



# Family function and eating behaviours among Hispanic/Latino youth: results from the Hispanic Community Children's Health Study/Study of Latino Youth (SOL Youth)

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## Abstract

**Objective:** To elucidate mechanisms across family function, home environment and eating behaviours within sociocultural context among Hispanic youth.

**Design:** Two models tested via path analysis (youth fruit and vegetable (FV) consumption; empty energy consumption) using data from the Study of Latino Youth (2011–2013).

**Setting:** Chicago, IL; Miami, FL; Bronx, NY; San Diego, CA.

**Participants:** Youth (8–16-year-olds), *n* 1466.

**Results:** Youth ate 2.4 servings of FV per d and received 27 % of total energy from empty energies. Perceiving higher acculturative stress was indirectly associated with lower FV consumption via a pathway of low family function and family support for FV ( $\beta = -0.013$ ,  $P < 0.001$ ) and via lower family closeness and family support ( $\beta = -0.004$ ,  $P = 0.004$ ). Being >12-year-olds was indirectly associated with lower FV consumption via lower family closeness and family support ( $\beta = -0.006$ ,  $P < 0.001$ ). Household food security was indirectly associated with greater FV consumption via family closeness and family support ( $\beta = 0.005$ ,  $P = 0.003$ ). In contrast, perceiving higher acculturative stress was indirectly associated with higher empty energy consumption (via family closeness and family support:  $\beta = 0.003$ ,  $P = 0.028$  and via low family function and low family support:  $\beta = 0.008$ ,  $P = 0.05$ ). Being older was associated with higher consumption of empty energies via family closeness (related to family support:  $\beta = 0.04$ ,  $P = 0.016$ ; parenting strategies for eating:  $\beta = 0.002$ ,  $P = 0.049$ ).

**Conclusions:** Findings suggest pathways of influence across demographic and sociocultural context, family dynamics and home environment. The directionality of these associations needs confirmation using longitudinal data.

## Keywords

Family function

Family closeness

Diet

Hispanic/Latino youth

Parenting feeding practices

Prevalence of obesity and diabetes among youth has been escalating globally, and Hispanics/Latinos (hereafter 'Hispanics') are disproportionately burdened by these diseases. Among youth 2–19-year-olds, obesity prevalence is higher among Hispanics at 21.9 v. 14.7 % for non-Hispanic whites in the USA<sup>(1)</sup>. By the time they reach adolescence,

Hispanics have higher rates of insulin resistance and impaired fasting glucose levels than non-Hispanic white youth<sup>(2)</sup>.

The importance of adopting a healthier diet to prevent obesity and diet-related chronic disease is well established. Consuming fruits and vegetables (FV) contributes to the intake of dietary fibre and of foods with lower glycaemic

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index, which help prevent obesity and diet-related chronic diseases<sup>(3-6)</sup>. The 2015 Dietary Guidelines for Americans recommend that people reduce their consumption of 'empty energies' (energies from solid fats, added sugars and alcohol) because they do not provide essential nutrients and can displace more nutrient-dense foods<sup>(7,8)</sup>. However, there is limited information on how to best support these dietary behaviours among youth.

The literature consistently documents that eating behaviours among youth are shaped by the environment at home, especially parental food practices and parenting styles<sup>(9-13)</sup>. These practices influence children's attitudes and beliefs about foods<sup>(13)</sup>. For example, parenting practices related to pressuring children to eat are consistently associated with greater obesogenic dietary intake<sup>(14)</sup>. Parenting styles that describe parent behaviours around child-rearing goals are also associated with obesogenic diets<sup>(15)</sup>. Authoritative parenting styles (high responsiveness to, and high demandingness of, youth) are associated with healthier weight and better diet among youth, whereas authoritarian and permissive parenting styles have been associated with unhealthy eating<sup>(16-23)</sup>. Nonetheless, the majority of these studies were conducted on non-Hispanic white populations, with more limited and equivocal findings about practices<sup>(24,25)</sup> and parenting styles<sup>(26-33)</sup> among Hispanics. Some investigators posit that Hispanic parenting styles and practices are sometimes nonconforming with parenting styles among the dominant US culture, emphasising the need for further research on the familial, sociocultural, psychological and economic context in which parenting practices and styles occur<sup>(34,35)</sup>.

According to Family Systems Theory, food parenting practices and styles are impacted by family dynamics and interactions<sup>(36)</sup>. Children's positive feelings about how the family behaves (family function<sup>(37,38)</sup>) and their perceptions about the warmth and love that they receive from their parents (family closeness<sup>(39)</sup>) are associated with better diet in some<sup>(40,41)</sup>, but not all<sup>(42)</sup>, studies. How family dynamics may influence parenting practices

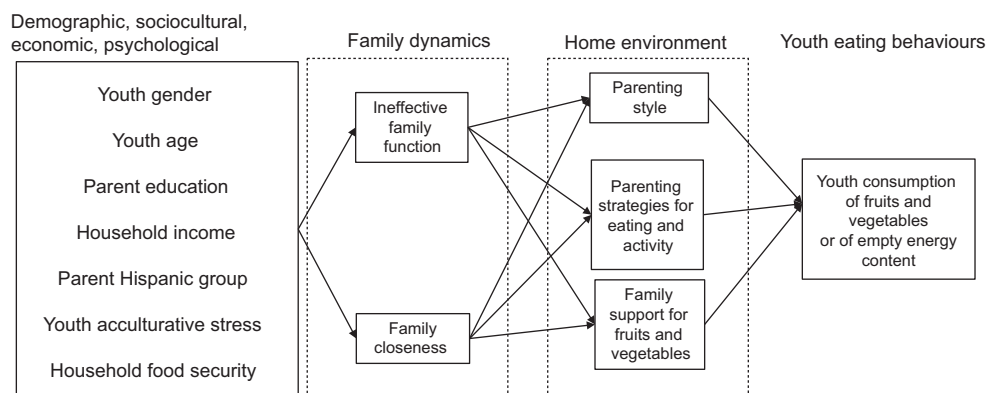
and styles, especially those related to feeding, as well as their offspring's eating behaviours are not well understood. A family that functions weakly, with conflict, less structure or less warmth may wish to spend less time together, is more likely to purchase foods away from the home and/or may be less aware of the dietary needs of the family members and therefore has less healthful items available at home.

Family dynamics may be influenced by the sociocultural, psychological and economic contexts of the household. For example, integration (bicultural orientation) has been associated with higher diet quality among Hispanic youth compared with youth who were assimilated to the USA<sup>(43)</sup>. Ethnicity, sociocultural norms and food insecurity may also influence parents' attitudes and practices towards child rearing and have been associated with child health or eating behaviours<sup>(44-46)</sup>. The role that these contextual characteristics may play in family dynamics and youth diet warrants further investigation in order to guide interventions that aim to promote healthful eating among youth. With the renewed emphasis on the interactions between multiple complex factors that influence dietary choices beyond personal choice<sup>(47)</sup>, there is an increased interest in elucidating the mechanisms between sociocultural context, family and home environments that may influence diet among Hispanic youth.

Drawing from Family Systems Theory<sup>(36)</sup> and the social-ecological approach<sup>(48)</sup>, the current study tested a model that posits that the socio-demographic and sociocultural context in which families live influence the home environment via family dynamics, and subsequently youth eating behaviours (Fig. 1).

## Methods

The current study used cross-sectional data from Hispanic Community Children's Health Study/Study of Latino Youth



**Fig. 1** Conceptual model depicting the proposed effects of demographic, sociocultural, economic and psychological variables on youth eating behaviours indirectly through family dynamics and home environment among Hispanic/Latino youth. Study of Latino Youth



(SOL Youth) to test the conceptual model depicted in Fig. 1 via path analysis. Figure 1 posits that demographic, socio-cultural, psychological and economic contexts of families influence family dynamics, which in turn relate to youth eating behaviours (consumption of FV as well as empty energies) via the home environment. Although the constructs of family dynamics are part of the many characteristics of the home environment, in this model, we intentionally separate family dynamics from home feeding environment to test if closeness/function affects parenting feeding practices and styles at home. Taking into account that these data are cross-sectional, we chose to use the terminology 'mediation path', 'influence' or 'effect' in these path analyses. A line with a single arrow represents a direct effect (relationship) between two variables with the head of the arrow pointing towards the variable being influenced by another variable.

### Data

Data were from 1466 Hispanic youths (aged 8–16 years) enrolled in SOL Youth between 2011 and 2013<sup>(49)</sup>. SOL Youth is an ancillary study of youth enrolled in the parent population-based study Hispanic Community Health Study (HCHS)/SOL<sup>(50)</sup>. HCHS/SOL participants were recruited from four US cities (Chicago, IL; Miami, FL; Bronx, NY and San Diego, CA) using probability sampling. Details about the methodology and protocols of SOL Youth have been described and published elsewhere<sup>(49–52)</sup>. SOL Youth included comprehensive measures for youth eating behaviours, food-related home environment, family dynamics and sociocultural and psychosocial characteristics among varied Hispanic background groups. Written informed consent and assent were obtained from parent/caregivers and their offspring, respectively. The study was conducted with approval from the institutional review boards of each of the institutions involved in the study.

### Outcomes

Two dietary outcomes were examined in the current study: youth FV intake (servings/d) and percentage of empty energies (percentage from energy) consumed. Both outcomes were assessed by two interview-administered 24-h dietary recalls using the multi-pass method with the Nutrition Data System for Research software developed by the University of Minnesota<sup>(53)</sup>. Nutrition Data System for Research contains over 18 000 foods and 8000 brand-name products and many Hispanic and Latino foods. Additional Hispanic/Latino foods were also added as new foods were reported by the diverse HCHS/SOL population. Total intake was calculated as the average of two 24-h dietary recalls. Fruits (without fruit juices) included whole fruits, fried fruits and fruit-based savoury snacks, as per established criteria<sup>(54)</sup>. Vegetables (excluding fried potatoes) included dark-green, deep-yellow, tomatoes, white potatoes, other starchy vegetables, legumes, vegetable juice and other vegetables as per

established criteria. FV were measured in standard serving sizes as detailed elsewhere<sup>(54)</sup>. Following the Healthy Eating Index 2010, empty energies (expressed as percentage of total energies) were defined as energies from solid fats, added sugars and alcohol beyond moderate amounts<sup>(55,56)</sup>. Alcohol was kept in the definition of empty energies because it could be a potential contributor, as 19% of SOL youth reported that they had ever used alcohol and 6% had used alcohol in the past 30 d<sup>(57)</sup>.

### Direct association: home environment

The food-related home environment included the constructs of parenting feeding practices and parenting styles<sup>(9–12,58)</sup>. First, *Family Support for FV Intake* (reported by youth) was measured with four items<sup>(59)</sup> (Cronbach's  $\alpha$  in SOL Youth = 0.76). Second, *Parenting Strategies for Eating and Activity Scale* (PEAS, reported by youth) was a twenty-six-item scale that asked parents about strategies that they used to encourage healthy youth eating behaviours, exercise and limits around screen time<sup>(26)</sup> ( $\alpha$  in SOL Youth = 0.88). Third, *Parenting Styles* (reported by parents) were measured with a sixteen-item scale designed to assess responsive and demanding parenting behaviours, with responses ranging from 1 to 4 ( $\alpha$  in SOL Youth = 0.84). Per established criteria<sup>(60)</sup>, parents were grouped into four parenting styles based on two subscales of demandingness and responsiveness: 'authoritative' (high in both demandingness and responsiveness), 'neglectful' (low in both demandingness and responsiveness), 'indulgent' (low in demandingness and high in responsiveness) and 'authoritarian' (high in demandingness and low in responsiveness). Consistent with research showing that authoritative parenting relates to healthier outcomes among youth, categories were collapsed to compare authoritative style with all others (e.g. neglectful, indulgent and authoritarian styles).

### Indirect influence: family dynamics

The constructs of family functioning and family closeness were used to capture the bidirectional relationships between family members. *Family functioning* (reported by youth) was a twelve-item subscale of the McMaster Family Assessment Device<sup>(37,38)</sup>, with responses ranging from strongly agree to strongly disagree in a four-point Likert scale ( $\alpha$  in SOL Youth = 0.77). The scale included questions such as 'In the times of crisis we turn to each other for support', 'Individuals are accepted for what they are', 'We confide in each other' and 'We don't get along with each other'. These questions alternated between positive feelings/effective family function and negative feelings/ineffective family function. In the original scale, higher scores indicate ineffective or weaker family functioning. *Family closeness* (reported by youth) was a six-item scale that asked them about their closeness to their mother and father, how much they thought these parents care for them and how they were warm and loving towards

the youth most of the time<sup>(39)</sup> ( $\alpha$  in SOL Youth = 0.70). This question was asked only for those youth who had a mother and father as the primary caregiver.

### **Indirect influence: sociocultural, economic and psychological context**

We tested various measures of these contexts, including household food security, acculturative stress and socio-demographic/economic variables. *Household food security* was measured with six items that asked parents about whether they worried about food running out, not lasting, not affording a balanced meal, relying on low-cost foods or not affording balanced meals for youth<sup>(49)</sup>. Higher scores mean higher food security. *Acculturative stress*, perceived by youth, was defined as the 'psychological, somatic and social difficulties that accompany the adaptation to the new culture'<sup>(61,62)</sup>. The nine-item acculturative stress index included three components: family acculturation conflicts, discrimination and language conflict<sup>(63,64)</sup>. The higher the score, the higher the acculturative stress. Youth gender and age, and parent-reported: parental education, household annual income and Hispanic group of origin/identity (Mexican, Caribbean (Puerto Rican, Dominican, Cuban) or other (Central/South American/mixed)) were also tested as variables that could influence youth eating behaviours indirectly through their effects on family dynamics. For path analysis models, income was dichotomised into <\$30k or >\$30k; parental education was dichotomised into high school or less, or more than high school; youth age was dichotomised into  $\leq 12$ - or >12-year-olds.

### **Statistical analysis**

To test the model (Fig. 1), we used Mplus 8.2<sup>(65)</sup> to estimate a path analysis model, which is an extension of multiple regression. A robust maximum likelihood estimator was used for model estimation. Maximum likelihood estimator provides parameter estimates with standard errors, model  $\chi^2$  statistic and fit indices that are robust to data non-normality. Maximum likelihood estimator allows an assumption of missing at random, which is more plausible than the assumption of missing completely at random in the traditional analytical methods. In addition, maximum likelihood estimator was implemented in conjunction with full information maximum likelihood for model estimation<sup>(65)</sup>; thus, every piece of information available in the data was used for model estimation<sup>(66,67)</sup>. All paths, including the double mediation paths, were tested using the multivariate delta method<sup>(68)</sup>. Model estimation incorporated stratification, clustering and sampling weights to account for the complex survey design of SOL Youth. Model fit was assessed according to the established criteria<sup>(65,69)</sup>. For each model, only significant direct and indirect effects with estimated standardised coefficients are reported.

## **Results**

Table 1 presents the descriptive statistics of the sample (unweighted). The majority of the sample was composed of youth >12-year-olds (almost 60%), who lived with parents of lower education attainment (had high school or less), lower household income (<\$30 000) and Mexican descent. On average, youth ate 2.4 servings of FV per d and received 27% of their total energies from empty energies.

### **Fruits and vegetables model**

Figure 2 depicts the direct (in arrows) and indirect (subscripts) effects of the variables tested in the model. The model fit statistics show that the data fit the model very well ( $\chi^2 = 0.454$ ;  $df = 2$ ;  $P = 0.80$ ; comparative fit index (CFI) = 1; Tucker-Lewis index (TLI) = 1; root mean square error of approximation (RMSEA) = 0.000, 90% confidence interval

**Table 1** Descriptive statistics for all variables used in path analysis. Study of Latino Youth (2011–2013) (unweighted  $n = 1466$ )

Sociocultural, economic and psychological context			
Household food security*, score range 5–15 (mean and SD)	12.60		2.70
Youth acculturative stress index, score range 1–5† (mean and SD)	1.63		0.59
Youth age ( $n$ and %)			
$\leq 12$ -year-olds	844		57.57
>12-year-olds	622		42.43
Female sex ( $n$ and %)	738		50.34
Parent education ( $n$ and %)			
High school or less	982		67.17
More than high school diploma	480		32.83
Household income ( $n$ and %)			
<\$30k	1031		71.70
$\geq$ \$30k	407		28.30
Youth Hispanic background ( $n$ and %)			
Mexican	709		48.66
Cuban, Dominican or Puerto Rican	470		32.26
Central/South American, mixed, other	278		19.08
Family dynamics (mean and SD)			
Low family function‡, score range 1–4	1.94		0.44
Family closeness§, score range 10–30 points ( $n = 1237$ )	27.07		3.28
Home environment			
Parenting styles ( $n$ and %)			
Authoritative	610		41.72
Neglectful	511		34.95
Indulgent	130		8.89
Authoritarian	211		14.43
Family support for fruits and vegetables, score range 4–20 (mean and SD)	13.42		4.35
Parenting strategies for eating and activity, score range 28–127 (mean and SD)	76.93		19.41
Youth eating behaviours			
Fruit (servings/d) (median and IQR)	0.50		0.0–1.11
Vegetables (servings/d) (median and IQR)	1.26		0.61–2.12
Empty energy content (mean percentage from energy and SD)	27.12		7.57

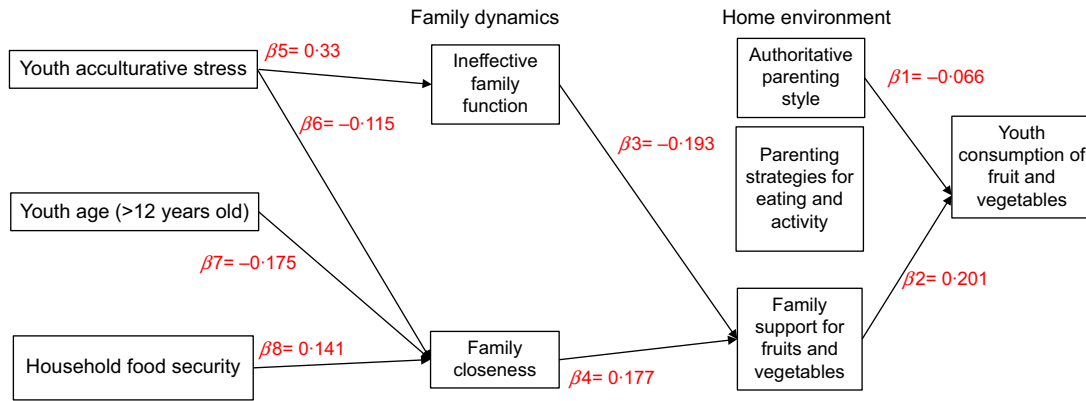
IQR, interquartile range.

\*Higher values indicate higher household food security.

†Higher values indicate greater acculturative stress on the youth.

‡Higher values indicate poorer family function.

§Reported for youth whose mothers or fathers were present.



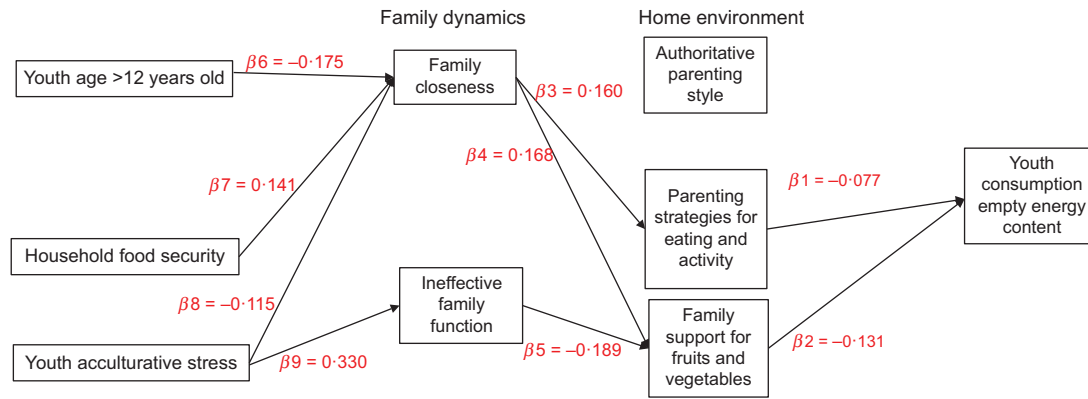
**Fig. 2** (colour online) Results from path analysis model on the consumption of fruits and vegetables among Hispanic/Latino youth. Study of Latino Youth. Only significant ( $P < 0.05$ ) pathways are presented. Indirect effects:  $\beta_3 \times \beta_2 = -0.039$  ( $P < 0.001$ ),  $\beta_4 \times \beta_2 = 0.036$  ( $P < 0.001$ ),  $\beta_5 \times \beta_3 \times \beta_2 = -0.013$  ( $P < 0.001$ ),  $\beta_6 \times \beta_4 \times \beta_2 = -0.004$  ( $P = 0.004$ ),  $\beta_7 \times \beta_4 \times \beta_2 = -0.006$  ( $P < 0.001$ ),  $\beta_8 \times \beta_4 \times \beta_2 = 0.005$  ( $P = 0.003$ ). Youth's gender, parent education and parent Hispanic group were controlled in the model. Model fit statistics:  $\chi^2 = 0.454$ ;  $df = 2$ ;  $P = 0.80$ ; CFI = 1; TLI = 1.08; RMSEA = 0.000, 90% CI 0.000, 0.033; WRMR 0.065

(CI) 0.000, 0.033; weighted root mean square residual (WRMR) 0.065). Youth gender, parent education, household income and parent Hispanic subgroups were not significantly associated with family dynamics and therefore are not depicted in the results. Youth FV consumption was directly associated with two scales of the food-related home environment: family support for FV ( $\beta_1 = 0.201$ ,  $P < 0.001$ ) and an authoritative parenting style ( $\beta_2 = -0.066$ ,  $P < 0.001$ ). This can be interpreted as an increase of one unit in the score for family support for FV was associated with a 0.2 increase in servings of FV per d, whereas an authoritative parenting style (compared with other styles of parenting) was associated with a decrease of 0.066 servings of FV per d, as reported by youth. Youth's perception of ineffective family function was directly negatively associated with youth's perception of family support for FV ( $\beta_3 = -0.193$ ,  $P < 0.000$ ), while their perception of family closeness was directly associated with higher family support ( $\beta_4 = 0.177$ ,  $P < 0.001$ ). Higher youth acculturative stress was directly associated with lower family function ( $\beta_5 = 0.33$ ,  $P < 0.001$ ) and lower family closeness ( $\beta_6 = -0.115$ ,  $P = 0.001$ ). Being older (>12-year-olds) was associated with perceived lower family closeness ( $\beta_7 = -0.175$ ,  $P < 0.001$ ), while household food security was positively associated with family closeness ( $\beta_8 = 0.141$ ,  $P < 0.001$ ).

Results from the simple mediation effects, family dynamics on youth FV consumption through the food-related home environment, suggested that the variables of family dynamics were associated with youth FV intake only via family support and not through the other variables of the home environment. To illustrate, youth's perception of ineffective family function had an inverse association with FV intake via family support ( $\beta_3 \times \beta_2 = -0.039$ ,  $P < 0.001$ ). On the other hand, youth's perception of family closeness was positively associated with family support for FV and greater consumption of youth FV ( $\beta_4 \times \beta_2 = 0.036$ ,  $P < 0.001$ ).

Results from the double mediation pathway on youth FV intake through family dynamics and food-related home environment suggested that higher youth acculturative stress was negatively associated with youth FV consumption via a pathway of ineffective family function and lower family support for FV ( $\beta_5 \times \beta_3 \times \beta_2 = -0.013$ ,  $P < 0.001$ ). Youth acculturative stress and youth age were also negatively associated with youth FV consumption via youth's perception of family closeness and family support ( $\beta_6 \times \beta_4 \times \beta_2 = -0.004$ ,  $P = 0.004$  for acculturative stress pathway and  $\beta_7 \times \beta_4 \times \beta_2 = -0.006$ ,  $P < 0.001$  for youth age pathway). Household food security was indirectly positively associated with FV consumption also via the youth's perception of family closeness and family support for FV ( $\beta_8 \times \beta_4 \times \beta_2 = 0.005$ ,  $P = 0.003$ ).

*Empty energies model:* The model for empty energies also fits the data very well ( $\chi^2 = 1.852$ ;  $df = 2$ ;  $P = 0.3961$ ; CFI = 1.00; TLI = 1.00; RMSEA = 0.000, 95% CI 0.000, 0.052, WRMR 0.140) (Fig. 3). Youth gender, parent education, household income and parent Hispanic subgroups were not significantly associated with family dynamics and therefore are not depicted in the results. PEAS ( $\beta = -0.077$ ,  $P = 0.018$ ) and family support for FV ( $\beta = -0.131$ ,  $P = 0.001$ ) were inversely directly associated with higher consumption of empty energies among youth. Family closeness was directly associated with PEAS ( $\beta_3 = 0.160$ ,  $P < 0.001$ ) and with family support for FV ( $\beta_4 = 0.168$ ,  $P < 0.001$ ). Ineffective family function was inversely directly associated with family support for FV ( $\beta_5 = -0.189$ ,  $P < 0.001$ ). Youth age and youth acculturative stress were inversely associated with youth's perception of family closeness ( $\beta_6 = -0.175$ ,  $P < 0.001$  for youth age and  $\beta_8 = -0.115$ ,  $P = 0.001$  for acculturative stress), whereas household food security and youth acculturative stress were directly positively associated with family closeness ( $\beta_7 = 0.141$ ,  $P < 0.001$  for household food security and  $\beta_9 = 0.330$ ,  $P < 0.001$  for youth acculturative stress).



**Fig. 3** (colour online) Results from path analysis model on consumption of empty energies among Hispanic/Latino youth. Study of Latinos Youth Study. Only significant ( $P < 0.05$ ) pathways are presented. Indirect effects:  $\beta_3 \times \beta_1 = -0.012$  ( $P = 0.031$ ),  $\beta_4 \times \beta_2 = -0.022$  ( $P = 0.004$ ),  $\beta_5 \times \beta_2 = 0.025$  ( $P = 0.002$ ),  $\beta_6 \times \beta_3 \times \beta_1 = 0.002$  ( $P = 0.049$ ),  $\beta_6 \times \beta_4 \times \beta_2 = 0.004$  ( $P = 0.016$ ),  $\beta_7 \times \beta_4 \times \beta_2 = -0.003$  ( $P = 0.021$ ),  $\beta_8 \times \beta_4 \times \beta_2 = 0.003$  ( $P = 0.028$ ),  $\beta_9 \times \beta_5 \times \beta_2 = 0.008$  ( $P = 0.005$ ). Youth gender, parent education, household income and parent Hispanic group were controlled in the model. Model fit statistics:  $\chi^2 = 1.852$ ;  $df = 2$ ;  $P = 0.3961$ ; CFI = 1.00; TLI = 1.00; RMSEA = 0.000, 95% CI 0.000, 0.052; WRMR 0.140

The indirect effects (simple and double mediations) of sociocultural, economic, psychological context and family dynamics on youth empty energies consumption through the food-related home environment are depicted in the subscripts of Fig. 3. Family closeness was negatively associated with empty energies consumption via PEAS ( $\beta_3 \times \beta_1 = -0.012$ ,  $P = 0.031$ ). Weaker family dynamics were also associated with greater consumption of empty energies via lower family support ( $\beta_4 \times \beta_2 = -0.022$ ,  $P = 0.004$  for family closeness pathway and  $\beta_5 \times \beta_2 = 0.025$ ,  $P = 0.002$  for ineffective family function pathway).

Older youth consumed more empty energies via two pathways, both related to lower family closeness: family closeness and PEAS ( $\beta_6 \times \beta_3 \times \beta_1 = 0.002$ ,  $P = 0.049$ ) and family closeness and family support ( $\beta_6 \times \beta_4 \times \beta_2 = 0.004$ ,  $P = 0.016$ ). Household food security was inversely associated with youth energy consumption via a pathway of family closeness and family support for FV ( $\beta_7 \times \beta_4 \times \beta_2 = -0.003$ ,  $P = 0.021$ ). Youth acculturative stress was positively associated with youth energy consumption via two pathways: family closeness and family support ( $\beta_8 \times \beta_4 \times \beta_2 = 0.003$ ,  $P = 0.028$ ) and via ineffective family function and lower family support for FV ( $\beta_9 \times \beta_5 \times \beta_2 = 0.008$ ,  $P = 0.005$ ).

## Discussion

We tested a model that positioned the sociocultural, economic and psychological contexts in which family dynamics may influence youth's eating behaviours via the home environment in a cohort of Hispanic youth. Our analyses partly supported the proposed model: better family dynamics (effective function/closeness) were associated with better home environment (family support for FV and PEAS, but not authoritative parenting style) and youth dietary consumption in the expected directions: higher

family function/closeness was associated with higher FV consumption via a pathway of family support for FV and PEAS; weaker family dynamics were associated with increased empty energies consumption via lower family support for FV and PEAS. Age and acculturative stress among youth and lower household food security indirectly influenced the hypothesised pathways in the expected directions.

The findings are congruent with Family Systems Theory, which posits that under conditions of weaker family functioning (e.g. less structure/rules, warmth/communication and problem-solving skills), youth may become more vulnerable to risk behaviours (e.g. poorer diet)<sup>(70)</sup>. The findings from the model are also in agreement with studies in other populations that have examined the relationship between level of family functioning and FV intake among youth, in which low family functioning is associated with inadequate FV intake and a diet high in red and processed meats, takeaway foods, confectionery and refined foods<sup>(41,71–73)</sup>.

The social–ecological approach posits that family dynamics are nested within socio-economic and cultural contexts. In support of this, the model findings suggest that family dynamics were indirectly associated with youth consumption: perceiving higher acculturative stress was indirectly associated with lower FV consumption and higher consumption of empty energies via a pathway of ineffective family dynamics and lower family support for FV and PEAS. Acculturative stress, defined as psychological, somatic and social difficulties that accompany the adaptation to the new culture<sup>(61,62)</sup>, has been identified as a key source of psychological distress among Hispanic immigrants, associated with depression, anxiety and marital discord<sup>(74–76)</sup>. Acculturative stress can lead to disruptions in family dynamics and relationships, potentially undermining parenting confidence<sup>(77)</sup> which, in turn, can negatively



influence behaviours related to youth well-being<sup>(78)</sup>. Low family functioning, potentially arising from these stressors, may then lead to lack of support for healthful eating, as our findings suggest. Although our study hypothesised that acculturative stress influenced weak family dynamics, the association could very well be bidirectional. Ineffective family function may be one aspect of family conflict, and acculturative stress measures also incorporate family acculturation conflicts<sup>(79)</sup>.

Acculturative stress is associated with food insecurity and family support systems: compared with peers in food-secure households, Hispanic youth in food-insecure households experienced greater parent/child acculturative and economic stress and weakened family support systems<sup>(46)</sup>. This is congruent with our findings that higher household food security was positively associated with FV consumption via a pathway of family closeness and family support for FV. Food insecurity may lead to psychological distress because parents feel that they do not have enough to feed their children<sup>(80–82)</sup>. Among immigrants, food insecurity may be exacerbated by the perception of limited access to culturally acceptable foods, in addition to low social support and less time for healthy food planning and preparation compared with prior to immigration<sup>(61,62,83,84)</sup>. However, a study on this same target population of Hispanic youth documented that parental stressors were associated with risk for youth obesity independent of the home food environment and child diet quality<sup>(85)</sup>, suggesting prospective studies to fully understand the temporal nature of these associations and mediators by behavioural risk factors for childhood obesity, including food insecurity and family dynamics.

The pathway between family dynamics and the home environment on eating behaviours seems to be shaped in part by age. Specifically, older age (>12-year-olds) was associated with lower FV consumption and higher empty energy consumption via the hypothesised pathways of family dynamics and home environment. Compared with younger youth, the influence of the home environment among adolescents is weaker and may compete with external influences<sup>(86)</sup>. Adolescents' poor food choices have been interpreted as an act of defiance to parental authority, seeking greater independence and autonomy to make their own decisions, and acceptance by their peer group<sup>(87)</sup>. Peer pressure and need for acceptance and conformity are important predictors of adolescents' purchase and consumption of empty energies<sup>(88,89)</sup>.

Our results suggest that the home environment as defined by food parenting practices but not by parenting styles was significantly associated with higher FV intake and lower energy intake. Our finding of a small but negative direct association between authoritative parenting style and youth FV intake is contrary to previous research and theory<sup>(90)</sup>. A possible explanation may be that Hispanic parenting is a 'non-traditional' mixture of authoritarian and authoritative styles, compared with the dominant

culture, as others have described<sup>(34,35,91,92)</sup>. To assist with the interpretation of our results, we ran *post hoc* analyses using continuous variables of responsiveness and demand-iness, but did not find that either subscale was significantly associated with consumption variables. Some researchers question the universal suitability of the parenting style scale to characterise other cultures' parenting styles, since the scale was developed largely for middle-class European Americans<sup>(35)</sup>. Others have suggested adding a bidirectional dimension to the parenting style scale to characterise how youth accept and interact with the parenting styles in order to better understand the dynamics of family and home environments on youth diet<sup>(93)</sup>.

### Strengths and limitations

The current study should be interpreted in light of its strengths and limitations. First, the study used cross-sectional data to test hypothesised mediation paths. We did not test all pathways in the model, and all causal paths were hypothesised to be in one direction even though bidirectional associations are plausible. Although this is the first study to examine such paths between socio-demographic variables, family dynamics and home environment using quantitative data, and based on theory, the hypothesised paths must be further examined using longitudinal data to test if the proposed paths may actually be bidirectional or reversed. Second, there are limitations inherent to self-reported data. Subjective self-ratings of some of the predictor variables may vary in meaning across individuals, since what one person considers to be high, another might consider to be low. However, we did analyse both parent-reported and youth-reported subjective measures for family function, PEAS and noted the medians and distributions in scores were similar between parent and youth reports. Self-reported dietary data are particularly challenging to collect accurately, especially among youth and racial/ethnic minority populations, and the validity of self-reported 24-h recalls has been called into question previously<sup>(94)</sup>. However, interviewer-assisted multiple 24-h recall data have recognised strengths related to increased accuracy and specificity in describing mean values for groups<sup>(95)</sup>. In addition, the current study did not control for other variables that may be important effect modifiers or mediators such as parent or youth depression, or youth school or work hours. In line with that, the analyses could have also reported on direct associations between social/economic context and parenting strategies or youth FV, but it purposefully does not because the premise of this specific study was to test the hypothesis that the demographic, psychological and economic contexts can indirectly associate with youth FV via family dynamics and home food environment. The study also has notable strengths including a large probability-based sample that



represents varied heritage and socio-economic facets of the US Hispanic population.

## Conclusion

Our findings suggest that family dynamics indirectly relate to youth's eating behaviours via parenting rules and practices towards a healthy lifestyle (family support for FV and PEAS) and that these paths also depend on youth's age, food security and acculturative stress. The pathways were statistically significant, but in general, predictors had a low magnitude, which suggests that other factors outside of the family environment are directly or indirectly influencing youth's dietary consumption. Whether these associations are evident in longitudinal research is needed to better evaluate strategies to address sociocultural, economic and psychological factors structures that influence family dynamics, the home environment and eating behaviours. The current study is a first step in elucidating complex system relationships to support healthful eating around youth.

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