Acculturation and Diet Among Mexican-American Women:

How Nativity and Language are Jointly Associated with Dietary Intake

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ABSTRACT

There is a growing literature that acculturation of Hispanic persons in the US corresponds with health behaviors. Diet is a key health behavior whose directional association with acculturation is inconclusive. Understanding the true association is fundamental for developing a comprehensive picture of the behavioral changes that can accompany acculturation, and the health outcomes these may engender. We use data from the 2000 National Health Interview Survey to investigate the relationship between acculturation and diet among Mexican-American women. We incorporate two proxy measures of acculturation – nativity and a language composite – to predict dietary intake. Our results demonstrate that women born in Mexico and women with lower levels of language acculturation have healthier dietary intakes, and that the proxy measures are uniquely related to intake estimates. These findings should inform public health efforts concerning Mexican-American women. Furthermore, our findings underscore the importance of incorporating both acculturation measures in similar research.

There is increasing evidence that Hispanic persons who are more acculturated into mainstream American socio-cultural practices engage in unfavorable health behaviors and experience higher mortality rates when compared to their less acculturated counterparts (1-4). Generally disadvantageous changes in health behaviors such as dietary quality (5-17), physical activity (18), smoking (6, 19), and substance abuse (6, 19-22) have been associated with acculturation processes. These behavioral changes are troublesome because they elevate risks for chronic diseases such as diabetes, cardiovascular disease and certain cancers (8, 23-25).

Previous evaluations of the relationship between acculturation and dietary quality among Hispanics have been mixed. Some studies report that acculturation is associated with a decline in dietary quality (5, 7-12, 26), while other studies report both healthy and unhealthy dietary choices are adopted (6, 13-15, 17). Two comprehensive reviews of acculturation literature concluded that inconsistent findings and study designs, particularly the inconsistent measurement of acculturation, hinder a definitive conclusion about the effects of acculturation on overall dietary quality and chronic disease risk (3, 27). Most studies include a single proxy measure of acculturation such as language, nativity, time in the US, or generational status. However, acculturation is a complex and multidimensional process that may evolve in an interactive and nonlinear manner (3, 28, 29). Recent literature encourages multidimensional measurements of acculturation that encompass contextual and process dimensions at a minimum (3, 28). Some suggest including both nativity and language because they tap multiple dimensions, and because they are the most practical measures that can be widely used in surveys and public health programs (3).

In this article, we examine the association between acculturation and diet using a two-dimensional assessment of acculturation. We use the 2000 National Health Interview Survey

(NHIS) to analyze data on Mexican-American women to determine whether acculturation is associated with changes in dietary outcomes. Specifically, we investigate whether including nativity, language and their interaction clarifies the association between acculturation and three summary measures of diet: percent of calories from fat, intake of fiber, and intake of fruits and vegetables.

MATERIALS AND METHODS

Sample

Subjects are 1,254 non-pregnant women of Mexican descent between 25 and 64 years of age who responded to the 2000 National Health Interview Survey sample adult questionnaire. The NHIS is the principal source of information on the health of the non-institutionalized civilian population of the United States and is one of the major survey programs of the National Center for Health Statistics. A detailed description of the survey and the sampling protocol are provided elsewhere (30). The 2000 sample adult questionnaire included a cancer control module sponsored by the National Cancer Institute. This module collected information on Hispanic acculturation and several health behaviors including diet, tobacco, physical activity and cancer screening. We used case-wise deletion for the few respondents who did not provide information for all variables in the regression models.

Acculturation

We use nativity and language as proxy measures of acculturation selected for the analysis. Nativity is measured as foreign versus US-birth. The language acculturation measure is

a constructed index from 5-items: language usually spoken, language usually spoken at home, language used as a child, language used to think, and language usually spoken with friends. For each of the five questions, respondents could choose from five ordinal responses ranging from only Spanish to only English and including a middle option to indicate both Spanish and English. These five questions are an abbreviated version of the Short Acculturation Scale and have been shown to have similarly high reliability and validity as the full scale (31). The coded responses across the five language questions (e.g., 1 = only Spanish, 5 = only English) were averaged for each respondent so that the range of the language index is between one and five.

Dietary Intake

The 2000 NHIS contains an innovative, abbreviated food frequency questionnaire (FFQ) developed by the National Cancer Institute to predict three summary dietary intake measures: percent energy from fat, intake of fiber, and intake of fruits and vegetables (30, 32, 33). These measures are particularly salient because higher intakes of fat and lower intakes of fiber, fruits and vegetables have been associated with higher risks and rates of cancer (5, 34). These three measures are calculated from respondents' stated typical frequency of consumption of 16 foods. The justification for these 16 foods and a description of the procedure used to estimate the dietary intake measures from them are provided elsewhere (32, 33).

Demographic Covariates

Age in years at interview, marital status, and educational attainment are included in the models as demographic covariates since they have been shown to be related to diet and health (6, 8, 12). The 2000 NHIS captures educational attainment beyond high school as categories labeled

by the type of degree granted instead of years of schooling. For the regression analyses, these educational attainment categories were recoded from degree granted (e.g., Bachelors degree) to years of education (e.g., 16 years).

Statistical Analysis

Weighted means and proportions for selected demographic variables were first calculated to describe the characteristics of the sample. We then estimated multiple regression models to predict changes in diet associated with acculturation, while controlling for the demographic covariates. The specific predictor variables include language acculturation, an indicator variable for nativity, and the interaction between nativity and language acculturation. The primary response variables are the three dietary intake estimates: percent energy from fat, intake of fiber, and intake of fruits and vegetables. Regression models were also created for each of the 16 food items to illuminate the food changes underlying the dietary intake estimates. For the 16 food items, logarithm transformations were applied to the annual food frequencies to improve the normality of the residuals (11). All analysis was conducted using STATA 8.0 survey commands and analytic weights to adjust for the complex sampling design of the 2000 NHIS (35).

RESULTS

Table 1 reports selected demographic characteristics of the 1,254 non-pregnant Mexican-American women between 25 and 64 years of age in the analysis. The table shows these characteristics for four subgroups of women classified by nativity and two language acculturation categories. The collapsed categories for language acculturation are presented to aid in visual comparisons. Compared to non-Hispanic White women of the same age range in the

2000 NHIS (comparisons not shown in the table), the Mexican-American women tended to have lower educational attainment (10.3 versus 13.9 years), are more likely to live in urban areas (91.3% versus 75.6%), are more likely to live below the poverty threshold (23.9% versus 6.5%), and tend to be younger (39.6 versus 43.4 years).

TABLE 1. Demographic characteristics of non-pregnant female respondents of Mexican descent between 25 and 64 years of age in the National Health Interview Survey, United States, 2000*

Variable	Mexican-born		US-born	
	Predominately Spanish speaking‡	Predominately English speaking‡	Predominately Spanish speaking‡	Predominately English speaking‡
Age in years (mean(SD†))	39.1 (7.3)	37.1 (7.0)	47.5 (7.9)	39.9 (7.6)
Education in years (mean(SD))	8.1 (2.9)	12.4 (2.0)	9.7 (2.6)	12.6 (1.8)
Married (%)	79.3	61.8	68.6	70.3
Living below poverty threshold (%)	33.8	10.8	34.6	13.4
Living in urban areas§ (%)	93.1	94.2	81.9	89.7
Language acculturation (mean(SD))	1.3 (0.3)	3.2 (0.4)	1.7 (0.4)	4.1 (0.6)
Respondents (no.)	577	110	68	499

* Table values were calculated using sample weights.
† SD, standard deviation.
‡ Language acculturation scores are collapsed into two groups for visual comparisons in this table. The 'Predominately Spanish speaking' group has acculturation scores between 0 and 2.5; the 'Predominately English speaking group' has scores greater than 2.5 and up to 5.0.
§ Urban area defined as 'Non-MSA' in NHIS 2000 codebook.

The distribution of language acculturation scores for Mexican-American women born in Mexico compared to those born in the US is shown in Figure 1. The average language acculturation score is 1.6 for the women born in Mexico and 3.8 for the women born in the US, which is significantly different. The chart demonstrates the granularity achieved by incorporating both nativity and language acculturation as measures of acculturation.

FIGURE 1. Nativity and language acculturation for non-pregnant female participants of Mexican descent between 25 and 64 years of age in the National Health Interview Survey, United States, 2000

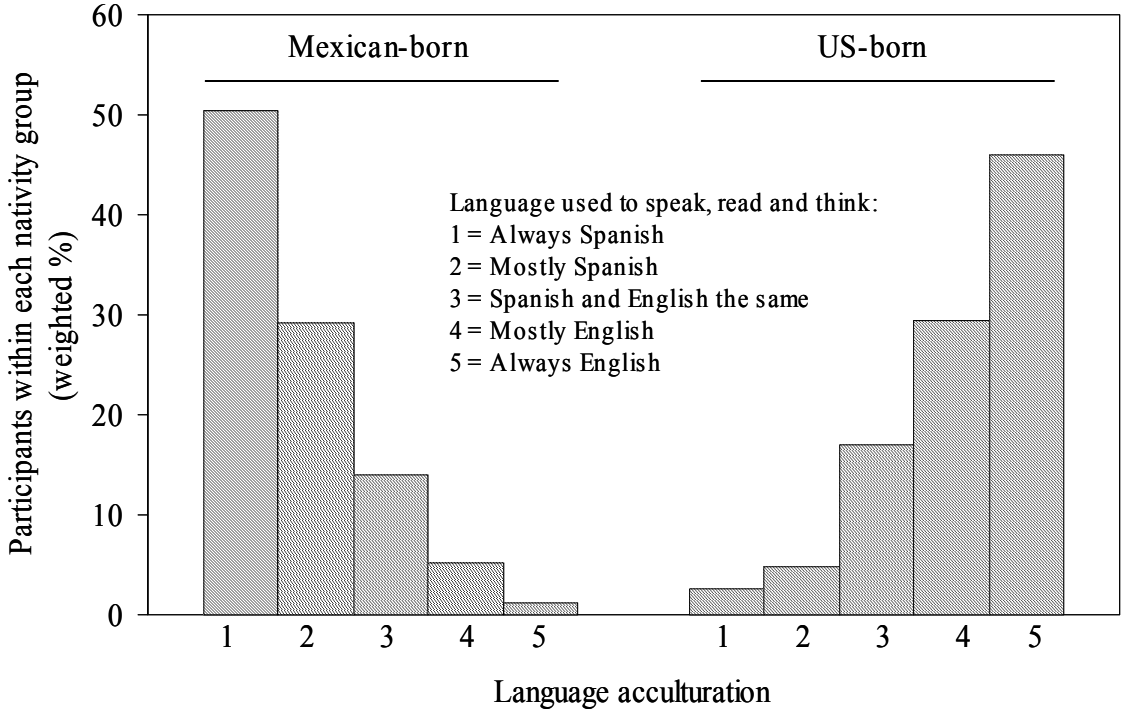


Table 2 reports weighted averages for the three dietary intake estimates and 16 annual food consumption frequencies for each of the four subgroups of Mexican-American women. Regression coefficients for nativity and language acculturation as predictors of the three dietary intake estimates are provided in Table 3

TABLE 2. Dietary intake estimates and number of times each food item is consumed per year for non-pregnant women of Mexican descent between 25 and 64 years of age in the National Health Interview Survey, United States, 2000*

Variable	Mexican-born		US-born	
	Predominately Spanish speaking‡	Predominately English speaking‡	Predominately Spanish speaking‡	Predominately English speaking‡
Dietary intake estimates (mean(SD))†				
Daily servings of fruits and vegetables	5.1 (1.4)	4.8 (1.3)	5.0 (1.7)	4.2 (1.2)
Daily intake of grams of fiber	21.3 (8.2)	18.3 (5.5)	18.5 (5.7)	15.4 (5.5)
Percent of calories from fat	31.8 (4.2)	32.2 (3.1)	32.8 (4.7)	34.1 (4.0)
Number of times food item is consumed annually (mean(SD)) †				
Cold cereal	138.0 (103.9)	125.0 (95.7)	125.1 (101.7)	96.9 (96.1)
Regular fat bacon or sausage	40.5 (49.3)	33.2 (38.0)	55.7 (63.5)	42.7 (45.4)
Beef or pork hot dogs	25.3 (37.2)	24.6 (33.6)	25.9 (38.2)	25.6 (38.4)
Whole grain bread	161.2 (134.9)	220.0 (142.7)	123.7 (116.0)	174.9 (153.6)
100% fruit juice	242.8 (145.9)	213.7 (121.6)	264.4 (245.8)	181.6 (129.5)
Fruit	355.6 (223.4)	364.5 (280.2)	332.7 (170.0)	253.1 (165.5)
Regular fat salad dressing or mayonnaise	85.5 (85.9)	107.6 (82.4)	85.7 (66.9)	118.0 (83.3)
Lettuce or green leafy salad	170.5 (113.3)	180.1 (92.5)	169.5 (104.1)	165.5 (103.8)
French fries, home fries, Hash brown potatoes	66.3 (60.4)	72.3 (58.8)	66.8 (54.3)	77.8 (60.9)
other white potatoes	80.0 (62.7)	84.4 (56.4)	82.3 (60.2)	85.2 (59.6)
Beans	250.9 (106.8)	162.5 (86.2)	182.5 (102.6)	105.7 (83.0)
Other vegetables	247.9 (130.6)	299.1 (214.4)	292.5 (137.3)	251.8 (130.6)
Pasta	88.8 (82.8)	87.7 (65.0)	89.9 (62.9)	95.3 (83.5)
Regular fat potato chips, tortilla, corn chips	61.7 (71.5)	65.0 (66.2)	78.7 (69.6)	91.0 (73.3)
Nuts or seeds	39.9 (59.6)	45.4 (55.9)	71.3 (70.6)	45.9 (60.3)
Whole milk	260.9 (157.3)	195.0 (141.6)	181.7 (139.5)	135.8 (134.3)

* Table estimates were calculated using sample weights. Unlike the distributions of intake estimates, the distributions of food item frequencies are not normally distributed which explains the high standard deviations in comparison to the means.

† SD, standard deviation.

‡ Language acculturation scores are collapsed into two groups for visual comparisons in the table. The 'Predominately Spanish speaking' group has acculturation scores between 0 and 2.5; the 'Predominately English speaking group' has scores greater than 2.5 and up to 5.0.

TABLE 3. Parameter estimates for nativity and language acculturation as predictors of dietary intake created from multiple regression models based on the 2000 NHIS, United States[†]

Variable	Dietary intake: Daily servings of fruits and vegetables		Dietary intake: Daily grams of fiber		Dietary intake: Percent of calories from fat	
	Parameter estimate (b coefficient)	95% CI	Parameter estimate (b coefficient)	95% CI	Parameter estimate (b coefficient)	95% CI
Nativity (US = 1)	0.21	-0.87, 1.28	-2.44***	-4.17, -0.72	2.06***	0.73, 3.39
Language acculturation	-0.02	-0.23, 0.19	-1.07***	-1.68, -0.46	0.09	-0.36, 0.54
Nativity *x* language[§]	-0.27*	-0.59, 0.05				

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

† Regression models were weighted to reflect the complex sampling design of the NHIS survey and controlled for age at interview, educational attainment and marital status.

‡Parameter estimates for nativity indicate the average increase or decrease in intake for US-born women compared to Mexican-born women. For example, on average, US-born women consume 2.44 less grams of fiber per day than do Mexican-born women. Parameter estimates for language acculturation indicate the change in intake for a one unit increase in language acculturation. For example, on average, for every one unit increase in language acculturation, respondents consumed 1.07 fewer grams of fiber per day.

§ Insignificant interaction terms were not retained in final model and are therefore not shown.

In general, increased acculturation is associated with a higher percent of calories from fat and lower intakes of fiber and fruits and vegetables. More specifically, only nativity is associated with percent of calories from fat. US-born Mexican American women consume a higher percentage of calories from fat than those born in Mexico. Both nativity and language are associated with fiber intake in an additive fashion. Mexican-born women have higher intakes of fiber than US-born women, and women with lower language acculturation levels have higher intakes of fiber, regardless of country of birth. Nativity and language have an interactive association with the intake of fruits and vegetables. Figure 2 illustrates this interaction. Increased language acculturation is associated with a decline in the intake of fruits and vegetables for both US-born and Mexican-born women; however, the decline is more dramatic for US-born women.

FIGURE 2. Interaction of Nativity and Language as Predictors of Fruit and Vegetable Intake

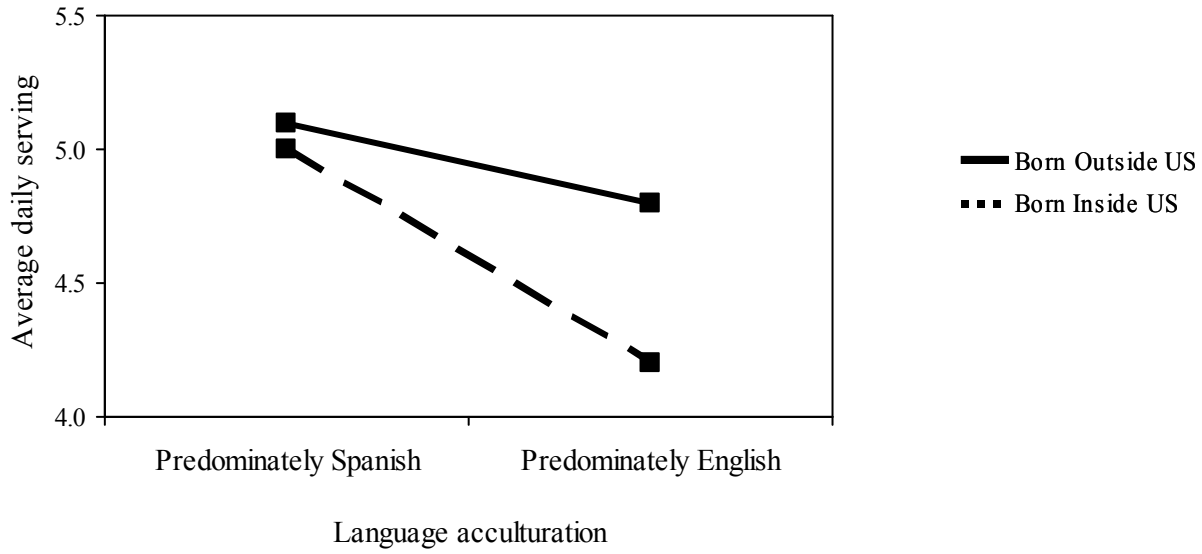


Table 4 reports the coefficients for nativity and language acculturation as predictors of the 16 individual food items contained in the food frequency screener, controlling for the demographic covariates. These models were created using logarithms of the annual food frequencies to improve the normality of the residuals. The results are directionally consistent with the summary intake estimates. The consumption of 11 of the 16 food items is associated with acculturation. Increased acculturation is associated with decreases in cold cereal, whole grain bread, 100% fruit juice, fruit, beans, and vegetables, as well as increases in bacon/sausage, added fats, French fries and fried potatoes, and potato chips. Hot dog consumption displays an unusual pattern: it is higher for US-born women yet lower for women with higher language acculturation, although nativity is a much stronger predictor than language in this case. The only arguably positive dietary change is the decrease in cold cereal consumption as cold cereals can contain a high proportion of sugar.

In general, nativity is more often associated with changes in food consumption than language acculturation and therefore appears to be a stronger predictor of dietary changes. Specifically, nativity is associated with 10 of the 11 foods that significantly changed whereas language acculturation is associated with only 6 of these 11 foods. However, using the two measures in combination provides the most insightful results. Specifically, nativity and language acculturation are associated with some foods in an additive fashion (fruits, beans), and associated with others in an interactive fashion (hot dogs, fruit juice, added fats, chips). Figure 3 illustrates these interactions. Increased language acculturation is associated with negative dietary changes for added fats, fruit juice and potato chips for US-born and Mexican-born women; however the deterioration is more dramatic for US-born women. The combination of a US-birth and increased language acculturation has particularly negative consequences on dietary quality; more so than a US-birth or language acculturation score alone would suggest. The only exception to this interactive trend is for hot dog consumption as described earlier.

TABLE 4. Parameter estimates for nativity and language acculturation as predictors of the logarithm of annual frequency of consumption of food items created from multiple regression models based on the 2000 NHIS, United States[†]

Food items	Variable					
	Nativity (US=1)		Language Acculturation		Nativity *x* Language Acculturation[§]	
	Parameter estimate (b coefficient)	95% CI	Parameter estimate (b coefficient)	95% CI	Parameter estimate (b coefficient)	95% CI
Beef or pork hot dogs	2.53**	0.37, 4.70	0.65*	-0.02, 1.32	-0.72*	-1.52, 0.09
100% fruit juice	0.27	-1.76, 2.31	0.52*	0.10, 0.95	-0.51*	-1.09, 0.06
Regular fat salad dressing or mayonnaise	3.08***	1.39, 4.76	0.70***	0.24, 1.16	-0.90***	-1.40, -0.40
Regular fat potato chips, tortilla, corn chips	3.21***	1.32, 5.09	0.80***	0.20, 1.40	-0.70**	-1.37, -0.03
Fruit	-0.50**	-1.00, -0.01	-0.27**	-0.55, -0.002		
Beans	-0.64***	-1.07, -0.22	-0.41***	-0.62, -0.20		
Regular fat bacon or sausage	1.25**	0.09, 2.41	0.24	-0.15, 0.63		
Whole grain bread	-1.66***	-2.67, -0.66	0.24	-1.66, 0.65		
French fries, home fries, hash brown potatoes	0.71*	-0.09, 1.51	0.23	-0.14, 0.60		
Other vegetables	-0.30*	-0.62, 0.02	0.06	-0.05, 0.16		
Cold cereal	-0.52	-1.68, 0.63	-0.38*	-0.80, 0.03		

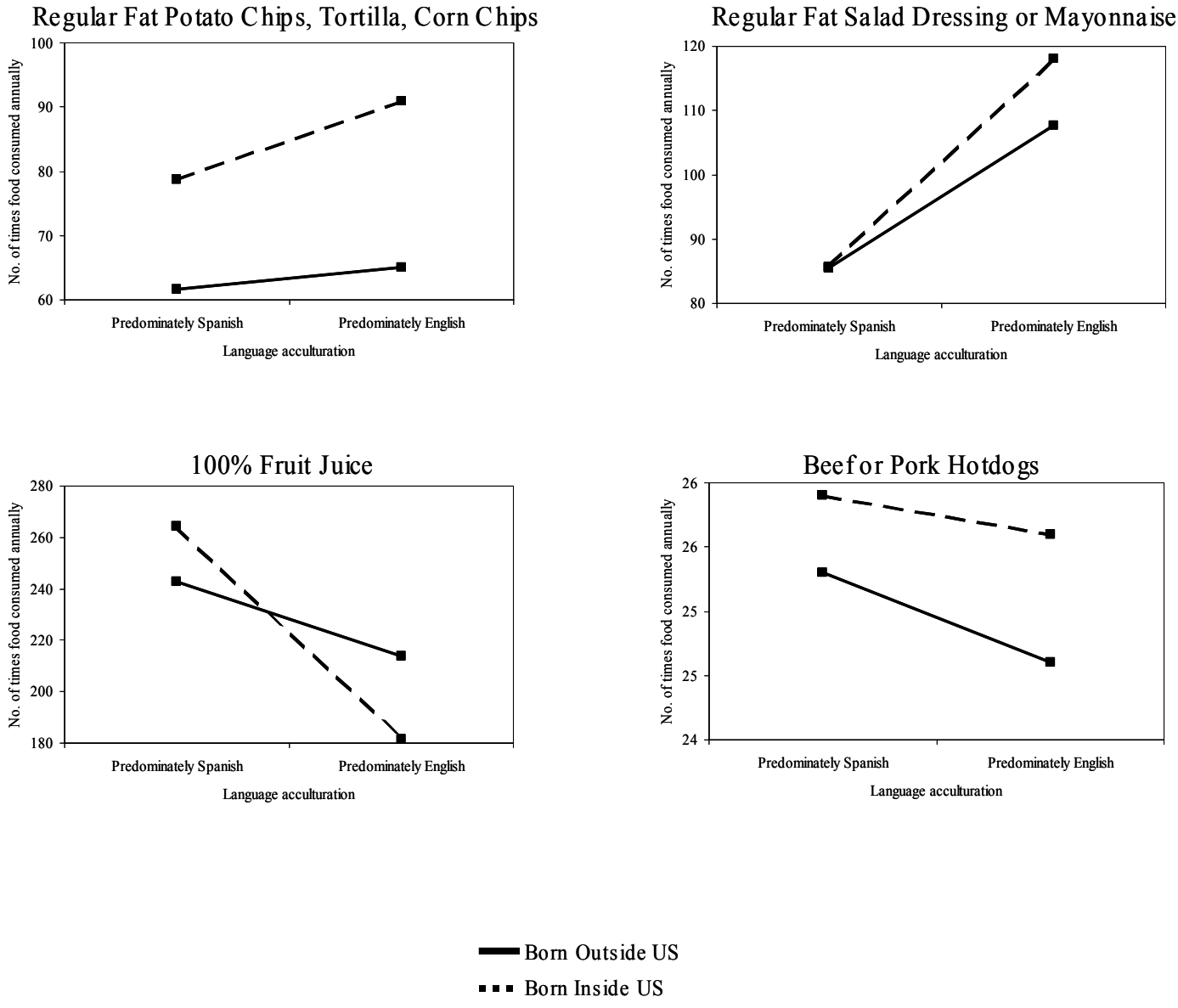
* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

† Regression models were weighted to reflect the complex sampling design of the NHIS survey and controlled for age at interview, educational attainment and marital status.

‡ Regression models were created using a logarithm transformation of the annual food frequencies to improve the normality of the residuals. The parameter estimates are shown in the log units to retain the integrity of the models. See table 2 for average annual frequencies in the original units. Nativity and language acculturation were not significant predictors of five food items (lettuce, other white potatoes, pasta, nuts and seeds, and whole milk), therefore these parameter estimates are not shown.

§ Insignificant interaction terms were not retained in final model and are therefore not shown.

FIGURE 3. Interaction of nativity and language acculturation as predictors of food consumption for the models that had statistically significant interaction terms



DISCUSSION

Our findings demonstrate that increased acculturation as measured by both nativity and language acculturation among Mexican-American women in the US is associated with primarily unfavorable diet outcomes. These findings are directionally consistent with other research that has shown increased acculturation measured by nativity, language use, or generational status is associated with increases in percent of calories from fat, and decreases in the intake of fiber and fruits and vegetables (7, 8, 26). However, our findings are unique in that they underscore the importance of including both nativity and language, and their interaction, in evaluating the relationship between acculturation and diet for Mexican American women.

This relationship is particularly relevant for the intake of fruits and vegetables because it is interactive between these two measures. The interaction shows that although the intake of fruits and vegetables declines with increasing language acculturation, the decline is much more dramatic for US-born women. This is perhaps the most interesting and intriguing finding as it suggests that US-born, English speaking women are qualitatively different with regard to several of their dietary choices. Others have similarly suggested that the acculturation process may be qualitatively different for US-born persons compared to foreign-born persons (36). These findings support the assertion that people enter the acculturation process with a unique set of contextual experiences and cultural luggage, and that these factors can shape the acculturation experiences and outcomes (36, 37). Furthermore, percent of calories from fat was associated only with nativity where US-born women consumed significantly more than Mexican-born women. However, it is worth noting that similar to fruit and vegetable intake, the increase in percent of calories from fat was more dramatic for US-born although the p-value (0.14) for this interaction fell below conventional significance thresholds and thus not reported in the tables. Finally, the

intake of fiber was associated with both nativity and language acculturation such that women born in the US and women with higher language acculturation scores consumed less fiber. As expected, the changes in underlying food frequencies paralleled the changes in the three dietary intake summary estimates.

An additional benefit of including nativity and language within a single study is that we can distinguish the relative importance of each proxy measure toward explaining dietary choices. Our findings show that nativity is a better predictor of nutritional changes than language acculturation, although the best results are likely obtained when both are included in a single study. Nativity was associated with all three dietary intake measures and was associated with 10 of the 11 underlying food items that significantly changed. In contrast, language acculturation was associated with two of the three dietary intake measures and only six of the 11 food items that changed. The finding that nativity is a stronger predictor is consistent with results from the 1988-1994 NHANES (8). Our study builds upon this previous study by distinguishing language acculturation among the Mexican-born women, which enabled us to test for interactions and additive relationships between nativity and language. One reason why nativity may be a better predictor of dietary changes is because dietary habits are often developed during childhood and, as such, can remain relatively stable throughout adulthood (8). However, this does not explain why our findings show the diets of Mexican-born women are more resilient than US-born women as language acculturation increases.

Our study has some limitations. One limitation is that the National Cancer Institute food frequency questionnaire used for the study is an abbreviated format which does not capture the full range of foods and nutritional detail included in other studies (7, 8). Nonetheless, there is evidence that the three dietary intake estimates do reflect actual intakes. An external validation

study found significant agreement between these estimates and more precise 24-hour dietary recall estimates (32). Furthermore, the relationships between dietary intake and demographic variables observed in the 2000 NHIS were consistent with relationships observed using more precise dietary measures (33). A second limitation of our study is the cross-sectional nature of the 2000 NHIS data which does not allow for causal statements regarding acculturation, diet and health.

The strengths of our study include the national coverage of the survey, recentness of the data, the over-sample of Mexican-American women, and the inclusion of a two dimensional assessment of acculturation. Our two dimensional assessment of acculturation provides additional granularity required to help distinguish the influence of contextual and process dimensions on acculturation outcomes. Another strength of our study concerns the measures of acculturation and diet. Nativity, the 5-item language index, and the abbreviated FFQ are practical and efficient measures that could be widely used in acculturation research and applications, and thus facilitate the much needed consistency across this literature.

These findings support our hypothesis and others' suggestions that including nativity and language provides a better description of the association between acculturation and diet (3, 8). The findings should assist public health practitioners in identifying the population segments most at risk of dietary deterioration and in developing appropriate message content and language. These results confirm a recent recommendation that public health efforts should 'promote the maintenance of healthy behaviors among the less acculturated and promote the reacquisition of these behaviors among the more acculturated' (3, p. 384). US-born, English speaking women appear to be the segment most at risk for unhealthy dietary behaviors. It is unclear why the food choices of US-born women are more sensitive to changes in language acculturation than their

Mexican-born counterparts. This question may be best explored with qualitative research. Qualitative research could illuminate the social, cultural or psychological basis behind this pattern, and perhaps uncover mechanisms for reversing it. Finally, these results provide a solid foundation for developing a holistic description of the health behavior changes that can accompany acculturation. The 2000 NHIS contains information on other health behaviors such as physical activity, tobacco use, and cancer screening for this population. Building upon the baseline we provide here with additional analyses of these behaviors with a single survey could create such a description.

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