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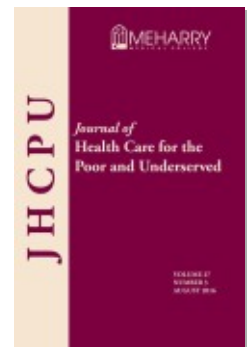
Sociodemographic Factors, Acculturation, and Nutrition Management among Hispanic American Adults with Self-reported Diabetes

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Sociodemographic Factors, Acculturation, and Nutrition Management among Hispanic American Adults with Self-reported Diabetes

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Abstract: This study aimed to examine whether sociodemographic factors and acculturation affect achievement of selected American Diabetes Association (ADA) nutrition therapy recommendations among Hispanics with diabetes. Cross-sectional data for Hispanics with diabetes in the National Health and Nutrition Examination Survey (NHANES) 2003–2010 were used. Achievements of the ADA recommendation for five nutrition components were examined (i.e., daily intake of saturated fat, cholesterol, sodium, and fiber, and daily servings of alcohol). Acculturation measurement derived from language use, country of birth, and length of residence in the U.S. Logistic regressions were performed. Only 49% of Hispanics with diabetes met three or more recommended criteria. Male gender and younger age (≤45) predicted poor recommendation adherence. More acculturated individuals had around 50% lower odds to achieve saturated fat [OR 0.5, CI 0.2–0.7], fiber [OR 0.5, CI 0.2–0.9], sodium [OR 0.5, CI 0.3–0.9] and cholesterol intake [OR 0.5, CI 0.3–0.8] recommendations than their less acculturated counterparts.

Key words: Sociodemographic variation, acculturation, nutrition management, Hispanic Americans with diabetes.

Nutrition management is an important and most challenging part of treatment for individuals with diabetes. Individuals' food choices have direct effects on energy balance and also affect blood pressure and lipid level.[1] Data from the National Health and Nutrition Examination Survey (NHANES) have shown that adherence to dietary recommendations is poor among U.S. adults with diabetes.[2] In accordance with nutri-

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tion therapy recommendations from the American Diabetes Association (ADA), one study reported that protein, saturated fat, and fiber recommendations were only met by 65%, 28%, and 18% of U.S. adults with diabetes, respectively.[2] Sociodemographic factors, such as age, gender, education, income, and insurance status, may affect to what extent diabetes patients incorporate recommended diets in their daily life;[3,4,5] cultural influences may also have an impact on nutrition management in some individuals with diabetes, particularly in groups comprising a large proportion of immigrants.[6–9] However, few studies have examined the sociodemographic variability of conformity to nutrition therapy recommendations among Hispanic American adults with diabetes. Even fewer studies have reported how cultural influences, acculturation for example, relate to their daily implementation of nutrition recommendations.

Socioeconomic status is a determinant of health and contributes significantly to disease and management disparities.[10] It is reported that more Hispanics live in poverty (8.6%) than non-Hispanic Whites (2.2%)[11] and many more Hispanic Americans with diabetes (60%) than non-Hispanic Whites with diabetes (28%) have an annual income below $20,000.[12] Evidence has also shown that Hispanic Americans with diabetes have poorer access to care, greater frequency of lacking health insurance, and poorer literacy than their White counterparts.[13,14] These barriers may keep Hispanic diabetes patients from engaging in healthy dietary behaviors, thus hampering the effectiveness of diabetes management. What makes maintaining a healthy diet more difficult for Hispanic American diabetes patients than U.S. individuals with diabetes in general is the influence of acculturation.[6–9]

Acculturation is the process by which minority groups adopt the attitudes, values, customs, beliefs, and behaviors and practices of the host society.[8] Previous studies have documented that when immigrants arrive in the host country, they are healthier than the native population. This may be because immigrants tend to represent selected groups of people, who are healthier than their counterparts who remain in the country of origin; the cultural orientation of immigrants is protective and can buffer against adverse health outcomes.[15] For example, the culture of immigrants may encourage healthy behaviors and strong social support systems, and reinforce positive health norms including a healthy diet. However, this initial health advantage erodes over time as unhealthy behaviors of the host county population are gradually adopted.[15] Some research has suggested that longer residence in the U.S. was associated with an increase in portion size and greater consumption of processed food, for example.[16] Country of birth and language have been shown in multiple studies to be associated with dietary quality decline in U.S. minority populations.[16–20] These studies further suggested that in Hispanic populations, acculturation is associated with suboptimal lifestyle choices, including low intake of fruits and vegetables and high consumption of sugar and fat.[16–20] Additionally, sociodemographic factors may influence acculturation, and lead to a variety of lifestyle changes including diet among immigrant populations. Poverty may create a speedier adoption of Western diet among immigrants living in disadvantaged neighborhoods.[21–24] It is documented that low-income neighborhoods are more likely to have fast-food restaurants, liquor stores, and convenient stores, all of which supply exposure and easier access to unhealthy foods.[22–24] Age and gender appear to influence acculturation,[25] bringing variability to nutritional profiles among Hispanic Americans

with diabetes. Younger individuals may assimilate and adopt Western dietary habits more quickly than their older counterparts.[25,26] This is probably due to their more frequent interaction with U.S. peers, and more speedy second language acquisition.[25,26] As heads of the households, immigrant men usually work long hours and may have more contact with American culture including fast foods.[27,28] Women, in contrast, may have household duties, greater chance of contact with culture of origin, and greater chance of adhering to traditional diets and cooking styles.[27,28]

It is likely that sociodemographic factors along with acculturation play a significant role in nutritional management among Hispanics with diabetes in the U.S.[29] However, few studies have explored in details of how nutritional profiles vary by these factors in this population. The diabetes epidemic has been disproportionately affecting Hispanic Americans; in comparison with non-Hispanic Whites, they have a higher prevalence of diabetes, more complications, and worse outcomes.[2,30,31] Recent research has projected that the prevalence of diabetes will continue increasing among Hispanic Americans.[31] To allocate public health resources to achieve better nutrition among Hispanic Americans with diabetes effectively, examination of how implementation of nutrition therapy recommendations differs by sociodemographic and acculturation level is needed.

The objectives of the current study were to determine 1) what sociodemographic factors are associated with achievement of selected ADA nutrition therapy recommendations in Hispanic American adults with diabetes, and 2) the degree to which the achievement is attributable to acculturation. The current study was informed by the most recent ADA statement on nutrition therapy for all individuals with diabetes, which was published in 2013.[1] The statement calls for initiatives to promote and support healthful eating patterns; to address individual nutrition needs based on personal and cultural preferences, healthy literacy, and numeracy, as well as access to healthful food choices; and to provide the individual with diabetes with practical tools for day-to-day meal planning.[1] This study focused on five selected ADA nutrition criteria regarding dietary fiber, saturated fat, dietary cholesterol, alcohol and sodium. Some nutrients (e.g., carbohydrates, protein, total fat, omega-3 fatty acids, micronutrients, and herbal supplements) were not included since the ADA found the available evidence too inconclusive to set a quantitative recommendation for intake. Other nutrients such as whole grains, fructose, and plant stanols and sterols were not included in the study due to the unavailability of data from NHANES dietary survey. We considered dietary fiber because of its beneficial effects in fasting blood glucose and HbA1C control for diabetes patients.[32,33] Saturated fat and dietary cholesterol are also relevant to the study because they are closely associated with obesity and cardiovascular diseases (CVD).[34,35] Excessive weight gain plays a central pathogenic role in the development of diabetes,[34] and CVD is a common cause of death among individuals with diabetes.[1] Additionally, moderate sodium intake is important because of its connection to blood pressure control, which can affect diabetes complications such as heart attack or stroke.[36] Finally, we considered alcohol consumption. Excessive alcohol consumption may pose risks for diabetes patients with delayed hypoglycemia, especially if they are taking insulin or insulin secretagogues.[37]

Methods

Design. Data from Continuous NHANES 2003–2010 were used for the current analysis. The Continuous NHANES is a complex, multistage probability sample of U.S. noninstitutionalized civilians that started in 1999. Six two-year cycles have been completed. Each of these cycles examines a nationally representative sample of approximately 10,000 people and collects information on the health and nutritional status of adults and children. The procedures are described in detail elsewhere.[38] Some subgroups are oversampled, including Non-Hispanic Blacks and Hispanics so that the reliability and precision of estimated health status indicators for these groups are ensured. Continuous NHANES is approved by the National Center for Health Statistics Research Ethics Review Board.

Sample. This current study included 622 Hispanic American adults (20 years of age or older) with a previous diagnosis of diabetes indicated via questionnaire. Individuals who answered affirmatively to the question, "Has a doctor ever told you that you have diabetes?" were eligible for the study.

Measures. *Acculturation status*. NHANES 2003–2010 has information on three proxies for acculturation: country of birth, language spoken at home, and length of time in the U.S. Country of birth was categorized as U.S.-born or foreign-born for this study. Individuals born in the U.S. were those born in the 50 U.S. states or Washington, D.C.; all others including individuals born in Mexico, Other Spanish-Speaking Country, or Other Non-Spanish Speaking County including U.S. territories were classified as foreign-born (n=1). Language spoken at home for Hispanics was classified as 1) English-speaking and pro-English (More English than Spanish and Only English) and 2) Spanish-speaking and pro-Spanish (only Spanish, more Spanish than English, both equally). Among the foreign-born, years in the U.S. was categorized as living in the U.S. 20 years or longer, living in the U.S. 10–19 years, and living in the U.S. less than 10 years.

We constructed an acculturation score for each individual based on these proxy measures. Combining country of birth and length of time in the U.S., a 0–3 score was assigned based on four categories (3=U.S. born, 2=foreign-born and lived in the U.S. ≥20 years, 1=foreign-born and lived in the U.S. 10–19 years, 0=foreign-born and lived in the U.S. <10 years.). A score of 0–2 was assigned to language spoken at home (2=English only or pro-English, 1= both equally, 0=Spanish or pro-Spanish). These scores were summed to yield a total acculturation score, ranging from 0 (least acculturated) to 5 (most acculturated). This scale was based on one used in a previous study of Hispanic and Chinese populations.[27] Instead of using the three components as separate variables, the authors argued that an acculturation score gives a more accurate representation of acculturation status than each independent indicator in that these characteristics are usually clustered within an individual and they are inseparable.[39] For the purpose of interpretability, scores were used to dichotomize individuals into less (0–2) and more (3–5) acculturated groups. This categorization was based on the distribution of the scores.

Five nutrition therapy recommendation guidelines. The main dependent variables of the analysis were daily saturated fat, dietary fiber, dietary cholesterol, and sodium

intakes and servings of alcohol. Information on these variables was obtained from NHANES dietary interviews 2003–2010. The average of total nutrient intake from two day's recall was calculated for each of the five dietary factors. NHANES dietary datasets prior to 2003 contain only one day's dietary recall data and were excluded from the analysis. Participants' diets were evaluated according to whether they met the most recent ADA nutrition therapy recommendations for individuals with diabetes.[1] Achievement of recommendations for each factor were defined as follows: dietary fiber≥14g/1,000 kcal daily; saturated fat ≤10% of caloric intake; dietary cholesterol <300 mg/day; alcohol ≤1drink/day (15mg) for women and ≤2 drinks/day (30mg) for men; and sodium ≤2300 mg/day.

Sociodemographic variables. Sociodemographic variables included gender, age (20–45, 46–60 or ≥61 years), education (<high school, =high school or equivalent or >high school), marital status (yes or no), and poverty-income ratio (PIR) (<1, 1≤PIR<3, or PIR≥3). Poverty-income ratio divides family income by the poverty threshold and was used as the indicator of income level in the analysis. The poverty thresholds are adjusted for state and family size and are updated annually for inflation.[39] A PIR below 1 indicates that the family is below the poverty threshold. Insurance coverage was categorized into 1) public insurance including Medicare and Medicaid and other forms of government insurance, 2) private insurance, and 3) no health insurance.

Analysis. Statistical analyses were conducted using SAS version 9.3(SAS Institute Cary, NC). Analyses incorporated the sampling weights generated for six Continuous NHANES survey cycles by the Centers for Disease Control and Prevention.[38] Univariate analyses were performed, with chi-square tests used to assess the statistical significance of differences in meeting nutrition recommendations according to sociodemographic factors. Multivariable logistic regressions were then conducted to investigate the associations of each sociodemographic variable with achievement of nutrition recommendations. We conducted multivariate analyses to assess the relative odds that Hispanics with diabetes with less acculturation (score 0–2) achieved each recommendation vs. those with more acculturation (score 3–5), controlling for the potential confounding variables of age, gender, education, marital status, insurance status and income.

Results

A majority of Hispanic Americans with diabetes fell into the oldest age group (60%) (≥61 years old), had limited educational attainment (less than high school) (61%), were married (59%), had public (37%) or no insurance (30%), and had low (PIR<1) (33%) or medium (1≤PIR<3) income (21%). Very few (7%) Hispanics with diabetes met all five nutritional targets. Less than half (48%) of them met three or more criteria.

ADA nutrition therapy recommendation achievement and sociodemographic factors. Only 51%, 18%, and 38% of Hispanic Americans with diabetes achieved saturated fat, fiber and sodium intake recommendations, respectively. Female Hispanics with diabetes had higher frequencies of reaching cholesterol, and sodium recommendations. Individuals in the 20 to 45 years group had the lowest frequencies of achievements of daily fiber, sodium and three or more goals. It appeared that low education group had higher frequencies of meeting saturated fat, fiber, sodium and three or more tar-

gets. Contrary to expectation, no insurance and public insurance groups had higher frequencies of adhering to fiber, sodium, and alcoholic drinks recommendations. Another unexpected result was that poverty group had higher frequencies of meeting fiber, sodium, and three or more criteria (Table 1).

Results from multivariable analysis showed that in comparison with female, male Hispanics with diabetes had 70% and 60% lower odds to have reduced daily cholesterol and sodium enough to achieve recommendations [OR 0.3, CI 0.1–0.5 and OR 0.4, CI 0.2–0.6, respectively]. Hispanics with diabetes in older age groups were more likely to achieve dietary fiber and sodium intake recommendations. The odds of having recommended sodium intakes were around four times and six times higher, respectively, in age groups 46 to 60 years old and 61 years old or older than of individuals 45 or younger [OR 4.0, CI 2.0–7.9 and OR 6.2, CI 3.2–11.9, respectively]. After adjusting for other covariates, educational attainment and insurance status no longer significantly predicted any criterion achievement. Family income was inversely associated with achieving dietary fiber recommendations. The odds of meeting the dietary fiber recommendation in the highest income group (PIR≥3) were 50% lower than of individuals under the poverty line [OR 0.5, CI 0.2-0.9] (Table 2).

ADA nutrition therapy recommendation achievement and acculturation status among Hispanics with diabetes. Results from univariate analysis of acculturation and achievement of the five nutrition therapy recommendations indicated that acculturation was significantly associated with poor adherence to saturated fat, fiber, cholesterol and sodium intake recommendations among Hispanics with diabetes (all p-values<.05). After adjusting for demographic factors (gender, age, education, marital status, insurance status, and family income), associations between acculturation and saturated fat, dietary fiber, cholesterol, and sodium intake recommendation achievement remained statistically significant. Individuals in the more acculturated group had 50% lower odds of achieving saturated fat [OR 0.5, CI 0.2–0.7)], 55% lower odds of achieving fiber [OR 0.5, CI 0.2–0.9)], 50% lower odds of achieving cholesterol [OR 0.5, CI 0.3–0.9], and 50% lower odds of achieving sodium [OR 0.5, CI 0.3–0.8] intake targets compared with their acculturated counterparts. More acculturated Hispanics with diabetes had overall worse adherence to the ADA's recommendation. They had 70% lower odds of achieving three or more criteria recommendations than their less acculturated counterparts [OR 0.3, CI 0.2–0.5] (Table 2).

Discussion

Our study highlighted gender, age and income differences in achievement of ADA nutrition therapy criteria among Hispanics with diabetes. Success in meeting three or more nutritional goals differed significantly by gender, with Hispanic female diabetes patients doing better than their male counterparts. In addition, Hispanic females with diabetes were more likely to meet cholesterol, sodium, and alcoholic drinks criteria specifically than their male counterparts. Older Hispanics with diabetes were more likely to meet fiber, sodium and three or more recommendations than younger ones. Notably, we found income was inversely related to fiber intake recommendations even after adjusting for other demographic factors. Prior studies have also suggested that

Table 1.

PERCENT ACHIEVEMENT WITH ADA NUTRITION THERAPY RECOMMENDATION BY SOCIODEMOGRAPHIC CHARACTERISTICS AND ACCULTURATION (N=622)[a,b]

	Saturated Fat (n, %)	Fiber (n, %)	Cholesterol (n, %)	Sodium (n, %)	Drink (n, %)	Achieved ≥3 criteria (n, %)
Gender	**	*		*	*	**
Male	130 (51)	43 (15)	144 (48)	77 (23)	243 (86)	104 (33)
Female	188 (49)	69 (16)	238 (75)	157 (40)	321 (94)	199 (54)
Age		**		**		*
20–45	40 (50)	7 (8)	41 (54)	13 (13)	70 (90)	27 (31)
46–60	78 (47)	30 (17)	106 (63)	57 (31)	151 (88)	77 (44)
≥61	200 (58)	75 (20)	235 (70)	164 (48)	343 (93)	199 (55)
Education	*	*		*		*
<High school	235 (57)	94 (21)	263 (67)	183 (38)	373 (91)	224 (50)
=High school or equivalent	40 (56)	4 (6)	40 (53)	26 (37)	71 (93)	34 (44)
>High School	42 (34)	14 (7)	77 (59)	24 (18)	117 (88)	44 (32)
Married						
Yes	183 (48)	67 (16)	221 (64)	133 (32)	332 (91)	176 (44)
No	135 (53)	45 (14)	161 (62)	101 (33)	232 (88)	127 (45)
Insurance				*	*	
Private	66 (48)	13 (8	85 (56)	40 (24)	131 (85)	60 (36)
Public	146 (45)	57 (17)	186 (69)	121 (40)	273 (94)	145 (47)
No	105 (58)	42 (20)	110 (62)	72 (32)	159 (91)	97 (49)

Table 1. (*continued*)

	Saturated Fat (n, %)	Fiber (n, %)	Cholesterol (n, %)	Sodium (n, %)	Drink (n, %)	Achieved ≥3 criteria (n, %)
PIR	*	*		*		*
<1	112 (53)	41 (16)	125 (63)	94 (39)	180 (92)	111 (50)
1≤PIR<3	132 (52)	46 (17)	163 (67)	85 (32)	229 (89)	123 (47)
PIR≥3	27 (37)	6 (5)	49 (53)	21 (20)	88 (89)	27 (29)
Acculturation	**	**	*	**		**
More acculturation	103 (62)	22 (8	158 (56)	78 (23)	260 (91)	99 (30)
Less acculturation	205 (62)	87 (23)	214 (69)	146 (41)	289 (89)	194 (58)

* p<.05
** p≤.001

[a] p-values are from chi-square tests for associations of each general sociodemographic characteristic and conformity to intake targets.
[b] All numbers and percentages of individuals in each specific category are weighted.
Note: Missings = PIR 1, Education 3, Insurance1; Fiber 33; Cholesterol 33; Sodium 33; Acculturation 16.

Table 2.

MULTIVARIABLE LOGISTIC ANALYSIS OF THE ASSOCIATION BETWEEN ADA NUTRITION THERAPY RECOMMENDATION ACHIEVEMENT[e] AND SOCIODEMOGRAPHIC CHARACTERISTICS AND ACCULTURATION[a,b,c]

	Saturated Fat OR (95% CI)	Fiber OR (95% CI)	Cholesterol OR (95% CI)	Sodium OR (95% CI)	Drink OR (95% CI)	Achieved ≥3 OR (95% CI)
Sociodemographics						
Gender						
Male	1.1	0.7	0.3**	0.4**	0.4*	0.3**
	(0.7–1.7)	(0.7–2.2)	(0.1–0.5)	(0.2–0.6)	(0.2–0.9)	(0.2–0.5)
Age						
46–60	1.0	2.5	1.3	4.0**	0.6	1.9*
	(0.6–1.6)	(0.8–8.0)	(0.7–2.5)	(2.0–7.9)	(0.28–1.35)	(1.1–3.3)
≥61	1.2	3.1*	1.8	6.2**	0.9	2.8**
	(0.7–2.0)	(1.0–9.5)	(0.9–3.6)	(3.2–11.9)	(0.3–2.6)	(1.5–5.1)
Education						
=High school or equivalent	1.4	0.4	0.6	1.3	1.4	1.2
	(0.7–2.5)	(0.2–1.1)	(0.3–1.1)	(0.6–2.8)	(0.4–4.8)	(0.6–2.7)
>High School	0.51*	0.60	0.87	0.56	0.81	0.80
	(0.3–0.8)	(0.3–1.3)	(0.5–1.5)	(0.3–1.1)	(0.4–1.7)	(0.5–1.4)
Married						
Yes	0.7	1.1	1.4	1.2	1.9*	1.0
	(0.4–1.0)	(0.6–2.0)	(0.9–2.1)	(0.7–2.0)	(1.0–3.1)	(0.6–1.7)

Table 2. (*continued*)

	Saturated Fat OR (95% CI)	Fiber OR (95% CI)	Cholesterol OR (95% CI)	Sodium OR (95% CI)	Drink OR (95% CI)	Achieved ≥3 OR (95% CI)
Insurance						
Private	0.6*	0.7	1.5	1.0	1.2	0.7
	(0.4–0.8)	(0.3–1.4)	(0.9– 2.5)	(0.6–1.7)	(0.5–3.1)	(0.4–1.1)
Public	1.0	0.6	1.1	1.0	0.5	0.9
	(0.7–1.4)	(0.3–1.3)	(0.5– 2.3)	(0.5–1.8)	(0.2–1.1)	(0.4–1.9)
PIR						
1≤PIR<3	1.0	1.1	1.4	0.7	0.8	1.0
	(0.7–1.4)	(0.6–2.0)	(0.9–2.3)	(0.4–1.2)	(0.3–2.1)	(0.6–1.5)
3≤PIR	0.8	0.5*	1.0	0.6	1.1	0.7
	(0.5–1.6)	(0.2–0.9)	(0.5–2.2)	(0.4–1.1)	(0.2–5.4)	(0.3–1.5)
Acculturation						
more Acculturation	0.5**	0.5	0.5*	0.5*	1.5	0.3**
	(0.2– 0.7)	(0.2– 0.9)	(0.3–0.9)	(0.3–0.8)	(0.8–3.0)	(0.2–0.5)

* p<.05
** P≤.001

[a] p-values are from chi-square tests for adjusted logistic regressions.
[b] All results are weighted.
[c] Gender: female as referent; Age: 20–45 as referent; Education: less than high school as referent.

Note: Married: not married as referent; Insurance: not insured as referent; PIR: less than 1 as referent; Acculturation: less acculturated as referent. OR stands for Odds ratio; numbers in parentheses are corresponding 95% confidence intervals. Covariates adjusted for in all models include age, gender, education, marriage status, insurance status, and poverty-income ratio.

Hispanic Americans with socioeconomic disadvantage may be more likely to maintain their traditional diet, which may be high in fiber.[7,40]

Acculturation and adherence to five nutrition therapy criteria. Acculturation among Hispanic Americans with diabetes, as measured by language, country of birth and length of residency in the U.S., was significantly associated with their adherence to the ADA's nutrition therapy recommendations, even after controlling for a variety of demographic factors. In Hispanics with diabetes, those who were less acculturated tend to have better nutrition therapy adherence than their more acculturated counterparts. These findings were consistent with Mainous and colleagues' study using NHANES 1999–2004 data that assessed acculturation and healthy lifestyle among Hispanics with diabetes;[6] those researchers concluded that less acculturated Hispanics with diabetes had better adherence to saturated fat and fiber intake recommendations. The influence of acculturation on these nutritional criteria adherence didn't appear to change over the two study periods.

We additionally updated the knowledge of acculturation and nutrition management based on our employment of the latest ADA guideline and more comprehensive acculturation measurement. The previous study used the 2006 ADA dietary guidelines, which have been replaced by the ADA's 2013 version. Moreover, they did not find a significant association between the acculturation and cholesterol recommendation adherence and didn't address the sodium intake recommendation at all. We did find a significant association between acculturation and cholesterol criterion compliance. In the latest ADA guideline, criterion of daily cholesterol intake became less strict compared with the previous version (<300 mg/day vs. <200 mg/day). It is likely that this criterion change resulted in the significant association between acculturation and cholesterol intake compliance observed in our study. The significant association found in our study may be also contributable to our more comprehensive operationalization of acculturation. In contrast with the previous study, we did not operationalise acculturation solely based on language use information but incorporated country of birth and length of residency as well. In fact, when acculturation was initially assessed by country of birth in the previous study, an association of low cholesterol intake was apparent, which further suggested that nativity plays a role in immigrants' nutrient intakes, and that acculturation measurement should take that into account in the assessment of its relationship with diet. We additionally examined the relationship of acculturation and sodium intake, which few studies had done before. The current average American sodium intake of 3400 mg/day is excessive and should be cut down, according to the ADA among others.[41] Approximately 75% or more of the sodium Americans eat is from processed, packaged foods. The increased consumption of processed food in the course of acculturation is a plausible reason for the heightened intake of sodium in Hispanics with diabetes. Adopting the dietary practices typical of the U.S. as a whole may also be the major reason for poor adherence to the ADA's nutritional criteria in general. We did not find a significant association between acculturation and achievement of recommendations on alcohol consumption. It is proposed that acculturation can promote increased alcohol consumption due to the adoption of more favorable drinking norms or the need to cope with the social stress of adaptation among general Hispanic immigrant populations.[42] However, findings regarding this relationship have

been equivocal, and have varied by gender and ethnic subgroups.[42] Our results suggest that the majority of Hispanics with diabetes achieved the recommended alcohol intake guideline, but acculturation did not appear to influence this achievement. Future studies with sample size adequate to stratify gender and Hispanic ethnic groups further would be valuable for the purposes of assessing the relationship between acculturation and alcohol intake among Hispanics with diabetes.

Strengths and limitations. Our study extended the evidence of sociodemographic heterogeneity in adherence to ADA nutrition therapy guidelines in U.S. Hispanics with diabetes and of the relationship of acculturation to nutrient criteria compliance among them. The study had several limitations. First, as individuals in our study were those who self-reported with a previous diagnosis of diabetes, individuals with undiagnosed diabetes were not included. Our study therefore did not capture the entire population of U.S. Hispanics with diabetes. However, we would argue that only those being told by doctors that they have diabetes or elevated risk of diabetes would be expected to show concern about diabetes-specific nutrition management. Therefore, it made sense to assess how diagnosed individuals with diabetes taking actions on attaining and maintaining proper diet and correspondingly suggest interventions. Another limitation of the study was fact that we were unable to distinguish type 1 and type 2 diabetes based on NHANES questionnaire data. However, nutrition management is necessary for both type 1 and type 2 diabetes patients.

Further, the findings on acculturation and nutrition therapy recommendation adherence are applicable to Hispanics with diabetes, but might not be generalizable to other minority populations such as Asian and Pacific Islanders. Additionally, this analysis may not include undocumented Hispanic immigrants, who make up a great percentage of the total Hispanic immigrant population in the U.S.[43] Finally, due to the cross-sectional design of the study, no causal relationships can be inferred.

Conclusion. Our study found that the overall adherence to recommended ADA nutrition therapy criteria among Hispanics with diabetes in the U.S. was poor, and it differed by sociodemographic factors. In general, older age and female gender predicted better adherence to recommended dietary criteria. Acculturation appeared to play an important role in individuals' attainment of recommended nutrient intakes. Intervention strategies emphasizing diets low in saturated fat, dietary cholesterol, and sodium and high in fiber may thus be particularly important for young and male Hispanics with diabetes. Efforts to increase the availability and accessibility of traditional foods and familiarity with healthy options available from more standard Western produce sources and other sources within Hispanic American communities are necessary. It is important for every level of the society, including health professionals, community groups, business, and government working together to help improve nutritional profiles of individuals with diabetes. Further, considering the critical role of family in diabetes control and management, and the fact that Hispanics greatly emphasize familism, intervention strategies targeting families may help engender commitment to these goals within these communities. A health promotion program that creates a supportive environment for learning about, sharing, and practicing healthy cooking skills and traditions could maximize cultural compatibility and be particularly effective in reducing the potential negative results of acculturation and changing

dietary behaviors for Hispanic Americans with diabetes, especially for younger individuals.

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