



# Gender-based eating norms, the family environment and food intake among Costa Rican adolescents

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## Abstract

**Objective:** To examine the association between family environment variables (parenting styles, family meal atmosphere), gender-based stereotypes and food intake in Latin American adolescents.

**Design:** Structural equation modelling applied to cross-sectional data, 2017.

**Setting:** Urban and rural sites of San José, Costa Rica.

**Participants:** *n* 813; 13–18 years old.

**Results:** Data suggest direct associations between gender-based stereotypes and intake of fruits and vegetables (FV) ( $\beta = 0.20$ ,  $P < 0.05$ ), unhealthy foods (fast food (FF)) ( $\beta = -0.24$ ,  $P < 0.01$ ) and ultra-processed foods ( $\beta = -0.15$ ,  $P < 0.05$ ) among urban girls; intake of legumes among rural girls ( $\beta = 0.16$ ,  $P < 0.05$ ) and intake of sugar-sweetened beverages (SSB) among rural boys ( $\beta = 0.22$ ,  $P < 0.05$ ). Family meal atmosphere was associated with legume intake ( $\beta = 0.19$ ,  $P < 0.05$ ) among rural girls. Authoritative parenting style was associated with FV intake ( $\beta = 0.23$ ,  $P < 0.05$ ) among urban boys and FF intake ( $\beta = 0.17$ ,  $P < 0.05$ ) among urban girls. Authoritarian parenting style was associated with FV consumption ( $\beta = 0.19$ ,  $P < 0.05$ ) among rural boys, and with SSB and FF consumption ( $\beta = 0.21$ ,  $P < 0.05$ ;  $\beta = 0.14$ ,  $P < 0.05$ , respectively) among urban girls.

**Conclusions:** Findings are the first to describe the complex family environment and gender-based stereotypes within the context of a Latin American country. They emphasise the need for culturally relevant measurements to characterise the socio-cultural context in which parent–adolescent dyads socialise and influence food consumption.

**Keywords**  
Gender stereotypes  
Social eating norms  
Family environment  
Parenting styles  
Food intake  
Costa Rica  
Adolescents

Adolescence is a period characterised by psychological, physical and social transformations that often result in the development of autonomy while an individual is still under the guardianship and norms of a caregiver authority<sup>(1,2)</sup>. Eating behaviours developed during that stage are shaped by perceived social norms and may persist into adulthood<sup>(3,4,5)</sup>. Conforming to social norms about eating is thought to be a major determinant of dietary quality later in life, affecting the short- and long-term consequences of diet-related chronic diseases<sup>(6)</sup>. Previous studies have reported that gender-based eating stereotypes determine what adolescents choose to eat<sup>(7–9)</sup>. For example, femininity stereotypes have been typically associated with

consuming vegetables, fruits, fish and sweets, and eating small quantities. In contrast, masculinity has been associated with consuming high energy-dense foods (e.g., fast food (FF), sugary drinks) and meats (mainly red) and eating quickly and in large quantities<sup>(10–15)</sup>. Adolescents may be particularly susceptible to gender-based social eating norms that contribute to solidifying their sense of gender identity and peer relations<sup>(16–18)</sup>.

As a primary socialisation agent, the family environment plays a salient role in defining gender-based norms for children<sup>(19–21)</sup>. Despite a growing desire for autonomy and independence, adolescent eating behaviour is influenced by many aspects of the familial environment. For instance,

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adolescents whose parents express conservative attitudes towards gender roles are more likely to hold traditional views about what females and males should eat<sup>(14–21)</sup>. Interactions between parents and children (often called 'parenting styles') have been associated with diet quality in multiple studies<sup>(22–27)</sup>. Authoritative parenting styles and having meals as a family have been found to protect against unhealthy eating behaviours in adolescents<sup>(21–32)</sup>. The more parents interact with adolescents during meals, the stronger their influence on weight gain, diet quality and gender-based eating norms<sup>(9,28–33)</sup>.

Noticeably, most of these studies have been conducted in Anglo-Saxon populations and may not translate to other ethnic groups where the family environment may be influenced by different cultural norms. Societal and cultural norms reinforce traditional dichotomous gender roles for men and women<sup>(34)</sup> and can modulate socialisation practices during interactions between parents and children<sup>(34)</sup>. In Latin America, parenting styles are generally stricter and less accepting of child autonomy<sup>(35,36)</sup>. For instance, compared with their North American and European counterparts, Costa Rican adolescents are less likely to contradict their parents<sup>(35,37)</sup>, show greater respect for parental authority and present higher stress levels in their relationships with their parents<sup>(35)</sup>. 'Familismo', a common Latin American cultural construct, encapsulates the dominant role of the family over the individual<sup>(36)</sup> and explains why social and cultural constructs, including gender-based stereotypes, may influence eating behaviours and norms.

There is anecdotal and qualitative evidence suggesting differences between cultural values and family environments in urban and rural areas, potentially leading to different gender-based stereotypes and eating norms within a particular country<sup>(38)</sup>. Some studies have reported that peer influence seems to increase with urbanisation due to changes generated by the familial work and living arrangements, social expectations and cultural values<sup>(39)</sup>. Food availability in urban and rural contexts is very similar; however, as in other parts of the world, there is a higher density of FF restaurants in urban areas<sup>(40)</sup>. In our studies of Costa Rican adolescents<sup>(41)</sup>, urban youths (especially males) seem to be more exposed to highly processed foods and beverages. Costa Rican urban adolescents are more likely to buy FF from international chains or franchises, whereas rural adolescents obtain FF more frequently at neighbourhood convenience stores<sup>(42)</sup>. Nevertheless, the associations between eating behaviours and various aspects of the family environment, such as parenting styles and family meal frequency, have not been studied in Costa Rica and have hardly been noticed in the literature, especially in Latin America. Understanding these associations could possibly inform various promotional strategies for healthful eating among Latin American adolescents and their families.

The current study sought to elucidate potential associations between family environment variables (parenting styles, family meals), gender-based food intake stereotypes

and dietary intake on a cohort of Costa Rican adolescents. Our objective draws from the socioecological framework positing that individual eating behaviours (consumption of fruits, vegetables, legumes, sugary drinks, ultra-processed foods (UPF) and FF) are influenced by the familial and social environments (gender-based eating norms; rural and urban residence)<sup>(16)</sup>. We hypothesised that: (a) gender-based stereotypes are positively related to nutritious food consumption in girls and unhealthy food consumption in boys, (b) family meal atmosphere is related to the consumption of nutritious foods and (c) authoritative parenting styles are associated with consuming nutritious foods, whereas authoritarian parenting styles are associated with unwholesome food consumption. We also wanted to explore how the hypothesised associations varied across areas of residence.

## Methods

### *Study population and setting*

The study population is drawn from Costa Rican adolescents (aged 13–18 years) enrolled in rural and urban schools in the province of San José. Adolescents represent 18% of the Costa Rican population<sup>(43)</sup> and are predominantly clustered in San José (30%)<sup>(44)</sup>. Most are enrolled in the school system (80%), attend school full-time and do not work for remuneration<sup>(44)</sup>. Of the adolescents enrolled in public schools, 86% are in urban areas and 100% are in rural areas<sup>(44)</sup>. Public schools offer a school feeding programme regulated by the Ministry of Education, which provides free lunches to all students<sup>(45)</sup>. The school food menus follow national nutritional guidelines and provide 30% of the daily recommended energy intake (8368 kJ (2000 kcal)) for adolescents<sup>(45)</sup>.

### *Data collection procedures*

The sample size for the observational study was determined prior to data collection assuming a sampling error for a population proportion with finite population correction<sup>(46)</sup>. Sample selection was carried out in three steps: (1) schools ( $n$  16) were selected using a proportional-size probability method<sup>(47)</sup>. A sampling criterion for schools was whether they were in urban or rural areas of San José. (2) Ten classrooms (two from each grade from 7 to 11) were selected in each school using simple random sampling. All the students in the selected classrooms were invited to participate in the study and provided with informed assent forms for themselves and informed consent forms for their parents. (3) Study participants were randomly selected from those who provided signed informed consent and assent forms.

Adolescents were first contacted at the schools and invited to participate in the study. Approximately 1500 students received informed assent and consent forms. Both

forms had to be duly signed and returned to the investigators before data collection started. Out of 975 (~63 %) students who returned the signed assent and consent forms, around 11 % decided not to participate in the study before the start. More males than females chose not to participate ( $P < 0.05$ ). There were no differences in age or area of residence between the students who participated and those who did not. The final study sample was 823 students.

At each high school, participants were gathered during regular school hours in a classroom reserved for the study. A researcher instructed the students on how to complete a printed survey and was available to answer any questions. Upon completion of the survey, the participants' weight and height were measured. The students were taught how to collect food intake data, as described further below.

#### *Predictor 1: gender-based food intake stereotypes*

Adolescents were asked to fill out the Gender-Based Food Intake Stereotypes Scale, developed and validated for the current study<sup>(48)</sup>. Briefly, this psychometric scale consists of twenty-one items that measure three dimensions: non-normative subordinate masculinity (stereotypical beliefs on what is considered typical in homosexual or effeminate men, eight items), normative subordinate femininity (stereotypical beliefs on what is considered ideal in heterosexual girls, eight items) and normative hegemonic masculinity (stereotypical beliefs on what is considered ideal in heterosexual men, five items). Response options follow a five-point Likert scale ranging from 1 (completely disagree) to 5 (completely agree). The scale has a hierarchical structure where gender-based food intake stereotypes are second-order factors; each subscale acts as an indicator. Thus, the three subscales contribute to the measured general construct. The score of each of the dimensions is the average of its items. Reliabilities for each dimension in this sample were:  $\alpha = 0.89$  for non-normative subordinate masculinity,  $\alpha = 0.84$  for normative subordinate femininity and  $\alpha = 0.70$  for normative hegemonic masculinity. The overall reliability of the scale was  $\alpha = 0.87$ .

#### *Predictor 2: family environment*

It was assessed using two constructs: parenting styles and atmosphere during family meals, per previous literature about important diet-related family environment variables<sup>(23–32)</sup>.

**Parenting styles.** Participants filled out a thirty-two-item questionnaire to assess their perception of their parents' parenting styles (Parenting Styles and Dimensions Questionnaire, short version)<sup>(49)</sup>. Responses follow a five-point Likert scale ranging from never (1) to always (5). Each item on the Parenting Styles and Dimensions Questionnaire assesses the perception of responsiveness and demandingness of mother and father, separately. In cases where participants lived only with the mother or with a stepfather who did not live with them during childhood, they completed the evaluation for the mother only. Items

are loaded into the following subscales: authoritative (high responsiveness and high demandingness), authoritarian (low responsiveness and high demandingness) and permissive (high responsiveness and low demandingness). The score for each of the dimensions is the average of its items. In this sample, the permissive parenting style did not have an acceptable internal consistency for mothers (Cronbach's  $\alpha = 0.52$ ) or fathers (Cronbach's  $\alpha = 0.51$ ); therefore, it was not included in the analysis. The authoritative and authoritarian parenting styles did have acceptable internal consistency for mothers (Cronbach's  $\alpha = 0.91$  and  $0.77$ , respectively) and fathers (Cronbach's  $\alpha = 0.92$  and  $0.77$  respectively). Since more than 20 % of adolescents did not report parenting style data for fathers (and since focusing on the fathers' styles might require a separate manuscript), the current study only includes the mothers' perceived parenting style.

Family Meals were assessed via the fourteen-item Family Meals Questionnaire<sup>(50)</sup> to characterise family meal atmosphere (four items), priority (five items) and structure/rules (five items). Participants were asked to score each item on a five-level Likert scale (1 = never, 5 = always). The original instrument was developed for US adolescents (50 % Caucasian)<sup>(50)</sup>. For the current sample, internal reliability was low for priority ( $\alpha = 0.61$ ) and structure/rules ( $\alpha = 0.48$ ). Therefore, only the subscale of family meal atmosphere was considered (Cronbach's  $\alpha = 0.76$ ). The score of this subscale is the average of its items. The following questions on family meal atmosphere were included: How strongly do you agree with the following statements? (i) I enjoy eating meals with my family, (ii) In my family, eating brings people together in an enjoyable way, (iii) In my family, mealtime is a time for talking with other family members, (iv) In my family, dinner time is about more than just getting food, we all talk with each other. The Parenting Styles and Dimensions Questionnaire and Family Meals Questionnaire were translated into Spanish by the authors (native Spanish speakers from Costa Rica). One hundred adolescents were polled using cognitive interviewing techniques<sup>(51)</sup> to evaluate survey item comprehension. Survey questions were later revised to increase comprehension.

**Age.** Several studies have shown that adolescent dietary quality and participation in family meals decline with increasing age<sup>(16,52,53,54)</sup>. Therefore, we considered it relevant to include age as a covariate.

#### *Main outcomes*

Diet quality was approximated in the consumption assessment of the following food groups: (1) fruits and vegetables (FV, g/d), (2) legumes (g/d), (3) sugar-sweetened beverages (SSB, g/d), (4) UPF (g/d) and (5) FF (g/d). These food groups were purposely selected because they represent the range of low and high consumption among Costa Rican adolescents, according to our previous analyses showing the differences in various food group intakes across 20 years in Costa Rica<sup>(40)</sup>.



Food group outcomes were measured using 3-d records<sup>(55)</sup> completed by the participants in real time and reviewed by nutritionists. To ensure that intake data captured any weekday/weekend variability, half of the participants were randomly selected to record the foods and drinks they consumed on Thursday, Friday and Saturday, while the rest were asked to record their intake on Sunday, Monday and Tuesday.

At each school, six trained nutritionists provided printed forms to the participants and instructed them on how to complete accurate food records for three consecutive days by having them write down detailed descriptions of everything they ate and drank from the time they woke up in the morning to the time they went to bed at night. Participants had to include food brand names when applicable, and the recipes and methods of preparation of all dishes and drinks whenever possible. The nutritionists taught the participants how to estimate serving sizes using an established manual that was developed for Costa Rica<sup>(56)</sup>. This manual includes photographs and diagrams of four to six serving sizes and weights for various local foods and preparations. Participants were instructed to report serving sizes using household utensils or volume and mass units.

Given the challenges related to incompleteness and inaccuracy when recording self-reported dietary data in young populations and specific demographic groups<sup>(57)</sup>, the nutritionists reviewed the completed 3-d food records thoroughly with each participant during school hours. The nutritionists prompted participants to provide information about commonly missed items or ingredients (e.g., added sweeteners, added fats, candies, beverages), add details about the types of food or drinks consumed (e.g., full fat or skimmed milk, whole or refined flour bread, peeled or unpeeled fruit, drinks with or without added sugar), verify or add serving sizes, and clarify illegible items. The nutritionists used food models, fresh foods and various utensils to verify serving sizes.

Data were collected during 9 months of the school year (February to November of 1996, 2006 and 2017), reflecting seasonal variations for Costa Rica: rainy season (May to November) and dry season (December to April).

### **Data analysis**

Using the data from the dietary intake forms, foods were grouped following these criteria: FV, including all FV, except natural or industrialised juices and raw or fried starchy vegetables; legumes, including all legumes such as beans, chickpeas and lentils; SSB, including all kinds of industrialised SSB, carbonated or not, such as industrialised fruit juices and fruit-flavoured drinks, carbonated drinks, hydrating drinks, tea-based drinks, water-based natural fruit/mixed fruit and vegetable blended drinks, and frescos (a traditional home-made beverage); UPF, including salty/sweet/savoury extruded or puffed packaged snacks, mass-produced packaged bread, buns,

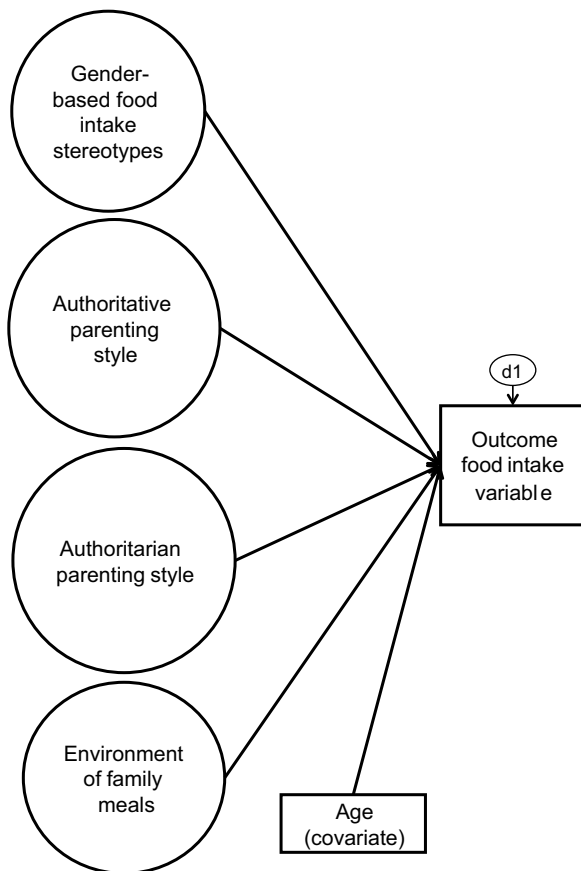
bakery and pastries, and confectionery; FF, including local FF like empanadas (deep-fried maize dough turnovers filled with meat, potato hash, refried beans or white farmer's cheese), Costa Rican tacos (deep-fried rolled maize tortillas filled with meat, shredded cabbage and drizzled generously with ketchup and mayonnaise), special croissants (croissant sandwiches filled with meat or cold cuts, processed cheese and fresh tomato) and 'arreglados' (puff pastries filled with meat, refried beans and fresh tomato). Other popular FF like hot dogs, pizza, hamburgers, wraps, nachos and fries were also included. Food group intakes were determined on a 4184 kJ (1000 kcal) basis to minimise the influence of gender-related differences in energy intake.

Structural equation modelling (SEM) was used to test five different models, one for each food-group intake variable as the dependent variable. SEM allows filtering out measurement errors and provides information about how well a hypothesised model fits the data. It is a preferred method when assessing psychological constructs, which often include latent variables (consisting of covariances of several items) rather than observed variables (a single score)<sup>(58)</sup>. Maximum likelihood was used as an estimation method in the Amos software package (Amos 23.0; SPSS Inc.). To elucidate the influence of family-related variables and gender-based social eating norms on food intake, a model with four predictors (gender-based stereotypes, authoritative and authoritarian parenting styles, and family meal atmosphere), a covariate (age) and one outcome variable was specified (Fig. 1). This model was replicated for each of the food intake outcomes, that is, five models were specified. We also examined whether relationships between putative predictors and each outcome variable differed based on sex and residence area. This was done using unconstrained multi-group SEM, a variation of SEM that allows examining whether parameters of interest vary appreciably across different samples, that is, whether sample membership moderates the relations specified in the model<sup>(58)</sup>. This was accomplished through several multi-group models: five 2-group models, by gender (girls and boys), five 2-group models by area of residence (urban and rural) and five 4-group models by gender and area (urban boys, rural boys, urban girls and rural girls). All these models added up to twenty SEM-based multiple regression models. All models were adjusted for age.

To examine goodness of fit, the following indices were used:  $\chi^2$ ,  $\chi^2/df$  ratio, Tucker Lewis index, comparative fit index and the root mean square error of approximation. As a guideline for evaluating fit, we used established criteria<sup>(59,60)</sup>. Significant differences between descriptive variables were examined using independent sample *t*-tests. Missing values were < 5% and were imputed using the expectation-maximisation algorithm before any analysis was performed.

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS Inc., version 23.0 for





**Fig. 1** Basic structural equation model specified in the current study. Only structural loadings are depicted. This model was separately specified and estimated five times, one for each of the food intake outcome variables: fruits and vegetables, legumes, sugary drinks, ultra-processed foods and fast food. Models were adjusted by age. Information on results for these models is presented in Tables 2–4

Windows). Only the models that had an acceptable fit are presented in the ‘Results’ section.

## Results

Table 1 describes the study sample ( $n$  813; mean age 15.3 years old; 64% female; 50% living in urban areas). The rural *v.* urban subsamples did not differ in terms of gender proportion (36 and 37% were boys in rural and urban areas, respectively; 63 and 64% were girls in rural and urban areas,  $P > 0.05$ ) or age (mean age: 15.1 (SD 1.73) years in rural areas and 14.9 (SD 1.67) years in urban areas,  $P > 0.05$ ). Similarly, gender subsamples did not differ significantly in terms of age.

### Food intake differences by sex

Consumption of legumes, SSB and FF/4184 kJ (1000 kcal) was significantly higher ( $P < 0.05$ ) among boys. Rural adolescents consumed significantly more ( $P < 0.001$ ) legumes/

4184 kJ (1000 kcal) than urban adolescents. Considering psychosocial variables, boys reported higher levels of gender-based food intake stereotypes (2.71 units of score,  $P < 0.01$ ) and authoritarian parenting style ( $P < 0.05$ ) when compared with girls.

### Food intake differences by area of residence

Urban adolescents consumed significantly more SSB ( $P < 0.001$ ) and FF ( $P < 0.01$ ) per 1000 kcal than their rural counterparts. There was also a marginally higher consumption of FF in urban areas ( $P = 0.06$ ) and of FV ( $P < 0.001$ ) and legumes ( $P < 0.001$ ) in rural areas.

### Family environment differences by area of residence

Considering differences in psychosocial variables by residence area, rural participants reported higher levels of authoritative parenting ( $P < 0.01$ ) while urban participants reported higher levels of authoritarian parenting ( $P < 0.001$ ). No differences were found in the mean score for family meal environment between boys and girls or urban and rural adolescents.

### Influences of family environment variables and gender-based social eating norms on food-group intake

Results from the SEM models, adjusted by age, are reported in Tables 2 (model fit indices) and 3 (direct associations between variables). Absolute fits were acceptable for the presented models, both in the general sample and in the subgroups based on sex or residence area (Table 2) using established criteria as reference<sup>(59,60)</sup>. The incremental fit (comparative fit index, Tucker Lewis index) of the multi-group models was somewhat lower, suggesting that some putative predictors were not associated with food intake. All correlations among factors in the measurement models ranged from  $-0.31$  to  $0.52$ , suggesting that there are no reasons to suspect overlap between variables and the models have met the assumption of no collinearity required for this analytic strategy.

Table 3 details the model results for the associations (measured by regression  $\beta$  weights) between family environment, gender-based social eating norms and food intake outcome variables, in the general one-sample model, and in the two-sample multi-group model.

Gender-based food intake stereotypes were associated with the intake of nutritious food items among girls (FV,  $\beta = 0.12$ ,  $P = 0.05$ ; legumes,  $\beta = 0.16$ ,  $P < 0.01$ ) and with lower consumption of FF ( $\beta = -0.19$ ,  $P < 0.001$ ). Interestingly, SSB intake was associated with stereotypes only among boys ( $\beta = 0.22$ ,  $P < 0.05$ ) and urban adolescents ( $\beta = 0.14$ ,  $P < 0.05$ ).

Further analyses based on a four-sample multi-group model to examine the potential moderating joint effect of

**Table 1** Description of study sample for the general study population and by sex and area of residence per study variable†

Variables	Sex†									
	General (n 813)		Girls (n 519)		Boys (n 294)		Urban (n 408)		Rural (n 405)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Fruits and vegetables intake (g/d/4184 kJ (1000 kcal))	36.7	27.3	34.5	36.5	31.1	27.3	32.1	23.4	27.6	24.4
Legumes intake (g/d/4184 kJ (1000 kcal))	22.1	24.1	19.5	16.5	26.7***	20.6	16.6	27.3	41.4***	36.3
Sugary drinks intake (g/d/4184 kJ (1000 kcal))	155.8	136.6	149.7	132.8	166.5**	142.6	188.4***	148.7	128.9	117.4
Ultra-processed foods intake (g/d/4184 kJ (1000 kcal))	10.4	6.0	9.9	5.9	10.7	6.2	10.6	6.3	10.2	4.8
Fast food intake (g/d/4184 kJ (1000 kcal))	19.3	15.9	21.4	28.7	36.7*	18.2	22.3**	12.9	16.4	11.3
Gender-based food intake stereotypes	2.1	0.5	2.0	0.5	2.2	0.6**	2.1	0.5	2.2	0.6
Family meal environment	3.2	0.7	3.2	0.7	3.2	0.7	3.2	0.7	3.1	0.7
Authoritative parenting style	3.4	1.1	3.4	1.1	3.5	1.1	3.5	1.1	3.3	1.1
Authoritarian parenting style	1.8	0.9	1.7	0.9	1.9*	0.9	1.7	0.8	1.9	0.9

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

†Mean differences were determined using independent sample *t*-tests.

‡For every variable, kurtosis and skewness were within the levels suggested by Kline (2011).

**Table 2** Model fit indices per food intake variable in the general and group models by sex and by residence area

Outcome variable	Fit indices
<b>(A) Measurement and general models</b>	
Fruits and vegetables	$\chi^2(649) = 1385.726, \chi^2/df = 2.13, CFI = 0.93, TLI = 0.92, RMSEA = 0.037 (0.035, 0.040)$
Legumes	$\chi^2(649) = 1398.306, \chi^2/df = 2.15, CFI = 0.93, TLI = 0.92, RMSEA = 0.038 (0.035, 0.040)$
Sugary drinks	$\chi^2(649) = 1389.703, \chi^2/df = 2.14, CFI = 0.93, TLI = 0.92, RMSEA = 0.037 (0.035, 0.040)$
Ultra-processed foods	$\chi^2(649) = 1376.657, \chi^2/df = 2.12, CFI = 0.93, TLI = 0.92, RMSEA = 0.037 (0.034, 0.040)$
Fast food	$\chi^2(649) = 1379.111, \chi^2/df = 2.12, CFI = 0.93, TLI = 0.92, RMSEA = 0.037 (0.034, 0.040)$
<b>(B) Multiple group models by sex</b>	
Fruits and vegetables	$\chi^2(1298) = 2225.775, \chi^2/df = 1.71, CFI = 0.91, TLI = 0.91, RMSEA = 0.030 (0.028, 0.032)$
Legumes	$\chi^2(1298) = 2250.226, \chi^2/df = 1.73, CFI = 0.91, TLI = 0.90, RMSEA = 0.030 (0.028, 0.032)$
Sugary drinks	$\chi^2(1298) = 2224.730, \chi^2/df = 1.71, CFI = 0.91, TLI = 0.91, RMSEA = 0.030 (0.028, 0.032)$
Ultra-processed foods	$\chi^2(1298) = 2207.951, \chi^2/df = 1.70, CFI = 0.91, TLI = 0.91, RMSEA = 0.029 (0.027, 0.031)$
Fast food	$\chi^2(1298) = 2219.925, \chi^2/df = 1.71, CFI = 0.91, TLI = 0.91, RMSEA = 0.030 (0.027, 0.032)$
<b>(C) Multiple group models by residence area</b>	
Fruits and vegetables	$\chi^2(1298) = 2345.132, \chi^2/df = 1.80, CFI = 0.90, TLI = 0.90, RMSEA = 0.032 (0.029, 0.034)$
Legumes	$\chi^2(1298) = 2398.197, \chi^2/df = 1.79, CFI = 0.90, TLI = 0.90, RMSEA = 0.031 (0.029, 0.033)$
Sugary drinks	$\chi^2(1298) = 2330.090, \chi^2/df = 1.79, CFI = 0.90, TLI = 0.90, RMSEA = 0.031 (0.029, 0.033)$
Ultra-processed foods	$\chi^2(1298) = 2324.523, \chi^2/df = 1.79, CFI = 0.90, TLI = 0.90, RMSEA = 0.031 (0.029, 0.033)$
Fast food	$\chi^2(1298) = 2321.081, \chi^2/df = 1.79, CFI = 0.90, TLI = 0.90, RMSEA = 0.031 (0.029, 0.033)$

CFI, comparative fit index; TLI, Tucker Lewis index; RMSEA, root mean square error of approximation.

both gender and area of residence suggest that gender-based stereotypes and food intake associations vary by a combination of these variables (Table 4). For example, the positive association between stereotypes and FV intake evidenced in girls was found only among urban girls ( $\beta = 0.20, P < 0.05$ ), while the association with legume intake was evidenced only in rural girls ( $\beta = 0.16, P < 0.05$ ). Likewise, the inverse association between stereotypes and unhealthy food items (FF and UPF) was evidenced in urban girls only ( $\beta = -0.24, P < 0.01; \beta = -0.15, P < 0.05$ , respectively). Among boys, the association between gender-based stereotypes and SSB intake was found to be specific to the rural area ( $\beta = 0.22, P < 0.05$ ).

*Family meal atmosphere* was associated with legume intake only among girls ( $\beta = 0.17, P < 0.01$ ) and rural adolescents ( $\beta = 0.21, P < 0.05$ ). In the multi-group SEM, the positive association between atmosphere and legume intake is only evident among rural girls ( $\beta = 0.19, P < 0.05$ ).

**Parenting styles**

An authoritative parenting style was significantly related to FV intake among boys ( $\beta = 0.18, P < 0.05$ ) and to FF and SSB intake among urban adolescents ( $\beta = 0.12, P = 0.05; \beta = 0.13, P = 0.05$ , respectively). Interestingly, in rural areas, the authoritarian, not the authoritative, parenting style was the one associated with higher consumption of FV ( $\beta = 0.13, P < 0.05$ ). Additionally, the authoritarian style was associated with SSB intake among girls ( $\beta = 0.11, P < 0.05$ ).

Results from the multi-group analysis suggest that the positive association between the authoritative style and FV intake in boys is specific to those living in urban areas ( $\beta = 0.23, P < 0.05$ ). Further, the authoritative style was associated with FF intake only among urban girls ( $\beta = 0.17, P < 0.05$ ). In contrast, the marginal association between the authoritative style and SSB intake among urban adolescents was not statistically significant. Multi-group analysis also suggests a positive association between the authoritarian

**Table 3** Direct age-adjusted associations between psychosocial inputs and food group intake outcome variables by sex and area of residence†,‡

Outcome variable	General sample (n 813)	Girls subsample (n 519)	Boys subsample (n 294)	Rural subsample (n 405)	Urban subsample (n 408)
Predictor: gender-based stereotypes					
Fruits and vegetables (g/d)	0.03	0.12*	-0.07	-0.04	0.06
Legumes (g/d)	0.10*	0.16**	-0.01	0.06	0.10
Sugary drinks (g/d)	0.11*	0.03	0.22*	0.08	0.14*
Ultra-processed foods (g/d)	-0.04	-0.06	-0.01	-0.01	-0.04
Fast food (g/d)	-0.09*	-0.19**	0.03	-0.08	-0.09
Predictor: family meals					
Fruits and vegetables (g/d)	0.02	-0.01	0.06	0.05	0.01
Legumes (g/d)	0.12*	0.17**	0.06	0.21**	0.05
Sugary drinks (g/d)	-0.03	-0.01	-0.06	-0.05	-0.03
Ultra-processed foods (g/d)	0.02	0.02	0.01	0.06	-0.03
Fast food (g/d)	-0.04	-0.10	0.03	0.01	-0.08
Predictor: parenting styles (authoritative, authoritarian coefficients)					
Fruits and vegetables (g/d)	0.11*, 0.03	0.07, -0.01	0.18*, 0.09	0.06, 0.13*	0.11, 0.00
Legumes (g/d)	-0.00, -0.05	-0.00, -0.05	-0.06, -0.11	0.00, 0.05	-0.06, -0.09
Sugary drinks (g/d)	0.06, 0.05	0.06, 0.11*	0.05, -0.04	0.13***, -0.03	0.04, 0.08
Ultra-processed foods (g/d)	0.07, 0.01	0.08, 0.04	0.04, -0.04	0.07, -0.07	0.08, 0.09
Fast food (g/d)	0.04, 0.00	0.07, 0.05	-0.01, -0.07	-0.04, -0.06	0.12***, 0.05

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P = 0.05$ .

†Data derived from SEM analysis.

‡Relationships between psychosocial inputs and food intake outcome variables are expressed in terms of standardised regression coefficients ( $\beta$ ).

parenting style and FV consumption only among rural boys ( $\beta = 0.19$ ,  $P < 0.05$ ), and a positive association between this style and SSB and FF consumption only among urban girls ( $\beta = 0.21$ ,  $P < 0.05$ ;  $\beta = 0.14$ ,  $P < 0.05$ , respectively).

## Discussion

The current study sought to expound on potential associations between family environment variables (parenting styles, family meal atmosphere), gender-based food intake stereotypes and dietary intake in a cohort of Latin American rural and urban adolescents. The results suggest direct associations between the above criteria and intake of specific food groups and that these associations may act differently on specific subgroups (rural *v.* urban boys and girls). Specifically, the results suggest an association between gender stereotypes and intake of nutritious food items (e.g., more FV and legumes, less FF and UPF) among girls and between gender stereotypes and consumption of unhealthy foods (SSB) among boys. This is in agreement with previous literature (mostly qualitative studies<sup>(10–15)</sup>) suggesting that food wholesomeness can be regarded as ‘masculine’ or ‘feminine’, and that, in consuming foods in agreement with gender stereotypes, adolescents may be consolidating the construction of their own gender identity<sup>(38)</sup>. The associations were more pronounced or apparent depending on area of residence, with more FV and less unhealthy food intake among urban girls, and with legume intake among rural girls. Likewise, the association was more pronounced among rural boys with more SSB consumption. This last result seems contrary to those from

the two-sample multi-group models. Specifically, the two-sample analyses showed an association between gender norms and SBB intake in urban adolescents, but the four-sample multi-group analysis found the effect only in rural boys. This might be related to sample sizes and effects on specific subgroups. When the sample is split into urban boys and girls, some statistical power is lost, and the effect is no longer found. When the sample is split into urban and rural boys, the effect is present only in rural inhabitants.

According to our findings, family meal atmosphere was directly associated with various food intake outcomes, but in different subpopulation groups. For example, family meal atmosphere was directly associated with legume intake only among girls and rural adolescents; the multi-group model suggests that the association was only significant among rural girls. Barring the obvious social desirability response bias<sup>(61)</sup>, other investigators have suggested that the psychological association between nutritious food intake and family meals may be more prominent in girls than boys<sup>(62,63)</sup>, plausibly because parents have a stronger or more direct influence on the socialisation processes of girls<sup>(62)</sup>. This may be even more pronounced in the context of a Latin American traditional culture that reinforces monolithic, hierarchical gender roles, especially in rural areas<sup>(34)</sup>: men are portrayed as dominant, independent figures in society, and women as obedient figures whose role is to complement and support the leadership of men in their families and society<sup>(34)</sup>. In these circumstances, rural boys could be more likely to adopt socially established ‘masculine’ norms and gender-based food intake stereotypes.

The findings on parenting styles and their association with gender and food intake in various subgroups are more difficult to interpret. While in urban areas the authoritative

**Table 4** Age-adjusted associations between psychosocial inputs and food group intake outcome variables by sex and area of residence†,‡

Outcome variable	Boys		Girls	
	Rural (n 146)	Urban (n 151)	Rural (n 258)	Urban (n 258)
<b>Predictor: gender-based stereotypes</b>				
Fruits and vegetables (g/d)	0.07	-0.10	-0.01	0.20*
Legumes (g/d)	-0.12	0.08	0.16*	0.09
Sugary drinks (g/d)	0.22*	0.12	-0.00	0.10
Ultra-processed foods (g/d)	-0.18	0.17	0.06	-0.15*
Fast food (g/d)	-0.09	0.20	-0.09	-0.24**
<b>Predictor: family meals</b>				
Fruits and vegetables (g/d)	0.09	0.06	0.03	0.00
Legumes (g/d)	0.20	-0.07	0.19*	0.13
Sugary drinks (g/d)	-0.06	-0.03	-0.03	0.00
Ultra-processed foods (g/d)	-0.01	-0.04	0.11	-0.06
Fast food (g/d)	0.04	-0.05	-0.02	-0.13
<b>Predictor: parenting styles (authoritative, authoritarian coefficients)</b>				
Fruits and vegetables (g/d)	0.07, 0.19*	0.23*, 0.02	0.06, 0.11	0.04, -0.04
Legumes (g/d)	-0.09, 0.02	0.00, -0.17	0.08, 0.04	-0.14, -0.05
Sugary drinks (g/d)	0.20, 0.02	-0.09, -0.11	0.08, -0.06	0.08, 0.21**
Ultra-processed foods (g/d)	0.13, -0.04	0.05, 0.01	0.04, -0.10	0.11, 0.14***
Fast food (g/d)	-0.00, -0.00	0.05, -0.09	-0.07, -0.11	0.17*, 0.14*
<b>Model fit indices per food intake variable in each multi-group model</b>				
Outcome variable	Fit indices			
Fruits and vegetables (g/d)	$\chi^2(2724) = 4468.705$ , $\chi^2/df = 1.64$ , CFI = 0.85, TLI = 0.84, RMSEA = 0.028 (0.027, 0.030)			
Legumes (g/d)	$\chi^2(2724) = 4458.164$ , $\chi^2/df = 1.63$ , CFI = 0.85, TLI = 0.84, RMSEA = 0.028 (0.027, 0.030)			
Sugary drinks (g/d)	$\chi^2(2724) = 4439.041$ , $\chi^2/df = 1.63$ , CFI = 0.85, TLI = 0.84, RMSEA = 0.028 (0.026, 0.029)			
Ultra-processed foods (g/d)	$\chi^2(2724) = 4423.349$ , $\chi^2/df = 1.62$ , CFI = 0.85, TLI = 0.85, RMSEA = 0.028 (0.026, 0.029)			
Fast food (g/d)	$\chi^2(2724) = 4423.349$ , $\chi^2/df = 1.62$ , CFI = 0.85, TLI = 0.85, RMSEA = 0.028 (0.026, 0.029)			

CFI, comparative fit index; TLI, Tucker Lewis index; RMSEA, root mean square error of approximation.

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P = 0.05$ .

†Data derived from multi-group SEM analysis.

‡Relationships between psychosocial inputs and food intake outcome variables are expressed in terms of standardised regression coefficients ( $\beta$ ).

parenting style was associated with higher FV intake among boys (keeping in agreement with previous literature in other study populations<sup>(64,65)</sup>, it was also associated with higher FF intake among girls. In contrast, the authoritarian parenting style was associated not only with higher SSB and FF intake among rural girls (also in agreement with previous literature<sup>(66)</sup>) but also with FV consumption among rural boys. These findings add to previous conclusions that the influence of parenting styles varies by food type and by the sociocultural context in which the parent-child dyads socialise<sup>(67)</sup>.

Most published literature on adolescents and eating habits focuses on urban youth. There is no literature on parenting styles and food consumption among rural adolescents, making any comparisons to our results complicated. Parenting styles may change according to the level of urbanisation and the norms, attitudes, beliefs and values assigned to the various family structures and emotional climate within which parents and adolescents interact<sup>(68)</sup>. Our findings assert the need for future research to throw light on those associations and on the interrelationships between parents and adolescents. A deeper understanding of these intersectionalities will help inform public health promotion strategies for healthy eating among Costa Rican adolescents.

The cross-cultural application of the traditional parenting styles questionnaire<sup>(69,70)</sup> to diverse populations can

be disputed. Some researchers question the universal suitability of parenting styles developed and validated largely for white, middle-class Americans, asserting that it has limited transferability to other populations, and suggesting that it does not capture Latin American culture and parental belief systems<sup>(71-74)</sup>. Parenting behaviours may be reactive to children's characteristics and the cultural and socio-economic contexts in which families live. Among children from diverse ethnic backgrounds, cultural differences may alter children's interpretations and responses to their parent's parenting styles<sup>(70,71,75-78)</sup>. Some studies<sup>(71-74)</sup> have found Latino parents to employ more authoritarian parenting styles, which has been associated with negative outcomes in other population groups. A more recent study has shown some variability in terms of child outcomes dependent on ethnicity (e.g., Mexican American and Dominican American)<sup>(79)</sup>. Culturally relevant and appropriate instruments should be used to assess parenting styles and family meal environments because they have serious implications on the design of family interventions. The evaluation of parenting styles must be refined to a measurement that is time, person and context specific. Researchers should devote time to adapt and develop culturally sensitive measures of the constructs they employ to understand the complex relationship between cultural and psychosocial variables and dietary intake, as others have suggested<sup>(71,72,74)</sup>.



Our findings contribute with quantitative data and analysis to the corpus of social anthropology literature about the numerous social meanings of food and food-related practices, beyond the mechanical act of feeding itself<sup>(80)</sup>.

### Strengths and limitations

The current study has several strengths and limitations. First, the cross-sectional associations must be interpreted as descriptive and do not suggest causality or direction. As the analyses were adjusted by eliminating the possible bias produced by age, results show a situation that is closer to reality. However, the social environment of Costa Rican urban and rural adolescents warrants further careful studies in order to design an integrated strategy for the promotion of healthy eating in this population group.

Secondly, in the study sample, the only subscales with an acceptable Cronbach's  $\alpha$  (close to 0.80) were the authoritative and authoritarian parenting styles subscales of the Parenting Styles and Dimensions Questionnaire and the family meal atmosphere subscale of the Family Meals Questionnaire. This raises questions about the psychometric properties of these tests when used to describe parental practices within the Latin American family environment, as others have suggested<sup>(71,72)</sup>. As discussed earlier, using a parenting styles questionnaire that is not sufficiently sensitive to Latin American styles has potential implications. Likewise, the instrument used to study family meals (developed for Project EAT) may not adequately measure family dynamics around meals in a Latin American context. This practice is influenced by family structure, rules at family meals and social background, as has been evidenced for Chilean families<sup>(81)</sup>. Still, the Parenting Styles and Dimensions Questionnaire and Family Meals Questionnaire were cognitively evaluated to ensure that the questions were easily understood and accurately reported by the adolescents.

In contrast, the scale designed to measure gender stereotypes has good reliability and is culturally sensitive for this population. Opportunities for future research are worth mentioning. For instance, although the gender-based stereotype scale was validated through its correlations with sexism<sup>(48)</sup>, one might consider a cultural overlap between gender and sexual orientation conceptions, as has been evidenced in other social contexts<sup>(82,83)</sup>. Further research on how gender stereotypes influence a sample of sexually diverse adolescents might provide valuable insights into our understanding of cultural influences on food intake.

Finally, our results provide some insight into how the associations between variables vary based on gender and area of residence. A future study could include more detailed analyses on the scales' psychometric properties and invariance levels<sup>(58)</sup> to gain a better understanding of any potential differences in the scales' interpretation by gender and area of residence, and how these differences may affect the reported patterns of associations.

### Conclusion

These findings attempt to describe associations between gender-based norms, the complex family environment and dietary intake in urban and rural adolescents. They emphasise the need for further research on the familial, sociocultural, psychological and economic contexts in which parenting practices and styles occur in order to help inform public health promotion strategies for healthy eating among Latin American adolescents.

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