



## Acculturation and Serum Nutrients Thought to Be Involved With Cancer Prevention Among Mexican American Men in the United States

Carlos A. Reyes-Ortiz, MD, PhD, Hyunsu Ju, PhD, Astrid Inniss, PhD, RD, Karl Eschbach, PhD, Yong-Fang Kuo, PhD, and James S. Goodwin, MD

**Background:** Mexican American men living in the United States who are more acculturated exhibit higher rates of cancer compared to those less acculturated. This study explored the association between acculturation and serum levels of nutrients thought to be involved with cancer prevention among Mexican American men.

**Methods:** Our sample included 2,479 Mexican American men from the Third National Health and Nutrition Examination Survey (1988–1994). Outcomes were serum levels of micronutrients. Acculturation in Mexican American men was assessed by a combined measure including country of origin, language of interview, and years of residence in the United States and was categorized as follows: (1) foreign-born, 0–5 years in the United States (lowest acculturation), (2) foreign-born, 6–15 years in the United States, (3) foreign-born, > 15 years in the United States, (4) US-born Spanish-speaking, and (5) US-born English-speaking (highest acculturation).

**Results:** Adjusted analyses showed that acculturation decreased the serum levels for vitamin E, vitamin C, and folate and also for some carotenoids (alpha and beta carotenes, beta cryptoxanthin, and lutein-zeaxanthin). By contrast, acculturation increased the serum levels for selenium and lycopene.

**Conclusions:** With the exception of selenium and lycopene, acculturation among Mexican American men decreased the serum levels for most carotenoids and for vitamin E, vitamin C, and folate. These changes in nutrient profiles, reflecting altered patterns in food consumption or other behaviors, may explain in part why Mexican American men who are more acculturated have an increased risk for diet-related cancer.

### Introduction

Overall rates of cancer incidence and mortality are approximately one-third lower in US Hispanics compared with non-Hispanic whites or blacks, but the

pattern varies by cancer site and gender.<sup>1</sup> Hispanic men have a lower incidence than non-Hispanic white men for cancers of the lung, prostate, and colon and rectum, and they have higher rates for cancers of the stomach and liver.<sup>1,4</sup>

Several animal and human studies have shown the potential effect of dietary components on cancer risk. Micronutrients most promising in reducing risk for cancer include selenium, lycopene, vitamin E, and vitamin D,<sup>5–8</sup> and other nutrients (eg, vitamin C, vitamin A, and other carotenoids) and foods (eg, soy products) may also provide protection against cancer.<sup>5–14</sup> The two mechanisms of micronutrients that are postulated to provide a protective effect against cancer are (1) the antioxidant effects that protect against DNA-damaging agents in normal cells (eg, selenium,

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From the School of Public Health at the University of North Texas Health Science Center, Fort Worth, Texas (CAR-O); the Sealy Center on Aging (HJ, Y-FK, JSG) and the Clinical Research Center (AD) at the University of Texas Medical Branch, Galveston, Texas; and the Institute for Demographic and Socioeconomic Research at the University of Texas at San Antonio, Texas (KE).

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Address correspondence to Carlos A. Reyes-Ortiz, MD, PhD, Department of Social and Behavioral Sciences, School of Public Health, University of North Texas Health Science Center (EAD -711B), 3500 Camp Bowie Boulevard, Fort Worth, TX 76107. E-mail: creyes@bsc.unt.edu

**Abbreviations used in this paper:** BMI = body mass index, kcal = total calories.

vitamins) and (2) inhibition of cell-cycle progression in cancer cells (eg, vitamin E, lycopene, and other carotenoids).<sup>5-14</sup> In addition, case-control and cohort studies have shown that vegetables and fruits are associated with a reduction in the risk of some cancers, including cancers of the mouth and pharynx, esophagus, stomach, colon-rectum, larynx, lung, breast (vegetable only), ovary (vegetable only), bladder (fruit only), and kidney.<sup>15-17</sup>

Cancer rates vary within a population due in part to cultural factors. For example, the cancer incidence rates of men of Japanese ancestry living in California are higher than those of men living in Japan, with Japanese men in Hawaii having rates intermediate between these two.<sup>18</sup> This same relationship applies to Hispanic men living in the United States. For example, from 1999 to 2001, foreign-born Hispanic men had a decrease of 18% of age-adjusted death rates for all cancers compared with US-born Hispanic men.<sup>19</sup> Mexican American men born in Mexico exhibit rates of prostate, colon, and bladder cancers that are about 30% lower compared with the rates of Mexican American men born in the United States and non-Hispanic white men.<sup>20</sup> Since the Hispanic population is the fastest-growing minority group in the United States, concern about cancer in this population is increasing.

Acculturation may influence the diet of Hispanics. In general, Hispanics have higher intakes of fruits, vegetables, and fiber than non-Hispanic whites have.<sup>21-23</sup> However, those dietary advantages of Hispanics may disappear with acculturation and assimilation to mainstream US culture.<sup>24-27</sup> The objective of this study was to explore the association between acculturation and serum levels of nutrients thought to be involved with cancer prevention among Mexican American men. We hypothesized that Hispanics who are more acculturated tend to have lower serum levels of nutrients that are thought to decrease the risk of cancer.

## Methods

### Data Source

Data were gathered from the Third National Health and Nutrition Examination Survey (NHANES III, 1988-1994). NHANES III, a large US survey formatted in a multistage probability design, is a major source of information on the nutritional and health status of the US population aged 2 months or more.<sup>28</sup> Mexican Americans were oversampled to produce statistically reliable health estimates for the largest ethnic minority group in the United States. Data were collected using standardized questionnaires administered by health professionals at participants' homes as well as via laboratory tests and standardized medical examinations by physicians, medical technicians, and other health professionals.<sup>29,30</sup>

### Sample

Of an initial sample of 2,682 Mexican American men aged 17 years and over, 203 subjects with missing nativ-

ity status were excluded, resulting in a study sample of 2,479. This sample represents the overall population of Mexican Americans with risk profiles (anthropometric or nutritional) for developing cancer.

### Measures

The outcomes were serum levels of nutrients, which have been shown to correlate well with dietary intake of respective nutrients.<sup>31</sup> The micronutrients examined included those considered to be of potential public health significance and thought to decrease the risk of cancer.<sup>5-14</sup> Serum levels of the following nutrients were obtained: selenium, vitamin E, vitamin D, vitamin A, vitamin C, folic acid, and carotenoids such as lycopene, alpha and beta carotene, beta cryptoxanthin, and lutein-zeaxanthin. Serum levels of nutrients were determined by nutritional biochemistry. Mobile examination centers collected blood samples and used the following assay methods and instrumentation for laboratory assessments: Quantaphase Folate RIA Kit/Bio-Rad Laboratories (folate), HPLC/Waters Chromatography (vitamin A, C, E, carotenoids, retinyl esters), INCSTAR 25-OH-D RIA Kit (vitamin D = 25-hydroxy vitamin D<sub>3</sub>), <sup>125</sup>I-folic, and GFAA/Perkin-Elmer Model 3030 and 5100 (selenium).<sup>28,29</sup> All nutrients were used as continuous variables.

Acculturation was assessed by a combined category using country of origin, language of interview, and years of residence in the United States (measures that exist only for foreign-born subjects). The years of residence for respondents identified as foreign-born (in Mexico) ranged from less than 1 year to 85 years (median = 11 years). Those who were foreign-born were subcategorized into three tertiles according to number of years in the United States: 0 to 5 years, 6 to 15 years, and more than 15 years. Those who were US-born were subcategorized into two categories according to the language they spoke at home (Spanish or English). We then created five categories of acculturation: (1) foreign-born and 0 to 5 years in the United States, (2) foreign-born and 6 to 15 years in the United States, (3) foreign-born and more than 15 years in the United States, (4) US-born and Spanish-speaking, and (5) US-born and English-speaking.

General risk factors for cancer that have a potential association with diet include physical activity, body mass index (BMI), waist circumference, total calories (kcal), percent kcal from saturated fat, and total dietary fiber. Physical activity was an additive index to measure respondents' participation in any activity (running, aerobics, yard work, dancing, weightlifting, bicycling, swimming, calisthenics, or any other sport or exercise) during their leisure time in the past month. BMI was computed as weight in kilograms divided by height in meters squared (k/m<sup>2</sup>). Waist circumference (a central adiposity indicator) was measured to the nearest 0.1

cm at the level of the iliac crest at the end of normal respiration. Determinations of kcal, percent kcal from saturated fat, and total dietary fiber were based on total nutrient intakes using a single 24-hour dietary recall that was administered by bilingual Spanish-speaking interviewers at the mobile examination centers. An automated, interactive interview and a coding system were used that featured a standardized interview format and automated probes to obtain detailed information about foods, including brand names, preparation methods, and ingredients used in preparation.<sup>32</sup> Three-dimensional food models, measurement aids, and food-specific units were used to estimate amounts consumed.

Control variables were age (years) and education (years) and were used as continuous variables. Respondents were asked if they have taken vitamins or mineral supplements in the past month (yes or no).

### Statistical Analyses

Analyses were carried out using the SAS System for Windows, Version 9.1 (SAS Institute, Cary, North Carolina) and incorporated sampling weights that adjusted for unequal probabilities of selection. We developed two sets of analyses. First, to determine the association between acculturation measures and sociodemographics (age, education), vitamin intake, and cancer risk parameters (physical activity, kcal, percent kcal from saturated fat, dietary fiber, BMI, and waist circumference), we used the chi-square test or analysis of variance (ANOVA) studies (*F* test for differences on means across acculturation categories). Because of differences in age and edu-

cation across acculturation categories, we adjusted the means of these two measures in cancer risk parameters; we also adjusted the means of BMI and waist circumference for physical activity as a potential confounder. Second, we used ANOVA to determine the association between acculturation measures and levels of serum nutrients (continuous variables). We reported crude and adjusted means (for age and education) for each serum level of nutrient outcome across acculturation categories, and *P* values were obtained by testing overall differences on means across the five acculturation categories. Because vitamin intake was significantly (all *P* values < .0001) and positively correlated with serum nutrients such as vitamin A (Pearson *r* = .12), vitamin C (*r* = .24), vitamin E (*r* = .25) and folate (*r* = .37) and with alpha carotene (*r* = .15) and beta carotene (*r* = .15), we also adjusted those nutrients for vitamin intake. In addition, we wanted to test if the adjusted means of serum nutrients have a linear trend across the five acculturation categories, from the lowest (foreign-born with 0–5 years in the United States) to the highest (US-born and English-speaking) acculturation level after adjusting for age, education, and vitamin intake, where appropriate. To obtain linear trend *P* values, we built linear orthogonal contrasts in ANOVA.

### Results

Subjects who were excluded (*n* = 203) were more likely to be younger, less educated, less physically active, and without vitamin intake than those who remained in the study (*N* = 2,479), and they were more likely to

**Table 1. — Characteristics of the Study Population (N = 2,479), Overall and by Acculturation Categories, Mexican American Men Aged 17–90 Years, NHANES III, United States, 1988–1994**

Variables	Foreign-Born				US-Born		P Value
	Overall Sample (N = 2,479)	0–5 Years in the United States (n = 493)	6–15 Years in the United States (n = 364)	> 15 Years in the United States (n = 361)	Spanish Use (n = 481)	English Use (n = 780)	
Age (yrs)	35.3 ± 0.3	29.2 ± 0.6	30.6 ± 0.4	44.7 ± 0.9	44.1 ± 1.0	35.0 ± 0.5	< .0001
Education (yrs)	9.2 ± 0.1	8.1 ± 0.2	7.2 ± 0.2	7.4 ± 0.4	8.4 ± 0.8	11.9 ± 0.1	< .0001
Vitamin use (%)	25.7	15.7	14.8	37.0	24.0	34.4	< .0001
Physical activity (0–9)*	1.76 ± 0.0	1.19 ± 0.1	1.24 ± 0.1	1.70 ± 0.1	1.54 ± 0.1	1.84 ± 0.1	< .0001
Total calories (kcal)*	2638.9 ± 30.4	2474.4 ± 56.4	2670.2 ± 61.0	2632.5 ± 65.4	2379.7 ± 70.4	2509.2 ± 46.4	.0071
% of kcal from saturated fat *	10.9 ± 0.1	10.2 ± 0.2	9.9 ± 0.2	10.6 ± 0.2	11.6 ± 0.2	11.6 ± 0.2	< .0001
Total dietary fiber (g)*	25.0 ± 0.4	28.2 ± 0.8	32.0 ± 0.9	25.4 ± 0.9	20.9 ± 1.0	19.9 ± 0.6	< .0001
Body mass index (BMI)*, **	26.7 ± 0.1	25.9 ± 0.2	26.5 ± 0.2	27.0 ± 0.2	27.6 ± 0.3	27.8 ± 0.2	< .0001
Waist circumference (cm)*, **	92.9 ± 0.3	91.5 ± 0.5	93.5 ± 0.6	95.0 ± 0.6	96.8 ± 0.7	97.2 ± 0.4	< .0001

Weighted means, standard error (± SE) of the mean and percentages (%) are reported.  
 \* Adjusted for age and education.  
 \*\* Adjusted also for physical activity.  
*P* values (for *F* or chi-square values) indicate testing overall difference on means or frequencies across the five acculturation categories: (1) foreign-born and 0–5 years in United States, (2) foreign-born and 6–15 years in United States, (3) foreign-born and > 15 years in United States, (4) US-born and Spanish-speaking, and (5) US-born and English-speaking. Data from the National Center for Health Statistics. National Health and Nutrition Examination Survey: NHANES III Data Files, Documentation, and SAS Code. <http://www.cdc.gov/nchs/about/major/nhanes/nh3data.htm>. Accessed January 12, 2009.

have lower waist circumference, higher kcal, and lower folate level. The mean age of the total sample was 35.3 years (SE = 0.3, median = 37.0, range = 17–90). The mean education (years) was 9.2 (SE = 0.1); the mean BMI was 26.7 (SE = 0.1), and the mean waist circumference was 92.9 cm (SE = 0.3) (Table 1). Recent immigrants (foreign-born with 0–5 years in the United States) comprised the youngest group. US-born English-speaking subjects had the highest level of education. US-born Spanish-speaking subjects had the lowest kcal intake. The percentage of kcal from saturated fat was lower in foreign-born subjects than in US-born subjects. Foreign-born subjects living 0–5 or 6–15 years in the United States had the lowest percentages of vitamin usage, the lowest levels of recreational physical activity, the highest intake of dietary fiber, the lowest BMI, and the lowest waist circumference compared with the other acculturation categories.

Table 2 shows the crude means of serum levels of nutrients across acculturation categories. Serum levels of nutrients for vitamins D and C and for carotenoids such as alpha carotene, beta cryptoxanthin, and lutein-zeaxanthin were higher in foreign-born subjects than in US-born subjects (either Spanish- or English-speaking). US-born English-speaking subjects had the highest means of serum levels for selenium and lycopene.

Table 3 shows the adjusted means of serum levels of nutrients across acculturation categories. There is a linear trend for increasing the means of serum levels for selenium and lycopene across acculturation categories, from the lowest (foreign-born with 0–5 years in the United States) to the highest (US-born English-speaking)

acculturation categories. By contrast, there is a linear trend for decreasing the means of serum levels for vitamin E, vitamin C, and folate, and the other carotenoids (alpha and beta carotenes, beta cryptoxanthin, and lutein-zeaxanthin) from the lowest to the highest acculturation categories.

## Discussion

The goal of the study was to examine associations between acculturation and serum nutrients thought to be involved with cancer prevention using a sample of Mexican American men aged 17 years and older. We found that Mexican American men who were more acculturated were more likely to have lower serum levels of most carotenoids and vitamins (E, C, and folate) and higher levels of selenium and one carotenoid (lycopene) compared with Mexican American men who were less acculturated.

Our first main finding — serum nutrients decreased relative to increasing acculturation and changes in food consumption — is consistent with other reports in the literature for Latinos. Less acculturated Mexican Americans have a higher intake of vitamins A, C, E, and B<sub>6</sub> and a higher intake of folate, calcium, potassium, and magnesium than do their more acculturated counterparts.<sup>24,25</sup> Harley et al<sup>35</sup> reported that the intake of folate, iron, and zinc for low-income women of Mexican descent decreased with time in the United States. Dietary patterns have been reported to be different and generally less healthy among US-born Mexican Americans compared with immigrant Mexican Americans. Highly acculturated Latinos consume about half the number of serv-

**Table 2. — Crude Means of Serum Levels of Nutrients Across Acculturation Categories Among Mexican American Men Aged 17–90 Years, NHANES III, United States, 1988–1994 (N = 2,479)**

Outcomes: Serum Nutrients	Foreign-Born			US-Born		P Value
	0–5 Years in the United States (n = 493)	6–15 Years in the United States (n = 364)	> 15 Years in the United States (n = 361)	Spanish Use (n = 481)	English Use (n = 780)	
Selenium (ng/mL)	121.2 ± 0.7	123.3 ± 0.7	127.4 ± 0.8	127.2 ± 0.9	128.0 ± 0.5	< .0001
Vitamin D (ng/mL)	27.7 ± 0.4	27.9 ± 0.5	28.2 ± 0.5	25.7 ± 0.6	27.0 ± 0.3	.0061
Vitamin E (µg/dL)	991.0 ± 20.4	1025.7 ± 22.3	1200.9 ± 25.5	1040.4 ± 27.2	1084.5 ± 15.9	< .0001
Folate (ng/mL)	4.50 ± 0.1	5.16 ± 0.2	5.96 ± 0.2	5.22 ± 0.2	4.92 ± 0.1	< .0001
Vitamin C (mg/dL)	0.70 ± 0.0	0.68 ± 0.0	0.67 ± 0.0	0.59 ± 0.0	0.59 ± 0.0	< .0001
Vitamin A (µg/dL)	55.1 ± 0.6	58.1 ± 0.7	59.8 ± 0.8	55.5 ± 0.9	57.8 ± 0.5	< .0001
Lycopene (µg/dL)	22.2 ± 0.5	22.4 ± 0.5	21.9 ± 0.6	19.8 ± 0.6	25.9 ± 0.4	< .0001
Beta carotene (µg/dL)	16.5 ± 1.1	16.0 ± 1.2	18.1 ± 1.3	12.5 ± 1.4	15.9 ± 0.8	.0712
Alpha carotene (µg/dL)	4.28 ± 0.2	4.59 ± 0.2	4.79 ± 0.2	3.63 ± 0.2	3.56 ± 0.1	< .0001
Beta cryptoxanthin (µg/dL)	16.8 ± 0.5	17.9 ± 0.5	17.4 ± 0.6	12.5 ± 0.6	11.0 ± 0.4	< .0001
Lutein-zeaxanthin (µg/dL)	26.0 ± 0.7	27.4 ± 0.7	26.6 ± 0.8	22.0 ± 0.9	20.1 ± 0.5	< .0001

Weighted means and standard error (± SE) of the mean are reported.

P values (for F values) indicate testing for overall differences on crude means across the five acculturation categories: (1) foreign-born and 0–5 years in the United States, (2) foreign-born and 6–15 years in the United States, (3) foreign-born and > 15 years in the United States, (4) US-born and Spanish-speaking, and (5) US-born and English-speaking. Data from the National Center for Health Statistics. National Health and Nutrition Examination Survey: NHANES III Data Files, Documentation, and SAS Code. <http://www.cdc.gov/nchs/about/major/nhanes/nh3data.htm>. Accessed January 12, 2009.

ings of fruits and vegetables than the less acculturated consume.<sup>27,33-35</sup> Guendelman and Abrams<sup>24</sup> reported that first-generation Mexican American women had a higher average intake vitamins A and C, folic acid, and calcium than second-generation Mexican women, whose nutrient intake resembles that of white non-Hispanic women. Also, Dixon et al<sup>25</sup> reported that US-born Mexican Americans consumed significantly less fiber and fewer vitamins and were less likely to meet dietary guidelines than were immigrant Mexican Americans.

Our second main finding — serum levels for selenium and lycopene increased with increasing acculturation — is consistent with one report in the literature. Stimpson and Urrutia-Rojas<sup>36</sup> reported the levels of lycopene in foreign-born individuals increase as they have more years of residence in the United States. A potential explanation of our finding may be that as Mexican origin individuals become more acculturated, they may increase consumption of foods of the host country that contain selenium and/or lycopene.<sup>37</sup> For example, they may increase the consumption of grains and tomato ketchup, important components of the American diet. However, it is unknown if increased serum nutrients thought to be involved with cancer prevention in other populations protects Hispanic men from cancer.

We also showed that acculturation in this population was associated with increased BMI and waist circumference. Those two risk factors have been associ-

ated to increased risk for cancer for both men and women in other populations.<sup>38-40</sup> Studies have shown that acculturation to the US culture among Mexican Americans was associated with increased dietary fat and sugar along with higher waist circumference and abdominal obesity.<sup>41-43</sup> A potential explanation on how acculturation affects diet among Mexican Americans is related to a greater availability and higher consumption of fast food.<sup>44,45</sup> Kaplan et al<sup>35</sup> reported a higher risk for obesity associated with length of residence in the United States and suggested the adoption of unhealthy dietary practices (eg, a diet low in fruits and vegetables) of the host country. More acculturated Hispanics (English speakers) have lower healthy eating index scores than less acculturated Hispanics (Spanish speakers) have.<sup>37,46</sup> Latino elders long residing in the United States have macronutrient profiles (eg, fats, sugars) and eating patterns similar to those of non-Latino whites.<sup>26</sup> We also found that acculturation was associated with increased physical activity, a finding that agrees with other studies. Using the NHANES III data, Crespo et al<sup>47,48</sup> reported that Mexican American men tend to have higher levels of physical inactivity compared with non-Hispanic white men and that Mexican American men who speak Spanish have a higher prevalence of physical inactivity than those who speak English (38% vs 15%, respectively). However, the NHANES III measure is based on leisure-time activities only and may not take into account the cul-

**Table 3. — Adjusted Means of Serum Levels of Nutrients Across Acculturation Categories Among Mexican American Men Aged 17–90 Years, NHANES III, United States, 1988–1994 (N = 2,479)**

Outcomes: Serum Nutrients	Foreign-Born			US-Born		Overall P Value	Linear Contrast Trend P Value
	0–5 Years in the United States (n = 493)	6–15 Years in the United States (n = 364)	> 15 Years in the United States (n = 361)	Spanish Use (n = 481)	English Use (n = 780)		
Selenium (ng/mL)	121.9 ± 0.7	124.8 ± 0.8	127.8 ± 0.8	126.9 ± 0.9	126.9 ± 0.6	< .0001	< .0001 ↑
Vitamin D (ng/mL)	27.0 ± 0.5	27.1 ± 0.5	28.2 ± 0.5	25.9 ± 0.6	26.6 ± 0.4	.0527	.2232
Vitamin E (µg/dL)	1128.7 ± 21.3	1162.4 ± 23.0	1166.9 ± 24.3	1022.2 ± 26.0	1104.6 ± 17.1	.0003	.0052 ↓
Folate (ng/mL)	5.11 ± 0.1	5.81 ± 0.2	5.69 ± 0.2	5.24 ± 0.2	4.81 ± 0.1	< .0001	.0102 ↓
Vitamin C (mg/dL)	0.70 ± 0.0	0.71 ± 0.0	0.66 ± 0.0	0.60 ± 0.0	0.53 ± 0.0	< .0001	< .0001 ↓
Vitamin A (µg/dL)	57.4 ± 0.7	60.7 ± 0.8	59.4 ± 0.8	55.2 ± 0.9	58.0 ± 0.6	< .0001	.0529
Lycopene (µg/dL)	20.2 ± 0.5	20.9 ± 0.5	22.5 ± 0.6	20.2 ± 0.6	24.3 ± 0.4	< .0001	< .0001 ↑
Beta carotene (µg/dL)	18.7 ± 1.2	18.5 ± 1.3	17.4 ± 1.3	12.5 ± 1.4	14.9 ± 0.9	.0033	.0002 ↓
Alpha carotene (µg/dL)	4.88 ± 0.2	5.26 ± 0.2	4.67 ± 0.2	3.56 ± 0.2	3.44 ± 0.1	< .0001	< .0001 ↓
Beta cryptoxanthin (µg/dL)	17.1 ± 0.5	18.2 ± 0.6	17.4 ± 0.6	12.5 ± 0.6	11.0 ± 0.4	< .0001	< .0001 ↓
Lutein-zeaxanthin (µg/dL)	28.2 ± 0.7	29.2 ± 0.8	26.0 ± 0.8	21.6 ± 0.9	21.7 ± 0.6	< .0001	< .0001 ↓

Weighted means and standard error (± SE) of the mean are reported.  
 All outcomes were adjusted for age and education; selenium, vitamins D, E, C, A, and folate as well as alpha and beta carotenes were adjusted also for vitamin intake.  
 Overall P values are testing for overall differences on adjusted means, and linear contrast trend P values are testing for linear trend differences on adjusted means (↑ = increasing, ↓ = decreasing) across the five acculturation categories: (1) foreign-born, 0–5 years in the United States (the lowest acculturation level), (2) foreign-born, 6–15 years in the United States, (3) foreign-born, > 15 years in the United States, (4) US-born and Spanish-speaking, and (5) US-born and English-speaking (the highest acculturation level). Data from the National Center for Health Statistics. National Health and Nutrition Examination Survey: NHANES III Data Files, Documentation, and SAS Code. <http://www.cdc.gov/nchs/about/major/nhanes/nh3data.htm>. Accessed January 12, 2009.

tural validity of those questions (eg, interpretation of leisure time for Mexican Americans) or other transportation or occupational activities that may explain or compensate those differences.

Studies have shown that Hispanic men who are more acculturated (second and third generations) tend to have greater cancer incidence or mortality than Hispanic men who are less acculturated (first generation).<sup>19,20</sup> Thus, we can speculate that more acculturated Hispanic men may tend to have higher rates of cancer because they have a misbalance of nutrients. On one hand, they have decreased levels of protective dietary factors such as vitamins and most carotenoids as shown in our study. In the other hand, it is unknown if increased levels of selenium and lycopene, which are thought to provide a level of cancer prevention in other ethnic populations, provide this protection in Hispanic men. Perhaps other environmental or behavioral factors or nutrients not measured in our study may influence protection against cancer in this population. For example, a high level of consumption of legumes such as beans has been associated with a low risk of cancer.<sup>49,50</sup> However, more research is needed to determine which, if any, risk or protective dietary factors for cancer are present in these populations.

A limitation of our study is the cross-sectional design of NHANES III, which prevented us from drawing causal inferences. The current rates of cancer for Hispanics have changed since the data were collected and may not reflect current risk profiles. Serum levels of nutrients are not representative of individual nutrient intakes due to day-to-day variations in food consumption. However, the serum level of nutrients is an objective measure.

## Conclusions

Acculturation was associated with lower levels of serum vitamins (E, C, and folate) and most carotenoids but with higher serum selenium and lycopene. These latter two nutrients are thought to be involved with cancer prevention. Nevertheless, the potential preventive effect of those nutrients for cancer among Hispanic men is unknown and warrants further investigation. These changes in nutrient profiles, reflecting changes in food consumption or other behaviors, may explain in part why more acculturated Mexican American men have increased risk for diet-related cancer.

## Disclosures

*No significant relationship exists between the authors and the companies/organizations whose products or services may be referenced in this article.*

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