Diet and food insufficiency among Hispanic youths: acculturation and socioeconomic factors in the third National Health and Nutrition Examination Survey[1–3]

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ABSTRACT

Background: Low socioeconomic status is associated with poor diet, food insufficiency, and poor child health. Hispanic households have disproportionately low incomes. Acculturation-related changes may augment the effects of poverty on children's diet and health.

Objective: The goal was to determine the associations that acculturation, measured by parents' language use, and income have with dietary intakes and food insufficiency among Hispanic youths.

Design: Data on 2985 Hispanic youths aged 4–16 y were from the third National Health and Nutrition Examination Survey (1988–1994). Nutrient intake data were from one 24-h dietary recall. The analysis was controlled for demographic, socioeconomic, and program variables.

Results: Parents' exclusive use of Spanish was associated in bivariate analyses with differences in intakes of energy, protein, sodium, and folate and in percentages of energy from fat and saturated fat. When other factors were controlled for, less acculturation was associated with differences in intakes of energy and sodium and in percentages of energy from fat and saturated fat. Individuals in poorer households had higher intakes of energy, protein, sodium, and some micronutrients. Although not significant for all indicators of food insufficiency, consistent patterns showed that household food insufficiency decreased with less acculturation (odds ratio: 0.4; 95% CI: 0.2, 0.7 for adult meal size reduced) and increased with low income [odds ratio: 5.9 (3.0, 11.7) for not enough food and 5.4 (2.2, 13.4) for child meal size reduced].

Conclusions: Both acculturation and poverty have roles in children's diets and in household food insufficiency. Culturally specific public health and nutrition education should complement efforts to improve the financial security of low-income households. *Am J Clin Nutr* 2003;78:1120–7.

KEY WORDS Acculturation, income, poverty, diet, food insecurity, food insufficiency, Hispanics, youths, children, third National Health and Nutrition Examination Survey, NHANES III

INTRODUCTION

Ethnicity, race, sex, education, and income are posited as key dimensions of underlying disparities in health (1). In the United States, low socioeconomic status is associated with poor child health outcomes (2, 3), including height, weight (4), and development (5). Adolescents living in lower-income households are twice as likely to be overweight or obese as are children living in higher-income households (1) and are >4 times as likely to be food insecure (1, 2). Hispanic families disproportionately have incomes below the poverty level compared with non-Hispanic white families (18.5% and 5.3%, respectively; 6). Hispanics' tendency to exhibit more nutritious diets despite their lower average socioeconomic status has prompted the assertion of culture-based protection against adverse health effects normally associated with low income.

Acculturation is a long-term process during which individuals simultaneously learn and modify certain aspects of their values, norms, and behavior—including diet and lifestyle (5). The linguistic, social, cultural, and economic assimilation of immigrant parents conditions the acculturation of their children and influences the children's health and well-being. Acculturation-related changes may increase the risk of obesity and chronic disease because of altered meal composition and patterns with more snacking and less physical activity (7). These changes have been noted previously among Mexican American adults in whom first-generation immigrants consumed significantly less fat and more fiber (8) and had a lower prevalence of overweight (9) than did immigrants of subsequent generations. Examining the associations between acculturation and children's dietary intakes will significantly enhance our understanding of these processes and their implications.

In this article, we examine the influence of acculturation and socioeconomic variables on the diet and food insufficiency of households in which US Hispanic youths live. The objectives were as follows: *1*) to report the energy, macronutrient, and micronutrient intakes of 4–16-y-old Hispanic youths according

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to level of acculturation and poverty; *2*) to examine associations between intakes of energy, macronutrients, and micronutrients and acculturation, poverty status, program participation, and other sociodemographic variables; and *3*) to evaluate associations between food insufficiency and the same explanatory factors.

We postulated that these family characteristics, particularly acculturation and poverty, would be associated with dietary intakes and with food insufficiency. In particular, we anticipated that acculturation and poverty would be associated with higher macronutrient intakes and lower micronutrient intakes. We also expected poverty to be positively associated with food insufficiency and acculturation to be negatively associated with food insufficiency. The expectation was that acculturation would mitigate the effect of poverty.

SUBJECTS AND METHODS

Data from the cross-sectional third National Health and Nutrition Examination Survey (NHANES III; 1988–1994) served as the basis for examining the role that acculturation and socioeconomic factors play in the dietary intakes of Hispanic youths (10). This survey involved a multistage, probability cluster sampling design that provided the basis for a comprehensive assessment of the nutritional status and health of the noninstitutionalized US population aged ≥ 2 mo; by design, Mexican Americans and blacks were oversampled. The analysis reported in the present article is based on data from 2985 youths aged 4–16 y who identified their ethnicity as Mexican American ($n = 2769$) or other Hispanic origin ($n = 216$). The sample weights were designed to represent the entire US Hispanic population. The data were collected by using a household questionnaire and a youth questionnaire that were administered by health professionals at the participants' homes and through a standardized medical examination conducted by physicians, medical technicians, and other health professionals at NHANES mobile examination centers.

Measurement of nutrient intakes and anthropometry

Nutrient intakes were obtained from foods and beverages reported in one 24-h dietary recall conducted by bilingual dietary interviewers during the medical examination. Some interviews for children aged 4–11 y and younger were completed by a proxy—usually the child's parent or guardian—or by the child and a proxy when the child was unable to report on his or her own. The dietary interviewers contacted other information sources such as daycare providers and schools to obtain complete dietary intake data for respondents.

Because the underlying age distribution of the youths in the language-based analysis groups did not differ significantly, the values for intakes of energy, protein, cholesterol, and sodium were reported as raw data. The percentage of energy from fat and from saturated fat was also available in the data set. Micronutrients that had been previously identified as problematic among Hispanics were analyzed (8, 11–13), with correction for age and sex. Calcium and folate were expressed as a percentage of the adequate intake (14, 15); vitamin A, iron, and zinc were expressed as a percentages of the recommended dietary allowance (16).

Measurement of food insufficiency

The survey measured food insufficiency as "an inadequate amount of food intake due to lack of money or resources" (17, 18). Measures of food insufficiency were based on 3 questions. One question was used for the entire sample: "Do you have enough food to eat, sometimes not enough to eat, or often not enough to eat?" We combined the 2 responses of "sometimes not enough" and "often not enough" because of the small proportion for the latter (16.1% and 1.3% of the sample, respectively). The second phase of NHANES III (1991–1994) added 2 questions about cutting the meal size for an adult or for a child because of a lack of money for food. A household in which the food intake of children was limited was considered to be worse off than one in which only adults were affected (19). A subanalysis with approximately one-half of the sample used data from these 2 last questions.

Explanatory variables

Acculturation, operationalized as the language spoken at home by the household head, was defined in 3 categories: Spanish, Spanish and English, and English only. Because of the relatively small sample size in the second group, some of the analysis included a dichotomous specification (Spanish only or Spanish and English compared with English only). Country of birth of the child's parents was strongly associated with the language spoken at home by the parents and was not included in the analysis. Demographic and socioeconomic factors included in the analysis were age and sex of the child, metropolitan residence (a central county of a metropolitan area with a population ≥ 1 million), household headship (a composite variable reflecting the sex and marital status of the head of the household), education and occupation of the household head, poverty index ratio (PIR; the ratio of annual family income to the federal poverty line multiplied by 100, accounting for calendar year of interview), and social integration (measured by duration of residence in present house). The PIR was dichotomized to reflect lower- and higher-income households ($\leq 130\%$ compared with $> 130\%$), with the lower level referring to the eligibility criterion for the government food stamp program. Additional variables were household participation in the food stamp program at the time of the interview and use of vitamin and mineral supplements in the past month. Income data were missing for $\approx$13% of individuals, which reduced the effective sample size for analysis.

Statistical analysis

Statistical analysis was conducted with SAS version 8.0 (20); statistical tests were carried out with WESVAR version 4.0 (21), taking into account the weights and cluster sampling associated with the survey's complex sample design for calculation of variance estimates. We used the 52 replicated weights from the original data set that were computed by using Fay's method with $k = 0.3$. The sample weights accounted for the differential probability of selection and adjusted for nonresponse. One-way analysis of variance (ANOVA) was used to evaluate the association of language with the continuous outcome variables and then the association of PIR with those outcome variables. When the ANOVA was significant ($P < 0.05$) for language, the significance of differences between each pair of parental language categories was determined by

use of the two-tailed Student's *t* test with Bonferroni post hoc adjustments for multiple comparisons (22). Analysis of covariance models were used to evaluate continuous outcome variables.

Logistic regression analyses were used to examine the relations between the 3 measures of food insufficiency and the independent variables. The odds ratio of a household experiencing not having enough food, cutting the size of adults' meals, or cutting the size of children's meals was calculated with respect to an indicated reference category, with control for the influences of all other variables in the model. Diagnostic tests showed no problem with multicollinearity in any of these analyses. Unless indicated otherwise, an alpha level of 0.05 was used to determine statistical significance.

RESULTS

The study population of Hispanic youths comprised slightly more males (51.3%) than females (48.7%) and had the following age distribution: 4–6 y, 25.6%; 7–10 y, 29.7%; 11–14 y, 30.8%; and 15–16 y, 13.9%. Parents' language spoken at home was predominantly Spanish only (49.8%), with a relatively small share being bilingual (11.4%) and a relatively larger share speaking English only (38.8%). The age and sex distribution of the study population did not vary significantly by parents' language.

To provide an interpretive context for this analysis, the Hispanic sample population was compared with a non-Hispanic white population. The households in which the Hispanic youths lived were more likely to be disadvantaged in socioeconomic terms and to have food-related problems than were the households of non-Hispanic whites. The prevalence of female-headed households among Hispanics (25.9%) was nearly twice that among non-Hispanic whites (14.7%; $P < 0.001$). Less than one-half (48.1%) of household heads in Hispanic households had completed high school, compared with 83.5% among non-Hispanic whites ($P < 0.001$). Hispanics were much less likely than non-Hispanic whites to be employed in semi-skilled, skilled, or professional occupations (42.8% compared with 75.9%; $P < 0.001$). More than one-half of Hispanic households had incomes ≤ 130% of the PIR (56.1%), ≈2.5 times the rate for non-Hispanic whites (22.3%; $P < 0.001$). Compared with non-Hispanic whites, nearly 3 times as many Hispanic households received food stamps (29.9% compared with 10.7%; $P < 0.001$), > 3 times as many experienced problems with food insufficiency (12.5% compared with 3.6%; $P < 0.001$), > 2 times as many cut meal size for adults (16.9% compared with 6.9%; $P < 0.001$), and > 5 times as many cut meal size for children (6.9% compared with 1.3%; $P < 0.001$).

Nutrient intakes

Dietary and nutrient intakes among Hispanic youths were examined according to the language that the youths' parents used at home and the household PIR (**Table 1**). Parents' exclusive use of Spanish at home was associated with lower intakes than was their use of both Spanish and English (for protein and sodium and percentage of energy from fat) or English only (for energy and sodium and percentage of energy from fat and saturated fat). In contrast, speaking only Spanish at home was associated with higher intakes of folate than was

TABLE 1
Energy and nutrient intakes among Hispanic youth, by language that parents use at home and poverty index (PI): third National Health and Nutrition Examination Survey[1]

	Spanish only	Spanish and English	English only
n			
PI ≤ 130%	907	198	348
PI > 130%	258	91	491
Energy (kJ)[2]			
PI ≤ 130%	8176.8 ± 3619.6[3]	8829.9 ± 6676.8	8864.6 ± 4618.7
PI > 130%	7106.9 ± 4165.7	9188.5 ± 4523.3	8943.3 ± 8565.7
Protein (g)[4]			
PI ≤ 130%	72.7 ± 36.1	75.6 ± 45.5	74.7 ± 56.6
PI > 130%	64.2 ± 50.4	85.9 ± 31.7	74.3 ± 78.0
Cholesterol (mg)[5]			
PI ≤ 130%	276.7 ± 170.5	283.7 ± 192.4	303.3 ± 368.4
PI > 130%	239.6 ± 324.9	315.2 ± 215.9	243.4 ± 338.5
Sodium (mg)[2,4]			
PI ≤ 130%	2935.7 ± 1730.9	3847.9 ± 4284.6	3402.3 ± 2016.9
PI > 130%	2760.9 ± 1913.7	3875.7 ± 1950.3	3292.1 ± 2897.0
Fat (% of energy)[2,4]			
PI ≤ 130%[2,6]	31.8 ± 12.2	32.3 ± 7.2	35.5 ± 6.3
PI > 130%[2,4]	30.7 ± 12.7	35.9 ± 6.8	34.6 ± 10.7
Saturated fat (% of energy)[2]			
PI ≤ 130%[2,6]	11.8 ± 6.1	11.7 ± 5.0	13.4 ± 4.1
PI > 130%[2,4]	11.3 ± 7.7	12.8 ± 2.5	12.6 ± 5.1
Calcium (% of AI)			
PI ≤ 130%	92.7 ± 78.6	86.3 ± 47.1	97.9 ± 73.3
PI > 130%	91.1 ± 92.2	84.5 ± 44.3	88.5 ± 68.3
Folate (% of AI)[2,4,5]			
PI ≤ 130%	123.2 ± 180.6	99.4 ± 55.3	103.3 ± 87.7
PI > 130%	100.3 ± 144.3	85.0 ± 71.1	92.1 ± 53.0
Vitamin A (% of RDA)			
PI ≤ 130%	125.6 ± 189.9	131.6 ± 111.7	123.7 ± 118.7
PI > 130%	119.0 ± 244.8	110.1 ± 112.3	128.5 ± 157.5
Iron (% of RDA)			
PI ≤ 130%	130.1 ± 120.5	130.1 ± 90.6	137.6 ± 109.2
PI > 130%	109.6 ± 108.6	119.3 ± 74.1	126.0 ± 101.8
Zinc (% of RDA)			
PI ≤ 130%	89.1 ± 64.4	88.7 ± 44.9	97.3 ± 92.8
PI > 130%	83.3 ± 102.9	99.0 ± 42.7	89.5 ± 97.9

[1] Sample weights were applied. Adequate intakes (AIs) were used for calcium (14) and folate (15). Recommended dietary allowance (RDA) references were used for vitamin A, iron, and zinc. Mean differences by parental language and PI were tested separately with ANOVA. When the ANOVA was significant ($P < 0.05$) for language, the significance of differences between each pair of language categories was determined by use of the two-tailed Student's *t* test with Bonferroni post hoc adjustments for multiple comparisons. Then, an interaction term combining Spanish only and PI ≤ 130% was included to predict each outcome; this term was significant for percentages of energy from fat and saturated fat, with differences specific to each PI group noted below.

[2] Spanish only significantly different from English only, $P < 0.0167$ (Bonferroni-corrected *t* test).

[3] $\bar{x}$ ± SD.

[4] Spanish only significantly different from Spanish and English, $P < 0.0167$ (Bonferroni-corrected *t* test).

[5] PI ≤ 130 significantly different from PI > 130%, $P < 0.05$ (ANOVA).

[6] Spanish and English significantly different from English only, $P < 0.0167$ (Bonferroni-corrected *t* test).

TABLE 2
Regression coefficients from analysis of covariance for energy and nutrient intakes among Hispanic youth in the third National Health and Nutrition Examination Survey[1]

Explanatory variable	Energy (kJ)	Protein (g)	Cholesterol (mg)	Sodium (mg)	Percentage of energy from fat (%)	Percentage of energy from saturated fat (%)
Spanish used by parents at home	−853.7[2]	−2.4	1.1	−200.7[3]	−3.5[4]	−1.3[4]
Poverty index ratio ≤ 130%	948.9[2]	6.8[3]	20.7	492.8[3]	1.0	0.4
Education of household head						
0–5 y	−1417.0[4]	−13.5[4]	2.2	−825.0[4]	2.0[3]	1.5[2]
6–8 y	−1261.1[4]	−9.0[2]	−35.0	−635.7[2]	1.9[3]	1.0[3]
9–11 y	−1001.6[3]	−11.2[4]	−54.1[2]	−542.6[2]	1.6	0.7
12 y	−708.5	−8.3[3]	−32.2	−251.6	1.6	1.2[2]
Occupation of household head						
Not in labor force	364.3	0.2	3.4	271.9	−0.4	−0.6
Agricultural worker	−59.1	0.5	−17.7	−84.4	−1.3	−0.8[3]
Service worker, nonfarm laborer	−234.0	−1.2	1.8	−88.8	0.3	−0.1
Female-headed household	−413.8[3]	0.9	22.2	−82.9	−0.7	0.1
Household receiving food stamps	256.0	3.4	23.5	−186.7[3]	−0.0	0.1
Vitamin or mineral supplements	833.9[2]	6.4[3]	1.4	469.4[2]	1.4[2]	0.8[4]
Parents living ≤ 10 y in present house	354.2[3]	3.0	29.2[2]	232.3[3]	−1.5[4]	−0.7[2]
Nonmetropolitan residence	−322.7	−5.4[3]	−31.2[3]	−78.0	0.4	0.6[2]
Female	−1329.9[4]	−14.5[4]	−47.3[4]	−553.1[4]	−0.3	−0.1
Age (y)	303.4[4]	2.4[4]	4.9[2]	119.6[4]	0.1	−0.1[2]
Constant	6388.7	58.4	232.9	2255.7	32.8	13.0
R^2	16.8%	12.8%	4.6%	13.7%	7.1%	7.9%

[1] Sample weights were applied; unweighted $n = 2209$. The interaction term combining Spanish only and poverty index ≤ 130% was included to predict each outcome; because this term was significant for energy only, these results are not presented. Reference categories, respectively, were as follows: parents do not speak Spanish at home; education of household head ≥ 13 y; household head has semiskilled, skilled, or professional occupation; poverty index ratio > 130%; male-headed household; no one receives food stamps; do not take vitamins; parents living > 10 y in present house; metropolitan area residence; male youth.
[2] $P < 0.01$.
[3] $P < 0.05$.
[4] $P < 0.001$.

use of either of the 2 other language groups. When the PIR was considered, those in households with a lower PIR had higher cholesterol intakes but also higher folate intakes.

For 2 outcomes, the 3 categories of parents' language use showed different patterns according to PIR level. The interaction terms were significant for percentage of energy from fat ($P = 0.006$) and percentage of energy from saturated fat ($P = 0.022$). Children in households with a lower PIR whose parents spoke English only had higher percentages of energy from fat and saturated fat than did those whose parents spoke either Spanish only or Spanish and English. In households with a higher PIR, children of both parents who spoke English only and parents who spoke Spanish and English had higher percentages of energy from fat and saturated fat than did children of parents who spoke Spanish only.

The associations of acculturation (contrasting speaking English only with speaking Spanish only or speaking Spanish and English) and income with energy and nutrient intakes were examined, controlling for key demographic, socioeconomic, and federal assistance program factors (**Table 2**). Limited acculturation was beneficial in terms of significantly lower intakes of energy and sodium and percentages of energy from fat and saturated fat, which is consistent with the analysis shown in Table 1. Low or moderate levels of education of the household head (compared with the reference category of postsecondary education) had an additional negative association with intakes of energy, protein, and sodium and, to a lesser extent, cholesterol. In contrast, low income was independently associated with higher intakes of energy, protein, and sodium.

Youths' taking of vitamin or mineral supplements was associated with higher intakes of most macronutrients. Taking vitamin or mineral supplements was positively associated with acculturation ($P < 0.001$); a separate analysis showed that the use of supplements was much higher ($P < 0.001$) among those in households in which parents spoke English only (35.4%) than among those in households in which parents spoke Spanish and English (26.4%) or Spanish only (25.9%).

Other factors showed significant associations with diet. As anticipated, female youths had lower nutrient intakes than did male youths, but there was no significant difference in the percentage of energy from fat. Age was positively associated with higher nutrient intakes but was also modestly associated with a lower percentage of energy from saturated fat. Relations with residence (metropolitan compared with nonmetropolitan and duration of residence) were mixed.

For all of the equations represented in Table 2, additional analyses were conducted that included an interaction term representing limited acculturation and low income. Because the interaction term was significant in only one equation (that for energy; $P = 0.024$), coefficients from these analyses are not presented here; only the energy equation is described. The PIR modulated the association between acculturation and energy

TABLE 3
Regression coefficients from analysis of covariance for micronutrient intakes among Hispanic youth in the third National Health and Nutrition Examination Survey[1]

Explanatory variable	Calcium	Folate	Vitamin A	Iron	Zinc
Spanish used by parents at home	−2.8	11.2	−9.1	−7.2	−5.7
Poverty index ratio ≤ 130%	5.2	20.1[2]	17.7	24.3[2]	10.1[3]
Education of household head					
0–5 y	0.9	−22.6[4]	−28.9[3]	−44.4[2]	−20.1[2]
6–8 y	−1.0	−13.3	−7.3	−21.8[4]	−7.6
9–11 y	2.9	−19.3[4]	−23.7[3]	−26.1[2]	−17.6[2]
12 y	0.3	−0.8	−35.3[4]	−24.3[2]	−16.8[4]
Occupation of household head					
Not in labor force	−17.0[2]	−2.3	−0.7	3.0	−2.6
Agricultural worker	1.4	5.7	−4.1	10.2	−6.3
Service worker, nonfarm laborer	−6.0	−6.9	−6.5	−2.2	−5.5
Female-headed household	5.4	9.2	−10.5	8.9	1.1
Household receiving food stamps	2.0	0.3	−21.0[3]	1.8	5.0
Vitamin or mineral supplements	3.0	2.7	3.2	6.6	7.3
Parents living ≤ 10 y in present house	2.4	3.8	13.5	−2.2	2.8
Nonmetropolitan residence	−5.1[3]	−0.9	−1.2	−2.9	−6.6
Female	−13.6[2]	−8.0[3]	2.1	−32.7[2]	−10.3[2]
Age (y)	−4.4[2]	−4.3[2]	−6.4[2]	−0.6	−0.1
Constant	145.5	145.1	207.3	157.5	105.0
R^2	13.3%	9.1%	5.0%	8.6%	4.5%

[1] Sample weights were applied; unweighted $n = 2209$. Adequate intakes were used for calcium (14) and folate (15). Recommended dietary allowance references were used for vitamin A, iron, and zinc (16). The interaction term combining Spanish only and poverty index ≤ 130% was included to predict each outcome; because this term was not significant, these results are not presented. Reference categories, respectively, were as follows: parents do not speak Spanish at home; education of household head ≥ 13 y; household head has semiskilled, skilled, or professional occupation; poverty index ratio > 130%; male-headed household; no one receives food stamps; do not take vitamins; parents living > 10 y in present house; metropolitan area residence; male youth.
[2] $P < 0.001$.
[3] $P < 0.05$.
[4] $P < 0.01$.

intake. Among lower-income households (PIR ≤ 130%), children whose parents spoke Spanish (both Spanish only and Spanish and English) had somewhat lower intakes (254 kJ) than did those whose parents spoke only English when all other variables were held constant. In contrast, there was a five-fold higher difference in energy intake between acculturation groups among the higher-income children. Children of Spanish-speaking parents consumed 1316 kJ less than did children of parents who spoke only English.

The percentage of recommended micronutrient intakes was also examined by using the same explanatory factors (**Table 3**). In this multiple linear regression analysis, parents' language use showed no significant relation with micronutrients. Low and moderate levels of education of the household head were associated with lower intakes of most micronutrients (folate, vitamin A, iron, and zinc) than was high education. The independent associations between low income and micronutrient intakes (higher folate, iron, and zinc) were opposite those of low education and micronutrient intakes (lower folate, vitamin A, iron, and zinc) and those of receiving food stamps and micronutrient intakes (lower vitamin A). Other predictors of lower micronutrient intakes were living in a nonmetropolitan residence (calcium), being female (calcium, folate, iron, and zinc), and being older (calcium, folate, and vitamin A).

An interaction term representing the combination of limited acculturation and low income was included for all of the equations reported in Table 3. In no case was this term significant; thus, the estimated coefficients are not reported in the table.

Food insufficiency

Three measures of food insufficiency were analyzed: not enough food, cut meal size for adult, and cut meal size for child (**Table 4**). Acculturation and socioeconomic factors were important in understanding patterns of food insufficiency. Limited acculturation was negatively associated with one indicator of food insufficiency: the most acculturated households (in which the parents spoke only English) were at increased risk of cutting adult meal size. Several indicators of low socioeconomic status were associated with individual indicators of an increase in the risk of food insufficiency: household head had a low educational level or was an agricultural worker, household income was low, the household head was female, and the household received food stamps. Use of vitamin and mineral supplements, being female, being in late adolescence, and living in a nonmetropolitan area were associated with a reduced risk of food insufficiency.

Overall, the patterns for acculturation, socioeconomic variables, and demographic variables were consistent among the 3 models of food insufficiency, although not all factors were significant for all models. Food insufficiency was clearly more problematic in households that were disadvantaged in socioeconomic terms. However, a lower degree of acculturation partially compensated for socioeconomic disadvantage. The interaction term representing the combination of limited acculturation and low income was included for all the equations in Table 4; in no case was this term significant.

TABLE 4
Adjusted odds ratios (and 95% CIs) for food insufficiency measures for Hispanic youth in the third National Health and Nutrition Examination Survey[1]

Explanatory variable	Not enough food (n = 2345)	Cut adult meal size[2] (n = 1120)	Cut child meal size[2] (n = 1123)
Spanish used by parents at home	0.7 (0.5, 1.1)	0.4[3] (0.2, 0.7)	0.8 (0.4, 1.6)
Poverty index ratio ≤ 130%	5.9[4] (3.0, 11.7)	1.8 (0.8, 4.2)	5.4[4] (2.2, 13.4)
Education of household head			
0–5 y	3.1[4] (1.8, 5.5)	4.2[5] (1.3, 13.7)	2.7 (0.8, 9.2)
6–8 y	2.2[5] (1.1, 4.4)	3.0[5] (1.0, 8.6)	2.2 (0.6, 7.5)
9–11 y	1.5 (0.8, 2.8)	3.4[5] (1.2, 9.6)	1.3 (0.3, 5.3)
12 y	0.9 (0.4, 2.0)	1.1 (0.4, 2.9)	0.6 (0.2, 2.2)
Occupation of household head			
Not in labor force	1.0 (0.7, 1.6)	1.1 (0.6, 1.9)	0.7 (0.3, 1.3)
Agricultural worker	2.3[3] (1.3, 4.1)	4.2[5] (1.3, 13.1)	4.0[5] (1.4, 11.6)
Service worker, nonfarm laborer	1.2 (0.7, 1.9)	0.9 (0.5, 1.9)	0.7 (0.4, 1.4)
Female-headed household	1.0 (0.6, 1.6)	2.3[5] (1.2, 4.5)	1.1 (0.4, 2.8)
Household receiving food stamps	2.4[4] (1.7, 3.4)	1.2 (0.7, 2.0)	2.3[3] (1.3, 4.0)
Vitamin or mineral supplements	0.8 (0.5, 1.2)	0.4[3] (0.3, 0.7)	0.6 (0.3, 1.2)
Parents living ≤ 10 y in present house	1.1 (0.8, 1.5)	1.1 (0.7, 1.7)	1.3 (0.6, 3.0)
Nonmetropolitan residence	1.1 (0.7, 1.8)	0.5[3] (0.3, 0.9)	0.5[5] (0.2, 0.9)
Female	0.6[3] (0.5, 0.9)	0.7 (0.4, 1.1)	0.5[3] (0.3, 0.8)
Age (y)	0.9[3] (0.9, 1.0)	1.0 (0.9, 1.0)	0.9[5] (0.9, 1.0)
Constant	0.1	0.0	0.0
Pseudo R^2	19.4%	14.5%	19.2%

[1] All analyses were completed by using sample design weights. The interaction term combining Spanish only and poverty index ≤ 130% was included to predict each outcome; because this term was not significant, these results are not presented. Reference categories, respectively, were as follows: parents do not speak Spanish at home; education of household head ≥ 13 y; household head has semiskilled, skilled, or professional occupation; poverty index ratio > 130%; male-headed household; no one receives food stamps; do not take vitamins; parents living > 10 y in present house; metropolitan area residence; male youth.
[2] Asked only in phase II.
[3] $P < 0.01$.
[4] $P < 0.001$.
[5] $P < 0.05$.

The relations between the principal macronutrients of concern (intakes of energy and protein and percentages of energy from fat and from saturated fat) and food insufficiency were also examined, showing some differences for energy and protein. Children living in households in which an adult's meal size was cut tended to have lower protein intakes (67.4 ± 56.0 compared with 76.4 ± 89.2 g; $P = 0.066$) than did children living in households that did not experience such cuts. Children living in households in which a child's meal size was cut had significantly lower energy intakes (7553.6 ± 4160.2 compared with 8695.2 ± 8899.5 kJ; $P = 0.012$) and tended to have lower protein intakes (68.5 ± 42.6 compared with 75.3 ± 82.0 g; $P = 0.097$) than did children living in households that did not experience such cuts. The overall measure of food insufficiency, however, was not significantly associated with differences in intake of any macronutrient. There were also no significant differences in the percentage of energy from fat or saturated fat for any measure of food insufficiency.

DISCUSSION

The key finding in this analysis was that limited acculturation partially ameliorated the negative association between poverty and dietary intake among Hispanic youths. Language use forms one important part of the complex set of changes that constitute acculturation (23). Acculturation involves multidirectional communication of values, norms, and practices (24). Spanish language use by parents at home was associated with lower intakes of macronutrients, with diets having a lower percentage of energy from fat, and with less food insufficiency. This culture-based protection, or buffering, has also been shown for other risky behaviors (eg, smoking and abuse of alcohol or drugs) via stronger familial and social support networks (25). It is important to identify pathways to retain positive aspects of culture, because the benefits of culture-based protection appear to diminish as acculturation proceeds (9, 26). Understanding these processes is especially important because Hispanic children as a group are those most at risk of exceeding the *Dietary Guidelines for Americans* (27) for saturated fat, cholesterol, and sodium. Recognizing that excessive childhood weight is often carried into adulthood, it is noteworthy that ≈15% of Mexican American children are overweight, and 29% of Mexican American adults are classified as obese (1).

Dietary intakes and food insufficiency were also shaped by resource limitations. Household socioeconomic characteristics are clearly important considerations in addressing problems of diet and food sufficiency among Hispanic youths. Lower-income households were at greater risk of food insufficiency. Female-headed households, in particular, had much lower average annual incomes ($13 307) than did other Hispanic households ($32 331). Consistent with previous research (28–30), youths in female-headed Hispanic households were at greater risk of experiencing food insufficiency. The results of previous

studies suggest that this is due to children living in households characterized by chronically inadequate incomes, adult unemployment, unusual expenses, and accumulated debts (31, 32). Food insufficiency is commensurate with these children's observed lower macronutrient intakes. It is also not surprising that children of agricultural workers had problems of food insufficiency, because agricultural work is associated with lower permanent income levels and part-time employment. In 1995, 27% of Mexican American families were food insufficient, more than twice the percentage of non-Hispanic white families (1).

Youths in households with members receiving food stamps experienced both food insufficiency and inadequate intakes of vitamin A. This suggests that their household's level of need was greater than was addressed by receipt of food stamps, and that the program was not fully effective in eliminating food insecurity. These results are consistent with those of previous research showing higher rates of food insufficiency, food insecurity, and hunger among households participating in the food stamp program than among nonparticipating, low-income households (12, 33). The long-term negative health implications of food insufficiency for children include establishing eating patterns based on foods with inferior nutritional quality (34), and these patterns contribute to childhood obesity and may socialize children to use similar behavioral patterns in adulthood (35). Food-insufficient children are also more likely to have poorer health status (36) and to experience a range of negative academic and psychosocial outcomes (37, 38).

Through directly comparable analysis of several key components of the diet and of food insufficiency, our findings underscore the importance of improving educational opportunities, job placement, and wages for members of lower-income households. Given the clear link between food insecurity and financial insecurity, our results support earlier findings concerning the importance of nonfood interventions designed to improve the financial security of low-income households (31). These include not only programs to improve household income but also interventions to lessen or offset the costs of other essential goods and services (eg, subsidized housing) and initiatives to assist low-income households in weathering sudden, precipitous changes in income or expenditure. Although publicly funded health and social programs have provided a safety net for very-low-income families (5), additional material, financial, and educational assistance is needed to reduce food insecurity and improve child health outcomes.

The findings reported here also indicate an important role for culturally specific interventions. Public health and dietary education efforts that address the disparate health needs of specific segments of target populations could be particularly valuable. Youths whose parents had low or moderate levels of education had a higher percentage of energy from fat and from saturated fat when the degree of acculturation was controlled for in the analysis. These results suggest that less education, regardless of other factors, is directly associated with poorer food choices. Thus, nutritional education for Hispanic parents with low levels of education seems especially important for improving children's diets (39). Innovative programs may serve as useful models for altering the trajectory toward overweight and obesity among minority children and their families through changes in diet and physical activity (40). In addition, the apparently healthy diets of youths in low-income households with Spanish-speaking parents suggests that qualitative research into the underlying communication and acculturation processes and their pathways to diet and nutrition would be of great benefit.

Research efforts designed to evaluate health education programs in school settings would benefit from paying special attention to acculturation processes among Hispanic youths. Meals eaten away from home, including school meals, tend to contain too much fat, saturated fat, and sodium and too little fiber and calcium (41). The US Department of Agriculture's School Meals Initiative for Healthy Children supports the development and dissemination of educational materials for food service staff, students, teachers, parents, and the community. Research directed toward understanding the specific role of acculturation in defining the conditions under which youths and teenagers take advantage of the nutritional benefits of healthier food options would be useful. This could be complemented by attention to means of increasing physical activity among this population (42).

Our efforts to assess the role of social integration, as measured by duration of household head's residence, were of limited success. It is difficult to infer meaning from the finding that shorter-term residents had higher macronutrient intakes whereas longer-term residents had diets with a higher percentage of energy from fat. Shorter-term residence could be interpreted in 2 ways: as signifying either less social integration (with a negative connotation) or higher mobility (with a possible positive connotation). Developing better measures of social integration in future research will help to address this issue (43–45). It would also be worthwhile to link measures of social integration with acculturation and socioeconomic status. Qualitative work has elucidated the complex, multilevel nature of social networks and the differentiated use of networks by members of different ethnic groups in dealing with food insufficiency (46). Further research is required to better explain the relations between social support and food security among low-income households.

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