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An Examination of Family Variables as Mediators of the Association of Acculturation with Sugar-sweetened Beverages among Latino Adolescents

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Abstract

The objective of this study was to examine the mediating effects of family support for dietary habits and family meal frequency on the relationship between acculturation and sugar-sweetened beverages (SSBs) among Latino adolescents (N=131). Acculturation was positively associated with SSBs ($B=.07$, $p<.01$). Results suggest family support for dietary habits and family meal frequency did not mediate the relationship between acculturation and SSBs. However, acculturation was negatively associated with family support for dietary habits ($B=-.10$, $p<.01$), and family meal frequency ($B=-.11$, $p<.05$). Future research should examine other family influences as mediators of the relationship between acculturation and SSBs.

Keywords

Latinos; acculturation; adolescents; diet; sugar-sweetened beverages; family influence

Introduction

Latinos are the second largest ethnic/racial group in the United States¹ and health disparities among Latinos, compared to their Non-Latino White counterparts, remain a public health concern.² Sugar-sweetened beverage consumption (SSBs) is an important outcome for this population not only due to its relationship with obesity,³⁻⁵ but also because SSBs has also been linked to other chronic diseases such as Type 2 diabetes, dental caries, dyslipidemia, and nonalcoholic fatty liver disease.^{3,6} The 2015-2020 Dietary Guidelines for Americans recommends less than 10% of total calories consumed from added sugars, and SSBs are a substantial contributor of added sugar in the diet among adolescents.⁷ Prior research from a large nationally representative sample of the US with a cross-sectional design suggests that

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Compliance with ethical standards: All procedures performed in study were in accordance with the ethical standards of the Institutional Review Board at Claremont Graduate University on September 4th, 2009. The protocol number was 1292. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest: C. Johansen, K. Reynolds, B. Xie and P. Palmer declare that they have no conflict of interest.

Data Availability: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Mexican-American adolescents 12-19 years old consumed 11.6% of calories from SSBs which was greater than both White adolescents (10.5%),⁸ and adolescents from Mexico (9.9%).⁹ Understanding the causes of these disparities in SSBs will permit health care practitioners to intervene in an effort to limit the onset of chronic diseases among Latino adolescents.

It is critical to identify determinants of SSB consumption. One potential determinant of SSB consumption is acculturation, given its association with diet in past studies.¹⁰⁻¹⁸ For example, Latinos who are less acculturated consumed more whole milk, whereas more acculturated Latinos consume more fast food, snacks, and added fats.¹¹⁻¹³ Less acculturated individuals consumed more fruit, rice, and beans.¹⁴⁻¹⁶ Less acculturated Latinos consumed less sugar and SSBs than more acculturated Latinos.^{17,18}

Acculturation is defined as “the dual process of cultural and psychological change that takes place as a result of contact between two or more cultural groups and their individual members.”¹⁹ Acculturation to the US culture and to the Latino culture of origin have been associated with dietary intake among Latinos in previous studies.^{10,13,16,20-23} Studies of Latino adults and adolescents have found that as self-reported US acculturation increased, SSB consumption increased.^{13,16,18,21,24-26} For example, a prior study found that 14-17 year old Latinos who were more acculturated consumed more SSBs compared to Latinos who were less acculturated.¹⁸ Another study found that second and third generation Mexican-American girls aged 12-19 years consumed more SSBs compared to their first generation counterparts, and Latina women whose primary language was English consumed more SSBs than Latina women who were bilingual.^{13,26} Finally, length of residence in the U.S. has been positively associated with SSB consumption among Latina women.¹³ In sum, greater acculturation to the US among Latinos, measured using various indicators of acculturation, appears associated with increased intake of SSBs.

Exploring factors that might mediate this association including intrapersonal, interpersonal, or environmental variables is needed since acculturation has been associated with dietary behavior. Information about these mediating variables would be useful for targeting prevention interventions to reduce SSBs. Furthermore, acculturation researchers have called for mediation analyses to systematically test socio-contextual variables that can explain the relationship between acculturation and health behaviors such as SSB consumption.²⁷⁻³¹

Prior studies that examined the association of acculturation and family variables is limited. Researchers found that less acculturated Latinos consumed meals (i.e., breakfast and dinner) more frequently with family at home each week compared to White adolescents in a large national sample.³² Another study among low acculturated Latino children found that having breakfast as a family at least four times per week played a greater role in healthful eating (i.e., consumption of fruits, and vegetables).³³ A prior study suggests that acculturation is negatively associated with perceived family support.³⁴ Although not specific to family support for dietary habits, the results suggest that acculturation is negatively associated with family support which may generalize to family support for healthy eating habits. While there is a dearth of research, these studies suggest that as acculturation increases, family meal frequency and family support for dietary habits decreases.

As individuals acculturate to a new culture (i.e., US culture), they might lose some protective cultural dietary habits from their heritage (Latino) culture and/or acquire US diets from US culture.^{10,35-37} This relationship might be explained via family pathways such as family meal frequency and family support for dietary habits. We postulate that adolescents who are acculturated will have a lower frequency of family meals, and lower family support for dietary habits. In turn, these family variables will be negatively associated with SSBs consumption (see Figure 1).

Methods

Data for the present study were taken from a larger research effort whose main objective was to identify cues for unhealthy snacking and SSB consumption among adolescents using Ecological Momentary Assessment (EMA), and a baseline self-report measurement battery. The source study is described in detail elsewhere.³⁸

Participants

A maximum of 15 students per high school were recruited from 13 high schools in Southern California. Schools were selected if they met the following inclusion criteria—a minimum of 25% of students in a free or reduced-price meal program, minimum of 25% Latino students, maximum of 25% Asian students, and minimum enrollment of 100 students. Inclusion criteria for students included being 14-17 years of age, living within 30 miles of the assessment site, free of major illness, and not receiving treatment for obesity. Only one student from each family was eligible. Spanish speaking recruiters and data collectors were available to assist parents who only spoke Spanish.

Procedures

Recruitment flyers were distributed during school hours. Flyers described the study objectives and compensation for participating. Recruiters collected contact information at school from students expressing interest in participating. Recruiters then called the parents to assess eligibility. In total, 251 families were screened by telephone for eligibility, 243 were scheduled for an assessment appointment and 158 adolescents completed assessments. Adolescents of all racial groups were included in the analyses if they self-reported as Latino/Hispanic (N=131).

Each participant came to a university facility with a parent/guardian for the consent and assessment appointment. Participants completed a series of assessments including anthropometrics (i.e., height, weight) and a computer-based questionnaire measuring health and dietary habits (e.g., acculturation, body mass index, diet, parenting style, social support, etc.). Participants then were trained on the completion of the Ecological Momentary Assessment (EMA) procedure. The research procedures were approved by the Claremont Graduate University and Arizona State University Institutional Review Boards.

Measures

Sugar-sweetened beverages.

Dietary intake was assessed with the Youth/Adolescent Questionnaire (YAQ).³⁹ The YAQ was designed for 9-18 year olds and consists of 151 food items over the past year ($r = .54$ when comparing YAQ with three 24-hour recalls) and is a reproducible measure.^{39,40} To assess SSBs consumption, the mean number of daily servings of six sugar-added or sugar-containing drink items was calculated (i.e., non-diet soda, lemonade or other non-carbonated fruit drinks, iced tea, coffee, milkshakes, and energy drinks). The YAQ did not ask if coffee was sweetened with sugar, and based on past studies examining beverage consumption in adolescents and showing that coffee is typically consumed with products that add sugar, we considered coffee to be a SSB.^{41,42} The mean number of daily servings was derived from typical past year intake (servings per day) which was specified as: a can for soda, a cup for tea/coffee, a glass for all other beverages. Response options included: never or <1/month, 1 to 3 cans/glasses/cups per month, 1 can/glass/cup per week, 2 to 6 cans/glasses/cups per week, 1 can/glass/cup per day, or 2 cans/glasses/cups per day.^{40,43} A serving of SSBs was defined as the equivalent of one glass or can as other researchers have reported.^{40,44,45}

Acculturation.

Acculturation was assessed with the 8-item Acculturation, Habits and Interests Multicultural Scale for Adolescents (AHIMSA).⁴⁶ The scale assesses language preferences, habits and interests for each of the eight items (e.g., *"I am most comfortable being with people from"*), with respondents indicating their preference using one of the four response options with response options *"United States," "country my family is from," "both,"* and *"neither."* The AHIMSA generates a score on four subscales of acculturation including Assimilation ($\alpha = .82$), Separation ($\alpha = .71$), Integration ($\alpha = .80$), and Marginalization ($\alpha = .64$). Only the Assimilation score was used for the present analyses due to low variance of Separation and Marginalization subscales, and due to the inverse relationship of Assimilation and Integration subscales ($r = -.89$, $p < .001$). This follows procedures outlined by Unger and colleagues (2004).⁴⁷ Lower scores on the Assimilation subscale indicate lower acculturation to the US.

Mediators

Frequency of Family Meals.

Frequency of family meals was assessed using a single item, "During the past seven days, how many times did all, or most, of your family living in your house eat a meal together"⁴⁸. Response options ranged from "never" coded as 1 to "7 or more times" coded as six. This item has demonstrated adequate test-retest reliability ($r = .70$).⁴⁹

Family Support for Dietary Habits.

This five-item subscale assesses diet-specific social support for meals and has been used among adolescents.⁵⁰ This scale asks questions about different dietary behaviors such as "In the past month, how often has a family member talked with you about eating more healthful

food?” with response options “Never” coded as 1 to “Very Often” coded as 5. This measure has demonstrated good reliability (Cronbach’s $\alpha=0.87$).⁵⁰

Covariates.

Demographics such as age, gender, and parent’s highest level of education along with anthropometrics—height and weight (measured by trained research assistants and then computed BMI percentile based on CDC’s BMI calculator for age and gender), were controlled for as covariates in the mediation model.

Statistical analyses

Descriptive statistics were run to obtain frequencies and percentages for categorical variables. A data check was conducted using SAS to determine the intra-class correlation (ICC) using the PROC Mixed procedure to ensure that the random effect was negligible. The ICC was small ($ICC=.0047$), therefore controlling for the random school effect was not necessary. Data were then analyzed using SPSS 25. A multiple mediation model was evaluated using Hayes’ Process macro.⁵¹ This mediation analyses examined the relationship between acculturation and SSBs, with family meal frequency and family support for dietary habits as mediators. This mediation analysis controlled for covariates (i.e., age, gender, BMI and parent education) that are associated with SSBs consumption. The Process macro provides estimates for each path within the mediation model, therefore it provides estimates on the effect of acculturation on family meal frequencies and family support for dietary habits, as well as the effect of family meal frequency and family support for dietary habits on SSBs. The Process macro uses bootstrapping to generate bootstrap 95% confidence intervals for the indirect effect, and we used 5,000 bootstrap samples.

Results

As summarized in Table 1, the mean age in the sample was 16 years ($SD=1.1$) and 58% of participants were female. Participants reported the highest education attained by their parents; 26.7% had less than high school, 29% were high school graduates, 27.5% had some college, 16.8% were college graduates. The mean BMI percentile of adolescents was 73.9% ($SD=25.4$). The mean acculturation score was 3.7 ($SD=2.5$) and a range of 0-8 with higher scores reflecting greater assimilation to the US. Family meal frequency varied among participants, 21.4% reported never having meals with families, 24.4% reported eating family meals 1-2 times per week, 18.3% reported eating family meals 3-4 times per week, 19.1% reported eating family meals 4-5 times per week and 16.8% reported eating family meals 7 or more times per week. The mean family support for dietary habits was 2.8 ($SD=.96$, Range 1 low support-4 high support). The mean number of daily SSBs was 1.3 ($SD=.99$).

The Process macro was used to investigate whether the relationship between acculturation and SSBs was mediated by family meal frequency and family support for dietary habits. Figure 2 illustrates the unstandardized beta coefficients and standard errors for each of the pathways. Utilizing this method, mediation is assessed by the indirect effect which is significant if the upper and lower bounds of the bootstrap 95% confidence intervals (CI) do not contain zero.⁵² Acculturation ($B=.07$, $p<.05$), was positively associated with SSBs (path

c) as predicted. Furthermore, acculturation was negatively associated with family support ($B = -.10, p < .01$) and family meal frequency ($B = -.11, p < .05$) (path a) as predicted. The direct effects of family support for dietary habits on SSBs ($B = -.04, p > .05$) and family meal frequency on SSBs ($B = .11, p > .05$) (path b) were not significant, contrary to prediction. The indirect effect of acculturation on SSB consumption (products of coefficients of paths a & b) via family meal frequency ($B = -.01, p > .05$) and family support for dietary habits ($B = .004, p > .05$), the primary tests for mediation, were also not significant. Finally, the direct effect of acculturation ($B = .07, p < .05$) was positively associated with SSBs (path c') as predicted. These results suggest that family meal frequency and family support for dietary habits did not mediate the relationship between acculturation and SSB consumption.

Discussion

The purpose of this study was to test family meal frequency and family support for dietary habits, as mediators of the relationship between acculturation and SSBs consumption among Latino adolescents. The primary tests for mediation, the indirect effects of acculturation on SSBs, were not significant for either mediator. The family meal frequency and family support mediators were not significantly associated with SSBs consumption. Acculturation was positively associated with SSBs among Latino adolescents replicating one prior study among Latino adolescents, and studies among Latino preschool and elementary school children.^{5,18,29} In addition, acculturation was negatively associated with family support for dietary habits and family meal frequency, the first time these associations have been empirically established among Latino adolescents.

To our knowledge, our study was the first to examine the association of acculturation with family support for dietary habits among Latino adolescents, although one prior study examined the association between acculturation and general family support among Latino children with no diet-specific indicators of family support.³⁴ We found that acculturation was negatively associated with family support for dietary habits consistent with our a priori hypothesis. One possible explanation for this finding relates to the acculturation level, and dietary patterns of the parents. Acculturated adolescents may be coming from acculturated families where parents are consuming a diet consistent with the receiving culture, and in this case, increased SSBs. As a result, family support for healthy dietary intake may be low. If correct, this interpretation suggests a need to intervene directly with parents in highly acculturated Latino families to improve diet and to change family environmental factors that are likely to sustain improved diet over time, including variables such as family support.

Acculturation was negatively associated with family meal frequency among Latino adolescents, as predicted, replicating the findings of a prior study.³² More acculturated adolescents reported eating fewer meals with their families, suggesting a cultural norm for individual meal consumption among more acculturated Latino families. By extension, we would expect the presence of a cultural norm for shared family meal consumption among less acculturated Latino families. It is also possible that teens who are more acculturated, and eating fewer meals with their families, may be reflecting the behaviors modeled by their acculturated or non-Latino peers, that of consuming meals apart from their family. This leaves open speculation about where Latino adolescents are consuming their meals, whether

alone in the home or outside of the home with their peers. If meals are being consumed with acculturated or receiving culture peers, these acculturated adolescents may be exposed to additional receiving culture influences through modeling and the availability of less healthy foods, including SSBs.

It is possible that alternative mediators not tested may help explain the relationship between acculturation and SSBs. Potential omitted mediators include family environment variables such as family interactions around food and family expressiveness.^{53,54} Latina mothers and their bicultural children reported greater family interactions and family expressiveness compared to Latina mothers and their assimilated children.⁵⁵ Therefore, it is plausible that these family environment variables may mediate the relationship between acculturation and dietary behaviors among Latino adolescents. Two other promising variables for the mediation of acculturation effects in Latino population might be *familismo*, which is defined as connectedness with and responsibility to one's family; and *respeto*, which is reflected by parental authority and a child's obedience.⁵⁶ Both variables are present in less acculturated families adhering to their Latino heritage culture and both might be expected to support the consumption of traditional heritage culture foods through direct family influence and the modeling of heritage culture behaviors. We also recommend that researchers consider the testing of other family variables less closely tied to Latino culture and perhaps including modeling, parenting style, and family cohesion as mediators of the relationship between acculturation and dietary behavior including SSBs.

Family meal frequency was not associated with SSBs consumption in the present study despite published empirical support for a positive association between family meal frequency and various dietary behaviors (e.g., increased fruit and vegetables, and reduced SSBs).^{48,57,58} It may be possible that during family meals, family members may also be consuming SSBs and therefore family meal frequency may not be a protective factor for SSBs consumption in our sample. Limited strength in the assessment of family meal frequency may also explain the null finding obtained. Only one item was used to measure family meal frequency across all meals and days of the week. It is possible that if family meal frequency was measured to capture additional variables such as day of the week, whether both parents were present, and meal (i.e., breakfast, lunch or dinner), we could begin to see associations of different family meal patterns with adolescent SSB intake.

In the present study, no statistically significant association was found between family support and SSB consumption. This was the first study to test this relationship among Latino adolescents, although prior research has found an association of family support with dietary outcomes, including fiber intake and snacking, among Mexican-American children.⁵⁹ The lack of association between family support for dietary habits and SSBs consumption may have been due to the focus on overall diet and snacking behaviors in the assessment with three items measuring family support for healthy eating, and two measuring support for healthy snacking. Family support for reducing SSB intake was not measured, potentially limiting the sensitivity to detect an association between family support and SSBs consumption.

Several limitations of the present study should be noted. The limited sample size may have reduced statistical power and the ability to find associations between the mediators and SSB intake. Due to the cross-sectional nature of the design, we cannot infer causation for any of the tested associations. The measures of family meal frequency and family support for dietary habits were limited in scope or focus and may not have adequately measured the underlying constructs of interest. Additionally, the family support for dietary habits measure has not been validated, but has been a widely used measure in dietary research with adolescents.^{50,60} Future research should also consider the role of environmental correlates of SSBs consumption. While we did not control for environmental determinants such as proximity of stores (e.g., convenience stores, grocery stores, or vending machines), we posit that these environmental covariates may make it easier to access SSBs. It is possible that more acculturated teens may access these services and amplify their consumption of SSBs. Another potential correlate is availability of healthy options in predominately Latino neighborhoods which may impact the foods and drinks consumed in those neighborhoods,^{61,62} and the inclusion of measures of proximity and availability may help us better understand the mechanisms underlying these effects on SSB consumption. Finally, the dataset had a limited number of family variables and plausible mediators were therefore omitted from the mediational model, limiting the ability to identify mediators of the relationship between acculturation and SSB intake.

We offer the following suggestions for future research that may help establish family variables as mediators of the association of acculturation with SSB intake. We recommend that future studies use longitudinal designs to better establish the causal relationship between acculturation and SSBs consumption as well as the mediating properties of family variables. Future research should recruit a sufficiently large sample to ensure adequate statistical power to detect associations within the mediational model. Parent and/or family acculturation may serve as potential mediators in the relationship between adolescent's acculturation and SSBs consumption and should be measured in future studies. We recommend improved measures of family meal frequency and family support for dietary habits which may help explain the relationship between family influences and SSBs consumption. Future research should include more family mediators when testing the association of acculturation and SSBs. Tests of mediation should be conducted for the association of acculturation with other health behaviors. Finally, directions for future interventions may want to target messaging strategy for lower acculturated Latinos to maintain their SSB consumption habits and also target higher acculturated youth with messaging strategies to lower their SSBs consumption, and/or increase water intake.

This study tested variables proposed to mediate the association between acculturation and SSBs consumption, consistent with the call for systematic tests of mediation proposed by acculturation researchers.^{20,28} Our study was the first to explore mediational pathways through which acculturation affects SSBs among Latino adolescents. Further research should examine other possible family mediators of acculturation and SSBs (e.g., *familismo*, *respeto*, family cohesion). Our study contributes to the literature by providing the first empirical evidence of an association of acculturation with family support for dietary habits and with family meal frequency among Latino adolescents.

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Figure 1. Family support and family meal frequency mediating the relationship between acculturation and SSBs.

Figure 2. Family support and family meal frequency as mediators of the relationship between acculturation and SSBs.

Note: * $p < .05$, ** $p < .01$. path c = Total effect which indicates the association between acculturation and (regression of acculturation on) SSBs without any mediating variables in the model; c' = direct effect which indicates the association between acculturation and SSBs with all mediating variables in the model. Indirect effects (products of coefficients of paths a & b) for family meal frequency and family support for dietary habits (mediating) effects of the variable controlling for other mediating variables. Covariates included in all analysis were: age, gender, parent education, and BMI. Indirect effect estimates for family support is $B = .004$ and its 95% confidence interval $[-.01, .03]$ contains zero; family meal frequency $B = -.012$ $[-.04, .005]$ and contains zero; and Total indirect effect is $B = -.009$ and its 95% confidence interval $[-.03, .01]$ and contains zero.

Table 1.

Participant Characteristics (N=131)

Characteristic	Mean (SD) or % (n)	Range
Age (years)	15.9 (1.0)	14-17
% Female	58 (77)	
% Male	42 (54)	
% Parent Education		
<HS	26.7 (35)	
HS graduate	29.0 (38)	
Some College	27.5 (36)	
College Graduate	16.8 (22)	
BMI percentile ^a	73.9 (25.4)	10.6-99.5
% Obese ^b	24.4 (32)	
% Overweight ^c	23.7 (31)	
% Not Overweight/Obese	51.9 (68)	
Acculturation ^d	3.7 (2.5)	0-8
Family Meal Frequency (% by Category)		
Never	21.4 (28)	
1-2 meals/week	24.4 (32)	
3-4 meals/week	18.3 (24)	
5-6 meals/week	19.1 (25)	
>7 meals/week	16.8 (22)	
Family Support Dietary Habits ^e	2.8 (.96)	1-5
SSBs (mean servings/day)	1.3 (.99)	0-3.3

Note: SD, standard deviation;

^a= based on CDC's BMI calculator based on age and gender

^b= defined as having a body mass index (BMI) that is in or over the 95th percentile

^c= defined as having a BMI that is greater than 85th percentile and less than 95th percentile

^d= higher scores reflect greater acculturation

^e= high scores reflect greater family support for dietary habits