics with sample sizes and 95% CIs.

Table 1. Sample Demographics of Latinos from National Health and Nutrition Examination Study 2007–2009 and 2009–2010, Adjusted for Sampling Cluster and Strata

Variable	n	%	95% Confidence Interval
Education			
Less than high school	1,891	49.0	46.2–51.8
High school or more	1,664	51.0	48.2–53.8
Sex			
Female	1,676	51.5	49.9–53.0
Male	1,879	48.6	47.0–50.1
Country of origin			
Mexican American	2,330	63.2	53.6–72.8
Other Latino	1,325	36.8	27.2–46.4
Poverty income ratio			
>130%	1,713	51.4	45.3–51.9
≤130%	1,842	48.6	48.1–54.7
Language at home			
English only	1,746	50.8	46.1–55.6
Some Spanish	1,809	49.2	44.5–53.9
Age, y			
18–34	1,172	42.7	40.6–44.9
35–55	1,288	40.9	39.2–42.5
>55	1,095	16.4	14.3–18.5
Body mass index			
Underweight (<18.5)	30	0.8	0.4–1.2
Normal (18.5–24.9)	803	23.9	21.5–26.3
Overweight (25–29.9)	1,349	38.4	36.2–40.7
Obese (≥30)	1,336	36.9	33.6–40.1
Nutrition label use			
At least sometimes	2,890	80.0	78.3–81.7
Rarely or never	665	20.0	18.3–21.7
Healthy Eating Index score[a]			
Below median	1,801	54.2	50.6–57.8
At or above median	1,754	45.8	42.2–49.4

[a]Median Healthy Eating Index score was 51.6.

Nutrition Facts Panel Use

A total of 80% of Hispanics in the NHANES survey reported using nutrition labels at least some of the time. In the univariate (unadjusted) analyses, nutrition label use was significantly higher for middle-aged (35–55 years) and older adults (>55 years) compared with younger adults (aged 18–34 years) (Table 2). Underweight individuals had only about one quarter of the odds of using nutrition labels ($P = .001$; odds ratio [OR] = 0.22; CI, 0.09–0.52) compared with normal-weight individuals. There were no significant differences between those of normal weight and those who were overweight ($P = .70$; OR = 1.02) or obese ($P = .55$; OR = 0.99). No other significant associations were observed in the unadjusted analyses.

In the multivariable logistic regression, acculturation moderated the association of poverty on the odds of using nutrition labels, adjusting for education, age, sex, country of origin, and BMI ($P = .01$ for interaction) (Table 3). Among those who were considered acculturated (they spoke only English at home), the odds of using nutrition labels were 56% lower for low-income compared with higher-income individuals ($P = .01$; OR = 0.44; 95% CI, 0.24–0.81). However, among less-acculturated respondents (those speaking at least some Spanish at home), there was no significant difference between the income groups in the odds of nutrition label use ($P = .99$; OR = 1.0) (Table 3). As shown in Figure 1, those speaking at least some Spanish had about equal rates of nutrition label use irrespective of income and this rate was higher than for low-income English speakers and only slightly below the rate for higher-income English speakers.

Dietary Quality

In the unadjusted, univariate analyses, age, sex, and nutrition label use had a significant association with dietary quality. Adults aged >55 years and those who were middle-aged (aged 35–55 years) had a lower risk of poor diet quality compared with young adults (aged 18–34 years) (respectively: $P < .001$, OR = 0.66, 95% CI, 0.57–0.78;

Table 2. Odds Ratios From Univariate Logistic Regressions Testing for Associations With Nutrition Label Use on Dietary Quality in Sample of Latinos From National Health and Nutrition Examination Study 2007–2008 and 2009–2010, Adjusted for Sampling Cluster and Strata

Effect	n	*P*	Odds Ratio[a]	95% Wald Confidence Interval
At least high school education				
No (reference)	1,891	–	–	–
Yes	1,664	.32	1.10	0.92–1.28
Age, y				
18–34 (reference)	1,172	–	–	–
35–55	1,288	< **.001**	**1.55**	1.23–1.94
>55	1,095	< **.001**	**2.23**	1.69–2.96
Sex				
Male (reference)	1,879	–	–	–
Female	1,676	.27	1.10	0.92–1.32
Country of origin				
Mexican (reference)	2,330	–	–	–
Other Latino)	1,325	.12	1.17	0.96–1.43
Body mass index			–	–
Underweight	30	**.001**	**0.22**	0.09–0.52
Normal (reference)	803	–	–	–
Overweight	1,349	.70	1.08	0.85–1.38
Obese	1,336	.55	1.11	0.88–1.38
Poverty income ratio < 130%				
Yes (reference)	1,842	–	–	–
No	1,713	.26	1.16	0.89–1.51
Language spoken at home				
English (reference)	1,746	–	–	–
Spanish	1,809	.43	0.90	0.69–1.18

[a]Significant effects ($P < .05$) are in bold.

Table 3. Odds Ratios From Multivariable Logistic Regression Model Testing for Associations With Nutrition Label Use in Sample of 3,555 Latinos From National Health and Nutrition Examination Study 2007–2008 and 2009–2010, Adjusted for Sampling Cluster and Strata

Effect	Odds Ratio[a]	95% Wald Confidence Interval
At least high school education		
Yes vs no	1.07	0.87–1.32
Age, y		
35–55 vs 18–34	**1.49**	1.19–1.88
>55 vs 18-34	**2.15**	1.59–2.91
Sex		
Male vs female	0.92	0.76–1.10
Country of origin		
Mexican vs other Latino	1.14	0.93–1.41
Body mass index		
Underweight vs normal	**0.24**	0.10–0.57
Overweight vs normal	1.02	0.80–1.30
Obese vs normal	0.99	0.79–1.24
Interaction between poverty and acculturation		
Poverty income ratio < 130% (yes vs no) for English	**0.44**	0.24–0.81
Poverty income ratio < 130% (yes vs no) for Spanish	1.00	0.77–1.31

[a]Significant ($P < .05$) effects are in bold.

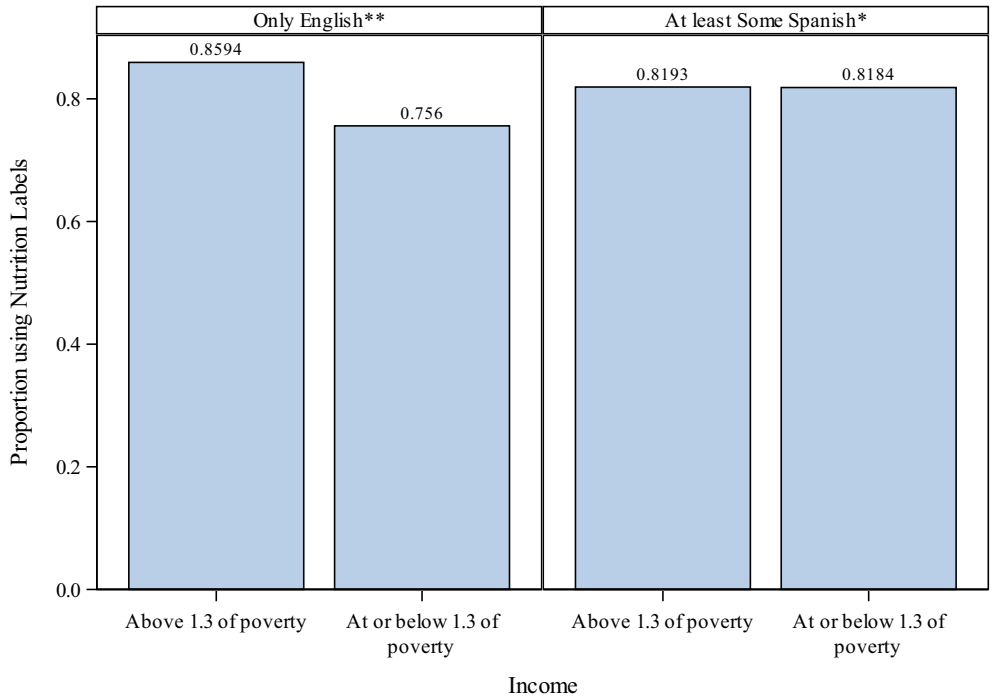

Figure 1. Effects of interaction between income and language spoken at home on nutrition label use for a sample of 3,696 Latinos from National Health and Nutrition Examination Study 2007–2008 and 2009–2010. $^{**}P = .011$; $^{*}P = .99$.

Table 4. Odds Ratios From Univariate Logistic Regressions Testing for Associations With Poor Dietary Quality (Healthy Eating Index < 51.6) in Sample of 3,555 Latinos From National Health and Nutrition Examination Study 2007–2008 and 2009–2010, Adjusted for Sampling Cluster and Strata

Effect	n	*P*	Odds Ratio[a]	95% Wald CL
High school education				
Less than high school	1,891	.13	1.11	0.97–1.28
At least high school	1,664	–	–	–
Age, y				
18–34 (reference)	1,172	–	–	–
35-55	1,288	< **.001**	**0.66**	0.57–0.78
> 55	1,095	< **.001**	**0.47**	0.38–0.58
Sex				
Male	1,879	< **.001**	**1.54**	1.27–1.87
Female (reference)	1,676	–	–	–
Body mass index				
Underweight	30	.17	1.65	0.82–3.34
Normal	803	–	–	–
Overweight	1,349	.91	1.03	0.84–1.28
Obese	1,336	.99	1.02	0.86–1.22
Country of origin				
Other Latino (reference)	2,330	.08	0.81	0.65–1.02
Mexican	1,325		–	–
Nutrition label use				
At least sometimes	2,890	**.001**	**0.70**	0.57–0.85
Rarely or never (reference)	665		–	–
Poverty income ratio < 130%				
Yes	1,842	.10	1.18	0.96–1.44
No (reference)	1,713		–	–
Language spoken at home				
Spanish	1,809	.58	1.08	0.82–1.41
English (reference)	1,746		–	–

[a]Significant ($P < .05$) effects are in bold.

$P < .001$, OR = 0.47, 95% CI, 0.38–0.58) (Table 4). Men had higher odds of poor diet quality ($P < .001$, OR = 1.54, 95% CI, 1.27–1.87). Those who used nutrition labels had lower odds of poor diet compared with those who did not use them ($P < .001$; OR = 0.70; 95% CI, 0.57–0.85). There were no differences in dietary quality by education, BMI, country of origin, income, or acculturation.

In the multivariable logistic regression examining the associations with poor quality diet, the odds of an HEI score below the median value varied significantly with age and sex but not education, BMI, or country of origin (Table 5). Middle-aged participants ($P < .001$; OR = 0.68; 95% CI, 0.58–0.80) and older participants ($P < .001$; OR = 0.48; 95% CI, 0.38–0.60) had lower odds of poor dietary quality compared with younger participants. Males had about 52% higher odds than did females of a low-quality diet ($P < .001$; OR = 1.52; 95% CI, 1.25–1.84). Nutrition label use moderated the association of acculturation ($P = .008$) but not of poverty ($P = .59$). Among those who spoke only English at home, the odds of a poor-quality diet were significantly lower for individuals who used nutrition facts panels compared to those who did not ($P = .001$; OR = 0.43; 95% CI, 0.26–0.69). However, among less-acculturated people (who spoke some Spanish at home), using nutrition labels did not change the odds of poor dietary quality ($P = .07$; OR = 0.82; 95% CI, 0.67–1.02). As can be seen in Figure 2, the dietary quality of nutrition label users was similar across levels of acculturation, but Spanish speakers who did not use nutrition labels had higher dietary quality than did English speakers who did not use them. Nutrition label use was associated with a reduced risk of poor

Table 5. Odds Ratios From Multivariable Logistic Regression Testing for Associations With Poor Dietary Quality (Healthy Eating Index < 51.6) in Sample of 3,518 Latinos From National Health and Nutrition Examination Study 2007–2008 and 2009–2010, Adjusted for Sampling Cluster and Strata

Effect	*P*	Odds Ratio[a]	95% CL
Age, y			
35–55 vs 18–34	< **.001**	**0.68**	0.58–0.80
>55 vs 18–34	< **.001**	**0.48**	0.38–0.60
High school education			
No vs yes	.33	1.08	0.93–1.26
Sex			
Male vs female	< **.001**	**1.52**	1.25–1.84
Country of origin			
Mexican vs other Latino	.23	0.86	0.67–1.10
Body mass index			
Underweight vs normal	.28	1.49	0.73–3.08
Overweight vs normal	.50	1.08	0.87–1.30
Obese vs normal	.15	1.14	0.95–1.38
Interaction between NLU and acculturation			
NLU (yes vs no) for English	**.001**	**0.43**	0.26–0.69
NLU (yes vs no) for Spanish	.07	0.82	0.67–1.02
Interaction between NLU and income			
NLU (yes vs no) for <130% poverty	**.010**	**0.62**	0.43–0.89
NLU (yes vs no) for ≥130% poverty	< **.001**	**0.57**	0.42–0.77

NLU indicates nutrition label use.
[a]Significant ($P < .05$) effects are in bold.

diet irrespective of income level. For those falling below 130% of the poverty line, the odds of a poor diet were 38% less than for those not using nutrition labels ($P = .01$; OR = 0.62; 95% CI, 0.43–0.89). For those falling above 130% of the poverty line, the odds of a poor diet were 43% less ($P < .001$; OR = 0.57; 95% CI, 0.42–0.77).

DISCUSSION

The results of this study demonstrate that frequent use of nutrition labels was associated with better diet quality for Latinos for both income levels, but with a higher positive association for those below 130% of the poverty line. There was also a positive association between label use and dietary quality for more acculturated people ($P = .001$) but not for less acculturated people ($P = .07$). Furthermore, the results suggested that nutrition label use could be a particularly effective strategy for nutrition education among the bicultural Latino segment, which may be more vulnerable to poor diet as a result of acculturation. Although the cross-sectional study precluded claims of causality, this population-based study adds to the body of literature suggesting a directional relationship, together with randomized experimental studies examining the effects of nutrition label use. This body of work suggests that there may be a causal relationship between nutrition label use and improved dietary quality, at least for some groups.

For example, the intervention to train Latinos with type 2 diabetes on using the Nutrition Facts panel found that using the nutrition labels not only improved diet quality but also reduced hemoglobin A1C levels.[34] Thus, the nutrition label may be a useful tool for avoiding the negative dietary consequences of acculturation, at least among some groups who may be motivated to manage their health.

In this study, low-income, bicultural (English-speaking) Latinos followed an underclass pattern of acculturation demonstrated by a lower likelihood of reading nutrition labels, and higher-income, bicultural Latinos followed a more successful selective pattern.

As was hypothesized, the association of nutrition label use with dietary quality was larger for people who spoke mainly English (highly acculturated) compared with those who spoke mainly Spanish (less acculturated). Surprisingly, there was little association of poverty with the use of nutrition labels for those who spoke Spanish, whereas there was a strong association for those who spoke English. The unadjusted associations with nutrition label use for both acculturation and poverty were not significant in the univariate models, and hence their associations

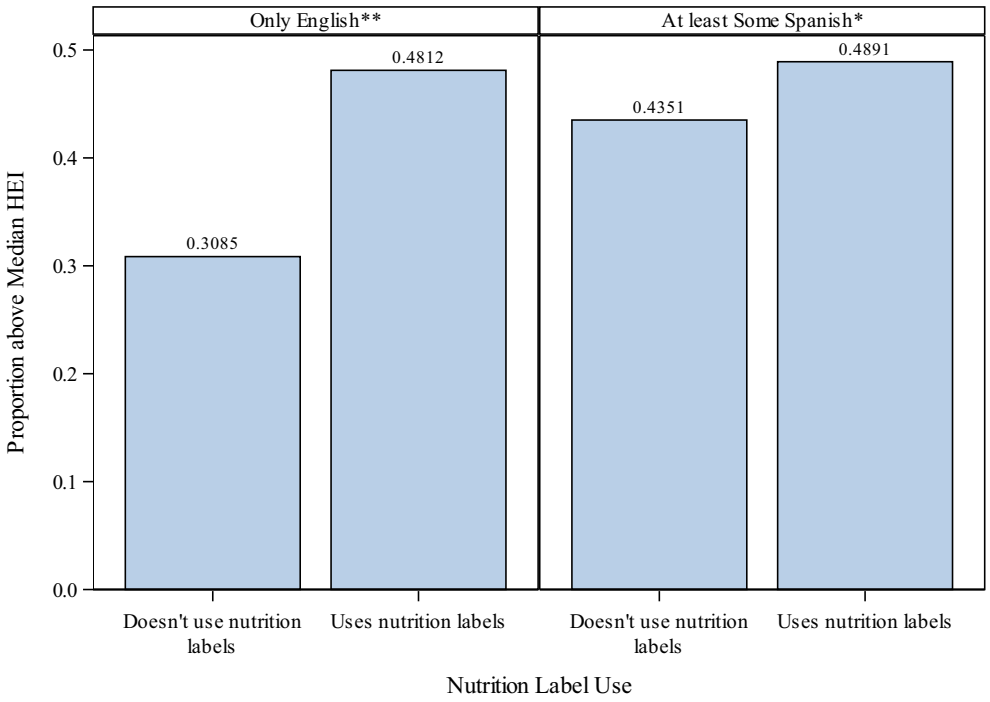

Figure 2. Interaction effects of nutrition label use and language spoken at home on dietary quality for a sample of 3,696 Latinos from National Health and Nutrition Examination Study 2007–2009 and 2009–2010. $^{**}P = .004$; $^{*}P = .46$.

are confounded if their interaction is not considered. Thus, failure to include interaction terms when examining complex issues can lead to faulty inference. One interpretation of this complex interaction could be that Latinos who retained some Spanish-speaking ability also retained some aspects of Latino culture, including diet. Therefore, the lack of nutrition label use may not have had as large an effect on dietary quality as it might have for English speakers who may have more fully adopted the practice of eating lower-quality packaged foods that are readily available in the US. This explanation is consistent with the observed Latino dietary acculturation paradox,[58] in which immigrant Latino populations eat more fruits and vegetables and less fat, but in which protective factors disappear through the process of acculturation, and with the current results showing that for those who did not use nutrition labels, Spanish speakers were more likely to fall above the median HEI than were English speakers (44% vs 31%) (Figure 2). This study's results were also consistent with the recent findings of Ramírez and colleagues,[59] which found through in-depth interviews that English-speaking Mexican American women perceived traditional Mexican food to be unhealthy and rejected this food in favor of American food as healthier. In conjunction with the current results, that study suggests that effective nutrition label use could help Latinos identify the healthfulness of foods more effectively and hence make better dietary choices.

Considered with prior studies, these results shed light on a potential mechanism for the dietary acculturation paradox: the differential effectiveness of nutrition labels across levels of acculturation and income. This study found evidence for the differential effectiveness of population-wide communication based on nutrition labels, varying across degree of acculturation.

In terms of nutrition label use, the current results suggest that interactions between acculturation and poverty may be important. In the presence of an interaction, an estimate of the main effect of poverty can be confounded (ie, nonsignificant or in the opposite direction of the true effect). This could explain the counterintuitive results of Sharif and colleagues,[40] in which poverty had a positive effect on nutrition label use. Those authors found that English speakers below the poverty line were less likely to use food labels ($P < .001$; OR = 0.44) whereas poverty had no effect on Spanish speakers ($P > .99$; OR = 1.0).

The income variable does not take into account geographic location, although the cost of living varies widely. The effect of this is likely to be an underestimation of observed effects, given that Latinos are concentrated in regions with a higher cost of living.[59] Dietary quality in this population has been changing (as it has in other populations) so that assessments in these NHANES waves may not reflect current dietary patterns, although other recent data suggested that diet quality is not improving for Mexican Americans and that income disparities in diet quality are worsening.[60] As with all cross-sectional studies, nonresponse bias is a potential problem and cause and effect cannot be inferred; hence,

associations may be spurious or confounded. Finally, this study relied on a label use frequency measure. A measure of nutrition label comprehension (or objective label use) would disentangle the frequency of label use with the quality of label use[30] and how these aspects of label use relate to dietary quality.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The current results showed the importance of considering interactions among income, acculturation, and nutrition label use and their associations with diet quality in future research. Future directions of research could explore how to make nutrition labels more accessible and more effective across the spectrum of income and acculturation in the Latino community, and which aspects of dietary quality are most associated with acculturation. Examining the HEI subscores that measure total vegetables, greens and legumes, whole fruits, whole grains, fats, and sugars would potentially elucidate more detailed differences in dietary quality between less acculturated and more acculturated Hispanics and how these differences may interact with income levels.

The current study also provides evidence of segmented assimilation, a framework[61] that identifies 3 distinct patterns of integration: classic assimilation (the adoption of mainstream values and behaviors and rejection of original culture), underclass acculturation (poverty and low educational attainment), and selective acculturation (retention of ethnic values along with economic and educational advancement).

This study extended previous research on nutrition label use by examining how acculturation and income influence Latinos' odds of using labels and by evaluating the extent to which acculturation and income modify the associations of using labels on dietary quality.

English-speaking Latinos, who may be considered acculturated to mainstream US culture, were more likely to use nutrition labels compared with Spanish-speaking, less acculturated Latinos. Moreover, English speakers appeared to benefit from using nutrition labels, whereas less-acculturated Spanish speakers did not. These results suggest that nutrition labels hold promise as an intervention to decrease the risk of disparities in diet and diet-related diseases, and particularly for acculturation-based disparities, because the most benefit from their use was derived by English-speaking Latinos who were identified in prior studies as particularly at risk for a poor diet.

The authors of this study, along with the developers of NHANES and many other studies, assumed that acculturation could at least be approximated by language use at home. Although many other researchers made the same assumption, a better measure of acculturation would improve studies such as these. Further work is needed to establish measures of immigrants' use and facility with nutrition labels to tease apart cultural attitudes vs English literacy.

ACKNOWLEDGMENTS

The project described was supported by the National Center for Advancing Translational Sciences, National Institutes of Health, through Grant No. UL1 TR001860 and by National Institutes of Health/National Cancer Institute Grant No. R01CA 159447 and Award No. K01CA 190659. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The data were obtained from NHANES surveys 2007–2008 and 2009–2010.

REFERENCES

1. Taylor CL, Wilkening VL. How the nutrition food label was developed, part 1: the nutrition facts panel. *J Am Diet Assoc*. 2008;108:437-442.
2. Ippolito PM, Mathios AD. New food labeling regulations and the flow of nutrition information to consumers. *J Public Policy Mark*. 1993;12:188-205.
3. Blitstein JL, Evans WD. Use of nutrition facts panels among adults who make household food purchasing decisions. *J Nutr Educ Behav*. 2003;38:360-364.
4. Kim SY, Nayga RM, Capps O. Food label use, self-selectivity, and diet quality. *J Consum Aff*. 2001;35:346-363.
5. Kollannoor-Samuel G, Shebl FM, Hawley NL, Perez-Escamilla R. Nutrition facts panel use is associated with higher diet quality and lower glycated hemoglobin concentrations in US adults with undiagnosed prediabetes. *Am J Clin Nutr*. 2016;104:1639-1646.
6. Kreuter MW, Brennan LK, Scharff DP, Lukwago SN. Do nutrition label readers eat healthier diets? Behavioral correlates of adults' use of food labels. *Am J Prev Med*. 1997;13:277-283.
7. Ollberding NJ, Wolf RL, Contento I. Food label use and its relation to dietary intake among US adults. *J Am Diet Assoc*. 2010;110:1233-1237.
8. Post RE, Mainous AG, Diaz VA, Matheson EM, Everett CJ. Use of the Nutrition Facts label in chronic disease management: results from the National Health and Nutrition Examination Survey. *J Am Diet Assoc*. 2010;110:628-632.
9. Neuhouser ML, Kristal AR, Patterson RE. Use of food nutrition labels is associated with lower fat intake. *J Am Diet Assoc*. 1999;99:45-53.
10. McArthur L, Chamberlain V, Howard AB. Behaviors, attitudes, and knowledge of low-income consumers regarding nutrition labels. *J Health Care Poor Underserved*. 2001;12:415-428.
11. Langellier BA, Massey PM. Nutrition activation and dietary intake disparities among US adults. *Public Health Nutr*. 2016;19:3123-3134.
12. Stran KA, Knol LL. Determinants of food label use differ by sex. *J Acad Nutr Diet*. 2013;113:673-679.
13. US Census Bureau. Annual Estimates of the Resident Population by Sex, Age, Race, and Hispanic Origin for the United States and States: April 1, 2010 to July 1, 2015, Table PEPASR6H. 2016. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed July 17, 2018.
14. Ogden CL, Carroll MD, Kit BK, et al. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*. 2014;311:806-814.
15. Vega WA, Rodriguez MA, Gruskin E. Health disparities in the Latino population. *Epidemiol Rev*. 2009;31:99-112.
16. Flórez KR, Abraído-Lanza A. Segmented assimilation. *Fam Community Health*. 2017;40:132-138.

17. Martin MA, Van Hook JL, Quiros S. Is socioeconomic incorporation associated with a healthier diet? Dietary patterns among Mexican-origin children in the United States. *Soc Sci Med*. 2015;147:20-29.
18. Rabbitt M, Smith MD, Coleman-Jensen A. Food Security among Hispanic adults in the United States, 2011-2014. https://www.ers.usda.gov/publications/pub-details/?pubid=44083. Accessed July 17, 2018.
19. Satia-Abouta J, Patterson RE, Neuhouser ML, Elder JP. Dietary acculturation: applications to nutrition research and dietetics. *J Am Diet Assoc*. 2002;102:1105-1118.
20. Sundquist J, Winkleby M. Country of birth, acculturation status and abdominal obesity in a national sample of Mexican-American women and men. *Int J Epidemiol*. 2000;29:470-477.
21. Bermudez OL, Falcon LM, Tucker KL. Intake and food sources of macronutrients among older Hispanic adults: association with ethnicity, acculturation, and length of residence in the United States. *J Am Diet Assoc*. 2000;100:665-673.
22. Abraído-Lanza AF, Chao MT, Flórez KR. Do healthy behaviors decline with greater acculturation? Implications for the Latino mortality paradox. *Soc Sci Med*. 2005;61:1243-1255.
23. Guendelman S, Abrams B. Dietary intake among Mexican-American women: generational differences and a comparison with white non-Hispanic women. *Am J Public Health*. 1995;85:20-25.
24. Mazur RE, Marquis GS, Jensen HH. Diet and food insufficiency among Hispanic youths: acculturation and socioeconomic factors in the third National Health and Nutrition Examination Survey. *Am J Clin Nutr*. 2003;78:1120-1127.
25. Winkleby MA, Albright CL, Howard-pitney B, Lin J, Fortmann SP. Hispanic/white differences in dietary fat intake among low educated adults and children. *Prev Med (Baltim)*. 1994;23:465-473.
26. Dixon LB, Sundquist J, Winkleby M. Differences in energy, nutrient, and food intakes in a US sample of Mexican-American women and men: findings from the Third National Health and Nutrition Examination Survey, 1988-1994. *Am J Epidemiol*. 2000;152:548-557.
27. Balcazar H, Castro FG, Krull JL. Cancer risk reduction in Mexican American women: the role of acculturation, education, and health risk factors. *Health Educ Behav*. 1995;22:61-84.
28. Ayala GX, Baquero B, Klinger S. A systematic review of the relationship between acculturation and diet among Latinos in the United States: implications for future research. *J Am Diet Assoc*. 2008;108:1330-1344.
29. Hieke S, Taylor CR. A critical review of the literature on nutritional labeling. *J Consum Aff*. 2012;46:120-156.
30. Miller LMS, Cassady DL. The effects of nutrition knowledge on food label use: a review of the literature. *Appetite*. 2015;92:207-216.
31. Lin C-T, Lee J-Y, Yen ST. Do dietary intakes affect search for nutrient information on food labels. *Soc Sci Med*. 2004;59:1955-1967.
32. Molitor F, Sugerman S, Yu H, et al. Reach of Supplemental Nutrition Assistance Program—Education (SNAP—Ed) interventions and nutrition and physical activity-related outcomes, California, 2011—2012. *Prev Chronic Dis*. 2015;12:140449.
33. Kollannoor-Samuel G, Shebl FM, Segura-Pérez S, Chhabra J, Vega-López S, Pérez-Escamilla R. Effects of food label use on diet quality and glycemic control among Latinos with type 2 diabetes in a community health worker—supported intervention. *Am J Public Health*. 2016;106:1059-1066.
34. Fitzgerald N, Damio G, Segura-Pérez S, Pérez-Escamilla R. Nutrition knowledge, food label use, and food intake patterns among Latinas with and without type 2 diabetes. *J Am Diet Assoc*. 2008;108:960-967.
35. Ramírez AS. Effects of ethnic targeting on the perceived effectiveness of cancer prevention messages among Latinas and non-Latina white women. *J Health Commun*. 2013;18:1256-1273.
36. Meyer OL, Liu X, Tancredi D, Ramírez AS, Schulz R, Hinton L. Acculturation level and caregiver outcomes from a randomized intervention trial to enhance caregivers' health: evidence from REACH II. *Aging Ment Health*. 2017;22:1-8.
37. Pérez-Escamilla R, Haldeman L. Food label use modifies association of income with dietary quality. *J Nutr*. 2002;132:768-772.
38. Kim SY, Nayga RM, Capps O. The effect of food label use on nutrient intakes: an endogenous switching regression analysis. *J Agric Resour Econ*. 2000;25:215-231.
39. Leung CW, Epel ES, Ritchie LD, Crawford PB, Laraia BA. Food insecurity is inversely associated with diet quality of lower-income adults. *J Acad Nutr Diet*. 2014;114:1943-1953.
40. Sharif MZ, Rizzo S, Prelip ML, et al. The association between nutrition facts label utilization and comprehension among Latinos in two East Los Angeles neighborhoods. *J Acad Nutr Diet*. 2014;114:1915-1922.
41. Drichoutis AC, Lazaridis P, Nayga RM. Nutrition knowledge and consumer use of nutritional food labels. *Eur Rev Agric Econ*. 2005;32:93-118.
42. Kiesel K, McCluskey JJ, Villas-Boas SB. Nutritional labeling and consumer choices. *Annu Rev Resour Econ*. 2011;3:141-158.
43. Flórez KR, Abraído-Lanza A. Segmented Assimilation. *Fam Community Health*. 2017;40:132-138.
44. Castro FG, Marsiglia FF, Kulis S, Kellison JG. Lifetime segmented assimilation trajectories and health outcomes in Latino and other community residents. *Am J Public Health*. 2010;100:669-676.
45. Van Hook J, Quiros S, Frisco ML, Fikru E. It is hard to swim upstream: dietary acculturation among Mexican-origin children. *Popul Res Policy Rev*. 2016;35:177-196.
46. Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey Data. Key Concepts About NHANES Sample Design. Hyattsville, MD: US Department of Health and Human Services. https://www.cdc.gov/nchs/tutorials/NHANES/Survey-Design/SampleDesign/Info1_I.htm . Accessed July 17, 2018.
47. UC Davis Office of Research. Does My Project Need Review by the IRB. https://research.ucdavis.edu/policies-compliance/irb-admin/researchers/review-by-the-irb/ . Accessed July 17, 2018
48. Guenther PM, Kirkpatrick SI, Reedy J, et al. The Healthy Eating Index-2010 is a valid and reliable measure of diet quality according to the 2010 Dietary Guidelines for Americans. *J Nutr*. 2014;144:399-407.

49. Centers for Disease Control and Prevention, National Center for Health Statistics. National Health and Nutrition Examination Survey. Healthy Eating Index SAS Macro. https://www.cnpp.usda.gov/sites/default/files/healthy_eating_index/Readme_HEI2010_NHANES0708_PopulationScore.pdf. Accessed July 17, 2018.
50. Solis JM, Marks G, Garcia M, Shelton D. Acculturation, access to care, and use of preventive services by Hispanics: findings from HHANES 1982-84. *Am J Public Health*. 1990;80 (suppl):11-19.
51. Elder JP, Castro FG, de Moor C, et al. Differences in cancer-risk-related behaviors in Latino and Anglo adults. *Prev Med (Baltim)*. 1991;20:751-763.
52. Lueck K, Wilson M. Acculturative stress in Latino immigrants: the impact of social, socio-psychological and migration-related factors. *Int J Intercult Relations*. 2011;35:186-195.
53. Otero-Sabogal R, Sabogal F, Pérez-Stable EJ, Hiatt RA. Dietary practices, alcohol consumption, and smoking behavior: ethnic, sex, and acculturation differences. *J Natl Cancer Inst*. 1995; 18:7-82.
54. Marin G, Sabogal F, Marin BV, Otero-Sabogal R, Perez-Stable EJ. Development of a short acculturation scale for Hispanics. *Hisp J Behav Sci*. 1987;9: 183-205.
55. Center on Budget and Policy Priorities. *A Quick Guide to SNAP Eligibility and Benefits*. Updated February 7, 2018. https://www.cbpp.org/research/food-assistance/a-quick-guide-to-snap-eligibility-and-benefits. Accessed March 29, 2018 .
56. Ervin RB, Kit BK, Carroll MD, Ogden CL. Consumption of added sugar among U.S. children and adolescents, 2005-2008. *NCHS Data Brief*. 2012: 1-8.
57. Centers for Disease Control and Prevention. About Adult BMI. https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html. Accessed July 17, 2018.
58. Pérez-Escamilla R. Acculturation, nutrition, and health disparities in Latinos. *Am J Clin Nutr*. 2011; 93(suppl):1163S–117S.
59. Ramírez AS, Golash-Boza T, Unger JB, Baezconde-Garbanati L. Questioning the dietary acculturation paradox: a mixed-methods study of the relationship between food and ethnic identity in a group of Mexican-American women. *J Acad Nutr Diet*. 2018;118: 431-439.
60. Stepler R, Lopez MH. U.S. Latino population growth and dispersion has slowed since onset of the Great Recession. Washington, DC: Pew Research Center. 2016. http://www.pewhispanic.org/2016/09/08/latino-population-growth-and-dispersion-has-slowed-since-the-onset-of-the-great-recession/. Accessed July 17, 2018.
61. Portes A, Fernández-Kelly P, Haller W. The adaptation of the immigrant second generation in America: theoretical overview and recent evidence. *J Ethn Migr Stud*. 2009;35:1077-1104.