Published in final edited form as:

J Immigr Minor Health. 2015 April ; 17(2): 349–357. doi:10.1007/s10903-013-9957-7.

Food Insecurity, Cigarette Smoking, and Acculturation Among Latinos: Data from NHANES 1999–2008

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Background

Food security is defined as “access by all people at all times to enough food for an active, healthy life” (1). Thus, limited or uncertain food supply or ability to acquire nutritionally adequate and safe food defines “food insecurity” (FI) (1). The strongest predictor of FI is poverty, but being from an ethnic/racial minority group, having lower educational attainment, and being of younger age are also important determinants of FI (2–4). These sociodemographic characteristics are common in Latinos, the youngest and fastest-growing racial/ethnic group in the United States (U.S.) (5). In 2010, the prevalence of FI among Latino households in the U.S. was almost double the national average (26.2% versus 14.5%, respectively) (6). Because FI is related to a wide range of adverse effects on health and quality of life across the lifespan (4, 7), this high rate of food insecurity among Latinos is a great public health concern; it is therefore important to understand risk factors associated with FI.

Common chronic diseases such as cardiovascular disease (CVD), cancer, diabetes, and depression, as well as poor general health, are related to both FI and smoking (4, 7–10) and are also highly prevalent among Latinos in the U.S. (11). FI is associated with consumption of more energy-dense (high-calorie) and low-cost foods to prevent hunger (4, 12). These high-calorie foods are often nutrient deficient and high in fat/sugar, and contribute to being overweight or obese and having poor general health (4, 12). Unhealthy diet and stress related to FI may also lead to the development of CVD, diabetes, or depression (9). It is plausible that both smoking and poor nutrition, particularly among food-insecure individuals, may contribute to the onset and progression of disease.

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There are no conflicts of interest to report.

The association between FI and acculturation, defined as the process by which immigrants adopt attitudes, values, customs, beliefs, and behaviors of a new culture (13), is unclear. Some studies have found that low acculturation is associated with FI (14–16), although these findings are not consistent (10, 17). Acculturation is known to be associated with cigarette smoking among Latinas, with smoking prevalence increasing with higher acculturation; however there is little evidence to suggest any association between smoking and acculturation among men (18).

Previous research indicated that smoking may be related to food insecurity (3, 19), although this relationship is still poorly understood. A nationally representative study by Cutler-Triggs and colleagues suggests that among adults, smoking inside the home was significantly associated with both FI (OR=2.2; 95% CI=1.6–3.0) and severe FI (OR=2.3; 95% CI=2.4–3.7) (3). Similarly, a study by Armour and colleagues reported that among low-income families smoking was associated with a 6% ($p < 0.01$) increased likelihood of FI (19).

Poverty encompasses different aspects of social and economic deprivation that are strongly associated with both food insecurity (1, 2, 6) and smoking (20, 21). Latinos in the U.S. have among the highest national poverty rates (26.7%) of any racial/ethnic group (22), and smoking is more prevalent among Latino adults living below the federal poverty level (31.1%) than among those at or above this level (19.4%) (21). This is concerning since evidence from the U.S. and abroad suggests that low-income smokers and tobacco-using households are likely to spend a larger proportion of their income on cigarettes than higher-income smokers, and may be diverting some of their income from necessary expenses, such as food, to purchasing tobacco (19, 23, 24).

Latinos within the U.S. are a vulnerable population who experience a disproportionate burden of poverty and other risk factors that are associated with morbidity and mortality (25). While the relationship between poverty and FI is well established, to our knowledge, no studies to date have assessed smoking and acculturation as potential risk factors for food insecurity while controlling for poverty status. This analysis aims to provide a deeper understanding of the possible risk factors associated with FI, including acculturation and smoking. We hypothesize that among Latinos, (1) current smoking will be associated with low food security; and (2) those who are less acculturated will show significant associations with low FI.

Methods

Data Source and Participants

This cross-sectional study used data from the 1999–2008 National Health and Nutrition Examination Surveys (NHANES), a nationally representative survey program that assesses the health and nutritional status of adults and children in the U.S. The NHANES is administered by the National Center for Health Statistics, which collected approximately 5,000 in-person surveys annually with 2-year data cycles being reported after 1999. Response rates across iterations were relatively consistent, ranging from 75.4–80%. NHANES oversampled certain population subgroups, including Latinos, to obtain more

reliable estimates from these groups. The survey design, which has been described in detail elsewhere (26), is a complex, multistage, probability-based sample of the civilian, non-institutionalized U.S. population. The current study restricted the sample to Latino adults 20 years of age and older, resulting in a sample of 6,935 eligible participants. Food insecurity data was missing for 254 respondents who were therefore excluded, leaving a final sample of 6,681 Latino adults.

Measures

Dependent Variable—FI was assessed using the U.S Department of Agriculture’s Food Security Survey Module (FSSM), a validated adult food security scale, included in NHANES since 1999, that is the basis for national-level reports of FI (6). Responses to the 10 FSSM questions about adult food security were categorized into three response levels based on the number of affirmative responses to FSSM questions (Table I). Adult food security was defined as follows: full food security (no affirmative response to any of these items), marginal food security (1–2 affirmative responses), and low food security (3–10 affirmative responses) (6). Full food security was the referent group for this study.

Independent Variables—Smoking status was defined as never, former, and current smoker. Using standard categorizations (21, 27), individuals who reported that they had never smoked or smoked less than 100 cigarettes during their lifetimes were classified as never smokers (the referent group). Former smokers were defined as participants who smoked at least 100 cigarettes during their lifetimes and were not currently smoking at the time of the survey. Participants who reported smoking at least 100 cigarettes in their lifetimes and smoked either every day or some days at the time of the survey were classified as current smokers.

While NHANES collects information that can be used to create a validated acculturation index based on language, these data were not consistently collected across all survey years, and consequently could not be used in this study. Therefore, language spoken, years in the U.S., and country of birth (nativity) were used as separate measures of acculturation. Although some researchers have assessed acculturation using a composite score (15, 28, 29) and these three measures are correlated, no standard approach has emerged regarding how to best create a composite variable with the measures we had available. Instead, research indicates that assessing individual aspects of acculturation is important since various aspects of acculturation are differentially associated with health outcomes (29–31). By testing each of the three chosen acculturation measures in separate statistical models, we can assess which is most strongly associated with FI. Additionally, the acculturation indicators (language, years in the U.S., and nativity) have been found to correlate significantly with more comprehensive acculturation scales (13), and account for a large portion of the variance in acculturation measures (32).

Language spoken at home was rated on a five-point scale from “only Spanish” to “only English.” These five categories were collapsed into three: “only/mostly Spanish,” “both equally,” and “only/mostly English” (the referent). Number of years in the U.S. was divided into five categories: “less than 5 years,” “5–9 years,” “10–19 years,” “20 or more years,”

and “born in the U.S.” (the referent). Finally, nativity was categorized as “born in Mexico,” “born in other Latin American country,” and “born in the U.S.” (the referent).

Covariates—The selection of covariates was theoretically driven and evaluated in bivariate and multivariate ordered logistic regressions. The NHANES sociodemographic variables of interest for this study included sex, age in years, educational attainment, poverty status defined by the poverty index ratio (PIR), marital status, and survey year. Data on other covariates of interest, such as social support and participation in food assistance programs, were only collected from older adults or were not collected consistently across all NHANES survey years and were therefore excluded from analysis. PIR is calculated by dividing family income by a poverty threshold (determined by the U.S. Census Bureau) specific to family size. PIR was used as a continuous variable with a range from 0 to 5. A PIR below 1.00 or 100% indicates that the income for the respective family is below the official definition of poverty, while a ratio of 1.00 or greater indicates income above the federal poverty level.

Analysis

All statistical analyses accounted for the complex, multistage, stratified, cluster-sampling design of NHANES and were weighted to give population-level estimates. Bivariate analyses (likelihood ratio chi-squares and *t* tests) were conducted to assess for group differences or associations between the dependent variable (FI) and each of the covariates (sex, age, PIR, educational attainment, citizenship, marital status, survey years), as well as the main independent variables (smoking status and acculturation indicators). Variables that were significant ($p \leq 0.05$) were retained for inclusion in a set of multivariable models. Educational attainment and citizenship variables were not included in the analyses because they were highly correlated with PIR and years in the U.S., respectively, and thus raised concerns about multicollinearity.

We next conducted multivariable logit regression models for ordinal outcomes using a partial proportional odds (PPO) model because the proportional odds assumption was violated. A strength of PPO models is that they allow the relaxation of the proportional odds assumptions for some or all of the predictors (33). This method avoids the loss of statistical power and decreased generalizability of our analytic conclusions by retaining the three categories instead of dichotomizing our ordinal outcome (33, 34). Statistical analysis employed a backward stepwise selection procedure that started with the full model and gradually imposed constraints in an iterative fashion using a series of Wald tests and an inclusion criterion of $\alpha = 0.05$. The model was then refitted with constraints, and the process was repeated until there were no more variables that met the parallel-lines assumption. A global Wald test was then conducted on the final model with constraints and compared to the original unconstrained (full) model to identify the best fitting model. The three acculturation measures were tested in separate models. We also allowed for listwise deletion, and therefore the PPO models were based on a reduced sample.

In all the models, we estimated odds ratios (ORs) and their 95% confidence intervals (CIs). In light of previous research that has revealed a differentiated association of acculturation,

sex, and poverty by smoking status (2, 10, 18, 31, 35), we included interaction terms in our models between smoking and each of the other variables to test their combined effects on FI. Thus, each of the following two-way interactions were tested in separate models: smoking status by each measure of acculturation, as well as smoking status by sex and smoking status by PIR for each measure of acculturation (separate models were created for each acculturation measure). All procedures were conducted using STATA 11.1 (StataCorp, College Station, Texas).

Results

Sample Characteristics

Table II describes the distribution of the sample's sociodemographic characteristics, smoking status, and acculturation indicators by food insecurity. While more than half of the sample (63.3%) self-reported being fully food secure, 16.0% were marginally secure, and 20.7% reported low food security. Most Latinos were young (56.1% were age 20–39), U.S. citizens by birth or naturalization (57.0%), spoke only or mostly Spanish (54.5%), and had incomes below 185% of the federal poverty level (60.9%) or a ratio of 1.85, which would qualify them for various food assistance programs (data not shown).

Latinos with low and marginal food security reported higher rates of current smoking (25.7% and 26.4%, respectively) than fully food-secure Latinos (19.7%). Latinos who spoke only or mostly Spanish made up 66.5% and 63.8% of Latinos with low and marginal food security, respectively, whereas 48.1% of fully food-secure Latinos spoke only/mostly Spanish. Compared to fully food-secure Latinos, a lower proportion of Latinos with low food security were born in the U.S., had some college education or more, were U.S. citizens by birth or naturalization, and lived in lower-income households (as indicated by the PIR). Men and women were nearly equally represented in each of the three food categories and more than half of the sample was married (58.4% among fully food secure and 52.9% among low food secure).

Multiple Partial Proportional Odds Models

The results of the adjusted multiple PPO models are presented in Table III (Model 1 = language, Model 2 = years in the U.S., Model 3 = nativity). Across the three models and compared to never smokers, current smokers had significantly higher odds of being marginally or low food secure versus being fully food secure ($OR \approx 1.50$). In contrast, when comparing full or marginal food security versus low food security, only Model 1 showed that current smokers had higher odds of low food insecurity compared to never smokers ($OR=1.32$; 95% $CI=1.11-1.57$).

Regarding the acculturation indicators, Latinos who spoke only or mostly Spanish (Model 1: $OR=1.24$; 95% $CI=1.07-1.43$) and those living in the U.S. between 10 and 19 years (Model 2: $OR=1.32$; 95% $CI=1.03-1.68$) had higher odds of food insecurity compared to Latinos who spoke only/mostly English or were born in the U.S. For Model 3 (nativity), only Latinos born in Mexico had higher odds of being food insecure than Latinos born in the U.S., but the result did not reach significance (Model 3: $OR=1.23$; 95% $CI=0.99-1.53$).

Poverty and being a younger or middle-aged adult (age 20–59) were strongly associated with being food insecure across all models.

No significant relationship was found between sex and food security in any of the models. Separate models assessed interactions between each of the acculturation indicators by smoking status, as well as sex by smoking status and PIR by smoking status with each respective measure of acculturation, but none of these interaction terms was found to be significant (data not shown).

Discussion

This research suggests that cigarette smoking is associated with FI among Latino adults in the U.S., a finding that has been previously demonstrated internationally and in the general U.S. population (3, 19, 23, 24). Our results showed that current smokers had higher odds of being food insecure compared to never smokers. These findings suggest that being a current smoker may contribute to nutritional deprivation in a population that is already disproportionately affected by poverty and poor health outcomes.

One potential explanation for this association is that smokers divert economic resources from food to purchase cigarettes (19, 23, 24), which suggests that smoking cessation could help improve food security. However, more complex relationships may be at work. Other factors may moderate the association between FI and smoking, such as stress related to FI and poverty or an increased difficulty with smoking cessation among those who are food insecure (36, 37). It is also possible that food-insecure people smoke to curb their appetites. While the correlate results of this study highlight an association between FI and smoking, additional research is needed to further elucidate this relationship.

Latinos face many socioeconomic disadvantages (25) that are associated with smoking, such as poverty, discrimination, and lower educational attainment (10, 20). As expected, we found that poverty was an important predictor of FI. In addition to its direct effect on FI, poverty is a major psychosocial stressor and a strong predictor of smoking behavior and lower cessation rates (36, 37). The combined effects of smoking, FI, poverty, and other underlying associated factors could contribute to or further complicate diseases related to smoking and FI, including CVD, diabetes, and cancer (4, 7–10, 12).

We found that acculturation is associated with FI among Latinos, although this relationship varied depending on the measure of acculturation. Less acculturated Latinos—as defined by those who speak primarily Spanish, and those living in the U.S. for 10–19 years—showed significant associations with FI when compared to highly acculturated individuals. These findings, consistent with previous studies, suggest that the language barrier could be one factor affecting Latinos' abilities to find well-paying employment, or to access and navigate public assistance programs that could help relieve FI (14, 38).

Our results show that Latinos living in the U.S. for 10–19 years had higher odds of FI than Latinos born in the U.S., but there was no significant relationship between FI and living in the U.S. less than 10 years. Explanations for this finding are not readily apparent and could not be discerned given the nature of the NHANES survey and dataset. Further research is

needed to confirm and clarify this finding. It is possible that using “years in the U.S.” to measure acculturation may not sufficiently capture the relationship between acculturation and FI compared to other aspects of acculturation such as language. Previous (albeit limited) research has noted that years in the U.S. and FI were not related (39), although, similar to our study, they do detect a relationship between language proficiency and FI (14–16, 39). By evaluating indicators of acculturation separately we assessed how specific components of acculturation relate to FI (30). In addition, the assessment of individual indicators of acculturation may be useful for the development of tailored public health interventions for Latinos. For instance, our study found that language spoken might be a better predictor for food insecurity than nativity, and therefore intervention efforts to alleviate food insecurity may be most effective by targeting Latinos that speak primarily Spanish.

Our study was subject to the following limitations: First, the cross-sectional nature of NHANES does not allow us to determine causal inferences between FI, acculturation, and smoking status. Longitudinal studies are needed to examine the temporal relationships between FI, acculturation, and smoking. Second, we cannot rule out unmeasured confounding due to factors we could not adjust for in the models that may be associated with FI, smoking status, and acculturation, such as food and nutritional assistance programs. Third, acculturation is a complex and multidimensional phenomenon. Although the proxies used in the study are important indicators of acculturation, they do not capture all the dynamics of this process. Lastly, we acknowledge that Latinos are a heterogeneous group with important differences in socioeconomic status, smoking rates, and, possibly, levels of FI. Because this information is crucial to tailoring smoking cessation and FI interventions, future research is warranted.

New Contribution to the Literature

In summary, the current study found that smoking and low acculturation predicted a higher prevalence of FI among Latinos. Smoking and FI can take a heavy toll on health. Considering that Latinos are the youngest and fastest-growing racial/ethnic group in the U.S., further research in this area will be of great public health importance. This study provides an initial effort to address some of the potential roots of health inequities related to FI and smoking among Latinos. Tobacco control researchers and the public health community at large should consider coordinating efforts with other public and social policy sectors to realize the shared benefits of an integrated approach to reducing FI and smoking in this vulnerable population.

Acknowledgments

This project has been funded in part with Federal funds from the National Cancer Institute, National Institutes of Health, U.S. Department of Health and Human Services, under Contract No. HHSN261201000043C.

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Table IU.S. Food Security Survey Module (FSSM)^a

Affirmative Responses to Food Security Survey Module (6)	
1	Was worried food would run out before we got money to buy more.
2	Brought food that did not last and did not have money to get more.
3	Could not afford to eat balanced meals.
4	Cut the size of meals or skipped meals because there was not enough money for food.
5	Cut the size of meals or skipped meals in 3 or more months over past 12 months.
6	Ate less than should because there was not enough money to buy food.
7	Was hungry but did not eat because could not afford enough food.
8	Lost weight because did not have enough money for food.
9	Did not eat for a whole day because there was not enough money for food.
10	Did not eat for a whole day in 3 or more months over last 12 months.

^a All items refer to status during the previous 12 months.

Weighted prevalence of sociodemographic characteristics of Latino participants by food security status, 1999–2008 National Health and Nutrition Examination Surveys ($n=6,681$)^a

Table II

Characteristics	Fully secure	Marginally secure	Low food security	Total
	($n=4240$, 63.3%) n (%) ^c	($n=1015$, 16.0%) n (%)	($n=1426$, 20.7%) n (%)	($n=6,681$) n (%)
Smoking status				
Current smoker	689 (19.7)	221 (26.4)	316 (25.7)	1226 (22.0)
Former smoker	1012 (19.8)	201 (15.4)	302 (18.0)	1515 (18.7)
Never smoker	2536 (60.6)	589 (58.2)	806 (56.3)	3931 (59.3)
Language spoken at home				
Only/mostly Spanish	2149 (48.1)	683 (63.8)	1037 (66.5)	3869 (54.5)
Both equally	651 (15.0)	109 (11.5)	160 (15.3)	920 (14.5)
Only/mostly English	1401 (37.0)	220 (24.7)	221 (18.2)	1842 (31.1)
Years in the U.S.				
<5	341 (11.1)	128 (14.8)	237 (16.7)	706 (12.8)
5–9	314 (8.9)	142 (16.1)	203 (14.2)	659 (11.1)
10–19	504 (14.9)	157 (17)	275 (21)	936 (16.5)
20+	1190 (24)	248 (19.9)	301 (19.1)	1739 (22.3)
Born in U.S.	1826 (41.2)	309 (32.2)	366 (29)	2501 (37.3)
Nativity				
Born in other Latin American country	702 (28.3)	157 (25.7)	206 (22.8)	1065 (26.7)
Born in Mexico	1711 (31.1)	549 (43.1)	854 (49.1)	3114 (36.8)
Born in U.S.	1826 (40.6)	309 (31.2)	366 (28.2)	2501 (36.5)
Sex				
Male	2028 (50.7)	456 (48.5)	678 (50.6)	3162 (50.3)
Female	2212 (49.3)	559 (51.5)	748 (49.4)	3519 (49.7)
Age (years)				
60+	1377 (13.5)	234 (8.6)	359 (10.2)	1970 (12.0)
40–59	1250 (32.3)	273 (29.3)	414 (32.7)	1937 (31.9)
20–39	1613 (54.2)	508 (62.1)	653 (57.1)	2774 (56.1)

Characteristics	Fully secure	Marginally secure	Low food security	Total
	(n=4240, 63.3%) n (%) ^c	(n=1015, 16.0%) n (%)	(n=1426, 20.7%) n (%)	(n=6,681) n (%)
Poverty index ratio				
Mean (95% confidence interval)	2.45 (2.35–2.56)	1.42 (1.29–1.54)	1.17 (1.05–1.29)	<0.001
Education				
< High school	2087 (38.8)	655 (59.6)	1056 (65.1)	3798 (47.6)
High school diploma/GEID	801 (21.2)	178 (19.3)	201 (17.8)	1180 (20.2)
Some college or associate degree	901 (26.2)	147 (17.8)	142 (13.8)	1190 (22.3)
College graduate +	439 (13.8)	31 (3.3)	25 (3.4)	495 (10.0)
Marital status				
Married	2872 (58.4)	695 (57.6)	928 (52.9)	4495 (57.1)
Divorced/widowed/separated	762 (13.9)	172 (12.3)	293 (15.7)	1227 (14.0)
Never married	1975 (27.7)	545 (30.1)	846 (31.4)	336 (28.9)
Citizenship				
Not U.S. citizen	1418 (36.7)	531 (53.5)	814 (54.4)	2763 (43.0)
Citizen by birth or naturalization	2807 (63.3)	477 (46.5)	606 (45.6)	3890 (57.0)
Survey year				
1999–2000	1016 (23.9)	210 (20.9)	323 (17.8)	1549 (22.2)
2001–2002	789 (19.5)	152 (15.3)	298 (22.2)	1239 (19.4)
2003–2004	722 (17.6)	153 (14.8)	223 (21.4)	1098 (17.9)
2005–2006	659 (17.6)	214 (22.3)	245 (16.6)	1118 (18.1)
2007–2008	1054 (21.4)	286 (26.7)	337 (22.1)	1677 (22.4)

^a Due to missing data, some demographic categories may not sum to the *n* indicated in column heading. Percentages may not sum to 100.0% due to rounding.

^b Likelihood ratio chi-squares and *t* statistics between smoking status and covariates.

^c Percents are weighted.

Separate Partial Proportional Odds Models of Food Insecurity for Each Acculturation Indicator,^a NHANES, 1999–2008

Table III

(Marginally & Low Food Secure) vs. Fully Food Secure ^b					Low Food Secure vs. (Fully & Marginally Food Secure ^c)				
Odds Ratio					95% CI				
Model 1: Language spoken					(n=6001)				
Smoking status					(n=6001)				
Never	Ref.				Ref.				
Former	1.14		0.99	1.32	1.14		0.99	1.32	
Current	1.51***		1.29	1.77	1.32**		1.11	1.57	
Language spoken at home									
Only/mostly English	Ref.				Ref.				
Both languages equally	0.87		0.71	1.06	0.87		0.71	1.06	
Only/mostly Spanish	1.24**		1.07	1.43	1.24**		1.07	1.43	
Sex									
Male	Ref.				Ref.				
Female	1.06		0.94	1.20	0.95		0.83	1.09	
Age									
60+ years	Ref.				Ref.				
40–59 years	1.64***		1.41	1.90	1.64***		1.41	1.90	
20–39 years	1.67***		1.45	1.93	1.44***		1.23	1.68	
Poverty index ratio ^d	0.42		0.39	0.45	0.42***		0.39	0.45	
Model 2: Years in the U.S.					(n=5953)				
Smoking status									
Never	Ref.				Ref.				
Former	1.04		0.82	1.34	1.04		0.82	1.34	
Current	1.51**		1.17	1.94	1.27		0.98	1.64	
Years in the U.S.									
Born in the U.S.	Ref.				Ref.				
20+ years	0.99		0.76	1.28	0.99		0.76	1.28	

(Marginally & Low Food Secure) vs. Fully Food Secure ^b					Low Food Secure vs. (Fully & Marginally Food Secure ^c)				
	Odds Ratio	95% CI	Odds Ratio	95% CI		Odds Ratio	95% CI	Odds Ratio	95% CI
10–19	1.32*	1.03	1.68	1.03	1.32*	1.03	1.68		
5–9	1.21	0.92	1.59		1.21	0.92	1.59		
<5	1.03	0.76	1.40		1.03	0.76	1.40		
Sex									
Male	Ref.				Ref.				
Female	1.03	0.88	1.21		0.91	0.77	1.07		
Age									
60+ years	Ref.				Ref.				
40–59 years	1.62***	1.29	2.03		1.62***	1.29	2.03		
20–39 years	1.34*	1.01	1.79		1.34**	1.01	1.79		
Poverty index ratio ^d	0.44***	0.38	0.51		0.44***	0.38	0.51		
Model 3: Nativity					(n=6047)				
Smoking Status									
Never	Ref.				Ref.				
Former	1.04	0.82	1.33		1.04	0.82	1.34		
Current	1.50***	1.17	1.91		1.26	0.98	1.64		
Nativity									
Born in U.S.	Ref.				Ref.				
Born in Mexico	1.23	0.99	1.53		1.23	0.99	1.53		
Born in other Latin American country	1.02	0.79	1.31		1.02	0.79	1.31		
Sex									
Male	Ref.				Ref.				
Female	1.03	0.89	1.20		0.92	0.78	1.08		
Age									
60+ years	Ref.				Ref.				
40–59 years	1.68***	1.36	2.08		1.68***	1.36	2.08		
20–39 years	1.41*	1.08	1.84		1.41*	1.08	1.84		
Poverty index ratio ^d	0.45***	0.39	0.51		0.45***	0.39	0.51		

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* $P < 0.05$;
** $P < 0.01$;
*** $P < 0.001$

NHANES= National Health and Nutrition Examination Survey, CI confidence interval, Ref =referent group
Note: These models also controlled for survey year (data not shown).

^a Acculturation indicators include: language spoken at home, number of years living in the U.S., and nativity.

^b Fully food secure is the referent.

^c Fully & marginally food secure are the referent.

^d Poverty index ratio is a continuous variable.