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Family environment, children's acculturation and mothers' dietary intake and behaviors among Latinas: an autoregressive cross-lagged study

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Abstract

Background: Many Latinos in the US do not meet dietary recommendations for healthy eating. Family systems theory posits that the family environment affects family members' dietary behaviors. Moreover, research suggests that children's acculturation is associated with Latina mothers' dietary intake and behaviors.

Purpose: This longitudinal study examined the effect of the family environment on Latina mothers' dietary intake and behaviors. Further, we examined whether these effects differed between mothers of assimilated versus bicultural children.

Methods: Secondary data were collected at three time points (baseline, and 4 and 10 months post-baseline) from 162 culturally traditional and bicultural Latina mothers residing in Imperial County, California, US. Participants were enrolled in the delayed treatment group of a randomized controlled trial. Mothers' daily fruit and vegetable intake, and sugary beverages, percent of calories from fat, weekly away-from-home eating, and percent of weekly grocery dollars spent on fruits and vegetables were examined. The family environment was measured by family expressiveness and family interactions around food. Separate autoregressive cross-lagged models

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examined the effects of the family environment on dietary outcomes, adjusting for sociodemographic variables. Interactions between the family environment and children's acculturation were also tested.

Results: Less positive family interactions around food at baseline predicted more frequent away-from-home eating four months later among mothers of assimilated children. More family expressiveness at four months predicted more grocery dollars spent on fruits and vegetables at ten months among mothers of bicultural children.

Conclusions: Findings suggest the importance of a positive family environment on socially-bound dietary behaviors (e.g., away-from-home eating) exhibited by the mother. Family interventions aimed at improving dietary intake and associated behaviors should promote a positive family environment around food, and consider the moderating role of children's acculturation.

Keywords

Latinos; diet; mothers; children; acculturation; family environment

1. Introduction

Most adults in the US are not meeting the daily recommended dietary intake of fruits and vegetables, and they are exceeding the recommended daily allowances for fats and sugar needed to prevent chronic health conditions (Krebs-Smith, et al., 2010). These trends persist among non-white racial/ethnic groups (Kirkpatrick, et al., 2012), including Latina mothers (Torres-Aguilar, et al., 2016). Research shows evidence of disparities in the quality of dietary intake between non-Latino whites and Latinos (Hiza, et al., 2013), though not in all cases (e.g., fiber intake (King, et al., 2012). Among Latinos, important differences in dietary quality by acculturation exist. More culturally traditional Latinos typically consume more fruits, vegetables, and fiber, and engage in less frequent away-from-home eating (which consists of more calories, added fats and sugars than foods prepared at home (An, 2015)), than less traditional Latinos (Ayala, Baquero, et al., 2008; Perez-Escamilla, 2011). Compared to Mexican-American mothers, Mexican immigrant mothers also consume healthier diets (Dondero & Van Hook, 2016).

Several personal (Creighton, et al., 2012), social (Akresh, 2007), and cultural (Sallis, et al., 2008) contributors to dietary intake have been identified among Latino populations including the role of family (Satia, 2009). Among traditional Latinos, the family is an important, central element of daily life (Galanti, 2003), which may have direct and indirect influences on Latinos' dietary intake. Research on the promotion of healthy dietary intake and related behaviors among Latinos may benefit from developing a better understanding of the role of the family, particularly for Latina women who are primarily responsible for the food shopping and meal preparation in their families (Sliwa, et al., 2015).

Family systems theory posits that various dimensions of 'the family' are important sources of influence on an individual's health behaviors especially those behaviors engaged in as a family (e.g., family meals). In contrast to most public health theories, the relationships and

interactions of family members, rather than the individuals are the primary interest in family systems theory (Bavelas & Segal, 1982). The quality of the relationships within the family, including how cohesive, disengaged, and expressive family members are with each other, characterizes the relationships within the family system (i.e., family environment). Because dietary intake and dietary behaviors typically take place among family members (Coveney, 2002), the family environment may be an important determinant of an individual's diet quality. According to family systems theory, because the family environment is contributed to and experienced by all family members, the family environment affects all members and their behaviors (Whitchurch & Constantine, 2009). In other words, the family environment has as much effect on mothers' outcomes as it does on children's outcomes; however, the latter has received most of the focus in family-centered health research (Chen & Kennedy, 2004; Evans, et al., 2011; Kitzman-Ulrich, et al., 2010; Rhee, 2008). It is also important to study the family environment among Latinos in light of traditional Latino cultural values such as *simpatía* and *respeto*, which emphasize interpersonal harmony, respect for parents, and deemphasize interpersonal conflict (Triandis et al., 1984; Valdez, 2017), and *familismo* and interdependence, which refers to the importance of family and the reliance between among family members in daily life (Galanti, 2003).

One indicator of the family environment is how expressive family members are with one another. As defined by Moos and Moos (Moos & Moos, 1994), family expressiveness is the extent to which family members are encouraged to act openly and express themselves directly. Eating behaviors may often require communication between family members. For example, family members likely express their opinions and preferences when deciding which restaurant to visit or which foods to purchase at the grocery store. The extent to which families express themselves may impact family members' food-related decisions. For example, children who openly express their preferences may have more say on what mothers cook for dinner versus children who are less expressive about their preferences. Therefore, investigating the role of family expressiveness may prove beneficial in understanding mothers' dietary intake and behaviors.

As with most research on family-level predictors of behavior (Fisher, 2006), studies examining the relation between family expressiveness and dietary intake in adults are limited. In a study of 42 mothers of children under the age of 12, no correlations were found between self-reported family expressiveness and mothers' dietary nutrients and intake (fruits and vegetables (Kintner, et al., 1981). Researchers examining 44 parents of 4th and 5th grade Girl Scout troops found no differences in parents' mean fruit, vegetable, or fiber intake by family expressiveness scores (Djuric, et al., 2006). However, these studies were limited by their small sample size, cross-sectional designs, and lack of Latinos in their samples. The central importance and daily influence of family members in traditional Latinos' lives suggests that the family environment, including family expressiveness, warrants further investigation among Latinos. Given the few studies in this area, additional research is needed to build the evidence on whether family expressiveness is a predictor of mothers' dietary intake and behaviors, and consequently, a promising target for future interventions.

Though the evidence is limited, the two studies described above did not show statistically significant correlations between family expressiveness and mothers' diet. While this may

have been attributed to the limitations previously described, it could also be that family expressiveness may be mediated by an unmeasured family-level construct. Family interactions around food (i.e., interpersonal communication regarding healthy eating among family members) may be an important mediator between family expressiveness and mothers' dietary intake and behaviors. Having more positive interactions around food has been found to be a strong predictor of behavioral strategies to increase dietary fiber and decrease dietary fat consumption among Latina mothers (Schmied, et al., 2014). In a study among 155 Midwestern wives, more positive family interactions around food were associated with less fat and saturated fat intake and more dietary fiber, fruit, and vegetable intake (Schafer, et al., 1999). Consistent with family systems theory, these studies suggest that family interactions around food are relevant to diet-related behavioral strategies and to dietary intake, though it remains unclear whether these interactions are associated with Latina mothers' dietary intake and behaviors. It is also important to determine whether families with more positive expressiveness give rise to more positive family interactions around food, resulting in better diet quality among mothers. It could also be the case that within Latino families, traditional cultural values that emphasize respect and harmony between family members (*respeto*, *simpatía*) deemphasize expressiveness if what is being expressed is negative or promote expressiveness if what is being expressed is positive.

Family relationships (e.g., mother-child dyads) are a salient aspect of family systems theory because the quality of these relationships can influence the overall family environment (Bavelas & Segal, 1982). According to Smokowski's acculturation gap-distress model (Smokowski, et al., 2008), the family environment can become less communicative, more detached, and more conflict-ridden because of differences in acculturation between Latina mothers and their children. Though not always the case (Telzer, 2011), the family environment may be negatively impacted when children adopt the behaviors, values, and norms of the dominant culture (i.e., become assimilated), which may differ from their parents' expectations (Miranda, et al., 2006). For example, in their meta-analysis, Shor and colleagues found that children who migrate to the US at young ages are more likely to adopt traditionally American foods than older children (Shor, et al., 2017). This can result in difficulties feeding children and adult family members with different food preferences (Soto, et al., 2018). In recent studies (Soto, et al., 2018; S. H. Soto, et al., 2017), having children who were assimilated to the US culture was associated with mothers' intake of lower quality foods and unhealthier dietary behaviors than having children who were bicultural. These studies demonstrated that children's acculturation might be important to mothers' diet quality; however, the role of children's acculturation on the association between the family environment and mothers' diet is unknown.

Based on family systems theory, we employed a longitudinal design using secondary data to explore the effects of the family environment (i.e., family expressiveness and family interactions around food) on Mexican-origin Latina mothers' dietary intake and behaviors. Specifically, we tested whether family interactions around food mediated the association between family expressiveness and mothers' dietary intake. We expected that greater family expressiveness would be associated with more positive family interactions around food, and thus better diet quality among mothers. We also examined differences in these associations by mothers of assimilated versus bicultural children. We expected that mothers of bicultural

children would have a more positive family environment and thus better diet quality than mothers of assimilated children.

2. Methods

2.1. Study design and sample

Mother-child dyads were recruited to participate in a randomized controlled trial (RCT) with two conditions: intervention versus a delayed treatment control condition. Potential participants were informed that this was a study funded by the American Cancer Society to promote healthy lifestyles among Latino families. Those in the delayed treatment control condition were told that they would receive a modified version of the intervention after the final assessment time-point (10 months post-baseline). In this study, we used baseline, and 4 and 10 -month post-baseline data that were collected from 181 Mexican-origin Latino mother-child dyads who were assigned to the delayed treatment control condition. The 4-month intervention (*Entre Familia: Reflejos de Salud*; Within the Family: Reflections of Health; (Ayala, et al., 2011)) was designed to modify family interactions with regard to dietary behaviors (e.g., parenting practices) through in-home visits and telephone calls from *promotoras* (community health workers). Results from the intervention have been published elsewhere (Ayala, et al., 2015; Horton, et al., 2013; Schmied, et al., 2014).

Between May 2009 and February 2011, a convenience sample of mother-child dyads was recruited from Imperial County, California, situated along the US-Mexico border. Mothers and children were recruited from health fairs, clinics, schools, newspaper ads, and mailed letters to parents of pediatric patients of *Clínicas de Salud del Pueblo*, Inc., a federally-qualified community health center. Mothers were eligible if they (a) self-identified as Latina; (b) had a child between the ages of 7–13; (c) could speak and read in Spanish so that they could understand the Spanish-language sitcom professionally developed for the intervention; and (d) lived in the same household as their child for at least four days of the week. If there was more than one eligible child, the one with the closest birthday to the baseline assessment was chosen to participate. We used Marin's Bidimensional Acculturation Scale (BAS; Marin, et al., 1987) to measure acculturation to the US and traditional Latino culture (Fox, et al., 2017). Based on the BAS, mothers who were either (a) culturally traditional (e.g., maintained traditional Latino culture and did not adopt US culture) or (b) bicultural (e.g., maintained both traditional and US culture) and children who were either (a) bicultural or (b) assimilated (e.g., rejected traditional culture and adopted US culture) were included in the present study (N=162 mother-child dyads). Dyads were excluded due to small sample sizes in the various acculturation groups as follows: marginalized mothers (e.g., rejection of both the dominant and traditional cultures; n=1) of marginalized children (n=7) and assimilated mothers (n=7) of traditional children (n=32). The study was approved by San Diego State University's Institutional Review Board.

2.2. Measures

Bilingual research assistants collected data in a location that was convenient to the families. Surveys were conducted separately with mothers and then children. Research assistants administered the surveys by reading aloud each question and showing the participants a

response card with response options for each item. Surveys were in Spanish for mothers and children had the option of English or Spanish. Unless otherwise specified, we used data collected from mothers. In addition to the measures described below, mothers responded to questions on behavioral strategies to reduce dietary fat dietary intake and increase dietary fiber intake, parenting strategies, food insecurity, and other lifestyle behaviors.

2.2.1. Dietary outcomes: Mother-reported dietary intake and behaviors—We used the 19-item National Cancer Institute (NCI) All-Day Screener (Thompson, et al., 2002) to assess daily servings of fruits and vegetables (excluding French fries, potatoes, and beans/legumes) separately at each time point. Mothers reported their frequency of consuming the fruit or vegetable during a typical day in the past month and estimated their usual serving size with the assistance of food models to improve the accuracy of self-report. We converted frequencies to daily averages and then multiplied by the MyPyramid serving size equivalent of the reported serving size of each food. In the validation study (Thompson, et al., 2002), the correlation between the summary score for daily servings of fruits and vegetables and 24-hour dietary recalls among women was moderate ($r = .51$).

The 5-item subscale from the Youth/Adolescent Questionnaire (YAQ; Rockett, et al., 1995) assessed daily servings of sugary beverages in the past month at each time point. The YAQ was based on the Willett Food Frequency Questionnaire (FFQ; Willett, et al., 1985). Response options for the frequency of consumption ranged from “Never/less than 1 per month” to “2 or more cans/glasses per day” and were converted into daily servings equivalent to one glass, bottle, or can and then summed to provide the average daily intake of sugary beverages during the past month. The correlation of the sugary beverages subscale between the YAQ and the Willett FFQ in a young adult sample between the ages of 18–31 was .62 (Larson, et al., 2012).

The 16-item NCI Multifactor Fat Screener (Thompson, et al., 2007) was used to estimate the daily percent of calories consumed from fat at each time point. Mothers reported their frequency of consuming each item over the past 12 months. Frequencies were standardized to the midpoint of responses and converted to the number of times per day. The frequencies were then multiplied by a weighted score based on participant’s age and gender for the portion size of each item (Thompson, et al., 2007). The Fat Screener was moderately correlated ($r = .58$) with biomarkers (true intake of fat) in women enrolled in the validation study (Thompson, et al., 2007).

Six items previously developed for Latinos assessed the frequency of consuming foods that were prepared away from home during a typical week in the last month at each time point (Ayala, Rogers, et al., 2008). We calculated a single sum score of mothers’ frequency of consuming foods that were prepared from any of the following away-from-home sources during a typical week: (a) grocery stores, (b) relatives’/friends’ homes, (c) fast food restaurants, (d) other restaurants, (e) cafeterias, and (f) other outlets including vending machines and on-street vendors.

Mothers in the current study estimated how much their family spent on: (a) all groceries and (b) fruits and vegetables every week in the past month at baseline and 10 months post-

baseline only. The amount spent on fruits and vegetables was divided by the total amount to obtain the percent of weekly grocery dollars spent on fruits and vegetables.

2.2.2. Mother-reported family environment—We assessed *family expressiveness* from mothers' perspective at each time point using 5 items from Bloom's Family Relationships Index in the Family Functioning Scale (Bloom, 1985). Sample items include, "*Family members felt free to say what was on their minds*" and "*In our family, it was important for everyone to express their opinion,*" with response options on a 4-point Likert scale (1=Very untrue, 4= Very true). We reverse coded two items so that higher mean scores indicate greater family expressiveness. Family expressiveness had an internal consistency of .77 at baseline.

We measured *family interactions around food* in the past month at each time point using a 5-item scale (Elder, et al., 2009; Gillespie & Achterberg, 1989). Mothers responded to items using a 5-point Likert scale (1=Never, 5=Very Often). Items assessed the frequency of family interactions (e.g., discussions) regarding food and dietary habits (e.g., "*I discussed the importance of eating a nutritious combination of foods with my family*" and "*Family members talked to each other about nutritious foods*"). We obtained a mean score of the five items, with higher scores indicating more positive family interactions around food. Internal consistency of this scale at baseline was .76 among mothers in the current study.

2.2.3. Potential moderator: Child-reported acculturation—Children self-reported their acculturation at baseline using the 24-item BAS (Marín & Gamba, 1996). The BAS assesses language use, linguistic proficiency, and language of electronic media in two languages to generate a score for the Hispanic/Spanish dimension and the non-Hispanic/English dimension. Item response options are on a 4-point Likert scale. We obtained a mean score ranging from 1–4 for each dimension with higher scores indicating greater Spanish/English language use. To categorize children as either *bicultural* (i.e., integrated, adherent to both dimensions; n=88) or *assimilated* (i.e.,, adherent to the non-Hispanic dimension but not to the Hispanic dimension; n=74), we used the mean cutoff score of 2.5 (Berry, 1997). In this sample of children, internal consistency for the BAS was .86 on the Hispanic and .75 on the non-Hispanic dimension.

2.2.4. Mother-reported sociodemographic characteristics—Sociodemographic characteristics reported by mothers at baseline included mother and child's age, mother's highest level of education completed, mother's employment status, household monthly income, marital status, the number of years living in the US, child's gender, and the number of children living in the home. Research assistants measured mothers' and children's height and weight, which were used to calculate body mass index (BMI, kg/m^2). For children, BMI was converted to categories using the CDC's age- and gender-adjusted cut points for normal weight, overweight, and obese for children (Kuczmarski, et al., 2002).

2.3 Data analyses

Sample sizes at each time point were 162 at baseline, 147 at the 4-month post-baseline, and 144 at the 10-month post-baseline assessment. Mothers missing 4 months post-baseline had

higher Hispanic dimension scores (M=3.66, standard deviation [SD]=0.29) than the total sample at baseline (M=3.47, SD=0.33, t(160)=2.10, p=.04). Mothers missing 10 months post-baseline were younger (M=34.39, SD=6.51) than the total sample at baseline (M=39.56, SD=7.88, t(159)=2.67, p=.01). To reduce biased parameter estimates, mothers' acculturation and age were treated as auxiliary variables in the model testing (Little & Rubin, 2014).

Data were initially explored using descriptive statistics and correlations between study variables in SAS® Version 9.4 (SAS Institute Inc., Cary, NC). We then conducted autoregressive cross-lagged (ARCL) models in MPlus (Muthén & Muthén, Los Angeles, CA; Muthén & Muthén, 2013) across three time points for each dietary outcome to test the effects of the family environment predictors on mothers' dietary intake and behaviors. ARCL analyses allowed us to examine patterns of influence between variables across time. By regressing variables on themselves measured at earlier time points, we can test for changes in a variable above and beyond its previous levels (autoregressive effects). We can also test the influence of one construct (e.g., family expressiveness) on another (e.g., fruit intake) at a later time (cross-lagged effects), controlling for earlier measured levels of both constructs (Selig & Little, 2012). ARCL also allows us to investigate mediation paths over time. Figure 1 depicts the theoretical model that was tested with each dietary outcome and shows the predictive paths of most interest in the current study.

Dietary outcomes were count variables and non-normally distributed; therefore, a maximum likelihood estimation with robust standard errors was employed in ARCL analyses (Yuan & Bentler, 2000). Sociodemographic characteristics that were marginally significantly ($p < .20$) correlated with study variables at baseline and were retained in models as covariates. We evaluated model fit using the Comparative Fit Index (CFI), the Root Mean Squared Error of Approximation (RMSEA), and the Standardized Root Mean Residual (SRMR). Models with CFI values greater than .90 (Bentler, 1990), and RMSEA (Steiger, 1990) and SRMR (Hu & Bentler, 1999) values at .08 or less were deemed to have an acceptable fit. Mediation was tested by estimating the indirect effects of each outcome 10 months post-baseline. Using the MODEL INDIRECT command in MPlus, we tested the indirect path from expressiveness at baseline to each dietary outcome 10 months post-baseline through family interactions around food 4 months post-baseline.

After testing ARCL models for each dietary outcome, we examined differences in the overall model by children's acculturation measured at baseline. We tested interactions between children's acculturation and the family environment predictors in time sequential paths between family interactions around food/family expressiveness variables and dietary outcomes (see Figure 1). Given the small sample size, we used a less conservative p-value cut-off for identifying interactions ($p < .10$). If interactions were found, separate models were conducted for mothers with assimilated and bicultural children to enable interpretation.

3. Results

3.1. Descriptive characteristics

Sociodemographic characteristics of mothers and children are shown in Table 1 and dietary intake and behaviors and family environment variables across time points and by child acculturation are shown in Table 2. Table 3 shows correlations and descriptive statistics of mothers' dietary outcomes and family environment variables across time.

3.2. The role of the family environment on mothers' dietary intake and behaviors

We tested an ARCL model for each dietary outcome to explore the effects of the family environment and mothers' dietary intake and behaviors. Below we report findings from each model that are specific to our research questions (i.e., temporal and correlational paths from the family environment variables to mothers' dietary intake and behaviors; Figure 1).

3.2.1. Mothers' daily intake of fruit—The ARCL model indicated that the family environment variables (interactions around food and family expressiveness) were not associated with future daily servings of fruit. We observed a negative correlation between more positive family expressiveness at 4 months post-baseline and fewer daily servings of fruit at the same assessment ($\beta = -0.10$, $p = .05$; Figure 2). Although the theorized model did not explain a significant proportion of fruit intake at four months post-baseline ($R^2 = 0.01$, $p = .52$), the model did explain a statistically significant proportion of fruit intake 10 months post-baseline ($R^2 = 0.20$, $p = .01$).

3.2.2. Mothers' daily intake of vegetables—The theorized model showed that neither family environment variable was associated with future daily vegetable intake in mothers (Figure 3). However, more positive interactions around food and greater family expressiveness were consistently correlated with more daily servings of vegetables at each time point. The ARCL model explained a non-significant proportion of daily vegetable intake 4 months ($R^2 = 0.04$, $p = .08$) and 10 months post-baseline ($R^2 = 0.23$, $p = .10$).

3.2.3. Mothers' daily servings of sugary beverages—The ARCL model did not indicate any temporal effects or correlational associations with mothers' sugary beverage intake (Figure 4). However, the theorized model explained a statistically significant proportion of sugary beverage intake 4 months post-baseline ($R^2 = 0.08$, $p = .04$) and 10 months post-baseline ($R^2 = 0.23$, $p < .001$).

3.2.4. Mothers' percent of calories from fat—Although the model did not show effects of the family environment variables on the percent of calories from fat, more positive interactions around food were consistently correlated with fewer intake of calories from fat across time points (Figure 5). The model did not explain a statistically significant proportion of percent calories from fat 4 months post-baseline ($R^2 = 0.09$, $p = .10$), but did explain a significant proportion 10 months post-baseline ($R^2 = 0.19$, $p = .003$).

3.2.5. Mothers' weekly away-from-home eating—Mothers who reported more positive family interactions around food at baseline reported consuming away-from-home

foods less frequently 4 months post-baseline ($\beta = -0.22$, $p = 0.01$). More positive family interactions around food 10 months post-baseline were correlated with more frequent away-from-home eating at the same time point ($\beta = 0.17$, $p = .04$). This model did not explain a significant proportion of mothers' away-from-home eating 4 months post-baseline ($R^2 = 0.18$, $p = .11$) or 10 months post-baseline ($R^2 = 0.13$, $p = .09$; data not shown). We also found differences in the role of family interactions around food at baseline of mothers' away-from-home-eating 4 months post-baseline ($\beta = -0.65$, $p = .06$) by child acculturation. A stronger effect was found between fewer positive family interactions around food at baseline and more frequent away-from-home eating 4 months post-baseline among mothers of assimilated children ($\beta = -0.34$, $p = .002$) than mothers of bicultural children ($\beta = -0.05$, $p = .56$; Figure 6).

3.2.6. Percent of weekly dollars spent on fruits and vegetables—Mothers who reported greater family expressiveness 4 months post-baseline spent more grocery dollars on fruits and vegetables 10 months post-baseline ($\beta = 0.26$, $p = .001$). A significant though small proportion of the variance in the percent of grocery dollars spent on fruits and vegetables 10 months post-baseline was explained by the model ($R^2 = 0.11$, $p = .01$; data not shown). We identified significant differences in the role of expressiveness 4 months post-baseline on the percent of dollars spent on fruit and vegetables 10 months post-baseline by child acculturation ($\beta = 0.49$, $p = .003$). A stronger effect was found between greater family expressiveness 4 months post-baseline and more grocery dollars spent on fruits and vegetables 10 months post-baseline among mothers of bicultural children ($\beta = 0.22$, $p = .02$) than mothers of assimilated children ($\beta = 0.20$, $p = .10$; Figure 7).

3.4 The mediational role of family interactions around food between family expressiveness and mothers' dietary intake and behaviors

We did not observe evidence of mediation in the path from family expressiveness at baseline to mothers' dietary outcomes 10 months post-baseline through family interactions around food 4 months post-baseline.

4. Discussion

Based on family systems theory, we examined the temporal effects and correlational associations between the family environment and Latina mothers' dietary intake and behaviors. Our findings suggest that among culturally traditional and bicultural mothers of Mexican origin, family expressiveness and interactions around food partially predicted the dietary behaviors that may involve communication between family members: eating foods prepared outside the home and grocery shopping. Although the family environment did not predict fruit, vegetable, sugary beverage, or fat intake, in many cases, within-time correlations revealed that a more positive family environment typically co-occurred with a better quality diet.

Our previous studies showed that culturally traditional mothers of assimilated children consumed more daily servings of sugary beverages, more calories from fat, and more frequent away-from-home foods than mothers of children who were not assimilated (Soto, et al., 2018; Soto, et al., 2017). The current findings suggest that one potential mechanism

for the difference in the diet quality of mothers of assimilated and bicultural children is the family environment. For example, mothers with assimilated children who had fewer positive interactions around healthy eating were more likely to purchase away-from-home foods. This may reflect a combination of factors including mothers' likelihood of acquiescing to assimilated children's request for away-from-home foods, particularly when families have fewer positive interactions around food. We also found that mothers who came from families with greater expressiveness also spent more grocery dollars on fruits and vegetables when they had a bicultural child. It may be that when mothers live in family environments that encourage and support their values, they are better able to stand firm in their decision to purchase traditional foods rich in fruits and vegetables. Thus, when mothers have a bicultural child who is more likely to be open and accepting of consuming traditional foods than an assimilated child, mothers may feel more empowered to purchase these foods. Interventions on dietary intake and behaviors that involve communication and shared decision-making among Latino family members may want to integrate strategies that promote a positive family environment.

Although our findings of positive family interactions and better quality diet may generalize to non-Latino groups, our results may be attributable to traditional Latino cultural values. For example, the Latino cultural concept of *simpatía*(Holloway, et al., 2009; Triandis, et al., 1984), may partially explain the associations found in the current study. It may be that bicultural children who hold similar values of *simpatía* as their mothers help create more positive interpersonal communication that facilitates mothers' healthy food decision-making than assimilated children (Halgunseth et al., 2006). The mediating role of traditional Latino cultural values (e.g., *familismo*, interdependence) in the association between daily social interactions and health behaviors have been posited in the literature but are under-studied empirically (Campos & Shenhav, 2014).

Children's acculturation as a moderator between the family environment and mothers' dietary behaviors also appears to support Smokowski's acculturation gap-distress model (Smokowski, et al., 2008), which suggests a weakening of the family environment in families where children assimilate to US culture faster than their parents. The literature focusing on the acculturation gap-distress model primarily focuses on child depression, substance use, and other maladaptive outcomes (Telzer, 2011). Our study extends this line of research to dietary outcomes among Latina mothers. In our previous qualitative study of mothers and children, we observed several explanations for why mothers of assimilated children had more difficulty consuming a better quality diet than mothers of bicultural children (e.g., differences in children's food preferences, differences in parenting behaviors (S. Soto, et al., 2018)). The current study builds on these mother-child explanations of mothers' dietary intake by investigating the family environment as a potential source of influence.

While not predictive of better quality dietary intake, the family environment typically correlated with a better quality diet. Research shows that parents who report low family functioning typically serve less healthful foods at dinner for themselves and their family (Neumark-Sztainer, et al., 2014). These findings have been expanded in the literature linking daily parental stress (e.g., interpersonal conflicts) and more unhealthful parenting practices

among a racially/ethnically diverse sample of parents (Berge, et al., 2018). However, as with most mother-child research on diet, there is a gap in studies investigating the effects of daily stressors, family functioning, and other family environment characteristics on *mothers'* dietary intake. The current study's findings of correlational associations suggest a need for using specialized methods to investigate (e.g., ecological momentary assessments (Shiffman, et al., 2008)) and test (e.g. just-in-time adaptive interventions (Nahum-Shani, et al., 2015) daily associations between the family environment and mothers' dietary intake.

4.1. Study limitations

Our study results should be considered in light of its limitations. Although we controlled for several sociodemographic factors, there may be other unmeasured confounders driving the effects observed. Our small sample size may have also attenuated the observed effects. Therefore, replication studies are needed to confirm and expand our findings. Our convenience sample of culturally traditional and bicultural mothers, which do not include assimilated mothers, further limited the generalizability of our findings. Similarly, the children in our study were limited to those who were bicultural or assimilated. Most mothers had multiple children in the home, however, data were not collected from other children, limiting our ability to include or control for other children's acculturation. Mothers' self-report of positive family interactions including expressiveness and interactions around food may have been subject to social desirability bias (Mejia, et al., 2015). This is especially a concern for traditional Latina mothers who may hold cultural values including *simpatía* (Holloway, et al., 2009; Triandis, et al., 1984). Mothers' endorsement of *simpatía* may have biased their report of family expressiveness, which was assessed through items that captured positive interactions rather than overt disagreement or confrontation from children. Mothers' endorsement of other potentially pertinent cultural constructs including *familismo*, communalism, *respeto*, and *personalismo* (Delgado, 2006) would help contextualize our findings within Latino culture. Finally, the dietary outcomes were self-reported, potentially introducing measurement error in the form of recall or social desirability bias. Future research should incorporate 24-hour recall assessments or biomarkers to more accurately assess dietary intake. In an effort to overcome the limitations of using self-reported measures, we trained research assistants to use food models during data collection to improve serving size estimates. We also assessed a variety of diet outcomes to cross-validate our findings. In most cases, relationships with the dietary outcomes were found to be in the expected direction. While our findings may not provide quantitatively accurate dietary results, they do provide trends that can be confirmed with future studies.

4.2. Conclusion

In sum, our study suggests that a more positive family environment may lead to mothers engaging in the types of healthier dietary behaviors that include discussion and negotiation between family members. Future interventions that seek to promote healthy dietary behaviors involving communication and shared decision-making may benefit from developing a more positive family environment. Further research that explores other potential confounders, examines a more generalizable sample of Latino families, and investigates dietary intake and behavior through a family systems lens will further explain our findings and provide direction for future interventions.

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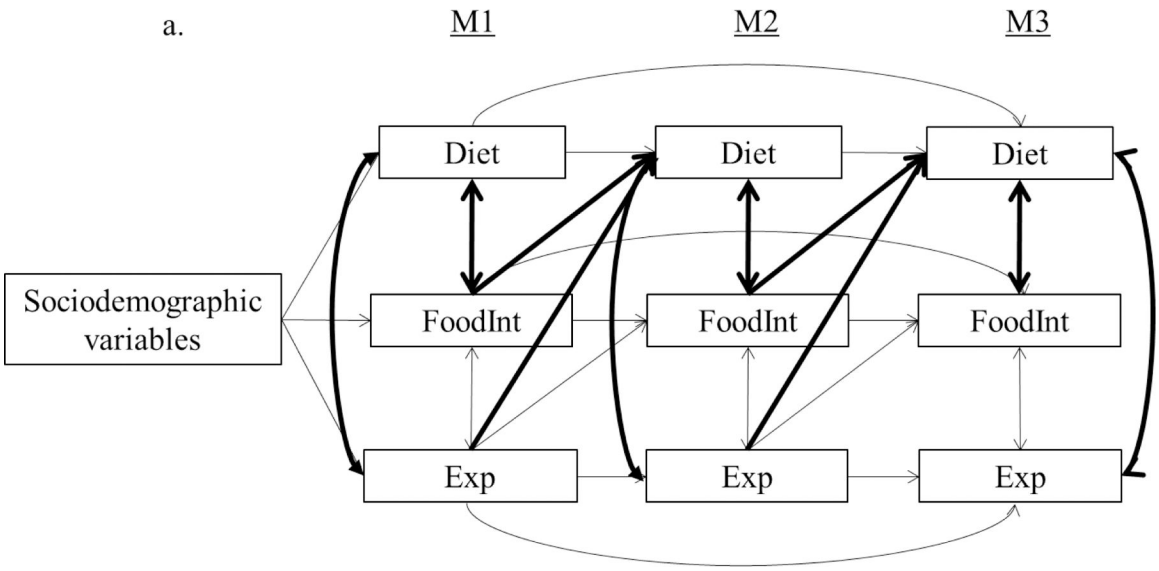

Figure 1. Theoretical model.

The bolded lines indicate paths that respond to the current study's primary research questions and are expected to differ by child acculturation. FoodInt = family interactions around food, exp = family expressiveness, C_Acc = child's acculturation.

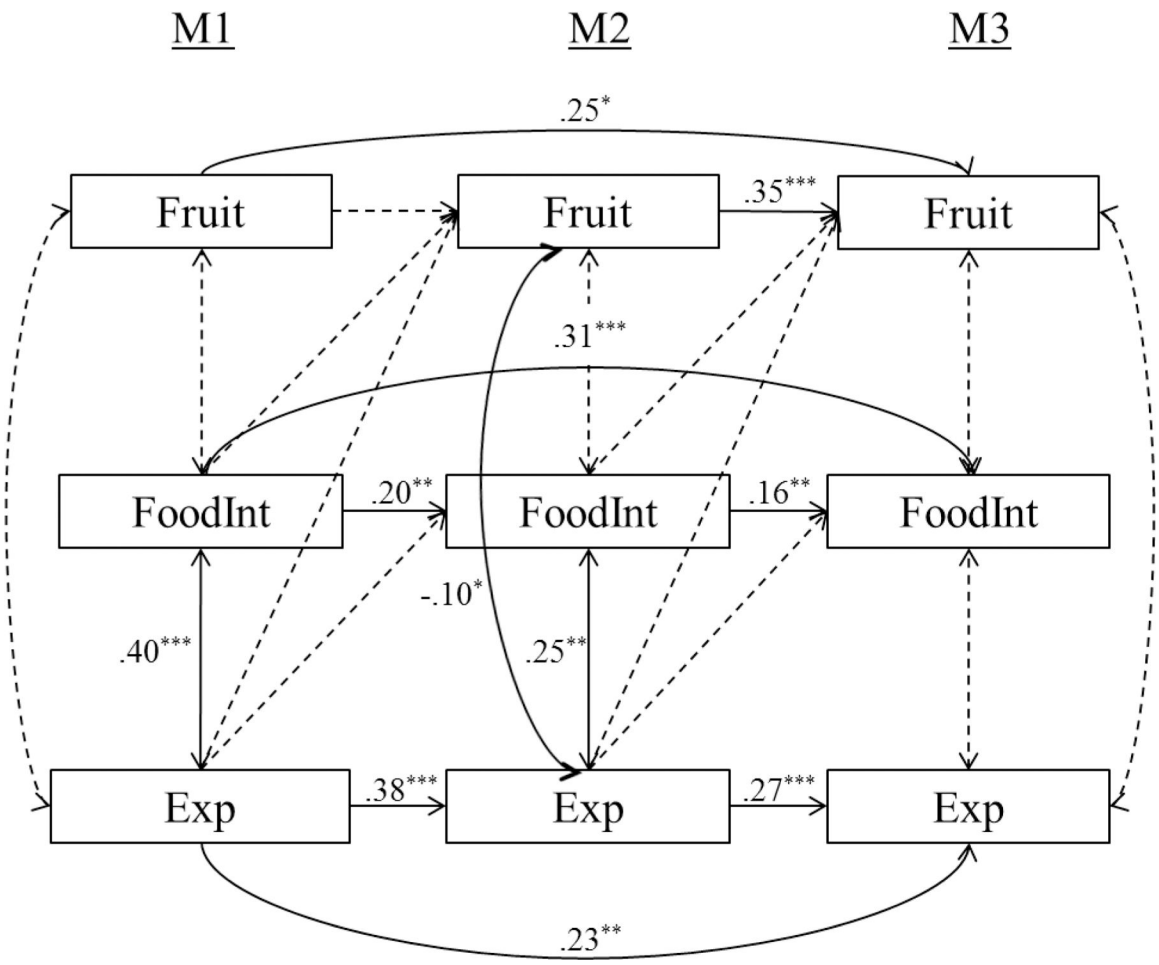

Figure 2. Auto-regressive lagged analysis results of family expressiveness and interactions around food with mothers' daily fruit servings.

Solid lines indicate statistically significant paths, dashed lines indicate non-significant paths. Standardized coefficients are shown. FoodInt = interactions around food, Exp = expressiveness. N=162; χ^2 118.03, *df*: 90, *p*-value: 0.03;*CFI*: 0.84; RMSEA: 0.04; SRMR: 0.07. [a] Model adjusted for mothers' marital status, employment, education, household income, and BMI, and children's gender, BMI, and acculturation group at baseline. * $p \leq 0.05$; ** $p \leq 0.01$, *** $p \leq 0.001$.

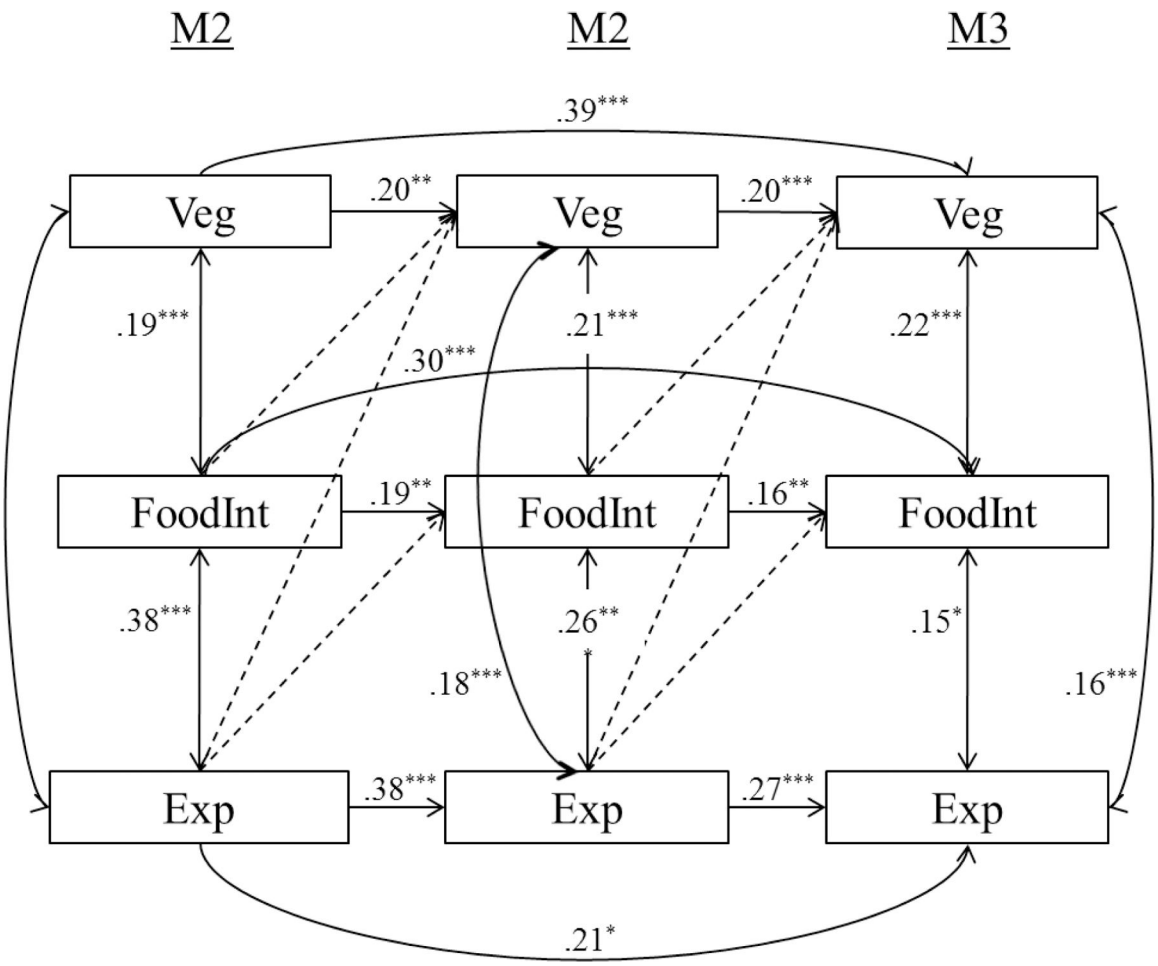

Figure 3. Auto-regressive lagged analysis results of family expressiveness and interactions around food with mothers' daily vegetable servings.

Solid lines indicate statistically significant paths, dashed lines indicate non-significant paths. Standardized coefficients are shown. FoodInt: interactions around food; Exp: expressiveness. N=162; χ^2 111.48, *df*: 91, *p*-value: 0.07; CFI: 0.90; RMSEA: 0.04; SRMR: 0.07. [a] Model adjusted for mothers' marital status, employment, education, household income, and BMI, and children's gender, BMI, and acculturation group at baseline. * $p \leq 0.05$; ** $p \leq 0.01$, *** $p \leq 0.001$.

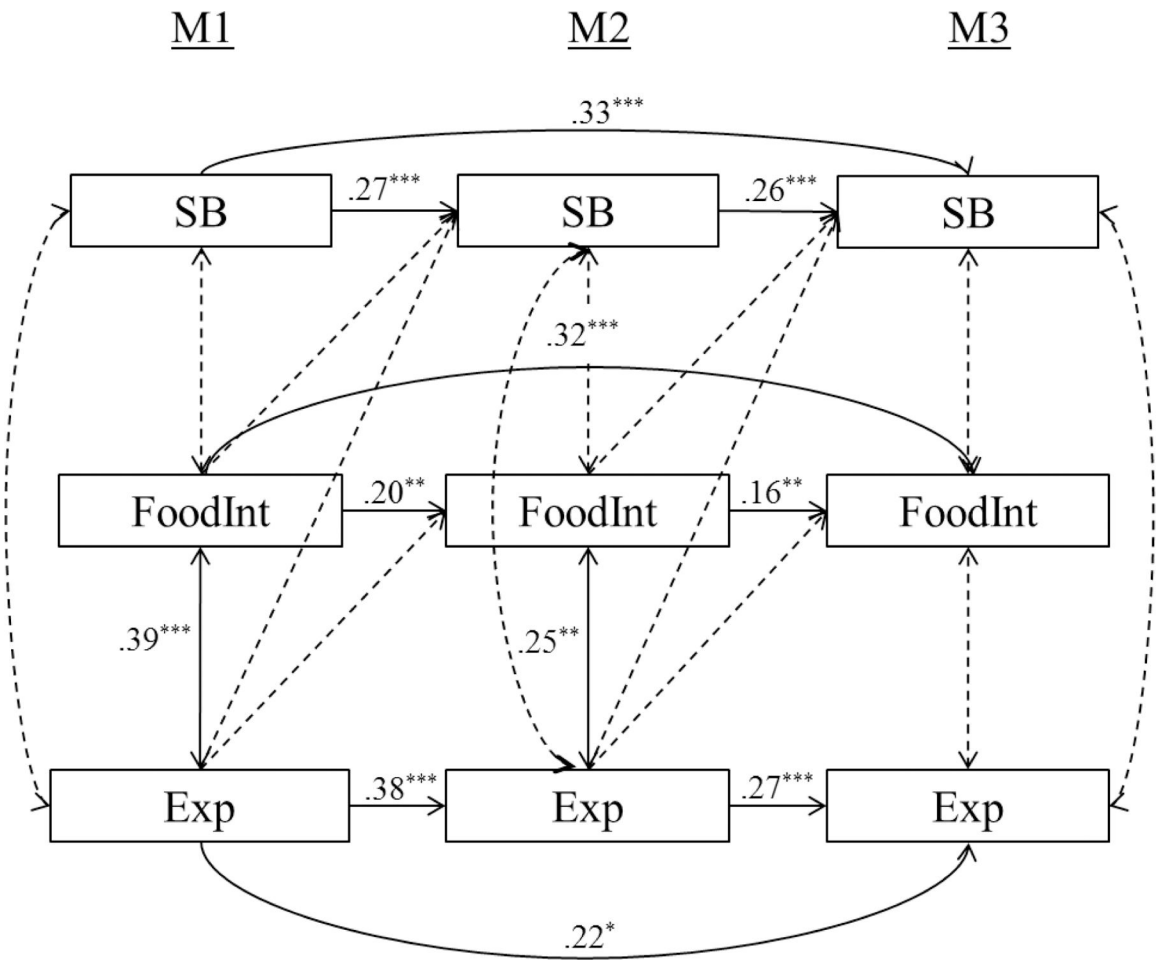

Figure 4. Auto-regressive lagged analysis results of family expressiveness and interactions around food with mothers' daily sugary beverage servings.

Solid lines indicate statistically significant paths, dashed lines indicate non-significant paths. Standardized coefficients are shown. FoodInt = interactions around food, Exp = expressiveness. N=162; χ^2 129.80, *df*: 84, *p*-value: 0.001; CFI: 0.78; RMSEA: 0.06; SRMR: 0.08. [a] Assimilated vs. bicultural, [b] Model adjusted for mothers' marital status, employment, education, household income, and BMI, and children's gender, BMI, and acculturation group at baseline. * $p \leq 0.05$; ** $p \leq 0.01$, *** $p \leq 0.001$.

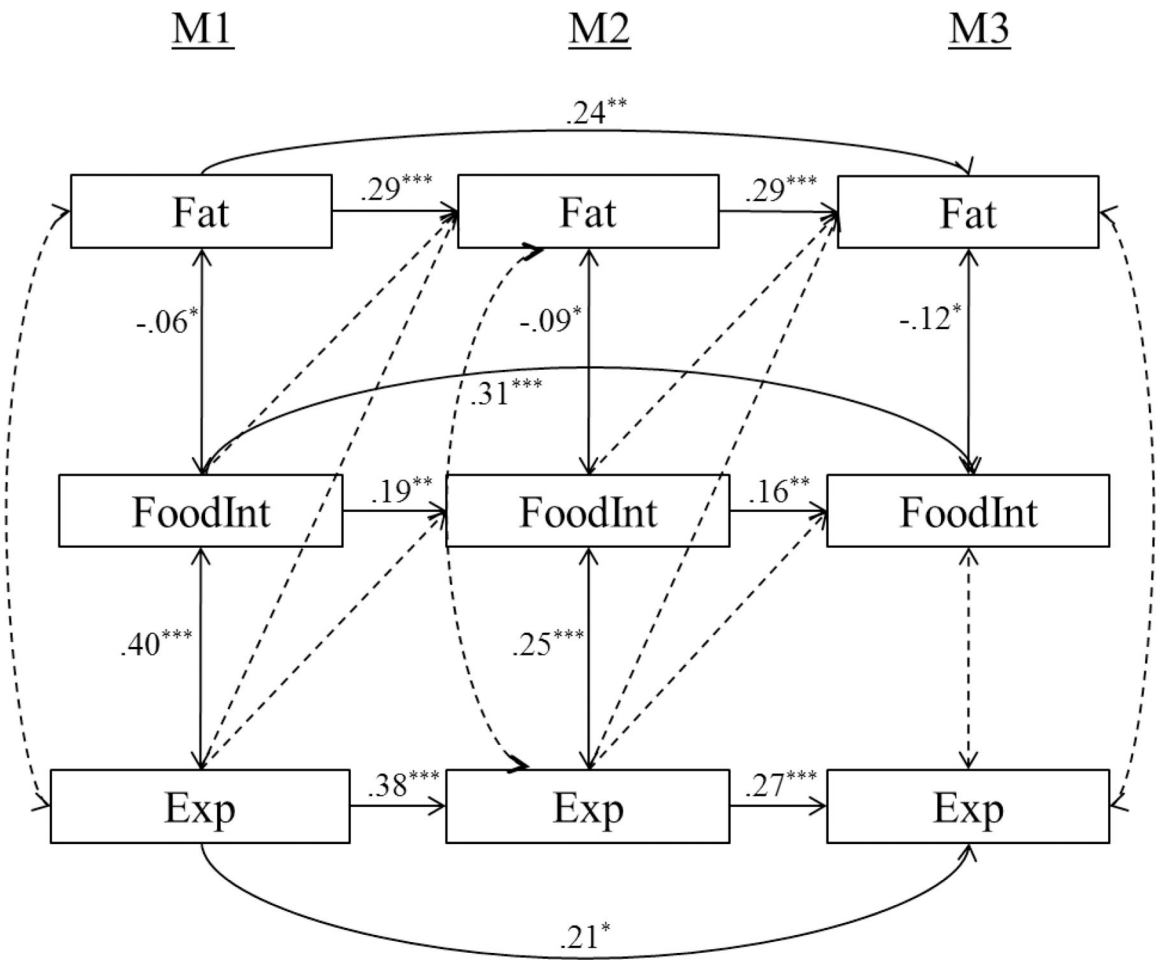

Figure 5. Auto-regressive lagged analysis results of family expressiveness and interactions around food with mothers' calories from fat.

Solid lines indicate statistically significant paths, dashed lines indicate non-significant paths. Standardized coefficients are shown. FoodInt = interactions around food, Exp = expressiveness. N=162; χ^2 96.27, *df*: 84, *p*-value: 0.17; CFI: 0.93; RMSEA: 0.03; SRMR: 0.07. [a] Assimilated vs. bicultural, [b] Model adjusted for mothers' marital status, employment, education, household income, BMI, and number of children in the home, and children's gender, BMI, and acculturation group at baseline. * $p \leq 0.05$; ** $p \leq 0.01$, *** $p \leq 0.001$.

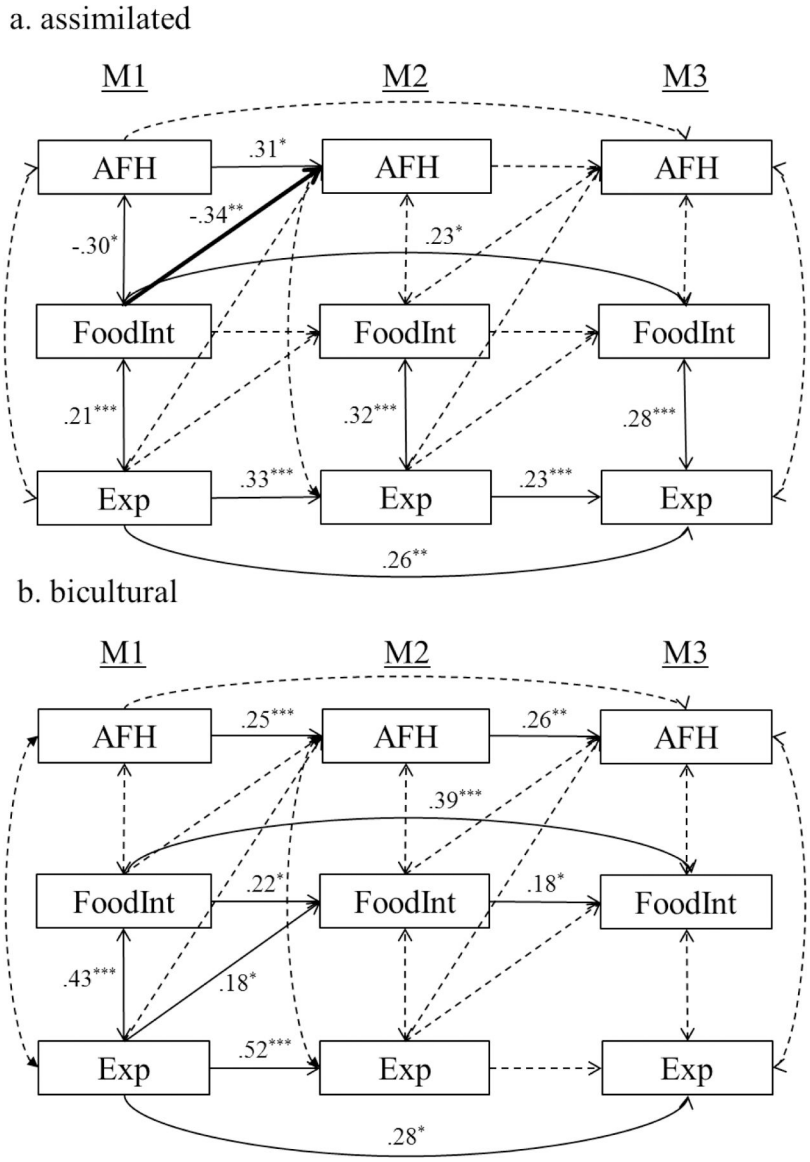

Figure 6. Auto-regressive lagged analysis results of family expressiveness and interactions around food with mothers' away-from-home eating among mothers with (a) assimilated and (b) bicultural children.

Solid lines indicate statistically significant paths, dashed lines indicate non-significant paths. Standardized coefficients are shown. AFH = away-from-home eating, FoodInt = interactions around food, Exp = expressiveness. (a) N=74; χ^2 28.22, *df*: 21, *p*-value: 0.13; CFI: 0.89; RMSEA: 0.07; SRMR: 0.13; (b) N=88; χ^2 18.03, *df*: 20, *p*-value: 0.59; CFI: 1.00; RMSEA: 0.00; SRMR: 0.07. * $p \leq 0.05$; ** $p \leq 0.01$, *** $p \leq 0.001$.

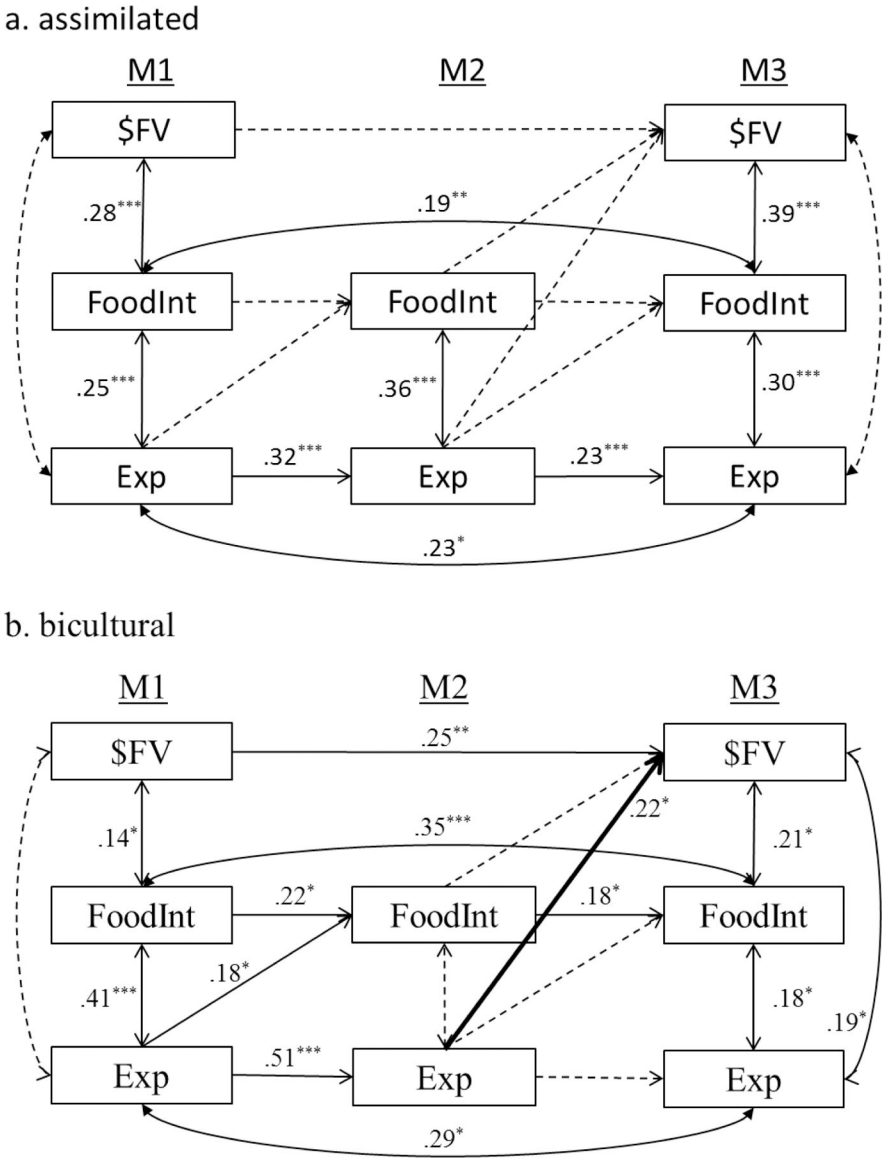

Figure 7. Auto-regressive lagged analysis results of family expressiveness and interactions around food with the percent of grocery dollars spent on fruits and vegetables among mothers with (a) assimilated and (b) bicultural children.

Solid lines indicate statistically significant paths, dashed lines indicate non-significant paths. The bolded line indicates paths of primary interest in the current study. Standardized coefficients are shown. $FV = percent of grocery dollars spent on fruits and vegetables, FoodInt = interactions around food, Exp = expressiveness. (a) N=74; χ^2 26.15, *df*: 18, *p*-value: 0.10; CFI: 0.83; RMSEA: 0.08; SRMR: 0.13; (b) N=88; χ^2 13.70, *df*: 14, *p*-value: 0.47; CFI: 1.00; RMSEA: 0.00; SRMR: 0.08. * $p \leq 0.05$; ** $p \leq 0.01$, *** $p \leq 0.001$.

Table 1.

Sociodemographic characteristics of mothers and children at baseline by children's acculturation group [a]

	Total sample (*N* = 162)		Mothers and bicultural children (*n* = 88)		Mothers and assimilated children (*n* = 74)	
	Mothers	**Children**	**Mothers**	**Children**	**Mothers**	**Children**
Mean age	39 ± 8	10 ± 2	38 ± 8	10 ± 2	38 ±8	10 ± 2
Married/cohabitating, *%*	90.7		87.5		94.6	
Completed education < high school/GED, *%*	50.0		50.0		50.0	
Household monthly income <$2,000, *%*	55.6		58.6		52.1	
Employed, *%*	31.5		30.7		32.4	
Mean number of children in the home	3 ± 1		2 ± 1		3 ± 1	
Female children, *%*		51.9		52.3		51.4
Mean Hispanic dimension score [b]	3.5 ± 0.3		3.6 ± 0.3		3.4 ± 0.4	
Mean non-Hispanic dimension score [b]	2.1 ± 0.8		2.0 ± 0.8		2.3 ± 0.9	
Mean BMI	31.8 ± 7.3		31.5 ± 6.6		32.1 ± 8.2	
Overweight/obese, *%*		49.7		48.9		50.7

[a] Based on score of 2.5 or higher on the Hispanic and non-Hispanic dimensions (bicultural) or a score of 2.5 or higher on the non-Hispanic dimension and a score less than 2.5 on the Hispanic dimension (assimilated) of the Bidimensional Acculturation Scale

[b] Higher scores indicated greater adherence to that dimension on the Bidimensional Acculturation Scale

Table 2.

Means and standard deviations of family environment and mothers' dietary outcomes stratified by time-point and children's acculturation groupk

	Baseline		4 months		10 months	
	n	**Mean (SD)**	**n**	**Mean (SD)**	**n**	**Mean (SD)**
Mothers' dietary intake and behaviors						
Daily servings of fruit						
Total sample	162	1.47 (1.72)	147	1.46 (1.65)	144	1.40 (1.16)
Child bicultural	88	1.36 (1.41)	80	1.52 (1.90)	78	1.44 (1.25)
Child assimilated	74	1.61 (2.02)	67	1.39 (1.30)	66	1.36 (1.04)
Daily servings of vegetables						
Total sample	162	1.15 (0.93)	147	1.31 (1.00)	144	1.51 (1.11)
Child bicultural	88	1.25 (1.11)	80	1.32 (1.13)	78	1.61 (1.19)
Child assimilated	74	1.03 (0.65)	67	1.31 (0.82)	66	1.39 (1.01)
Daily servings of sugary beverages						
Total sample	162	1.72 (1.35)	146	1.58 (1.18)	144	1.51 (1.01)
Child bicultural	88	1.49 (1.00)*	79	1.47 (1.18)	78	1.27 (0.86)*
Child assimilated	74	1.98 (1.64)*	67	1.72 (1.18)	66	1.80 (1.10)*
Percent calories from fat						
Total sample	159	31.74 (5.38)	145	31.06 (4.43)	143	31.05 (3.82)
Child bicultural	85	30.77 (3.46)*	79	30.86 (3.50)	77	30.74 (3.84)
Child assimilated	74	32.86 (6.83)*	66	31.31 (5.36)	66	31.42 (3.79)
Weekly away-from-home eating						
Total sample	162	3.28 (2.96)	147	2.80 (2.70)	144	2.62 (1.99)
Child bicultural	88	2.98 (2.09)	80	2.78 (2.22)	78	2.55 (2.09)
Child assimilated	74	3.64 (3.73)	67	2.82 (3.20)	66	2.70 (1.89)
Percent of weekly grocery dollars spent on fruits and vegetables						
Total sample	162	31.13 (13.29)			143	32.75 (12.39)
Child bicultural	88	32.03 (13.25)			78	35.55 (14.03)*
Child assimilated	74	30.05 (13.35)			65	29.39 (9.10)*
Family environment						
Family interactions around food [a]						
Total sample	162	3.21 (0.85)	146	3.32 (0.71)	144	3.34 (0.69)
Child bicultural	88	3.32 (0.86)	79	3.44 (0.65)*	78	3.40 (0.61)
Child assimilated	74	3.07 (0.83)	67	3.19 (0.75)*	66	3.28 (0.78)
Family expressiveness [b]						
Total sample	162	3.55 (0.60)	146	3.61 (0.48)	144	3.60 (0.50)
Child bicultural	88	3.60 (0.54)	79	3.69 (0.44)*	78	3.70 (0.44)*

	Baseline		4 months		10 months	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Child assimilated	74	3.49 (0.66)	67	3.53 (0.51)*	66	3.48 (0.54)*

Note: SD = standard deviation

[a] Scores range from 1–5 with higher scores indicated more positive interactions

[b] Scores range from 1–4 with higher scores indicated greater expressiveness

* Statistically significant differences between mothers with assimilated versus with bicultural children ($p \leq 0.05$) based on independent samples t-tests

Table 3.

Correlations among family environmental variables and mothers' dietary intake and behaviors

	Mothers' dietary intake and behaviors																
	Daily fruit intake			**Daily vegetable intake**			**Daily sugary beverage intake**			**% calories from fat**			**Weekly away-from-home eating**			**% of weekly $ spent on FVs**	
	M1	**M2**	**M3**	**M1**	**M2**	**M3**	**M1**	**M2**	**M3**	**M1**	**M2**	**M3**	**M1**	**M2**	**M3**	**M1**	**M3**
FoodInt M1	.13	−.08	.13	.32*	.01	.19*	−.05	−.03	.03	−.29*	−.16	−.18*	−.20*	−.27*	−.03	.28*	.29*
FoodInt M2	.17*	.10	.12	.20*	.21*	.20*	−.02	−.17*	−.11	.03	−.03	.01	.01	−.12	.03	.02	.13
FoodInt M3	.02	−.11	−.02	.12	−.08	.16	.08	−.04	−.05	−.14	−.14	−.14	−.22*	−.34*	.06	.16	.29*
Exp M1	.06	−.09	.08	.21*	.08	.13	−.18*	−.11	−.13	−.17*	−.16	−.07	−.10	−.10	−.07	.18*	.09
Exp M2	.07	−.07	.03	.17*	.16	.11	−.04	−.03	−.16	.01	−.03	.00	.00	−.04	−.01	.02	.24*
Exp M3	−.10	−.00	−.21*	.00	−.06	.14	−.05	−.21*	−.03	−.07	−.09	−.03	−.16*	−.15	.04	.07	.12

Note: FoodInt=mother-reported family interactions around food, scores ranged from 1–5, higher scores indicated more positive interactions; Exp=mother-reported family expressiveness, scores ranged from 1–4, higher scores indicated greater expressiveness; M1=baseline; M2=6 months post-baseline; M3=10 months post-baseline; % dollars spent on fruits and vegetables was only measured at M1 and M3

* $p \leq 0.05$