Public Health Nutrition: 24(15), 5133–5141 doi:10.1017/S1368980021002846

Influence of paternal general parenting on Latino early adolescents' energy balance-related behaviours and interactions with behaviour-specific parenting practices

Youjie Zhang[1,*], Sayaka Nagao-Sato[2], Aysegul Baltaci[2], Ghaffar Ali Hurtado Choque[3] and Marla Reicks[2]

[1]Department of Child and Adolescent Health and Social Medicine, School of Public Health, Medical College of Soochow University, 199 Ren Ai Road, Suzhou, Jiangsu 215123, People's Republic of China: [2]Department of Food Science and Nutrition, University of Minnesota, Minneapolis, USA: [3]School of Public Health, University of Maryland, College Park, USA

Submitted 31 October 2020: Final revision received 28 May 2021: Accepted 22 June 2021: First published online 21 July 2021

Abstract

Objective: To investigate the influence of general parenting dimensions on adolescents' energy balance-related behaviours (EBRB) and its interactions with behaviour-specific parenting practices based on Darling and Steinberg's contextual model of parenting style.

Design: Multiple linear regression analyses and the Hayes PROCESS procedure to analyse self-reported cross-sectional survey data.

Setting: In-person survey.

Participants: Latino early adolescents and their fathers (n 225 dyads) recruited using convenience sampling from metropolitan areas of north-central USA.

Results: Both paternal parenting dimensions of warmth and autonomy granting were positively associated with adolescents' fruit intake, vegetable intake and physical activity. Coercive control was positively associated with adolescents' sugary drink intake and sweets/salty snack intake. These associations were predominantly mediated by the parenting practices of setting expectations/allowances, role modelling, and managing availability and accessibility for corresponding EBRB. After adjusting for parenting practices, paternal warmth was inversely associated with adolescents' screen time, paternal autonomy was positively associated with sugary drink intake, and both paternal warmth and autonomy granting were positively associated with adolescents' fast food intake. In addition, positive associations between fathers' parenting practices and adolescents' sugary drink intake were significantly stronger among those who perceived high *v.* low levels of paternal warmth and autonomy granting.

Conclusions: Paternal warmth and autonomy granting showed mixed effects on adolescents' EBRB, and coercive control showed undesirable relationships with adolescents' dietary intake via interactions with behaviour-specific parenting practices. Lifestyle intervention programmes for Latino adolescents need to consider incorporating paternal parenting education components.

Keywords
General parenting
Parenting practices
Latino fathers
Early adolescents
Energy balance-related behaviours

In the context of paediatric obesity research, general parenting has demonstrated salient relationships with adolescents' weight and weight-related behaviour outcomes[1,2], thus indicating a need for its application in addressing the obesity epidemic among youth. General parenting is defined as a constellation of attitudes communicated to the child and an emotional climate created by parent's behaviours[3]. Common operationalisations of general parenting involve parenting dimensions of warmth/responsiveness, control/demandingness and autonomy support, as well as Baumrind's typology of authoritative, authoritarian, permissive and uninvolved parenting styles derived from high and low levels of warmth/responsiveness and control/demandingness[4]. Among these general parenting constructs, authoritative parenting has shown a consistent protective nature against unhealthy weight gain and nurturance of favourable

*Corresponding author: Email ujzhang@suda.edu.cn

energy balance-related behaviours (EBRB) as compared to non-authoritative parenting styles[1,2,4,5]. Various parenting dimensions, adapted to different contexts and situations, have also demonstrated significant associations with adolescents' dietary behaviours[6–8]. Further investigation of how general parenting has influenced adolescents' EBRB and weight status would contribute to improving intervention components of parental involvement.

According to Darling and Steinberg's theoretical framework, general parenting exerts overarching effects on adolescent outcomes[3]. The two primary mechanisms are that behaviour-specific parenting practices mediate the influence of general parenting on adolescent behaviours, and general parenting moderates the influence of parenting practices on adolescent behaviours[3]. For example, our previous research using data from a national sample of American adolescents found that about 60 % of the total association between authoritative parenting and adolescents' fruit and vegetable intake was mediated by parenting practices of promoting fruit and vegetable intake[9]. In addition, the promotive effect of parenting practices related to adolescents' physical activity was only significant among those whose parents had relatively high levels of responsiveness[9]. Therefore, in addition to acknowledging parenting practices, focusing on how parents engage in parenting practices could help parents promote an energy-balanced lifestyle to prevent unhealthy weight gain among youth.

Fathers are generally underrepresented in childhood obesity research. A systematic review of observational studies on parenting and childhood obesity found that only 10 % of studies reported results for fathers[10]. Some evidence suggested the importance of paternal influence on childhood obesity and EBRB[4]. For example, higher levels of conflict with fathers predicted greater adiposity risks among girls during adolescence[11]. Fathers' general parenting dimensions of structure and behaviour control were associated with more restrictive snacking parenting practices and lower adolescents' snack intake[6]. However, existing evidence remains inconsistent, and specific pathways of paternal influence need to be further explained[12].

National surveys indicate that Latino adolescents living in the USA are disproportionately at risk of obesity and are likely to have EBRB characterised by excessive energy intake and inadequate energy expenditure[13–16]. The Latino culture of familism and personalism suggests the importance of family relationships in shaping adolescents' lifestyle behaviours[17,18]. Latino fathers usually serve as the head of the household and are responsible for making decisions for their families[19,20]. Previous focus group studies with Latino mothers documented Latino fathers' direct or indirect participation in food and activity parenting[21,22]. Interestingly, in a focus group study exclusively conducted with Latino fathers, we found that fathers identified similar food or activity parenting practices but indicated that they employed the practices differently based on different parenting styles[23]. For example, some fathers expected their adolescents to be physically active using encouragement by saying 'have fun, play, learn' or providing options, while others used demands such as 'push him to play, not ask for permission, simply tell'[23].Therefore, the interactions between Latino fathers' general parenting and behaviour-specific parenting practices need further study to explore how Latino fathers can be important agents of change for paediatric obesity prevention.

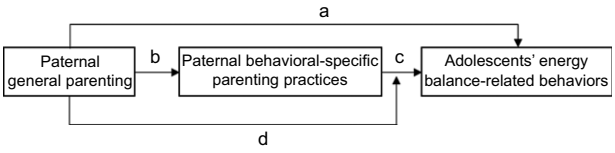

Fig. 1 The conceptual model of how paternal general parenting and behavioural-specific parenting practices could potentially influence adolescents' energy balance-related behaviours

Few studies have examined Latino fathers' potential influence on adolescents' EBRB in the family context, supporting the need for additional studies. Related empirical findings would support the development of intervention strategies that could enhance family-based interventions for preventing unhealthy weight gain among Latino adolescents. Therefore, the current study aimed to: (1) investigate associations between paternal general parenting and adolescents' EBRB (pathway a, Fig. 1); (2) examine whether these associations were mediated by behaviour-specific parenting practices (pathway b and c, Fig. 1); and (3) examine whether general parenting moderates the associations of parenting practices with adolescents' EBRB (pathway d, Fig. 1).

Method

Participants and sampling

This study used a cross-sectional design applying a convenience sampling strategy to recruit Latino adolescent–father dyads from community centres, food shelves and churches serving Latino families in Minnesota metropolitan areas between August 2017 and February 2020. Participants were recruited using oral and written invitations and screened based on the following criteria: adolescents aged between 9 and 14 years and able to speak and read English, fathers self-identified as Latino, able to speak and read Spanish, and had meals with the adolescents at least three times in a week. The number of dyads meeting the inclusion criteria and providing consent and assent determined the sample size. Fathers and adolescents responded to the questionnaire survey independently with the help from research assistants if needed and received cash compensation ($35 and $25, respectively) for completing the data collection. The current study only focused on early adolescents' perceptions of paternal general parenting

Public Health Nutrition

Dimension	How often does your father…? (5-point Likert scale from "almost never" to "almost always")	Cronbach's α
Warmth	1. tell you how much he appreciates it when you help him? 2. listen when you have something to say? 3. try to make you feel better when you are sad? 4. say something nice when you do something good?	0·87
Autonomy granting	1. ask you to show how you feel and what you think? 2. ask your opinion about decisions that will affect you? 3. encourage you to talk about your troubles? 4. think about whether you want to do something before asking you to do it?	0·86
Coercive control	1. don't let you get angry at him? 2. threaten to punish you? 3. let you know that he is the boss in the house. 4. demand you to behave in certain ways?	0·72
RMSEA: 0·059, Comparative Fit Index: 0·971, Bentler-Bonett Nonnormed Fit Index: 0·934, Non-normed Index: 0·960.		

Fig. 2 Latino early adolescent-reported survey items of general parenting and their psychometrics (*n* 225)

dimensions and EBRB parenting practices. Because, our previous studies found that Latino early adolescents and fathers had poor agreement in reporting parenting practices and father-reported paternal parenting practices were not or weakly correlated with adolescents' EBRB[24,25].

General parenting measurement

Survey items of general parenting were primarily adapted from the Parenting Style Observation Rating Scale for Latino parents with additional items from the Parenting Style and Dimension Questionnaire and the Comprehensive General Parenting Questionnaire[26–28]. Cognitive testing was individually conducted with five Latino adolescents by asking them to think aloud about how they selected their responses, rate the level of difficulty in answering each item and to repeat the survey items using their own words. Items with poor performance (e.g. hard to answer and inconsistent interpretations) were deleted. The remaining items were further refined by examining internal consistencies using Cronbach's α, factor loading using exploratory factor analysis and model fit using confirmatory factor analysis among the sample of the current study (*n* 225). Figure 2 demonstrates the final set of twelve items in a three-dimensional structure with a good model fit of root mean squared error of approximation $\leq 0{\cdot}06$, comparative fit index, Bentler–Bonett non-normed fit index, and non-normed index $\geq 0{\cdot}90$, respectively[29]. The three dimensions were identified as warmth, autonomy granting and coercive control.

Paternal food and activity parenting practices

The three types of paternal parenting practices (setting expectation/allowance, behavioural modelling, and managing availability and accessibility) corresponding to seven types of EBRB (consumption of fruit, vegetables, sugary drinks, sweets/salty snacks and fast food, physical activity, and screen time) were assessed based on adolescents' reports. Paternal expectations were assessed by asking how many times in a day (or hours in a day) the father wants the adolescent to eat fruits and vegetables (or be physically active). The response options for fruit and vegetable intake were '0 times or I don't know = 0', '1 time = 1', '2 times = 2' and '3 times or more = 3'. The response options for physical activity were '0 min, as much as I want, or I don't know = 0', '30 min or less = 1', '30 min to 1 h = 2', '1 to 2 h = 3' and '2 h or more = 4'. Paternal allowance was assessed by asking how often (or how many hours in a day) the father allows the adolescent to drink sugary drinks and eat sweets/salty snacks and fast food (or have screen time). The response options for drinking sugary drinks and eating sweets/salty snacks were 'not allowed = 0', 'less than 1 time in a week = 1', '1–3 times in a week = 2', '4–6 times in a week = 3' and '1 or more times in a day, as often as I want, or I don't know = 4'. The response options for allowing screen time were 'not allowed = 0', '30 min or less = 1', '30 min to 1 h = 2', '1 to 2 h = 3', and '2 h or more, as much as I want, or I don't know = 4'. Paternal behavioural modelling was assessed by asking how many times in a week the adolescent sees the father eating fruits and vegetables, drinking sugary drinks, eating sweets/salty snacks and fast food, being physically active, or having screen time, and how many times in a week the adolescent engages in these behaviours with their father. The response options ranged from 'almost never or never = 1' to 'once a day or more = 5'. Paternal management of availability/accessibility was assessed by asking how often the father buys, prepares and makes sure the adolescents have different kinds of

fruits and vegetables to choose from, how often the father buys, prepares and gives money to buy sugary drinks, sweets/salty snacks and fast food; how often the father takes the adolescent to places, sends the adolescent outside or provides opportunities for the adolescent to be physically active; and how often the father provides screen time opportunities to the adolescent. The response options ranged from 'almost never to never = 1' to 'almost always or always = 5'. A previous publication described the development and validation of these survey items in detail[25]. Scores of paternal parenting practices corresponding to each EBRB were calculated by summing the mean scores of the three key parenting practices.

Adolescents' energy balance-related behaviours

Survey items adapted from the Block Kids food frequency questions were used to assess adolescents' intake frequencies of fruit, vegetables, sugary drinks, sweets/salty snacks and fast food[30]. Each food category had a typical list of food items that were commonly consumed by Latino adolescents[25]. The response options of intake frequencies were never, less than once a week, 1–3 times/week, 4–6 times/week, and once a day or more and were converted to a daily intake frequency of 0, 0·11, 0·29, 0·71 and 1. The daily intake frequency score of each food category was the sum score of daily intake frequency of all items in the specific food category.

Adolescents reported weekly hours they participated in vigorous and moderate exercises, respectively, using response options of 0, < 30 min, 0·5–2 h, 2·5–4 h, 4·5–6 h and >6 h. These responses were recoded to 0, 0·3, 1·3, 3·3, 5·3, and 8 and were summed to estimate weekly hours spent in moderate to vigorous physical activity. The survey items were adapted from the assessment method developed by Godin and Shephard and applied in the Project EAT study[31,32]. Adolescents responded to survey items regarding their media use time on a typical weekday and weekend day, respectively[33]. The specific media use included watching TV/DVD/videos, using a computer not for study or work, and playing electronic games while sitting, using response options ranging from 0 h to > 5 h. Weekly screen time was calculated as a weighted sum of weekday and weekend day screen time.

Sociodemographic characteristics

Adolescents reported their sex and age, and fathers reported their age, marital status, years living in the USA, language spoken at home, the highest level of formal education attained, and household income and food security status. Fathers' acculturation levels were determined based on their length of stay in the USA and language spoken at home[24,34]. Food insecurity of the family was assessed using a two-item screener that showed adequate sensitivity and specificity[35].

Statistical analysis

All analyses were performed using the statistical software package SAS version 9.4 (SAS Institute Inc.). Descriptive statistics including count, percentage, mean, standard deviations, median and interquartile range were obtained for all variables as applicable. Simple relationships of paternal general parenting dimensions with adolescents' EBRB and corresponding parenting practices were assessed using Spearman's correlation analyses. Because the values of EBRB were right-screwed, square root transformations were applied prior to the multiple regression analyses. The PROC REG procedure was used to examine linear associations between paternal general parenting dimensions and adolescents' EBRB. Covariates included in model 1 were adolescents' age and sex, fathers' age, employment status (full-time *v.* not full-time), acculturation level (high *v.* low), and household food security status (secure *v.* insecure). Model 2 was additionally adjusted for behaviour-specific parenting practices. Simple mediation analyses were performed for significant associations from model 1 using corresponding parenting practices as mediators. Confidence interval (CI) of the mediated effects were generated using the PROCESS macro for SAS (version 3.1) developed by Hayes[36]. Moderation analyses were performed for associations between parenting practices and adolescents' EBRB by high and low levels (median splits) of general parenting dimensions using the PROC GLM procedure. Each analysis addressed missing data separately so that we did not eliminate participants with missing data from the sample. Post hoc statistical power was calculated using G * Power 3.1. The present study reached a minimum power of 97 % for linear multiple regression with an effect size of 0·1 and eight predictors. Two-tailed P values < 0·05 were considered statistically significant.

Results

Sample characteristics

The sample consisted of 225 Latino adolescent–father dyads. Adolescents' sex was about equally distributed (Table 1). Adolescents' mean age was 11·7 years. Fathers' mean age was 41·6 years, and about 92 % were married or living with a spouse. About two-thirds of fathers attained high school or higher degrees, and the majority had full-time employment. The majority of fathers reported annual family income ≤ $34 999 and 40 % were food-insecure. On average, fathers had lived in the USA for 19·5 years, and about 80 % reported that they primarily spoke their native language at home.

Median scores of adolescent-reported paternal warmth, autonomy granting and coercive control were 4·00, 3·25 and 2·50, respectively (Table 2). Median scores of adolescent-reported paternal parenting practices ranged from 5·33 for fast food and 9·00 for screen time. Adolescents' median daily intake frequencies of fruit, vegetable, sugary drink, sweets/salty snack and fast food were 1·49, 0·70,

Public Health Nutrition

Table 1 Sociodemographic characteristics of the 225 Latino early adolescent–father dyads

Variable	Count or mean	% or SD
Adolescent-reported		
Age, years	11·7	1·5
Sex		
Male	109	48·4
Female	114	50·7
Father-reported		
Age, years	41.6	7·4
Marital status		
Married or with a partner	206	91·6
Single	14	6·2
Education attainment		
Middle school or less	83	36·9
High school or GED	91	40·4
Some college or more	47	20·9
Employment status		
Full-time	161	71·6
Not full-time	53	23·6
Annual family income		
≤ $34 999	131	58·2
≥ $35 000	83	36·9
Food-insecure		
Yes	91	40·4
No	130	57·8
Years lived in the USA	19·5	6·9
Language spoken at home		
Primarily native language	176	78·2
Equally or primarily English	43	19·1
Acculturation level		
Low	179	79·6
High	31	13·8

GED, general educational development.

Table 2 Adolescent-reported paternal general parenting, parenting practices and adolescent energy balance-related behaviours (EBRB)

Variables	Medium	Interquartile range
Parenting dimensions (range)		
Warmth (1–5)	4·00	3·00, 4·75
Autonomy granting (1–5)	3·25	2·50, 4·00
Coercive control (1–5)	2·50	1·75, 3·00
Parenting practices specific to adolescents' EBRB (range*)		
Fruit intake (2–13)	8·00	6·33, 9·67
Vegetable intake (2–13)	8·67	6·33, 10·33
Sugary drink intake (2–14)	6·33	4·67, 8·00
Sweets/salty snack intake (2–14)	6·00	4·50, 7·50
Fast food intake (2–14)	5·33	4·17, 6·83
Physical activity (2–14)	8·83	6·17, 10·83
Screen time (2–14)	9·00	7·50, 12·50
Adolescents' EBRB		
Fruit intake (times/d)	1·49	0·77, 2·39
Vegetable intake (times/d)	0·70	0·29, 1·11
Sugary drink intake (times/d)	0·58	0·33, 1·15
Sweets/salty snack intake (times/d)	0·99	011, 1·55
Fast food intake (times/d)	0·62	0·33, 0·84
Physical activity (h/week)	1·60	0·60, 3·60
Screen time (h/week)	28·75	18·00, 53·50

*A higher parenting practice score indicated that adolescents perceived fathers engaging in practices that promote the corresponding energy-based behaviour to a greater extent.

0·58, 0·99 and 0·62, respectively. Adolescents' median weekly hours in physical activity and screen time were 1·60 and 28·75, respectively.

Relationship analyses

Paternal warmth was positively correlated with adolescents' fruit intake, vegetable intake and physical activity ($r_s = 0{\cdot}22$, 0·23 and 0·18, $P < 0{\cdot}01$; see online Supplemental Table 1), as well as corresponding parenting practices ($r_s = 0{\cdot}41$, 0·41 and 0·38; $P < 0{\cdot}001$). Paternal autonomy granting was positively correlated with adolescents' fruit intake, vegetable intake, sugary drink intake and physical activity ($r_s = 0{\cdot}22$, 0·29, 0·18 and 0·15; $P < 0{\cdot}05$), and parenting practices of fruit intake, vegetable intake and physical activity ($r_s = 0{\cdot}44$, 0·44 and 0·39; $P < 0{\cdot}001$). Paternal coercive control was positively correlated with adolescents' sugary drink intake and sweets/salty snack intake ($r_s = 0{\cdot}21$ and 0·14; $P < 0{\cdot}05$), and parenting practices of sugary drink intake and fast food intake ($r_s = 0{\cdot}21$ and 0·14; $P < 0{\cdot}05$).

After adjusting for adolescents' age and sex, fathers' age, employment status, acculturation level and household food security status (Table 3, model 1), paternal warmth was positively associated with adolescents' fruit intake, vegetable intake and physical activity ($\beta = 0{\cdot}12$, 0·10 and 0·14, $P < 0{\cdot}01$). Paternal autonomy granting was positively associated with adolescents' fruit intake, vegetable intake, sugary drink intake, fast food intake and physical activity (β ranged from 0·08 to 0·14, $P < 0{\cdot}05$). Paternal coercive control was positively associated with adolescents' sugary drink intake and sweets/salty snack intake ($\beta = 0{\cdot}10$ and 0·09, $P < 0{\cdot}05$). After further adjusting for paternal parenting practices (model 2), paternal warmth was no longer associated with adolescents' fruit intake, vegetable intake and physical activity but showed a positive association with adolescents' fast food intake ($\beta = 0{\cdot}04$, $P < 0{\cdot}05$) and an inverse association with adolescents' screen time ($\beta = -0{\cdot}27$, $P < 0{\cdot}05$). Paternal autonomy granting was no longer associated with adolescents' fruit intake, vegetable intake and physical activity, but the positive associations with adolescents' sugary drink intake and fast food intake remained ($\beta = 0{\cdot}06$ and 0·06, $P < 0{\cdot}05$). Paternal coercive control was no longer associated with adolescents' sugary drink intake and sweets/salty snack intake.

For mediation analyses results, associations between paternal general parenting dimensions and adolescents' EBRB were mediated by corresponding parenting practices (Table 4), except that paternal warmth showed independent associations with adolescents' fast food intake and screen time ($\beta = 0{\cdot}04$ and $-0{\cdot}28$, $P < 0{\cdot}05$), and paternal autonomy granting showed independent associations with adolescents' sugary drink intake and fast food intake ($\beta = 0{\cdot}06$ and 0·05, $P < 0{\cdot}05$).

For moderation analyses results, associations between parental parenting practices and adolescents' EBRB were not different by high and low levels of parenting dimensions of warmth, autonomy granting and coercive control (see online Supplemental Table), except that the significantly positive associations between parental parenting practices and adolescents' sugary drink intake were

Public Health Nutrition

Public Health Nutrition

Table 3 Associations between paternal general parenting and adolescents' energy balance-related behaviours (EBRB)

	Warmth				Autonomy granting				Coercive control			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
EBRB†	*β*	95 % CI	*β*	95 % CI	*β*	95 % CI	*β*	95 % CI	*β*	95 % CI	*β*	95 % CI
Fruit intake	0·12	0·03, 0·20**	0·05	−0·04, 0·14	0·13	0·05, 0·21**	0·06	−0·03, 0·14	−0·01	−0·11, 0·09	−0·01	−0·11, 0·09
Vegetable intake	0·10	0·03, 0·17**	−0·02	−0·09, 0·05	0·14	0·07, 0·20***	0·03	−0·03, 0·10	0·03	−0·06, 0·11	0·01	−0·06, 0·09
Sugary drink intake	0·04	−0·03, 0·11	0·04	−0·02, 0·10	0·08	0·02, 0·15*	0·06	0·00, 0·12*	0·10	0·02, 0·18*	0·06	−0·02, 0·13
Sweets/salty snack intake	0·01	−0·06, 0·08	0·03	−0·03, 0·09	0·04	−0·03, 0·11	0·03	−0·02, 0·09	0·09	0·01, 0·17*	0·05	−0·02, 0·13
Fast food intake	0·04	−0·00, 0·09	0·04	0·00, 0·08*	0·08	0·02, 0·11**	0·06	0·02, 0·09**	0·04	−0·01, 0·10	0·02	−0·03, 0·07
Physical activity	0·14	0·04, 0·25**	0·02	−0·09, 0·13	0·13	0·03, 0·23*	0·03	−0·07, 0·13	0·03	−0·09, 0·16	0·00	−0·11, 0·12
Screen time	−0·22	−0·51, 0·07	−0·27	−0·53, −0·01*	−0·06	−0·34, 0·21	−0·17	−0·42, 0·08	0·27	−0·06, 0·60	0·12	−0·19, 0·42

Model 1 was adjusted for adolescents' age and sex, and fathers' age, employment status, and acculturation level, and household food security status.
Model 2 was based on model 1 with an additional adjustment for corresponding parenting practices.
†Square root transformation was applied to the EBRB variables.
*$P < 0·05$.
**$P < 0·01$.
***$P < 0·001$.

significantly different between low and high levels of paternal warmth (β: 0·06 *v.* 0·11, $P = 0·048$) and autonomy granting (β: 0·03 *v.* 0·11, $P = 0·004$).

Discussion

The present study examined associations between paternal general parenting and adolescents' EBRB, and relevant mediation and moderation mechanisms involving EBRB-specific parenting practices among a sample of 225 Latino early adolescent–father dyads from relatively low-income and less-acculturated immigrant families. No validated surveys were readily available for assessing paternal general parenting for Latino early adolescents; therefore, parental general parenting was measured using items primarily adapted from an observational scale of parenting style for first-generation Latino immigrant parents of 4- to 9-year-olds[26] and two other established measures with special attention to age appropriateness[27,28]. The three general parenting dimensions that emerged with a good model fit were warmth, autonomy granting and coercive control.

Paternal warmth was positively associated with adolescents' favourable EBRB including fruit intake, vegetable intake and physical activity. High levels of warmth were featured in authoritative and permissive parenting styles which were associated with adolescents' fruit and vegetable intake and physical activity in several other studies that primarily consisted of female caregivers[37–41]. Jago and colleagues found that 10- to 11-year-olds with permissive mothers and/or fathers reported high levels of logistic support and modelling which may explain the supportive effect of permissive parenting[40]. Berge and colleges found that both paternal permissive and authoritative parenting predicted higher fruit and vegetable intake among multi-ethnic adolescent girls than authoritarian parenting in a 5-year follow-up study[41]. These authors suggested that the warmth and caring adolescents felt from fathers were more important than parental control for promoting fruit and vegetable intake[41]. Our findings appear to support Jago *et al.*'s interpretation because associations between paternal warmth and adolescents' fruit intake, vegetable intake and physical activity were predominantly mediated by corresponding parenting practices. Whereas, paternal warmth did not show moderation effects on associations between paternal parenting practices and adolescents' EBRB. However, the current sample generally perceived high levels of paternal warmth as the score at the first quartile was 3·0 on the five-point scale, which may not adequately reflect the potential influence of low paternal warmth.

Interestingly, after adjusting for corresponding paternal parenting practices, paternal warmth was positively associated with adolescents' fast food intake and inversely associated with adolescents' screen time. The US National Health and Nutrition Examination Survey 2015–2018 showed that, on average, 12–19 years old Latino

Table 4 Total, direct and indirect effects of paternal general parenting on adolescents' energy balance-related behaviours (EBRB) and the mediation effects of corresponding paternal parenting practices

	Total effect		Direct effect		Indirect effect‡	
Parenting dimension × adolescents' EBRB†	*β*	95 % CI	*β*	95 % CI	*β*	95 % CI
Warmth × fruit intake	0·13	0·05, 0·22**	0·04	–0·04, 0·14	0·08§	0·04, 0·14§
Warmth × vegetable intake	0·09	0·02, 0·16*	–0·02	–0·09, 0·05	0·11§	0·07, 0·16§
Warmth × fast food intake	0·03	–0·01, 0·08	0·04	0·001, 0·08*	–0·01	–0·03, 0·01
Warmth × physical activity	0·14	0·03, 0·24**	0·02	–0·09, 0·12	0·12§	0·06, 0·19§
Warmth × screen time	–0·23	–0·52, 0·06	–0·28	–0·53, –0·02*	0·04	–0·08, 0·18
Autonomy granting × fruit intake	0·13	0·05, 0·22**	0·05	–0·03, 0·14	0·08§	0·04, 0·13§
Autonomy granting × vegetable intake	0·13	0·06, 0·19***	0·03	–0·03, 0·10	0·10§	0·05, 0·14§
Autonomy granting × sugary drink intake	0·08	0·02, 0·15*	0·06	0·00, 0·12*	0·02	–0·00, 0·05
Autonomy granting × fast food intake	0·05	0·01, 0·10*	0·05	0·02, 0·09**	0·00	–0·02, 0·02
Autonomy granting× physical activity	0·14	0·04, 0·24**	0·03	–0·07, 0·13	0·11§	0·06, 0·17§
Coercive control × sugary drink intake	0·10	0·02, 0·18*	0·05	–0·02, 0·13	0·05§	0·01, 0·09§
Coercive control × sweets/salty snack intake	0·09	0·01, 0·18*	0·05	–0·02, 0·13	0·04	–0·00. 0·09

†Square root transformation was applied to the EBRB variables.
‡The indirect effect referred to the mediation effects of paternal parenting practices, CI generated from bootstrapping excluding 0 indicated rejections to null hypotheses and *P* values were not generated for this column.
§The significant effects.
*$P < 0·05$.
**$P < 0·01$.
***$P < 0·001$.

adolescents consumed 18·5 % of daily calories from fast food, which was higher than the 14·8 % among non-Hispanic White adolescents[42]. Latino adolescents with high paternal warmth may feel more supported in their preferences for consuming fast food. This finding may also explain the greater influence of fathers' promotive parenting practices on sugary drink intake among adolescents who perceived high paternal warmth than those who perceived low paternal warmth. Whereas, the inverse association between paternal warmth and screen time may attribute to more quality time between Latino fathers and adolescents engaging in activities free of screen-based devices or better compliance with paternal control of screen time.

Similar to paternal warmth, paternal autonomy granting showed favourable associations with adolescents' fruit intake, vegetable intake and physical activity, which were also predominantly mediated by corresponding parenting practices. In addition, autonomy granting showed a direct effect on adolescents' sugary drink intake and fast food intake independent of corresponding parenting practices and moderated the promotive effect of paternal allowing, modelling and offering sugary drinks. Autonomy support is usually considered as a desirable child-centred parenting dimension that nurtures independence and proper socialisation[43]. However, our findings suggest that autonomy granting among Latino fathers may also facilitate the consumption of less healthy foods, which indicates a need for modification in order to fully support adolescents' healthy EBRB. Vaughn and colleagues proposed that food parenting practices that support adolescents' autonomy include nutrition education, child involvement, encouragement, praise, reasoning and negotiation[44]. Adolescents may benefit from intervention programmes that guide fathers to apply these food parenting practices.

Measures of coercive control used in the present study reflected paternal dominance and intrusiveness, which characterise authoritarian parenting. Coercive control complies with the Latino cultural norm of having a dominant male parent in the family. In the context of food parenting, coercive control includes parenting practices of restriction, pressure to eat, threats and bribes, and using food to control negative emotions[44]. Some of these behaviours were identified by Latino fathers in our previous focus group studies[23], consistent with the positive associations of paternal coercive control with adolescents' sugary drink intake and sweets/salty snack intake, which were mediated by corresponding parenting practices in the present study. However, we did not find any moderation effects of paternal coercive control on fathers' parenting practices, possibly because the majority of the sample perceived low levels of paternal coercive control.

According to the psychometric assessment of general parenting measures, we retained the parenting dimension of coercive control which was different from the standard behavioural control construct (monitoring, maturity demands and non-intrusive discipline) used in the Baumrind typology of parenting styles[28,45]. Thus, general parenting measured in the present study limited cross-study comparisons, as most previous studies applied the Baumrind typology in assessing the influence of general parenting on adolescents' weight and weight-related behaviours[1].

Another major limitation of our study was the cross-sectional design which did not allow for inferences about causation and compromised the validity of mediation analyses to reveal the longitudinal mediation effects[46].

In addition, we used convenience sampling, so the study findings cannot be generalised to the broader population of Latino early adolescents and their fathers living in the USA. Adolescents' reports of paternal general parenting, food and activity parenting practices, and their own EBRB were also subject to recall and social desirability biases. Moreover, adolescents' perceptions of interparental incongruence have been shown to attenuate the favourable impact of paternal influence on adolescents' snack intake[6]. The current study did not assess adolescents' perceptions of maternal general parenting dimensions and EBRB parenting practices. Thus, the study findings may be confounded to some extent by familial dynamics in parenting.

Conclusion

Findings from the present sample of Latino early adolescent–father dyads who were primarily from low-income and less-acculturated families showed that paternal warmth and autonomy granting may facilitate both healthy and less healthy behaviours among Latino early adolescents, including higher intakes of fruit and vegetables, more physical activity, less screen time, as well as higher intakes of sugary drinks and fast food. Paternal coercive control could facilitate sugary drink intake and sweets/salty snack intake. These potential effects were primarily mediated by corresponding behaviour-specific parenting practices, and parenting dimensions of paternal warmth and autonomy support also moderated associations between parenting practices and adolescent' sugary drink intake. In general, the current study suggests that Latino fathers exert influence on adolescents' EBRB either directly by their warmth, autonomy granting, and coercive control, or by the mediation and moderation interactions with behaviour-specific parenting practices. Future research needs to incorporate parenting education with healthy lifestyle interventions to support Latino fathers' efforts to prevent unhealthy weight gain among early adolescents.

Acknowledgements

Acknowledgements: The authors have special thanks for all participants for their involvement and thank community partners and research assistants for their support. *Financial support:* This project was supported by the Agriculture and Food Research Initiative (grant no. 2016-68001-24921) from the USDA National Institute of Food and Agriculture. The funder had no role in study design, data collection, and analysis, decision to publish, or preparation of the manuscript. *Conflict of interest:* There are no conflicts of interest. *Authorship:* M.R., Y.Z. and G.A.H.C. were responsible for study design and implementation. M.R., Y.Z. and A.B. collected the data. Y.Z. analysed the data and wrote the manuscript with contributions from M.R., S.N.S., A.B. and G.A.H.C. All authors read and approved the final manuscript. *Ethics of human subject participation:* This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the University of Minnesota Institutional Review Board Human Subjects Protection Committee. Written informed consent was obtained from fathers and assent was obtained from youth.

Supplementary material

For supplementary material accompanying this paper visit https://doi.org/10.1017/S1368980021002846

References

1. Sokol RL, Qin B & Poti JM (2017) Parenting styles and body mass index: a systematic review of prospective studies among children. *Obes Rev* **18**, 281–292.
2. Vollmer RL & Mobley AR (2013) Parenting styles, feeding styles, and their influence on child obesogenic behaviors and body weight. A review. *Appetite* **71**, 232–241.
3. Darling N & Steinberg L (1993) Parenting style as context: an integrative model. *Psychol Bull* **113**, 487.
4. Sleddens EFC, Gerards SMPL, Thijs C *et al.* (2011) General parenting, childhood overweight and obesity-inducing behaviors: a review. *Int J Pediatr Obes* **6**, e12–e27.
5. Shloim N, Edelson LR, Martin N *et al.* (2015) Parenting styles, feeding styles, feeding practices, and weight status in 4–12 year-old children: a systematic review of the literature. *Front Psychol* **6**, 1849.
6. Gevers DWM, van Assema P, Sleddens EFC *et al.* (2015) Associations between general parenting, restrictive snacking rules, and adolescent's snack intake. The roles of fathers and mothers and interparental congruence. *Appetite* **87**, 184–191.
7. Braden A, Rhee K, Peterson CB *et al.* (2014) Associations between child emotional eating and general parenting style, feeding practices, and parent psychopathology. *Appetite* **80**, 35–40.
8. Melbye EL, Bergh IH, Hausken SES *et al.* (2016) Adolescent impulsivity and soft drink consumption: the role of parental regulation. *Appetite* **96**, 432–442.
9. Zhang Y, Davey C, Larson N *et al.* (2019) Influence of parenting styles in the context of adolescents' energy balance-related behaviors: findings from the FLASHE study. *Appetite* **142**, 104364.
10. Davison KK, Gicevic S, Aftosmes-Tobio A *et al.* (2016) fathers' representation in observational studies on parenting and childhood obesity: a systematic review and content analysis. *Am J Public Health* **106**, e14–e21.
11. Niu Z, Tanenbaum H, Kiresich E *et al.* (2018) Impact of childhood parent-child relationships on cardiovascular risks in adolescence. *Prev Med* **108**, 53–59.
12. Neshteruk CD, Nezami BT, Nino-Tapias G *et al.* (2017) The influence of fathers on children's physical activity: a review of the literature from 2009 to 2015. *Prev Med* **102**, 12–19.
13. Ogden CL, Fryar CD, Martin CB *et al.* (2020) Trends in obesity prevalence by race and Hispanic origin—1999–2000 to 2017–2018. *JAMA* **324,** 1208–1210.

14. Dunford EK & Popkin BM (2018) 37 year snacking trends for US children 1977–2014. *Pediatr Obes* **13**, 247–255.
15. Kann L, McManus T, Harris WA *et al.* (2018) Youth risk behavior surveillance: United States, 2017. *MMWR Surveill Summ* **67**, 1–114.
16. Moore LV, Thompson FE & Demissie Z (2017) Percentage of youth meeting federal fruit and vegetable intake recommendations, youth risk behavior surveillance system, United States and 33 states, 2013. *J Acad Nutr Diet* **117**, 545.e3–553.e3.
17. Halgunseth LC, Ispa JM & Rudy D (2006) Parental control in Latino families: an integrated review of the literature. *Child Dev* **77**, 1282–1297.
18. Knight GP, Gonzales NA, Saenz DS *et al.* (2010) The Mexican American cultural values scales for adolescents and adults. *J Early Adolesc* **30**, 444–481.
19. Saracho ON & Spodek B (2008) Demythologizing the Mexican American father. *J Hispanic High Educ* **7**, 79–96.
20. Villarruel FA & Chahin J (1997) Beyond the myths: paternal values of Latino fathers. *Michigan Fam Rev* **3**, 17–30.
21. Lora KR, Cheney M & Branscum P (2016) Hispanic mothers' views of the fathers' role in promoting healthy behaviors at home: focus group findings. *J Acad Nutr Diet* **117**, 914–922.
22. Mena NZ, Gorman K, Dickin K *et al.* (2015) Contextual and cultural influences on parental feeding practices and involvement in child care centers among Hispanic parents. *Child Obes* **11**, 347–354.
23. Zhang Y, Hurtado GA, Flores R *et al.* (2018) Latino fathers' perspectives and parenting practices regarding eating, physical activity, and screen time behaviors of early adolescent children: focus group findings. *J Acad Nutr Diet* **118**, 2070–2080.
24. Zhang Y, Baltaci A, Overcash F *et al.* (2020) Latino adolescent-father discrepancies in reporting activity parenting practices and associations with adolescents' physical activity and screen time. *BMC Public Health* **20**, 1–10.
25. Zhang Y, Reyes Peralta A, Arellano Roldan Brazys P *et al.* (2020) Development of a survey to assess Latino fathers' parenting practices regarding energy balance-related behaviors of early adolescents. *Health Educ Behav* **47**, 123–133.
26. Domenech Rodríguez MM, Donovick MR & Crowley SL (2009) Parenting styles in a cultural context: observations of "protective parenting" in first-generation Latinos. *Fam Process* **48**, 195–210.
27. Olivari MG, Tagliabue S & Confalonieri E (2013) Parenting style and dimensions questionnaire: a review of reliability and validity. *Marriage Fam Rev* **49**, 465–490.
28. Sleddens EFC, O'Connor TM, Watson KB *et al.* (2014) Development of the comprehensive general parenting questionnaire for caregivers of 5–13 year olds. *Int J Behav Nutr Phys Act* **11**, 15.
29. Suhr D (2013) Exploratory or confirmatory factor analysis? *Statistical Data Analysis.* https://support.sas.com/resources/papers/proceedings/proceedings/sugi31/200-31.pdf (accessed July 2020).
30. Hunsberger M, O'Malley J, Block T *et al.* (2015) Relative validation of Block Kids Food Screener for dietary assessment in children and adolescents. *Matern Child Nutr* **11**, 260–270.
31. McGuire MT, Hannan PJ, Neumark-Sztainer D *et al.* (2002) Parental correlates of physical activity in a racially/ethnically diverse adolescent sample. *J Adolesc Health* **30**, 253–261.
32. Godin G & Shephard RJ (1985) A simple method to assess exercise behavior in the community. *Can J Appl Sport Sci* **10**, 141–146.
33. Utter J, Neumark-Sztainer D, Jeffery R *et al.* (2003) Couch potatoes or French fries: are sedentary behaviors associated with body mass index, physical activity, and dietary behaviors among adolescents? *J Am Diet Assoc* **103**, 1298–1305.
34. Kandula NR, Diez-Roux AV, Chan C *et al.* (2008) Association of acculturation levels and prevalence of diabetes in the multi-ethnic study of atherosclerosis (MESA). *Diabetes Care* **31**, 1621–1628.
35. Hager ER, Quigg AM, Black MM *et al.* (2010) Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics* **126**, e26–e32.
36. Hayes A (2017) *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*, 2nd ed. New York: The Guilford Press.
37. Kremers SPJ, Brug J, De Vries H *et al.* (2003) Parenting style and adolescent fruit consumption. *Appetite* **41**, 43–50.
38. Franchini B, Poínhos R, Klepp K-I *et al.* (2011) Association between parenting styles and own fruit and vegetable consumption among Portuguese mothers of school children. *Br J Nutr* **106**, 931–935.
39. Schmitz KH, Lytle LA, Phillips GA *et al.* (2002) Psychosocial correlates of physical activity and sedentary leisure habits in young adolescents: the Teens eating for energy and nutrition at school study. *Prev Med* **34**, 266–278.
40. Jago R, Davison KK, Brockman R *et al.* (2011) Parenting styles, parenting practices, and physical activity in 10- to 11-year olds. *Prev Med* **52**, 44–47.
41. Berge JM, Wall M, Loth K *et al.* (2010) Parenting style as a predictor of adolescent weight and weight-related behaviors. *J Adolesc Health* **46**, 331–338.
42. Fryar CD, Carroll MD, Ahluwalia N *et al.* (2020) Fast food intake among children and adolescents in the United States, 2015–2018. *NCHS Data Brief.* https://www.cdc.gov/nchs/data/databriefs/db375-h.pdf (accessed September 2020).
43. Skinner E, Johnson S & Snyder T (2005) Six dimensions of parenting: a motivational model. *Parent Sci Pract* **5**, 175–235.
44. Vaughn AE, Ward DS, Fisher JO *et al.* (2016) Fundamental constructs in food parenting practices: a content map to guide future research. *Nutr Rev* **74**, 98–117.
45. Maccoby EE & Martin JA (1983) Socialization in the context of the family: parent–child interaction. In *Handbook of child Psychology: Socialization, Personality and Social Development*, 4th ed, pp. 1–101 [PH Mussen & EM Hetherington, editors]. New York: Wiley.
46. Maxwell SE & Cole DA (2007) Bias in cross-sectional analyses of longitudinal mediation. *Psychol Methods* **12**, 23–44.

Public Health Nutrition