Acculturation Determines BMI Percentile and Noncore Food Intake in Hispanic Children[1–3]

James F. Wiley,[4]* Michelle M. Cloutier,[4,5] Dorothy B. Wakefield,[6] Dominica B. Hernandez,[7] Autherene Grant,[4] Annamarie Beaulieu,[4] and Amy A. Gorin[7,8]

[4]Children's Center for Community Research, Connecticut Children's Medical Center, Hartford, CT; [5]Department of Pediatrics and [6]Center for Public Health and Health Policy, University of Connecticut Health Center, Farmington, CT; and [7]Department of Psychology and [8]Center for Health, Intervention, and Prevention, University of Connecticut, Storrs, CT

Abstract

Hispanic children in the United States are disproportionately affected by obesity. The role of acculturation in obesity is unclear. This study examined the relation between child obesity, dietary intake, and maternal acculturation in Hispanic children. We hypothesized that children of more acculturated mothers would consume more unhealthy foods and would have higher body mass index (BMI) percentiles. A total of 209 Hispanic mothers of children aged 2–4 y (50% female, 35.3 ± 8.7 mo, BMI percentile: 73.1 ± 27.8, 30% obese, 19% overweight) were recruited for an obesity prevention/ reversal study. The associations between baseline maternal acculturation [Brief Acculturation Rating Scale for Mexican Americans-II (Brief ARSMA-II)], child BMI percentile, and child diet were examined. Factor analysis of the Brief ARSMA-II in Puerto Rican mothers resulted in 2 new factors, which were named the Hispanic Orientation Score (4 items, loadings: 0.64–0.81) and U.S. Mainland Orientation Score (6 items, loadings: −0.61–0.92). In the total sample, children who consumed more noncore foods were more likely to be overweight or obese ($P < 0.01$). Additionally, children of mothers with greater acculturation to the United States consumed more noncore foods ($P < 0.0001$) and had higher BMI percentiles ($P < 0.04$). However, mothers with greater Hispanic acculturation served fewer noncore foods ($P < 0.0001$). In the Puerto Rican subgroup of mothers, Puerto Rican mothers with greater acculturation to the United States served more noncore foods ($P < 0.0001$), but there was no association between acculturation and child BMI percentile in this subgroup. These mothers, however, served fewer sugar-sweetened beverages ($P < 0.01$) compared with non-Puerto Rican mothers, and this may have negated the effect of noncore food consumption on BMI percentile. These data suggest a complex relation between acculturation, noncore food consumption, and child BMI percentile in Puerto Rican and non-Puerto Rican Hispanic children. J. Nutr. 144: 305–310, 2014.

Introduction

Hispanics are the fastest growing minority population in the United States (1) and are disproportionately affected by many chronic diseases including asthma (2) and obesity (3,4). Increased rates of obesity have been reported in Hispanics of all ages, and Hispanic children have a higher prevalence of overweight or obesity compared with non-Hispanic blacks and non-Hispanic whites (3–5). When compared with non-Hispanic groups in the United States, Hispanics also experience increased rates of obesity-related diseases (1). Increased rates of obesity in Hispanic communities have been linked with failure to recognize obesity (6), mothers' perception of their own weight (7), length of time living in the mainland United States (8), maternal BMI (9), allostatic load (10), and acculturation (4,11–13); however,

there is no clear consensus on the role of each factor in the elevated obesity rates observed in Hispanics.

Acculturation is a measure of "the phenomena that result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original cultural patterns of either or both groups" (14). Greater U.S. acculturation as measured by English language use or a variety of acculturation instruments is associated with increased rates of obesity and overweight in Hispanics living in the United States (3,4,8,9,11–13). Yet a closer analysis suggests that the relation between acculturation in Hispanics and obesity and overweight is more complex. Some studies have reported no association between acculturation and obesity (15), whereas other studies have found an association between lower U.S. acculturation and higher BMI percentiles (16) and still others report an association between greater U.S. acculturation and lower BMI percentile (13,17). These mixed findings may reflect in part the tendency to examine Hispanic individuals as one group, rather than exploring Hispanic subgroups, which may exhibit different cultural backgrounds and migration status.

Additionally, they may indicate differences in acculturation-driven dietary and physical activity patterns within Hispanic subgroups.

Studies that have found an association between acculturation and obesity suggest that the exposure to obesogenic influences in the United States is a key factor in obesity risk. These studies assert that U.S.-acculturated Hispanic families may be more likely to deviate from traditional dishes and adopt a more "Westernized" or "Americanized" diet with nutrient-poor, energy-dense products, or a higher consumption of sugar-sweetened beverages (3,4). The Puerto Rican diet is characterized traditionally by a large percentage of energy derived from rice and rice dishes, whereas the U.S. diet is characterized by a higher consumption of noncore foods such as doughnuts, cookies, cakes, processed foods, and sugar-sweetened beverages (18). Acculturation to the mainland United States could lower the nutritional quality or "erode" the traditional diets of Hispanics and lead to higher noncore food and sugar-sweetened beverage consumption, which could produce higher rates of obesity (19).

The goal of this study was to examine the relation between acculturation, obesity, and diet in young children. We hypothesized that maternal acculturation would be associated with child BMI percentile and that the greater the acculturation of a child's primary caregiver to the mainland United States, the more likely the child would consume a more "Americanized" diet consisting of sugar-sweetened beverages, including soda and fruit juices, and unhealthy, energy-dense foods such as processed foods and fast food, resulting in a higher BMI percentile.

Methods

Patient population. Between October 2010 and November 2011, 535 mother-child dyads were approached by bilingual staff in the waiting room of a large urban pediatric primary care clinic that serves primarily low-income, Medicaid-insured Hispanic families as part of a prospective study of the effectiveness of brief motivational counseling in preventing/reversing obesity in young children (Steps to Growing Up Healthy). A total of 252 caregivers with 2- to 4-y-old children were eligible and provided informed consent. Primary caregivers [usually mothers (96%); hereafter referred to as "mothers"] were eligible if they had a child 2–4 y of age, received state food stamp and dietary supplemental benefits, and resided in the greater Hartford area. Mother/child dyads were excluded if the child or mother had special needs (i.e., dietary, physical, or emotional), if the family planned to move out of the greater Hartford area in the next 12 mo, or if the mother was <18 y of age. For final analysis, we excluded underweight children ($n = 6$) and children of mothers who did not complete the Brief Acculturation Rating Scale for Mexican Americans, leaving 209 mother-child dyads for this analysis.

The study was approved by the Institutional Review Board at Connecticut Children's Medical Center.

Anthropometric measures. Weight in kilograms and height in centimeters were measured using standard techniques, and results were used to calculate the BMI for each child (weight in kilograms/height in meters squared). BMI percentile was determined using the CDC BMI growth chart. Children were classified as underweight (BMI: <5th percentile), normal weight (BMI: 5th–84th percentile), overweight (BMI: 85th–94th percentile), or obese (BMI: ≥95th percentile) (20).

Study instruments. The Brief Acculturation Rating Scale for Mexican Americans-II (Brief ARSMA-II)[9] is a 12-item previously validated instrument with demonstrated high reliability in Mexican Americans

(21). The Brief ARSMA-II uses a 5-point Likert scale to measure acculturation among 3 primary factors: language, ethnic identity, and ethnic interaction. The instrument is used to capture a respondent's Mexican Orientation Scale (MOS) (composed of 2 subscales) based on an average of 6 questions, and Anglo Orientation Scale (AOS) based on an average of a separate 6 questions. The instrument has been used primarily for Mexican Americans but also has been used to a limited extent for a mixed population of Mexican Americans and other Hispanic Americans, including some Puerto Ricans (22). Questionnaires were read aloud in the preferred language of the mother and all responses were recorded.

The Children's Dietary Questionnaire (CDQ) is a 29-item instrument designed to determine a child's average consumption of 4 categories of foods or beverages. The questionnaire has demonstrated a high degree of internal consistency and validity (23). The 4 categories are further divided into 4 separate scores: a fruits and vegetables score, a fat from dairy products score, a sweetened beverage score, and a noncore food score (23).

Statistical analysis. Data were analyzed using SAS 9.3 (SAS Institute). Significance was defined as $P < 0.05$. Descriptive data included categorical variables expressed as the percent of total and continuous variables expressed as means and SDs.

For the Brief ARSMA-II, means, medians, and ranges were calculated for each item and for both of the factor scales. Data are presented in the text as a percent of the total sample (%), a mean ± SD, or a correlation coefficient, *r*. The non-Puerto Rican mothers completed the Brief ARSMA-II without difficulty; for these mothers, AOS and MOS scores were calculated according to Cuellar et al. (14).

Forty percent of the Puerto Rican mothers could not answer one or both of the questions on the Brief ARSMA-II pertaining to interactions with "Anglos." Because the study population was composed primarily of Puerto Rican mother-child dyads and the experience using the Brief ARSMA-II with Puerto Rican respondents was limited, an exploratory factor analysis with a varimax rotation was conducted on the Brief ARSMA-II using the responses of the Puerto Rican mothers only. Visual inspection of eigenvalues and scree plot analysis were used as criteria in deciding the number of components to be retained. Cronbach α was calculated for each factor. Factor analysis produced 2 separate factors that were different from the 2 factors originally determined by Cuellar (21). These 2 new factors were named the U.S. Mainland Orientation Scale (USMOS) to indicate an Americanized acculturation and the Hispanic Orientation Scale (HOS) to indicate a Hispanic acculturation. For each Puerto Rican participant, a mean HOS score was computed by summing the scores of the HOS items and dividing by the number of HOS items. Likewise, a mean USMOS score was obtained by summing the USMOS items and dividing by the number of USMOS items. Because acculturation is a multidimensional process, results were analyzed separately for each of the 2 scores as described by Berry (24).

To evaluate relations between acculturation, CDQ score, and BMI percentile in the entire sample, we grouped the USMOS scores with the AOS scores to evaluate "Anglo/American" acculturation. Similarly, the HOS and MOS scores were grouped to evaluate "Hispanic" orientation in the entire sample. For clarity, USMOS/AOS-grouped scores are referred to as "Anglo" acculturation, and HOS/MOS-grouped scores are referred to as "Hispanic" acculturation.

Two sample *t* tests were used to compare age and BMI percentiles of Puerto Rican and non-Puerto Rican children, and chi-square analysis was used to compare parental employment status, survey language, child gender, and child weight category.

The relation between overall acculturation in the entire sample and dietary patterns was explored using general linear models with acculturation scale scores as the independent variables and the 4 CDQ scores as the dependent variables. All models controlled for child age, gender, parent employment status, and household size. Similar models examined the relation between child BMI percentile and CDQ scores using BMI percentile as the dependent variable and CDQ scores as the independent variable.

The SAS macro INDIRECT was used to test the mediation effect of the noncore food score on the relation between BMI percentile and

---

Anglo acculturation. Using methods based on Preacher and Hayes (25), estimates for the total, direct, and indirect effects of the Anglo acculturation score on BMI percentile through the noncore food score were calculated.

Results

Participant demographics. Study participants were primarily Puerto Rican (67%) (**Table 1**). Non-Puerto Rican participants were Mexican (11%) as well as Central and South American, Dominican, and Cuban (22%), which is consistent with the Hispanic population in this community. Puerto Rican mothers were primarily English speaking (84%) and unmarried (90%) compared with non-Puerto Rican mothers ($P < 0.001$). Puerto Rican mothers demonstrated significantly greater acculturation to the United States when compared with non-Puerto Rican Hispanic mothers ($P < 0.001$), whereas non-Puerto Rican mothers demonstrated significantly greater Hispanic acculturation than Puerto Rican mothers ($P < 0.001$).

Brief ARSMA-II factor analysis in Puerto Rican population. Approximately 40% of the Puerto Rican participants did not answer 1 or both of the 2 questions on the Brief ARSMA-II that asked about their ethnic interaction ("I associate with Anglos," "My friends are Anglo-American") compared with 10% of the non-Puerto Rican Hispanic participants. The two factors generated from Cuellar's Brief ARSMA-II were used in the non-Puerto Rican participants to assess acculturation.

Because Puerto Rican respondents stated they did not understand who an Anglo was and thus left these statements blank, these 2 questions were excluded and the exploratory factor analysis was performed on the remaining 10 questions to extract the most independent constructs relevant to the Puerto Rican population in the study. A 2-factor solution with 2 eigenvalues of >1, which accounted for 66.8% of the cumulative sample variance, was found (**Supplemental Table 1**). Factor 1, with an eigenvalue of 4.11, accounted for 41.1% of the variance; factor 2, with an eigenvalue of 2.57, accounted for 25.7% of the variance. All items in factor 1 and factor 2 had loadings of > 0.5. Although factor 1 items were similar to Cuellar's Anglo Orientation Scale and factor 2 items were similar to his Mexican

Orientation Scale, neither of these new factors were identical to the original factors reported by Cuellar (21). The 2 new factors were named the USMOS (6 items) and the HOS (4 items). Of the 6 items on the original AOS, 4 loaded with the new USMOS. All 4 of the items that loaded with the HOS were present among the original 6 items of the MOS. Cronbach αs were 0.90 for the USMOS and 0.79 for the HOS. The USMOS factor consisted of items 2, 4, 6, 7, 8, and 9 (Supplemental Table 1). Items 7 and 8 loaded negatively and were reverse-scored for analysis. The factor loadings for the USMOS factor ranged from 0.61 to 0.92. The HOS factor consisted of items 1, 3, 5, and 10 with factor loadings for the HOS factor ranging from 0.64 to 0.81.

Acculturation. Mothers who completed the questionnaires in English had higher mean Anglo acculturation scores (4.5 ± 0.60) ($P < 0.0001$) compared with mothers who completed the questionnaires in Spanish (1.9 ± 0.56). Similarly, mothers who completed the questionnaires in English had lower mean Hispanic acculturation scores (3.9 ± 0.92) ($P < 0.0001$) than those who completed them in Spanish (4.8 ± 0.36). Higher Anglo acculturation scores were inversely associated with household size ($r = -0.15$, $P < 0.03$), whereas higher Hispanic acculturation scores were associated with larger households ($r = 0.18$, $P < 0.01$).

Puerto Rican mothers demonstrated higher Anglo acculturation scores and lower Hispanic acculturation scores (measured by USMOS and HOS scores in this subgroup) compared with non-Puerto Rican Hispanic mothers (measured by AOS and MOS in this subgroup) ($P < 0.001$). The relatively high USMOS and HOS scores of Puerto Rican mothers suggest that these participants were highly bicultural as a group compared with the primarily Hispanic-oriented non-Puerto Rican mothers.

Children's dietary questionnaire. For all participants, a higher Anglo acculturation score was associated with a higher noncore food score ($P < 0.0001$) (**Table 2**). The Anglo acculturation score was not associated with the fruits and vegetables, dairy fat, or sweetened beverage scores.

For all participants, a higher Hispanic acculturation score was associated with a lower dairy fat score ($P < 0.02$) and a lower noncore foods score ($P < 0.0001$) (Table 2). The Hispanic acculturation score was not associated with the fruits and vegetables score or the sweetened beverage score.

In Puerto Rican mothers, a higher USMOS score was associated with a higher noncore food score ($P < 0.0001$) and a lower sweetened beverage score ($P < 0.01$) but was not related to the fruits and vegetables score or to the dairy fat score. The HOS score in Puerto Rican mothers was not associated with any of the dietary components (**Table 3**).

TABLE 1 Demographics of study population[1]

	Puerto Rican (*n* = 140)	Non-Puerto Rican Hispanic (*n* = 69)
Survey language: English	118 (84)	10 (14)*
Employment status: employed	50 (35)	28 (41)
Marital status: married	14 (10)	19 (28)*
Acculturation score		
USMOS/AOS	4.2 ± 1.1	2.1 ± 1.0*
HOS/MOS	4.0 ± 0.9	4.6 ± 0.6*
Child age, *mo*	34.9 ± 8.4	36.2 ± 9.2
Child gender: female	73 (52)	31 (45)
Child BMI percentile	75.7 ± 25.4	67.8 ± 31.6
Child weight category		
Overweight	30 (21)	9 (13)
Obese	41 (29)	21 (30)
Insurance: Medicaid	136 (97)	63 (91)

[1] Values are means ± SDs or *n* (%). *Different from Puerto Ricans, *P* < 0.05. Study population was 11% Mexican and 22% Central/South American, Dominican, Cuban, or other. AOS, Anglo Orientation Scale; HOS, Hispanic Orientation Scale; MOS, Mexican Orientation Scale; USMOS, U.S. Mainland Orientation Scale.

TABLE 2 Univariate correlation of acculturation score with CDQ in overall sample[1]

Dietary component score	Anglo acculturation		Hispanic acculturation	
	USMOS/AOS	*P*	HOS/MOS	*P*
Noncore food	0.40*	<0.0001	−0.29*	<0.0001
Sweetened beverage	−0.09	<0.20	0.01	<0.96
Dairy fat	0.06	<0.39	−0.16*	<0.02
Fruits and vegetables	−0.13	<0.07	−0.06	<0.42

[1] Results are shown as *r* values. *Statistically significant correlation. The results are representative of the entire sample when not broken down into Puerto Rican and non-Puerto Rican Hispanic subgroups. AOS, Anglo Orientation Scale; CDQ, Children's Dietary Questionnaire; HOS, Hispanic Orientation Scale; MOS, Mexican Orientation Scale; USMOS, U.S. Mainland Orientation Scale.

In non-Puerto Rican Hispanic mothers, a higher MOS score was associated with a lower noncore food score ($P < 0.03$) but was not associated with any of the other dietary components. The AOS score was not associated with any of the dietary components in the non-Puerto Rican Hispanic mothers (Table 3).

BMI percentile. In all participants, a higher BMI percentile was associated with both a higher Anglo acculturation score ($P < 0.04$) and a higher noncore food score ($P < 0.01$) (Table 2). BMI percentile was not related to the Hispanic acculturation score, the other dietary scores, or either of the 2 subgroups (i.e., Puerto Rican mothers or non-Puerto Rican Hispanic mothers).

In a mediation model, we hypothesized that the noncore food score would mediate the relation between Anglo acculturation and BMI percentile (**Fig. 1**). Regression equations tested each pathway and each equation controlled for child's age. Results supported the hypothesized mediation model. The effect of the Anglo acculturation score on the noncore food score was significant ($b = 0.29$, SE $= 0.05$) ($P < 0.0001$). Additionally, as expected, the path from the noncore food score to BMI percentile was significant; participants who had a higher noncore food score had children with higher BMI percentiles ($b = 4.17$, SE $= 2.01$) ($P = 0.04$). Similarly, the path from the Anglo acculturation score to BMI percentile was significant; participants with higher Anglo acculturation scores had children with higher BMI percentiles ($b = 2.74$, SE $= 1.34$) ($P = 0.04$). With the noncore food score in the model, Anglo acculturation did not affect the BMI percentile ($b = 1.54$, SE $= 1.45$) ($P = 0.29$). Additionally, the CI for the effect of the indirect pathway via noncore food did not include "0" (0.16–2.25), indicating a significantly mediated pathway. The overall mediation model was significant [$F(3,200) = 3.59$] ($P = 0.01$) and accounted for ~5% of the variance in BMI percentile ($R^2 = 0.05$, adjusted $R^2 = 0.04$). Thus, the model of a relation between Anglo acculturation, noncore food score, and BMI percentile was supported by the data.

Discussion

In this sample of Puerto Rican and non-Puerto Rican Hispanic caregivers, greater maternal acculturation to the mainland United States was associated with higher child noncore food consumption and a higher child BMI percentile. Higher noncore food consumption in the sample was associated with higher rates of overweight and obesity, suggesting that the relation between child BMI percentile and acculturation is mediated by noncore

TABLE 3 Univariate correlation of acculturation score with BMI percentile and CDQ by ethnicity[1]

	Puerto Rican		Non-Puerto Rican Hispanic	
	USMOS	HOS	AOS	MOS
Dietary component score				
Fruits and vegetables	−0.03	−0.12	−0.05	−0.15
Dairy fat	−0.04	−0.10	0.12	−0.20
Sweetened beverage	−0.21*	0.01	−0.02	0.09
Noncore foods	0.27*	−0.16	0.09	−0.26*
BMI percentile	−0.05	0.09	0.06	0.05

[1] Results are shown as *r* values. *Statistically significant correlation, $P < 0.05$. AOS, Anglo Orientation Scale; CDQ, Children's Dietary Questionnaire; HOS, Hispanic Orientation Scale; MOS, Mexican Orientation Scale; USMOS, U.S. Mainland Orientation Scale.
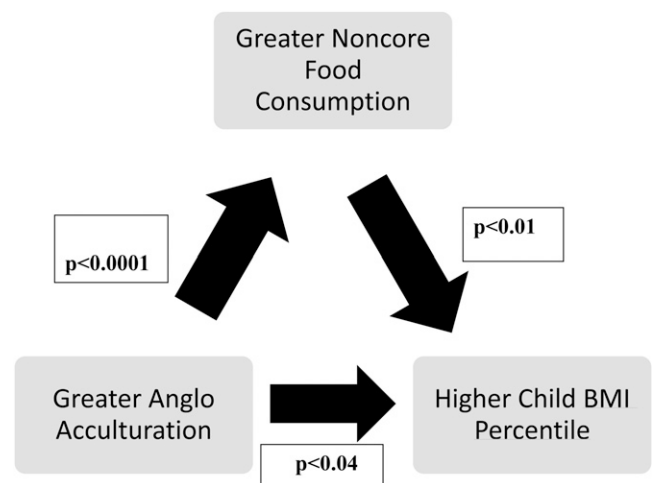
FIGURE 1 Mediation model of the relation between Anglo acculturation, noncore food consumption, and BMI percentile. A positive association is shown between greater maternal Anglo acculturation and child BMI percentile. This relation is mediated by higher noncore food consumption in children of mothers with greater Anglo acculturation. This higher noncore food consumption is associated with greater child BMI percentile.

food consumption. In the Puerto Rican caregivers, however, the relation was more complex. Again, greater maternal acculturation to the mainland United States was associated with higher child noncore food consumption, but this was not associated with higher BMI percentile. These same caregivers, however, reported lower sugar-sweetened beverage consumption, which suggests a potential obeso-protective factor in these children. Thus, the obesogenic contribution of the noncore food consumption may have been offset by the obeso-protective contribution of lower sugar-sweetened beverage consumption and diluted the association between noncore food consumption and obesity in this subgroup.

Acculturation is a multidimensional construct involving simultaneous maintenance and adaptation of cultural characteristics, and may be either protective of health or place individuals at greater risk of poorer health outcomes. These differences in health outcomes have been explained as the Hispanic health paradox and the acculturation hypothesis (16,26). The Hispanic health paradox posits that Hispanic immigrants are healthier than the U.S.-born population and have better health outcomes as measured, for example, by lower rates of low-birth–weight infants (26). In contrast, the acculturation hypothesis proposes that Hispanic immigrants are at a health outcome disadvantage with studies documenting higher rates of obesity in first- and second-generation immigrants (16). Most of these studies in Hispanics have involved predominantly Mexican Americans. Migrants from Puerto Rico, however, are not immigrants because of Puerto Rico's commonwealth status with the United States. Nevertheless, they face many of the same obstacles as immigrants including needs for health, housing, and other services (27). Health outcomes for Puerto Ricans are different from other Hispanics. Infants of Puerto Rican–born mothers have a lower risk of low birth weight compared with infants of U.S.-born Puerto Rican women, but they also have higher rates of mortality from violent causes including homicide compared with other Hispanics and non-Hispanic whites (26).

The Brief ARSMA-II, which was developed, tested, and used primarily in Mexican Americans, produced 2 new factors in the Puerto Rican subgroup that were similar to the 2 factors

reported by Cuellar et al. (14) and later examined by Bauman (21) but not identical. Two questions that used the word "Anglo" were not understood by these families and were, therefore, dropped. We categorized the resulting 2 factors as indicating a high level of acculturation to the mainland United States (USMOS) or a high level of Hispanic acculturation (HOS). Many Puerto Rican caregivers demonstrated high levels on both scales indicative of a bicultural orientation compared with other Hispanic caregivers who, in general, demonstrated low levels of acculturation to the mainland United States and a high level of Hispanic acculturation. Children of these bicultural caregivers showed no differences or similarities regarding consumption of sugar-sweetened beverages or BMI percentile when compared with children of highly acculturated caregivers.

Highly "Americanized" mothers, as determined by their acculturation scores, were more likely to serve noncore foods to their children compared with highly Hispanic-oriented mothers. These results suggest that mothers who are more acculturated to the mainland United States, or an "Anglo" lifestyle, are more likely to incorporate "Americanized" fast foods and processed foods into the diets of their children and support the conclusion that acculturation "erodes the diet quality of Hispanics" living in the United States over time by introducing more junk foods and nontraditional processed items (19). However, more Anglo-acculturated Puerto Rican mothers were also less likely to serve their children sugar-sweetened beverages, which may have mitigated the effect on obesity of the fast foods and processed foods. Whether this is related to the duration of time on the mainland, socioeconomic status, or stress and other emotional factors is not known.

In contrast, Hispanic-oriented, non-Puerto Rican mothers were less likely to serve "Americanized" foods to their children. A higher Hispanic acculturation score, however, was not associated with a lower child BMI percentile; thus, we did not find evidence to support the Hispanic paradox and the protective effect of lower categories of acculturation.

Portion sizes, TV time, and physical activity are additional obesogenic factors (28,29) that were not examined in this study and could potentially explain why a higher Hispanic accultur-ation score was associated with lower noncore food consumption but not with a lower child BMI percentile. Differences in portion sizes, TV time, or physical activity could also explain why there was no association between either of the Hispanic subgroups and child BMI percentile. Future studies should look for an associ-ation between these untested variables and acculturation. We also found no association between dairy fat intake and BMI percentile, a result that is in contrast to recent findings (30).

The use of the Brief ARSMA-II in a predominantly Puerto Rican/Hispanic, non-Mexican population should also be further explored. Additional investigations in different Hispanic, non-Mexican populations are needed to evaluate the usefulness of the Brief ARSMA-II in a general Hispanic population. The validity of the modified instrument created in this study must also be further tested. Both the new subscales created in this study and the original Brief ARSMA-II heavily emphasize language as a key component of acculturation. More insight into the concept of acculturation and what other factors in addition to language influence and shape the acculturation of an individual is needed.

Additionally, future efforts should examine the association of acculturation and causative stressors such as poverty and other variables that influence food insecurity, diet, and the general health of a study population. The public health sector would also be better served not only to describe the acculturation of a population and the associations with this level of acculturation,

such as diet and obesity, but also to provide a deeper under-standing of causative factors (e.g., employment and income) for the associations determined.

Finally, although the CDQ is a validated instrument for the age group examined in this study, it is an imperfect measure because it uses self-reported dietary food intake.

In summary, our results suggest that higher acculturation to the mainland United States is associated with a higher child BMI percentile and with higher noncore food consumption. A bicultural orientation or a low U.S. acculturation was not protective of a higher child BMI percentile. Helping immigrants maintain their traditional healthier diets or emphasizing the importance of limiting the consumption of sweetened drinks and noncore foods may protect their children from overweight and obesity.

Literature Cited

1. Pawson IG, Martorell R, Mendoza FE. Prevalence of overweight and obesity in US Hispanic populations. Am J Clin Nutr. 1991;53(6 Suppl):1522S–8S.

2. Lara M, Akinbami L, Flores G, Morgenstern H. Heterogeneity of childhood asthma among Hispanic children: Puerto Rican children bear a disproportionate burden. Pediatrics. 2006;117:43–53.

3. Sussner KM, Lindsay AC, Greaney ML, Peterson KE. The influence of immigrant status and acculturation on the development of overweight in Latino families: a qualitative study. J Immigr Minor Health. 2008;10:497–505.

4. Sussner KM, Lindsay AC, Peterson KE. The influence of maternal acculturation on child body mass index at age 24 months. J Am Diet Assoc. 2009;109:218–25.

5. Whitaker RC, Orzol SM. Obesity among US urban preschool children: relationships to race, ethnicity, and socioeconomic status. Arch Pediatr Adolesc Med. 2006;160:578–84.

6. Intagliata V, Ip EH, Gesell SB, Barkin SL. Accuracy of self- and parental perception of overweight among Latino preadolescents. N C Med J. 2008;69:88–91.

7. Ariza AJ, Chen EH, Binns HJ, Christoffel KK. Risk factors for overweight in five- to six-year-old Hispanic-American children: a pilot study. J Urban Health. 2004;81:150–61.

8. Himmelgreen DA, Perez-Escamilla R, Martinez D, Bretnall A, Eells B, Peng Y, Bermudez A. The longer you stay, the bigger you get: length of time and language use in the U.S. are associated with obesity in Puerto Rican women. Am J Phys Anthropol. 2004;125:90–6.

9. Hernández-Valero MA, Wilkinson AV, Forman MR, Etzel CJ, Cao Y, Barcenas CH, Strom SS, Spitz MR, Bondy ML. Maternal BMI and country of birth as indicators of childhood obesity in children of Mexican origin. Obesity (Silver Spring). 2007;15:2512–9.

10. Tucker KL. Stress and nutrition in relation to excess development of chronic disease in Puerto Rican adults living in the Northeastern USA. J Med Invest. 2005;52(Suppl):252–8.

11. Buscemi J, Beech BM, Relyea G. Predictors of obesity in Latino children: acculturation as a moderator of the relationship between food insecurity and body mass index percentile. J Immigr Minor Health. 2011;13:149–54.

12. Pérez-Escamilla R. Acculturation, nutrition, and health disparities in Latinos. Am J Clin Nutr. 2011;93:1163S–7S.

13. van Rompay MI, McKeown NM, Castaneda-Sceppa C, Falcon LM, Ordovas JM, Tucker KL. Acculturation and sociocultural influences on

dietary intake and health status among Puerto Rican adults in Massachusetts. J Acad Nutr Diet. 2012;112:64–74.

14. Cuellar I, Arnold B, Maldonado R. Acculturation rating scale for Mexican Americans-II: a revision of the original ARSMA scale. Hisp J Behav Sci. 1995;17:275–304.

15. Van Hook J, Baker E. Big boys and little girls: gender, acculturation, and weight among young children of immigrants. J Health Soc Behav. 2010;51:200–14.

16. Elder JP, Arredondo EM, Campbell N, Baquero B, Duerksen S, Ayala G, Crespo NC, Slymen D, McKenzie T. Individual, family, and community environmental correlates of obesity in Latino elementary school children. J Sch Health. 2010;80:20–30; quiz 53–5. Erratum in: J Sch Health. 2010;80:159.

17. Zsembik BA, Fennell D. Ethnic variation in health and the determinants of health among Latinos. Soc Sci Med. 2005;61:53–63.

18. Tucker KL, Bianchi LA, Maras J, Bermudez OI. Adaptation of a food frequency questionnaire to assess diets of Puerto Rican and non-Hispanic adults. Am J Epidemiol. 1998;148:507–18.

19. Aldrich L, Variyam JN. Acculturation erodes the diet quality of U.S. Hispanics. Food Review. 2000;23(1):51–5.

20. Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, Flegal KM, Guo SS, Wei R, Mei Z, Curtin LR, Roche AF, Johnson CL. CDC growth charts: United States. Adv Data. 2000;314:1–27.

21. Bauman S. The reliability and validity of the brief acculturation rating scale for Mexican Americans-II for children and adolescents. Hisp J Behav Sci. 2005;27:426–41.

22. Jimenez DE, Gray HL, Cucciare M, Kumbhani S, Gallagher-Thompson D. Using the Revised Acculturation Rating Scale for Mexican Americans (ARSMA-II) with older adults. Hisp Health Care Int. 2010;8:14–22.

23. Magarey A, Golley R, Spurrier N, Goodwin E, Ong F. Reliability and validity of the Children's Dietary Questionnaire; a new tool to measure children's dietary patterns. Int J Pediatr Obes. 2009;4:257–65.

24. Berry JW, editor. Acculturation: theory, models and some new findings. Boulder, CO: Westview; 1980.

25. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav Res Methods. 2008;40:879–91.

26. Franzini L, Ribble JC, Keddie AM. Understanding the Hispanic paradox. Ethn Dis. 2001;11:496–518. Epub 2001 Sept 27.

27. Deren S, Shedlin M, Decena CU, Mino M. Research challenges to the study of HIV/AIDS among migrant and immigrant Hispanic populations in the United States. J Urban Health. 2005;82(2 Suppl 3):iii13–25.

28. Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low-income preschool children. Pediatrics. 2002;109:1028–35.

29. Fisher JO, Arreola A, Birch LL, Rolls BJ. Portion size effects on daily energy intake in low-income Hispanic and African American children and their mothers. Am J Clin Nutr. 2007;86:1709–16.

30. Tanasescu M, Ferris AM, Himmelgreen DA, Rodriguez N, Perez-Escamilla R. Biobehavioral factors are associated with obesity in Puerto Rican children. J Nutr. 2000;130:1734–42.