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Adherence to Dietary Recommendations Is Associated with Acculturation among Latino Farm Workers[1,2]

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Abstract

We examined adherence to dietary recommendations on fruit/vegetable and fat intake and identified correlates with acculturation indicators as well as with family, lifestyle, and occupational factors in a farm worker cohort in central California. Interviewer-administered questionnaires for this cross-sectional study were completed from January 2006 to April 2007. Participants were 18- to 55-y-old Latinos living in Mendota in a farm worker household. We assessed fruit/vegetable consumption and fat intake using the Block Fruit/Vegetable/Fiber Screener and the Block Dietary Fat Screener, respectively. Survey data analysis methods for contingency tables and logistic regression were used for assessing associations. The sample included 802 participants, reporting mean fruit and vegetable intake (± SD) of 5.0 ± 1.5 daily servings, and 47% reporting <5 daily servings. Being born in Mexico or Central America and longer United States residency were associated with higher odds of consuming ≥5 daily fruit/vegetable servings and more frequent consumption of field products while working was associated with lower adherence to this recommendation. The average daily percent of calories from fat was 35.0 ± 4.1% and 53% of participants consumed >35% of daily calories from fat. Men born in Mexico, women born in Central America, and participants who worked in fruit or vegetable crops had higher odds of consuming ≤35% of calories from fat. Higher acculturation level, United States school attendance, and having a child at home were associated with lower adherence to this recommendation. Acculturation, family, and occupational correlates of diet quality were identified in this underserved, immigrant population. Our findings may assist program targeting and intervention efforts. J. Nutr. 143: 1451–1458, 2013.

Introduction

Hired farm workers are the basis for California's labor-intensive agricultural sector. Data from the 2003–2004 National Agricultural Workers Survey indicated that 95% of California's farm workers are Latino immigrants, 91% were born in Mexico, 53% have lived in the United States for <10 y, and 64% worked in agriculture before coming to the United States (1). Additionally, 43% of farm workers and 30% of farm worker families earned <$10,000/y and overall, 22% of farm workers reported incomes below the federal poverty level (1).

The health burden on farm workers is understudied and often difficult to measure, because the workforce is mostly immigrant and mobile. In California, less than one-third of hired farm workers have health insurance (1–3), and 25% of men and 13% of women have never had a medical or clinic visit (2). The California Agricultural Workers Health Survey demonstrated high rates of chronic health conditions (2,3), including high serum cholesterol and high blood pressure, particularly among men. Additionally, 79% of males and 74% of females were either overweight or obese (2,3). Similarly, high prevalences of chronic health conditions were reported in 150 Michigan migrant farm workers, among whom 60% were obese (BMI >27.8 for men and >27.3 for women), 39% had diabetes, 23% had hypertension, 18% had anemia (hematocrit <39% for men and <36% for women), and 20% had hypercholesterolemia (≥5.72 mmol/L total cholesterol) (4). These chronic health conditions are all strongly related to suboptimal diet. Although little is known about diet quality, the seasonality and demands of farm work in conjunction with low incomes likely increase risk for poor nutrition. A diet assessment of migrant farm workers in Michigan revealed inadequate intake of fruit and vegetables, with 89% consuming <5 daily servings (4).

Acculturation, defined as the process by which a racial/ethnic group adopts the cultural patterns (e.g., beliefs, language, etc.) of a dominant host group (5), may adversely influence positive health behaviors, including dietary choices in Latino immigrants (6–11). National data for 1245 nonpregnant Mexican-American women in the United States showed that acculturation (measured

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as country of birth and language) was associated with decreased consumption of fruit and vegetables, lower fiber intake, and greater percentage of energy consumed from fat (11). Similarly, higher acculturation (measured as language use, ethnic self-identification, and birthplace) associated with lower consumption of fruits and vegetables and poorer fat-related diet habits was reported in a sample of 735 Mexicans living in Washington state (8). However, the evidence is inconsistent, probably due to the use of different methods to assess acculturation and the cultural diversity among Latino subgroups (7).

To our knowledge, no studies have explored how diet is influenced by the acculturation process in Latino farm workers, a group that includes more recent (1) and less acculturated immigrants (12) who face a high health burden (2–4). Using data from the Mexican Immigration to California: Agricultural Safety and Acculturation (MICASA)[6] cohort, we examined adherence with fruit/vegetable and fat intake recommendations in this population and their association with acculturation. Additionally, we assessed whether family, lifestyle, and occupational factors were also associated with both dietary outcomes.

Methods

The MICASA study is a cohort study of occupational and environmental health risks in a population-based sample of hired farm households in Mendota, California. This analysis uses data collected at baseline in the MICASA cohort (13).

Sampling strategy. The city of Mendota, located in agriculturally rich Fresno County, was selected as the research site for the high proportion of immigrants and farm workers residing there. To obtain a representative sample for the MICASA study, a 2-stage sampling process was used with random sampling of census blocks and door-to-door enumeration. Further details of this procedure are described elsewhere (13). At the time of the enumeration, study eligibility and household composition were determined. Households with no farm workers were not enumerated. For all occupants of each enumerated household, the following was determined: relationship to the head of household (spouse, child, sibling, parent, etc.), age, gender, ethnicity, involvement in farm work, and years of residence in Mendota. Eligible households were then randomly selected and invited to participate in the study.

Overall, 467 households were recruited, reflecting a 70% participation rate (among eligible households) and comprising 843 individual adult interviews.

Eligibility criteria. Eligible participants for the MICASA study included men and women ages 18–55 y who self-identified as Mexican or Central American and resided in Mendota at the time of the baseline interview. Households included at least one member who was engaged in farm work for at least 45 d in the year prior to recruitment. Additionally, in recruiting households, we attempted to interview both the head of household and spouse, resulting in 376 households in which both were interviewed.

This analysis was restricted to participants interviewed in family households. Forty-one unaccompanied males (men who were in the United States for work while their families remained in their country of origin) were excluded due to dissimilar lifestyles and dietary patterns compared with participants residing in family units.

Data collection. The MICASA baseline data were collected from January 2006 to April 2007 by trained Spanish-speaking interviewers. The survey instrument included questions on demographic characteristics, occupational and environmental risk factors, diet and physical activity, acculturation, lifestyle behaviors, and health outcomes, including respiratory health, injuries, and mental health. The questionnaire was translated into Spanish and then back translated into English by bilingual individuals. All participants provided written informed consent and all interviews were conducted in Spanish. The study protocol was approved by the University of California, Davis Institutional Review Board.

Outcome measures. The primary outcome measures consisted of the number of fruit and vegetable servings per day and percent of total daily caloric intake from fat. Consumption of fruit and vegetables during the past year was assessed using the Block Fruit/Vegetable/Fiber Screener (14), a brief screening tool that includes 7 questions about fruit and vegetable intake and 3 questions about foods high in fiber. Fat intake during the past year was evaluated using the 17-item Block Dietary Fat Screener (14). Both screeners require the use of prediction equations to translate the scores into daily intake. These equations were constructed by the screeners' authors using linear regression techniques and for the dietary outcomes examined in this study, they included gender as a covariate (14). Thus, we used these prediction equations with collected data as input to generate estimates of total fruit/vegetable servings per day and percent dietary fat for statistical analysis. To assess adherence to dietary recommendations, the estimated number of fruit/vegetable servings per day was dichotomized into $\geq$5 vs. <5 daily servings (15) and the estimated percentage of daily calories from fat was dichotomized into $\geq$35 vs. <35%, a cutoff based on the Institute of Medicine's recommendation of the maximum intake associated with reduced risk of chronic disease (16).

Acculturation measures. Acculturation was measured using both proxy indicators and an acculturation scale. Proxy indicators included country of birth, years residing in the United States, age at immigration, and school attendance in the United States. For analyses, years living in the United States and age at immigration were dichotomized at the median. Country of birth was categorized into: United States, Mexico, and Central America (with 89% born in El Salvador). Additionally, an acculturation score was obtained using the Acculturation Rating Scale for Mexican Americans (ARSMA)-II short version (17). The ARSMA-II short version includes 12 items derived from the 30-item ARSMA-II that assesses acculturation along 3 primary factors: language use and preference, ethnic identity, and ethnic interaction (18). The ARSMA-II short version is highly correlated with the full scale and has adequate internal consistency (17). The scale's authors categorize scores into a continuous scale with 5 levels of acculturation: 1 = very Mexican oriented, 2 = Mexican oriented to approximately balanced bicultural, 3 = slightly Anglo oriented bicultural, 4 = strongly Anglo oriented, and 5 = very assimilated, Anglicized. Due to low variability in acculturation scores (94% of participants were categorized as "very Mexican oriented"), we collapsed these 5 categories into 2: low acculturated (category 1) compared with medium/high acculturated (categories 2–5).

Family, lifestyle, and occupational measures. Two family characteristics were assessed: presence of a child ($\leq$18 y old) in the household (yes vs. no), and frequency that the family ate dinner together during the past week (<4 times/wk vs. $\geq$4 times/wk). Lifestyle variables included current smoking (yes vs. no), moderate/heavy alcohol consumption [on average >3 alcoholic drinks/wk vs. light or no alcohol consumption, defined as $\leq$3 drinks/wk (19)], and less than once per week fast food consumption during the past month (yes vs. no). Occupational factors were assessed and analysis of these factors was restricted to those reporting ever working in agriculture. Participants reported total number of years working in agriculture, dichotomized at the sample median. From 12-mo work history data, a variable to indicate whether the agricultural work was primarily in a fruit or vegetable crop was created. Respondents were also asked about the frequency of eating products from the field while working during the past year (never, sometimes/half time, or most times/always).

Statistical analysis. Descriptive statistics to characterize the study sample consisted of frequency distributions for categorical data and

[6] Abbreviations used: AOR, adjusted OR; ARSMA, Acculturation Rating Scale for Mexican Americans; MICASA, Mexican Immigration to California: Agricultural Safety and Acculturation.

means and medians for all continuous data. Values in the text are means ± SDs. We used F-based Wald tests for log-linear models to examine bivariate associations between acculturation factors, family, lifestyle, and occupational variables with the 2 dietary outcomes while taking into account the survey design (20) (via SAS PROC SURVEYFREQ). Univariate and multivariate logistic regression models for clustered survey data (via SAS PROC SURVEYLOGISTIC) were built to assess the independent association of each of the acculturation, family, lifestyle, and occupational variables with the diet outcomes. Census tract and block were specified in the survey data analyses as design variables to adjust variance estimates and test statistics. Thus, each of the exposure variables of interest was independently modeled, first without any other covariates (unadjusted model), and then along with potential confounders (adjusted model). Unadjusted and adjusted logistic regression model results are presented. Adjusted models included age, education, income, and season of the year when the interview was conducted as potential confounding variables. These variables were selected based on preliminary data analysis and a priori knowledge from scientific literature about their association with the outcomes and were kept in the adjusted models regardless of the effect on the estimates. Because the association between acculturation and nutrition outcomes may be modified by gender (21), we included an interaction term (e.g., country of birth × gender) to test for effect modification when we modeled the acculturation variables as predictors for the 2 dietary outcomes; the Wald chi-square test and a $P < 0.10$ significance level were used for testing interaction terms based on the moderate study sample size warranting the trade-off between an elevated Type-1 error in exchange for a meaningful reduction in Type-2 error (22). All statistical analyses were performed with SAS (version 9.2, 2007, SAS Institute).

Results

A total of 802 participants were included in this analysis. Assessment of fruit/vegetable consumption was completed for 98% (n = 783) of the sample; assessment of fat intake was completed for 89% (n = 717) of the participants. Those with missing fat intake data were similar to the remaining sample for age, gender, education, income, country of birth, and acculturation level. An acculturation score was obtained for 97% (n = 780) of the sample.

On average, participants were 37 ± 10 y old, with a mean United States residency of 16 ± 10 y and mean age at immigration of 22 ± 8 y old. Fifty-nine percent of participants completed elementary education or less, 97% were married (or living together), and 51% were heads of household (**Table 1**). Income levels were low, with 86% of participants reporting an annual household income of $30,000 or less. Ninety percent of participants had worked in agriculture in their lifetime, for 14 ± 9 y (median = 12), and 82% had done so for at least 45 d during the last year.

Only 4% of participants were born in the United States, 67% were born in Mexico, and 29% were born in Central America (Table 1). Most participants were low acculturated (94%) and only 20% attended school in the United States. Eighty-two percent of family households included a child. Moderate or heavy consumption of alcohol and current smoking were uncommon (16 and 10%, respectively). Most participants had worked in fruit or vegetable crops during the past year (91%) and 58% reported eating products from the field while working.

Fruit and vegetable intake. Overall, participants' consumption of fruit and vegetables averaged 5.0 ± 1.5 servings/d and 47% of subjects ate <5 servings/d during the past year. The average number of fruit and vegetable servings per day was higher among males than females (5.2 ± 1.5 vs. 4.8 ± 1.5; $P <$ 0.001). In bivariate analysis, consumption of ≥5 servings of fruits and vegetables per day was associated with higher frequency of family meals and less frequent intake of field products while working (Table 1). In logistic regression models adjusted for age, gender, education, income, and season at interview, being born in Central America was associated with increased odds of consuming ≥5 servings of fruits or vegetables per day [adjusted OR (AOR): 2.7; 95% CI: 1.2, 6.2; P = 0.024]. Unexpectedly, longer residence in the United States was associated with increased odds of meeting the dietary recommendation (AOR: 1.5; 95% CI: 1.0, 2.3; P = 0.035). Conversely, eating field products while working most of the time or always (AOR: 0.5; 95% CI: 0.3, 0.7; P = 0.0007) was associated with a significantly decreased odds of consuming at least 5 daily servings of fruits and vegetables (**Table 2**).

Fat consumption. Overall, the mean daily percent of calories obtained from fat was 35.0 ± 4.1%, and 47% of participants consumed >35% of their daily calories from fat. The percent dietary fat was lower in males compared with females (33.8 ± 4.1% vs. 36.1 ± 3.9%; $P <$ 0.0001). Bivariate associations examining fat intake suggested that school attendance in the United States and higher acculturation level were associated with increased fat intake (Table 1). Similarly, the presence of a child at home was associated with higher fat intake (Table 1). Conversely, alcohol consumption and longer time working in agriculture were associated with lower fat consumption (Table 1). Consistent with the bivariate results, logistic regression models adjusted for age, gender, education, income, and season at interview showed that medium/high acculturation level (AOR: 0.2; 95% CI: 0.1, 0.5; P = 0.0003), school attendance in the United States (AOR: 0.5; 95% CI: 0.3, 0.7; P = 0.0004), and having a child at home (AOR: 0.4; 95% CI: 0.3, 0.7; P = 0.0006) were associated with lower odds of consuming ≤35% of daily calories from fat (**Table 3**). After adjusting for age, gender, education, income, and season at interview, working in a fruit or vegetable crop during the past year was associated with increased odds of consuming ≤35% of daily calories from fat (AOR: 2.9; 95% CI: 1.3, 6.4; P = 0.0072) (Table 3). The association between country of birth and fat consumption was modified by gender (Wald chi-square test on 2 d.f. = 5.83; P = 0.05). Thus, males born in Mexico and females born in Central America had increased odds of maintaining an appropriate intake of calories from fat compared with their counterparts born in the United States (AOR: 2.8; 95% CI: 1.1, 7.2; P = 0.0378 and AOR: 4.8; 95% CI: 1.6, 14.7; P = 0.0062, respectively).

Discussion

To our knowledge this is the first report focused on the adherence to diet recommendations and its association with acculturation factors among Latino farm workers, a population with a high chronic disease burden. About one-half of participants did not meet the recommended daily intake of fruits and vegetables and consumed more dietary fat than is recommended. Although these results are worrisome, compliance with the recommended fruit/vegetable intake was considerably higher in this population than the 24% reported in the United States general population in 1999–2002 (23). Similarly, the average number of daily servings of fruits and vegetables was relatively high and comparable with estimates reported in other Latino samples (8,11), but higher than what was observed among older Mexican American women in Arizona (24) and in the United States general population (23,25). The average percent of calories obtained

TABLE 1 Overall distribution of socio-demographic, acculturation, family, lifestyle, and occupational variables of MICASA study participants at baseline interview (2006–2007) and by dietary outcomes[1]

Variable	Overall (n = 802)	≥5 fruit/vegetable servings/d[2] (n = 783)	≤35% of calories from fat[2] (n = 717)
	n (%)	*n (%)*	*n (%)*
Socio-demographic factors			
Age, y			
18–30	221 (28)	102 (47.0)*	95 (47.0)**
31–40	290 (36)	161 (57.1)	123 (47.9)
≥41	291 (36)	149 (52.5)	159 (61.6)
Sex			
Male	381 (48)	198 (53.4)	226 (66.3)***
Female	421 (52)	214 (51.9)	151 (40.2)
Education			
No school	38 (5)	20 (54.1)	22 (66.7)**
Primary	399 (54)	196 (50.5)	203 (56.2)
More than primary	297 (40)	148 (50.9)	115 (43.4)
Annual household income			
≤$10,000	138 (18)	60 (44.4)	70 (56.0)
$10,001–$20,000	345 (44)	186 (55.0)	164 (52.6)
$20,001–$30,000	190 (24)	107 (56.9)	86 (50.3)
>$30,000	105 (14)	49 (49.0)	50 (56.2)
Acculturation factors			
Country of birth			
United States	35 (4)	15 (42.9)	9 (31.0)**
Mexico	534 (67)	269 (51.5)	241 (50.0)
Central America	233 (29)	128 (56.6)	127 (61.7)
Years living in United States			
<14	391 (49)	187 (49.0)	175 (49.2)
≥14	408 (51)	224 (56.3)	201 (56.0)
Age came to United States, y			
≤21	397 (52)	207 (53.6)	191 (53.2)
>21	369 (48)	190 (52.6)	177 (54.0)
School attendance in United States			
No	618 (80)	333 (55.2)	314 (56.5)***
Yes	150 (20)	66 (44.9)	48 (36.4)
Acculturation level			
Low acculturation	731 (94)	374 (52.3)	359 (54.5)***
Medium/high acculturated	49 (6)	24 (49.0)	10 (24.4)
Family characteristics			
Frequency of family meals			
<4 times during last week	166 (21)	71 (43.0)*	78 (52.4)
≥4 times during last week	626 (79)	335 (54.8)	294 (52.3)
Presence of child at home			
No	143 (18)	71 (50.7)	86 (68.3)**
Yes	659 (82)	341 (53.0)	291 (49.2)
Lifestyle factors			
Current smoker			
No	722 (90)	372 (52.9)	336 (51.9)
Yes	79 (10)	39 (49.4)	41 (59.4)
Alcohol drinking			
Light or no drinker	667 (84)	345 (52.8)	298 (50.1)***
Moderate/heavy alcohol drinker	126 (16)	65 (53.7)	75 (66.4)
Consumed fast food ≥1 time/wk			
No	561 (70)	284 (51.8)	281 (55.1)
Yes	238 (30)	126 (54.1)	95 (46.3)
Occupational factors[3]			
Time working in agriculture			
<12 y	353 (50)	173 (50.1)	147 (46.4)***
≥12 y	359 (50)	192 (55.0)	201 (64.0)

(Continued)

TABLE 1 *Continued*

Variable	Overall (n = 802)	≥5 fruit/vegetable servings/d[2] (n = 783)	≤35% of calories from fat[2] (n = 717)
Worked in fruit or vegetable crop			
No	56 (9)	35 (64.8)	21 (44.7)
Yes	600 (91)	304 (51.8)	303 (56.7)
Ate field products while working			
Never	281 (42)	157 (57.1)*	140 (56.2)
Sometimes/half time	292 (43)	153 (52.8)	146 (56.6)
Most times/always	101 (15)	38 (40.0)	42 (46.7)
Season at baseline interview			
Spring	282 (35)	161 (58.1)	138 (53.5)***
Summer	109 (14)	51 (48.1)	62 (67.4)
Fall	165 (20)	85 (52.5)	96 (62.3)
Winter	246 (31)	115 (48.3)	81 (38.0)

[1] Statistical tests for association were adjusted for the survey design (PROC SURVEYFREQ) using F-based Wald tests of independence for a log-linear model. *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$. MICASA, Mexican Immigration to California: Agricultural Safety and Acculturation.
[2] Frequency and percent of participants in each exposure level within the specified dietary outcome category.
[3] Sample limited to those who ever worked in agriculture.

from fat was lower than that reported by Kristal et al. (26) (38.4 ± 6.9%) for Latino women in a multi-racial/ethnic study where no differences were observed among women across racial/ethnic groups. Some of these differences may be due to the rural nature of the farm worker population and/or the connection to agricultural work.

Measures of acculturation, including an acculturation scale and country of birth, years living in the United States, age at immigration, and school attendance in the United States were the primary exposures examined in this analysis of dietary outcomes in Latino farm workers. Having different measures of acculturation allowed us to explore more comprehensively the association between acculturation and the study dietary outcomes. Being born in Central America was associated with >2-fold increased odds of consuming at least 5 servings/d compared with those born in the United States. Similar findings were

TABLE 2 Unadjusted ORs and AORs and 95% CIs for consumption of ≥5 fruit/vegetable servings per day among MICASA study participants[1]

Variable	n[2]	≥5 fruit/vegetable servings/d	
		OR (95% CI)	AOR[3] (95% CI)
Acculturation			
Country of birth (ref: United States)	697		
Mexico		2.0 (1.0–3.8)	2.1 (1.0–4.2)
Central America		2.6 (1.2–5.7)	2.7 (1.2–6.2)
≥14 y living in United States (ref: <14)	694	1.3 (0.9–1.8)	1.5 (1.0–2.3)
≤21 y old at immigration to United States (ref: >21)	666	1.1 (0.7–1.6)	1.1 (0.8–1.7)
Attended school in United States (ref: no)	667	0.7 (0.4–1.0)	0.6 (0.4–1.0)
Medium/high acculturation level (ref: low)	679	0.8 (0.4–1.4)	0.7 (0.4–1.6)
Family characteristics			
Family ate together ≥4 times/wk (ref: no)	691	1.6 (1.1–2.4)	1.5 (1.0–2.4)
Child at home (ref: no)	697	1.1 (0.8–1.6)	1.1 (0.7–1.7)
Lifestyle factors			
Current smoker (ref: no)	696	0.8 (0.5–1.4)	0.8 (0.5–1.3)
Moderate/heavy alcohol drinker (ref: light drinker)	689	1.0 (0.7–1.5)	1.0 (0.7–1.4)
Consumed fast food ≥1 time/wk (ref: no)	695	1.1 (0.8–1.6)	1.1 (0.8–1.6)
Occupational factors[4]			
≥12 y working in agriculture (ref: <12 y)	621	1.2 (0.8–1.8)	1.5 (1.0–2.5)
Worked in a fruit or vegetable crop (ref: no)	575	0.5 (0.3–1.0)	0.5 (0.3–1.1)
Ate field products while working (ref: never)	588		
Sometimes/half time		0.9 (0.6–1.3)	0.9 (0.6–1.3)
Most times/always		0.5 (0.3–0.7)	0.5 (0.3–0.7)

[1] AOR, adjusted OR; MICASA, Mexican Immigration to California: Agricultural Safety and Acculturation; ref, reference.
[2] Sample sizes vary due to intermittent nonresponse.
[3] Separate multiple logistic regression models were fit for each reported independent variable to statistically adjust for age, gender, income, education, and season at baseline interview.
[4] Sample limited to those who ever worked in agriculture.

TABLE 3 Unadjusted ORs and AORs and 95% CIs for consumption of ≤35% of calories from fat among MICASA study participants[1]

Variable	n[2]	≤35% of calories from fat	
		OR (95% CI)	AOR[3] (95% CI)
Acculturation			
Country of birth times gender[4]	641		
Mexico (vs. United States) among males		2.9 (1.0–7.8)	2.8 (1.1–7.2)
Mexico (vs. United States) among females		2.3 (0.7–8.0)	2.3 (0.7–7.2)
Central America (vs. United States) among males		2.8 (1.0–8.1)	2.5 (0.9–7.1)
Central America (vs. United States) among females		5.0 (1.0–16.8)	4.8 (1.6–14.7)
≥14 y living in United States (ref: <14)	639	1.2 (0.9–1.7)	0.8 (0.6–1.2)
≤21 y old at immigration to United States (ref: >21)	615	1.0 (0.7–1.3)	1.0 (0.7–1.5)
Attended school in United States (ref: no)	614	0.4 (0.3–0.6)	0.5 (0.3–0.7)
Medium/high acculturation level (ref: low)	626	0.2 (0.1–0.4)	0.2 (0.1–0.5)
Family characteristics			
Family ate together ≥4 times/wk (ref: no)	636	1.0 (0.6–1.6)	1.0 (0.5–1.7)
Child at home (ref: no)	641	0.4 (0.3–0.6)	0.4 (0.3–0.7)
Lifestyle factors			
Current smoker (ref: no)	641	1.2 (0.7–2.3)	0.8 (0.4–1.7)
Moderate/heavy alcohol drinker (ref: light drinker)	633	1.8 (1.2–2.7)	1.1 (0.8–1.7)
Consumed fast food ≥1 time/wk (ref: no)	639	0.7 (0.5–1.1)	0.7 (0.5–1.1)
Occupational factors[5]			
≥12 y working in agriculture (ref: <12 y)	568	1.8 (1.3–2.5)	1.3 (0.9–2.0)
Worked in a fruit or vegetable crop (ref: no)	525	1.9 (1.0–3.5)	2.9 (1.3–6.4)
Ate field products while working (ref: never)	535		
Sometimes/half time		1.0 (0.7–1.4)	0.9 (0.7–1.3)
Most times/always		0.8 (0.4–1.4)	0.7 (0.4–1.2)

[1] AOR, adjusted OR; MICASA, Mexican Immigration to California: Agricultural Safety and Acculturation; ref, reference.
[2] Sample sizes vary due to intermittent nonresponse.
[3] Separate multiple logistic regression models were fit for each reported independent variable to statistically adjust for age, gender, income, education, and season at baseline interview.
[4] Wald chi-square (2 df) for country of birth × gender term = 5.83, $P = 0.05$.
[5] Sample limited to those who ever worked in agriculture.

previously reported (11,27), although one study was limited to women born in Mexico (compared to United States born) and reported effect modification by country of birth and language acculturation with fruit and vegetable intake (11). However, acculturation level and age at immigration were not associated with fruit and vegetable intake, whereas a tendency to consume fewer fruit and vegetables was observed among those who attended school in the United States. Unexpectedly, longer residence in the United States, assumed to indicate higher acculturation, was positively associated with meeting the fruit and vegetable intake recommendation. We are puzzled by the direction of this association, as no other acculturation indicator performed similarly for either diet outcome.

More highly acculturated Latino farm workers and those who attended school in the United States had lower odds of consuming <35% of calories from fat. Previous reports on the association between saturated fat intake and higher acculturation among other Latino populations have been inconsistent, with one reporting an association consistent with our results (28) and another describing a negative association between higher acculturation and fat consumption (29), although the latter involved only women. To our knowledge, there is no previous information on the influence of school attendance on diet among Latino immigrants; nevertheless, our findings call for further exploration of such an association.

In our study, women born in Central America had higher odds of meeting the fat intake recommendation. These findings support previous research reporting greater consumption of higher fat foods among United States-born Latinas compared with foreign-born Latinas from both Mexico and Central America (30). However, Harley et al. (31) found no association between percent of calories from fat and birthplace in a study comparing only Mexican-born Latinas to their United States-born counterparts. Thus, differentiating Latinas born in Mexico from those born in Central America appears relevant to characterizing dietary fat and may relate to country-specific traditional foods and food preparation methods.

Having a child at home was associated with higher fat intake. Qualitative data collected from low-income Latino mothers have indicated that presence of children at home may influence fruit and vegetable purchase and consumption (32). Although there is no evidence of such influence regarding fat consumption, children may also affect purchase and consumption of other foods in the household. A cross-sectional survey of Latino children reported that, on average, parents had purchased 3 of the 6 types of foods the children reported seeing advertised on TV (33). Targeted by food advertising and the media, children of immigrants may become eager to assimilate and adopt the new foods; consequently, this may affect food purchasing and intake at home. Furthermore, the presence of children has been consistently associated with food insecurity in farm worker families (34,35), which in turn is related to higher fat intake (36,37). Further exploration of this association is warranted.

Eating products from the field more frequently (compared with never) was associated with lower odds of consuming at

least 5 daily servings of fruits/vegetables, while eating them less frequently (sometimes to one-half the time) was not. Latino farm workers are more likely to obtain fruits and vegetables from work than nonfarm workers (38). In our sample, 91% of participants worked in fruit or vegetable crops during the past year and 58% reported eating products from the field while they were working. Thus, it is possible that participants did not consider the fruits and vegetables eaten while working when they responded to the diet screener, resulting in greater underreporting among those who more often ate products from the field. Another potential explanation is that consumption of field products from work occurred more frequently among those facing a higher level of food insecurity because of lower availability of those foods at home. Food insecurity is prevalent among farm workers (34,35) and has been associated with lower fruit and vegetable availability in Latino households (39) and lower consumption in rural New York (40). Potential confounding by food insecurity would have been worth exploring; unfortunately, we were unable to assess this due to lack of an appropriate measure of food insecurity.

There were several limitations to this study, primarily related to the reliance on self-reported questionnaire data. Dietary assessment employed the use of short FFQs (screeners). Although multiple-day recalls, food records, and even full-length FFQs are more comprehensive and preferred measures in research, their use in large population-based studies such as MICASA was not practical due to the time and cost to administer them. Moreover, a short interviewer-administered tool seemed more appropriate given the low education and/or low literacy of the population. An additional benefit of using a simpler dietary tool may be in reducing the potential for response bias that can be introduced from lower response rates associated with more rigorous methods (41). Furthermore, the food screeners used in this study were validated and proven to provide a reasonably accurate measurement of nutrient intake similar to full-length dietary questionnaires (14). The lack of variability in acculturation scores was another limitation and may have affected our ability to detect significant associations with the dietary outcomes. However, other indicators of acculturation were also related to diet and may be important for inclusion in studies with less-acculturated populations.

In summary, it is concerning that about one-half of participants were not meeting the recommendation for fruit, vegetable, and fat intake, particularly due to their high chronic disease burden. In general, greater acculturation (measured by several indicators) negatively affected adherence to diet recommendations in this underserved, immigrant, farm worker population. However, longer United States residence was an exception, showing a positive association with fruit and vegetable intake in this population. Among the acculturation indicators used, non-United States birthplace was consistently associated with both diet outcomes; however, family and occupational factors may also play a role in this population. Further research to better understand some of these associations is warranted, including qualitative research to explore the mechanisms by which school attendance deteriorates diet quality and bi-national, longitudinal, or retrospective studies to disentangle the potential effect of globalization compared with acculturation on diet changes in this population. Nevertheless, these findings may assist program targeting and intervention efforts, which could have public health implications given the strong association between diet and health as well as the potential for dietary changes to benefit long-term health.

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