

Parenting style as longitudinal predictor of adolescents' health behaviors in Lebanon

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Abstract

This prospective study aimed to examine how parenting style relates to health behaviors and body mass index of Lebanese adolescents while checking for interactive effect of child characteristics (age and gender). About 341 students from private and public schools in Mount Lebanon and Beirut area, aged between 16 and 18 years, completed a self-administered survey assessing socio-demographics, parenting styles and health behaviors. Adolescents were surveyed at two time points, six months apart. Anthropometric measurements were also taken. Authoritative parenting was associated with better outcomes compared to the neglectful style. Adolescents raised with an authoritative style had higher adherence to the Mediterranean diet and lower consumption of alcohol intake. Parenting style was a significant predictor of eating behavior and alcohol intake of Lebanese adolescent. Interventions aiming at improving health behaviors should also encompass healthy parenting style strategies.

Introduction

Adolescence is considered a critical developmental phase during which adolescent engages in lifestyle behaviors that can affect their health and lead to long-term health implications [1]. Unhealthy eating, lack of physical activity (PA), alcohol and substance use are all health-related risk behaviors that

negatively impact adolescents' life, both physically and mentally [2, 3]. Harmful drinking substantially increases the risk of illness, violence and injury [4]. Moreover, tobacco, alcohol, unhealthy eating and sedentary behaviors are all important risk factors for the development of non-communicable diseases in later life and consequently are linked to higher morbidity and mortality [5, 6].

The World Health Organization estimated that globally one in six adolescents was overweight in 2016, four in five adolescents do not meet the guidelines for daily activity level and at least 1 in 10 adolescents uses tobacco [7]. These problematic behaviors also affect Lebanese adolescents. The latest Global School-based Student Health Survey shows that 24.6% of Lebanese adolescents aged 13–17 years are overweight, 36.6% currently use tobacco products and 18.9% consume alcohol beverages [8]. Furthermore, Lebanon has been witnessing a nutritional transition from the traditional Mediterranean diet into a Westernized dietary pattern [9]. Adolescents' diets are becoming higher in fats and sugar and lower in nutrient density [10]. This dietary transition coupled with an unhealthy lifestyle such as sedentarity, smoking and drinking has been associated with an increased risk of obesity among Lebanese adolescents and are reportedly leading causes for non-communicable diseases in later-life [11, 12]. Lebanon has been also found to have one of the highest estimated prevalence of metabolic syndrome among both adolescents and adults in the East Mediterranean region [13, 14]. Non-communicable diseases and obesity have subsequently emerged as primary cause for morbidity

and mortality in Lebanon [15]. Health compromising behaviors may not only affect Lebanese adolescent health today but are known to extend into adulthood and affect their future health [16, 17], hence the importance of addressing these behaviors early and understand what influence them. Adolescent health and well-being have indeed been the focus of many studies and interventions and are now on the global agenda for sustainable development [18]. Investing in adolescents' health will bring benefits for adolescents now, into their future lives and for the next generations [16, 17].

From an ecological perspective, parents—being a part of the immediate or microenvironment of adolescents—can have a strong influence on their children's outcomes and development of behaviors [19, 20]. Parents can influence their children's health behaviors in various ways; such as modeling of behaviors [21] or controlling availability and accessibility to healthy food or activity opportunities [22, 23]. Parents might also exert their influence through specific parenting practices (such as rules related to dietary intake or limiting screen time) or more global aspect of parental behavior referred to as general parenting style [24]. Parenting style is described as the emotional climate in which parents communicate or interact with their children [25]. Parenting style can be categorized into four prototypes based on the combination of two dimensions of parental behavior: responsiveness and demandingness [26, 27]. The four types being authoritative (demanding but responsive), authoritarian (highly demanding but unresponsive), permissive (more responsive than demanding) and neglectful (unresponsive and undemanding) [25].

Compared to the other styles, authoritative parenting is considered as the most optimal style with positive and protective effects on the child's development. Authoritative parenting has been shown to have a protective role for adolescents by decreasing their engagement in health-risk behaviors such as smoking [28, 29], alcohol consumption [30, 31] and substance use [32, 33]. Moreover, children of authoritative parents were found to have healthier dietary behaviors: higher intake of fruits [34], fewer unhealthy snacks [35] and have lower

body mass index (BMI) values [36–39]. However, inconsistencies exist among studies; while the latter showed positive associations of parenting styles with health behaviors, other studies failed to find any association at all. De Bourdeaudhuij *et al.* [40] and Vereecken *et al.* [41] found that general parenting was not related to dietary habits including fruit and vegetable consumption, it is rather food-specific parenting practices that have an impact on eating habits. In addition, different associations were found for different populations; when comparing relationships between parenting and BMI between a sample of American and Czech children, Humenikova and Gates [42], found that among American children permissive parenting was related to higher BMI, whereas, for Czech children authoritative parenting appeared to be associated with higher BMI. Hence, the influence of parenting styles may thus differ per culture.

The influence of parenting style may also depend on child characteristics. For example, some studies suggest that gender moderates the effect of parenting style on health behaviors. A controlling parenting style was found to be associated with unhealthier eating in girls but not in boys [43]. Similarly, authoritative parenting was found to have positive effect on PA for boys, whereas authoritarian parenting had the most positive effect in girls [44].

Parents are notably a major source of influence and consequently important targets for interventions. However, the impact of parenting styles on nutrition habits of their children remains understudied in Lebanon with only one cross-regional study that examined parenting in eight Middle Eastern countries including Lebanon [45]. This study revealed that compared to conservative countries such as Saudi Arabia in which authoritarian parenting prevail, Lebanese parents have a more lenient parenting pattern which is a combination of authoritative and permissive parenting comparable to the styles found in Jordan and Algeria [45]. Additionally, it was found that male Arab adolescents, including Lebanese, reported to experience higher levels of authoritarian parenting compared to females [45]. Parenting style in Lebanon and its

influence on future behavior is yet to be understood; longitudinal studies on parental styles and how they relate to the development of health behaviors of Lebanese youth are lacking. Studies on parenting are mainly focused on Western countries and more recently Asian culture [46, 47]. Since parenting styles may differ across cultures and community context [48], it is important to explore the patterns of parenting in the Lebanese cultural context as this will help guide interventions targeting this particular group.

Hence, the purpose of this article is to examine the prospective influence of parenting styles on health behaviors (diet, PA, smoking and alcohol) and BMI of Lebanese adolescents at 6-month follow up. In addition, we will examine whether child characteristics (age and gender) influence the impact of parenting styles on health behaviors. This study will improve our understanding of the parental styles used in Lebanon and its impact on Lebanese adolescent's health behaviors and may help to provide directions for the development of interventions in Lebanon aiming at optimizing both parenting practices and health behaviors.

Methods

Study design

This longitudinal prospective study was based on a secondary analysis of data from a larger research project that took place between March 2017 and March 2018 investigating the predictors of academic achievement in Lebanese adolescents. As part of this project, adolescents aged 15–18 years, from private and public schools completed a survey assessing lifestyle factors, school-related factors, socio-demographics, and motivational factors. The students were surveyed at baseline (t1) and after 6 months (t2) and 12 months (t3). The study questionnaire was reviewed and approved by the Lebanese Ministry of Education and Higher Education and the study design and conduct were performed according to the guidelines laid down in the Declaration of Helsinki [49]. Informed consent

was obtained from adolescents and parents before participation and ethical approval was obtained from Al Hayat Hospital ethical committee. For the purpose of the current study, data were drawn from the second (t2) and third wave (t3) of data collection as parenting style was not assessed at baseline. The predictor variable parenting style was taken at t2, the control variables socio-demographics were also taken at t2 and the outcome variables health behaviors and BMI were taken at t3.

Participants and recruitment

Ten schools in Beirut and Mount Lebanon area were randomly selected from the Ministry of Education's list. The school directors were approached with the study questionnaire and seven (four private and three public) agreed to take part in the study. From these schools, all students enrolled in the 10th and 11th grades were invited to partake in the survey. All students agreed to participate resulting in a total baseline sample of 600 adolescents of which 563 (94%) with valid data. For the current study, only participants with complete measurements at t2 (64.3%) and t3 (61.3%) were included resulting in a total sample of 341 adolescents (60.56%).

Procedure

Students individually completed the questionnaire by hand inside their classroom. Trained dietitians read aloud each question and the corresponding answers to the entire class and were present for any clarification and assistance. The survey was completed in ~1 h. The dietitians collected the students' anthropometric measurements in the classroom using standardized procedures and calibrated equipment [50]. Height was measured to the nearest 0.5 cm using a portable stadiometer (ADE stadiometer, Germany) and after removal of shoes. Weight was taken to the nearest 0.1 kg using a Secacalibrated electronic weighing scale (Hamburg, Germany) without shoes and in light indoor clothing. All measurements were taken twice and the average of the two values was used.

Instruments and measures

Demographic variables

Socio-demographic variables measured at t2 included students' gender (1 = male; 2 = female), age (1 = 15; 2 = 16; 3 = 17; 4 = 18), type of school (1 = public; 2 = private), educational level of parents (1 = low [never went to school & primary school]; 2 = medium [complementary & secondary school]; 3 = high [technical school & university]) and religion (1 = Christian; 2 = Muslim). The categories male, public school, high educational level of parents and Christian, were taken as referent groups.

Parenting style

Parenting styles measured at t2 were assessed using the Authoritative Parenting Index (API) [30]. The API measures students' perception of parenting behavior and more specifically two dimensions: responsiveness and demandingness. Scores on the two dimensions are used to categorize parents into four styles: authoritative, neglectful, permissive and authoritarian.

The responsive dimension consists of nine items measuring indicators of parental warmth, acceptance, involvement and supportiveness. (e.g. 'She/he listens to what I have to say') The demanding dimension consists of seven items measuring indicators of parental supervision, assertive control, monitoring and permissiveness (e.g. 'She/he has rules that I must follow'). In this study, the items were worded in reference for both parents (e.g. 'They make sure I go to bed on time'). The response categories for all items were (1 = Not like them, 2 = Sort of like them, 3 = A lot like them and 4 = Just like them) indicating how well the statements are like their parents, with higher scores indicating higher levels of responsiveness and demandingness. The final scales were coded 9–36 (responsiveness) and 7–28 (demandingness).

Parenting styles were created using median splits on demandingness and responsiveness. That is, we divided the responsiveness and demandingness scales into high and low levels of responsiveness and demandingness. The four parenting style

categories were established based on combination of the levels of responsiveness and demandingness. The four parenting styles were categorized as authoritative (high on both), authoritarian (high demandingness and low responsiveness), permissive (low demandingness and high responsiveness) and neglectful (low on both). Based on previous research that authoritative parenting is related to the best outcomes [30], authoritative was used as the referent group in the multivariate regression.

Outcome variables: health behaviors

Diet quality. In this study, adherence to the Mediterranean diet, known as one of the healthiest eating patterns, was used as an indicator of diet quality. Students completed a semi-quantitative Food Frequency Questionnaire (FFQ) that included 64 food and beverage items commonly consumed in Lebanon [51] and answered questions on food habits (breakfast consumption, snacking and frequency of eating fast-food). KIDMED index (Mediterranean Quality Index for children and adolescents) was calculated using data from the FFQ and food habits questions (breakfast consumption and frequency of fast-food intake) measured at t3.

The KIDMED index evaluates the adherence to the Mediterranean diet by measuring the consumption of 16 items, of which 12 are positively scored and four negatively scored. Items denoting a concordance with the Mediterranean diet are assigned a value of +1: (1) fruit/fruit juice every day, (2) second fruit every day, (3) vegetables regularly once a day, (4) vegetables more than once a day, (5) fish at least 2–3 times/week, (6) pulses more than once a week, (7) pasta or rice consumption ≥ 5 /week, (8) cereals or grains for breakfast, (9) nuts at least 2–3 times/week, (10) regular use of olive oil, (11) a dairy product for breakfast and (12) two yoghurts and/or some cheese (40 g) daily. Items denoting a negative association to the Mediterranean diet are assigned a value of -1: (1) fast food > 1 /week, (2) skipping breakfast, (3) commercially baked goods or pastries for breakfast, (4) eating sweets and candy several times every day. The total score ranges from 0 to 12 with higher score reflecting a higher adherence to the Mediterranean diet. The score can be taken as

continuous variable or classified into three levels: 0–3 reflects poor adherence to the MeD, 4–7 average adherence and 8–12 high adherence to the Mediterranean diet [52].

Physical activity. Physical activity was measured at t3 using the short version of the International Physical Activity Questionnaire (IPAQ). The IPAQ has been shown to be a reliable and valid tool to obtain estimates of PA [53]. The questionnaire covers three specific levels of activity: walking, moderate and vigorous-intensity activities and their frequency (days per week) and duration (minutes per day). Total PA was calculated by multiplying time spent in each activity intensity by its metabolic equivalent of task (MET) estimated at 3.3 for walking, 4.0 for moderate intensity activity and 8.0 for vigorous intensity activity (e.g. walking MET-minutes/week = $3.3 \times$ walking minutes \times walking days). MET-minutes/week for each activity are summed to derive the total PA MET-minutes/week. Three categories of PA were assigned on the basis of MET-min/week: (i) low: <600 , (ii) moderate: ≥ 600 to <3000 and (iii) high ≥ 3000 [54].

Smoking and alcohol. Prevalence of smoking in the past 30 days was assessed at t3 with the question: 'During the past month, on how many days did you smoke?' the responses were '0 days; 1 or 2 days; 3–5 days; 6–9 days; 10–19 days; 20–29 days; All 30 days'. For comparability to the reported prevalence used in the Global School-based Student Health Survey, the responses were then dichotomized into (i) no = 0 days and (ii) yes = 1–30 days [8, 55].

Prevalence of alcohol consumption in the past 30 days was assessed at t3 with the question: 'During the past month, on how many days did you drink alcohol?' the responses were '0 days; 1 or 2 days; 3–5 days; 6–9 days; 10–19 days; 20–29 days; All 30 days'. In line with the reported prevalence used in the Global School-based Student Health Survey, the responses were then dichotomized into (i) no = 0 days and (ii) yes = 1–30 days [8, 55].

Not smoking and not drinking were taken as reference group as they are hypothesized as the groups with less risk.

Body mass index. Body mass index was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). Overweight and obesity were defined according to cut-off values from the International Obesity Task Force for BMI of children aged 2–18 years, where centile curves were drawn, which at age 18 years passed through the widely used cut-off points of 30 and $25 \text{ kg}/\text{m}^2$ for adult obesity and overweight [56]. BMI was classified as overweight versus not overweight, the group overweight included adolescents who are overweight and obese and the group not overweight included underweight ($n = 11$) and normal-weight adolescents. The category not overweight was used as the referent group.

Statistical analysis

The Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois), version 24.0 was used for data entry, management, cleaning and analyses. Data cleaning was performed on a sample of 50 questionnaires (from the included sample) that were completely checked for errors. The error rate was $<1\%$; thus, data entry was considered adequate. Missing data were not replaced for this analysis, due to their low prevalence ($<5\%$) [57].

Data were described as number and percent for categorical variables, whereas the mean and standard deviation (\pm SD) were calculated for continuous ones. Bivariate analyses to determine the association between parenting style and other categorical variables were carried out by using Pearson chi-square. ANOVA test was used for the association with continuous variables.

Multivariate regression analyses were used to assess the association of parenting style at t2 with smoking, alcohol, KIDMED and PA at t3 as dependent variables while adjusting for potentially confounding variables (age; gender; type of school; religion; father education and mother education at t2). Logistic regression was used for the outcomes smoking and alcohol and a linear regression was carried out for the outcomes KIDMED and PA. To test whether child characteristics moderate the influence of parenting styles on health behaviors, we calculated interaction terms between the parenting

styles and child characteristics (age and gender). The interaction terms Parenting Style \times age and Parenting Style \times gender were added to the regression analyses. *P*-values of 0.05 was set for the entry of potential predictors into the model, whereas a *P*-values of 0.1 was set for removal from the model. Results are presented as adjusted odds ratios (AOR) and their corresponding 95% confidence intervals (CI) for the logistic regression and Unstandardized Beta coefficients with their 95% CI for the linear regressions. For all statistical analyses performed, values with a *P*-values ≤ 0.05 were considered statistically significant.

Results

Sample characteristics

The study sample consisted of 341 adolescents, with a mean age of 16.56 (SD = 0.75). Of the study participants, 53.7% were girls, 66% attended private school. Only 12.6% of the study participants reported smoking in the past month and 60.1% reported drinking. Adolescents had an average adherence to the Mediterranean diet (5.51 ± 2.30) and 39.4% of the participants were overweight or obese. Most adolescents reported an authoritative parenting style (31.4%) versus 29.3% for authoritarian, 19.4% for neglectful and 19.9% for permissive. In all, 53.7% of mothers had a high educational level versus 42.8% for fathers (Table I).

Bivariate associations between parenting styles (t2) and health behaviors (t3) and socio-demographics (t2)

Girls were more likely to perceive their parents as authoritative (41%) whereas boys were more likely to report authoritarian parenting (30.4%) ($P < 0.0001$). In addition, parenting style was significantly associated with type of school; adolescents attending private schools were significantly more likely to report authoritarian (29.3%) parenting ($P = 0.035$). Regarding health behaviors, adolescents who reported not drinking in the past 30 days were more likely to report authoritative parenting (38.2%) ($P = 0.047$). Finally, adolescents

whose father have a high educational level were more likely to report authoritative parenting (32.2%) ($P = 0.011$) (Table II).

Multivariate analysis (influence of parenting style at t2 on health behaviors at t3)

Parenting style was associated with diet quality and alcohol consumption 6 months later, with authoritative parenting having protective effects for both behaviors. There was no interaction between parenting styles and adolescents' gender or age. Adolescents of neglectful parents ($\beta: -0.84$; 95% CI $-1.53, -0.15$) were significantly less likely to adhere to the Mediterranean diet at t3 compared to adolescents of authoritative parents. Adolescents of neglectful (AOR: 2.39; 95% CI 1.12, 5.09) parents were significantly more likely to report drinking alcohol 6 months later compared to adolescents of authoritative parents. No significant effects for parenting style with smoking and PA were found ($P > 0.05$) (Tables III and IV).

Discussion

The distribution of the study sample by sex and school sector was comparable to that of the Lebanese secondary student population [58]. In addition, the percent of overweight and obese in our study was similar to that reported in other studies on Lebanese adolescents [59]. The percentage of adolescents who reported smoking was also comparable to the findings of the latest Global School-based Student Health Survey (GSHS) (12.6% versus 13.7%), however, the percentage of adolescents who reported drinking was higher in our sample compared to the GSHS (60.1% versus 18.9%) [8]. A possible explanation to the high percentage of drinking adolescents may be related to the difference in the ages included between the samples. The GSHS included also younger adolescents starting from Grade 7, whereas the current study reports the prevalence for older adolescents from Grades 11 and 12. Previous research has shown that late adolescence is marked by an increase in alcohol

Table I. Demographic and lifestyle characteristics of study participants (*n* = 341)

Characteristics	Frequency (%)
Gender	
Male	158 (46.3)
Female	183 (53.7)
Age	
Mean (\pm SD)	16.56 \pm 0.75
Type of school	
Public	116 (34)
Private	225 (66)
BMI	
Not overweight	206 (60.6)
Overweight	134 (39.4)
Religion	
Christian	299 (87.7)
Muslim	42 (12.3)
Having snacks during the day	
No	9 (2.6)
Yes	332 (97.4)
Type of snacks consumed	
Sandwich	40 (12)
Fruit and veg	96 (28.9)
Candies/Choco and cookies	158 (47.6)
Chips, crackers, and nuts	38 (11.4)
Frequency of eating fast-food (per week)	
Never/once	185 (54.3)
Twice or more	156 (45.7)
Smoking cigarette	
No	298 (87.4)
Yes	43 (12.6)
Alcohol drinking	
No	136 (39.9)
Yes	205 (60.1)
Breakfast intake	
No	61 (18)
Yes	277 (82)
Physical activity	
Low	106 (31.1)
Moderate	142 (41.6)
High	93 (27.3)
KIDMED score	
Mean (\pm SD)	5.51 \pm 2.30
<3 poor	66 (19.5)
4–7 average	198 (58.6)
\geq 8 high	74 (21.9)
Father education	
Low	28 (8.2)
Medium	148 (43.4)
High	146 (42.8)

(continued)

Table I. (continued)

Characteristics	Frequency (%)
Mother education	
Low	12 (3.5)
Medium	139 (40.8)
High	183 (53.7)
Parenting style	
Neglectful	66 (19.4)
Permissive	68 (19.9)
Authoritarian	100 (29.3)
Authoritative	107 (31.4)

consumption compared to the young teenage years associated with other life transitions such as physical changes, identity exploration and increased independence [60–62]. Additionally, our sample is mainly from an urban setting where prevalence of alcohol consumption is presumably higher [63, 64]. Moreover, a study conducted in neighborhoods of the capital Beirut pointed to a high alcogenic environment with alcohol outlets located near educational establishments creating conditions conducive to increased access to alcohol and drinking among youth [65].

This is the first study to longitudinally assess the influence of parenting styles on health behaviors (diet, PA, smoking and alcohol) and BMI in Lebanese adolescents. The findings of the present study indicate that parenting style is prospectively associated with diet and alcohol consumption of Lebanese adolescents.

The distribution of cases by parenting style was 31.4% for authoritative parenting which is comparable to percentage in Western countries [30, 66], followed by 29.3% for authoritarian, 19.9% for permissive and 19.4% for neglectful parenting. Lebanon is mainly a country of patriarchal nature, hence, one would expect a more authoritarian model of parenting. However, our results showed that authoritative parenting was the most adopted parenting style. This might be explained by the socio-cultural diversity within the Lebanese society allowing a blend of Western and Arab values [67]. Compared to other Arab countries, Lebanon is considered more liberal and open to Western influence which might explain the high prevalence of

Table II. Association of parenting style (t2) with demographics (t2) and health behaviors (t3) of Lebanese adolescent (n = 341)

	Parenting style				P-value
	Neglectful N = 66 (19.4%)	Permissive N = 68 (19.9%)	Authoritarian N = 100 (29.3%)	Authoritative N = 107 (31.4%)	
Gender					<0.0001
Male	45 (28.5)	33 (20.9)	48 (30.4)	32 (20.3)	
Female	21 (11.5)	35 (19.1)	52 (28.4)	75 (41)	
Age					0.065
Mean (\pm SD)	16.72 \pm 0.75	16.67 \pm 0.74	16.47 \pm 0.70	16.48 \pm 0.80	
Type of school					0.035
Public	16 (13.8)	19 (16.4)	34 (29.3)	47 (40.5)	
Private	50 (22.2)	49 (21.8)	66 (29.3)	60 (26.7)	
BMI					0.127
Not overweight	37 (18)	36 (17.5)	69 (33.5)	64 (31.1)	
Overweight	29 (21.6)	32 (23.9)	30 (22.4)	43 (32.1)	
Religion					0.231
Christian	60 (20.1)	61 (20.4)	82 (27.4)	96 (32.1)	
Muslim	6 (14.3)	7 (16.7)	18 (42.9)	11 (26.2)	
Having snacks during the day					0.238
Yes	66 (19.9)	66 (19.9)	95 (28.6)	105 (31.6)	
Type of snacks consumed					0.254
Sandwich	11 (27.5)	6 (15)	10 (25)	13 (32.5)	
Fruit and veg	13 (13.5)	21 (21.9)	32 (33.3)	30 (31.3)	
Candies/Choco and cookies	35 (22.2)	26 (16.5)	44 (27.8)	53 (33.5)	
Chips, crackers, and nuts	7 (18.4)	13 (34.2)	9 (23.7)	9 (23.7)	
Frequency of eating fast-food (per week)					0.173
Never/once	29 (15.7)	35 (18.9)	56 (30.3)	65 (35.1)	
Twice or more	37 (23.7)	33 (21.2)	44 (28.2)	42 (26.9)	
Smoking cigarette in the past 30 days					0.353
Yes	11 (25.6)	8 (18.6)	15 (34.9)	9 (20.9)	
No	55 (18.5)	60 (20.1)	85 (28.5)	98 (32.9)	
Alcohol consumption in the past 30 days					0.047
Yes	48 (23.4)	40 (19.5)	62 (30.2)	55 (26.8)	
No	18 (13.2)	28 (20.6)	38 (27.9)	52 (38.2)	
Breakfast intake					0.528
Yes	55 (19.9)	52 (18.8)	83 (30.3)	87 (31.4)	
No	10 (16.4)	16 (26.2)	15 (24.6)	20 (32.8)	
Physical activity					0.605
Mean (\pm SD)	2411.98 \pm 2149.36	2510.18 \pm 2471.26	2054.90 \pm 2654.63	2115.12 \pm 2715.76	
Low	17 (16)	16 (15.1)	36 (34)	37 (34.9)	0.415
Moderate	28 (19.7)	30 (22.1)	43 (30.3)	41 (28.9)	
High	21 (22.6)	22 (23.7)	21 (22.6)	29 (31.2)	
KIDMED score					0.255
Mean (\pm SD)	5.02 \pm 2.18	5.70 \pm 2.67	5.53 \pm 2.16	5.67 \pm 2.21	
<3 poor	18 (27.3)	13 (19.7)	16 (24.2)	19 (28.8)	0.102
4–7 average	40 (20.2)	34 (17.2)	64 (32.3)	60 (30.3)	
\geq 8 high	8 (10.8)	20 (27)	18 (24.3)	28 (37.8)	

(continued)

Table II. (continued)

	Parenting style				P-value
	Neglectful N = 66 (19.4%)	Permissive N = 68 (19.9%)	Authoritarian N = 100 (29.3%)	Authoritative N = 107 (31.4%)	
Father education					0.011
Low	2 (7.1)	3 (10.7)	16 (57.1)	7 (25)	
Medium	35 (23.6)	36 (24.3)	34 (23)	43 (29.1)	
High	26 (17.8)	26 (17.8)	47 (32.2)	47 (32.2)	
Mother education					0.422
Low	2 (16.7)	3 (25)	3 (25)	4 (33.3)	
Medium	32 (23)	22 (15.8)	47 (33.8)	38 (27.3)	
High	32 (17.5)	42 (23)	48 (26.2)	61(33.3)	

P-values were derived from ANOVA and chi-square test for continuous and categorical variables, respectively. Bold values denote statistical significance at the $p < 0.05$ level.

Table III. Multivariate analysis of parenting style (t2) with smoking and alcohol (t3) of Lebanese adolescents

Variables	Smoking (reference: no)		Alcohol (reference: no)	
	AOR (95% CI)	P-value	AOR (95% CI)	P-value
Stepwise method				
Parenting style—authoritarian	1.06 (0.37–3.02)	0.915	1.77 (0.92–3.40)	0.089
Parenting style—neglectful	0.70 (0.23–2.16)	0.536	2.39 (1.12–5.09)	0.024
Parenting style—permissive	0.83 (0.26–2.69)	0.760	1.42 (0.69–2.88)	0.337
Age	2.01 (1.19–3.38)	0.008	—	—
Gender (female)	0.29 (0.12–0.70)	0.006	—	—
Religion (Muslim)	6.58 (1.19–36.23)	0.030	0.02 (0.006–0.115)	<0.0001
KIDMED	0.79 (0.66–0.94)	0.010	—	—
Alcohol	22.88 (4.12–126.89)	<0.0001	—	—
Smoking	—	—	32.71 (5.83–183.63)	<0.0001

Outcome variables: smoking, alcohol. Results of the final models of stepwise logistics regression analyses (only showing regression coefficients for the significant independent variables in each model). Imposed: parenting style (reference: authoritative). Association was significant: $P < 0.05$. Variables included in the model were: age, gender (reference: male), type of school (reference: public), religion (reference: Christian), mother education (reference: high educational level), father education (reference: high educational level), BMI (reference: not overweight), smoking (reference: no), alcohol (reference: no), physical activity, KIDMED, parenting style \times age and parenting style \times gender. AOR, adjusted odds ratio; CI, confidence interval.

perceived authoritative parenting (31.4%) [45, 68]. However, the coexistence of both traditional and modern societies in Lebanon is also reflected by authoritarian parenting being the second highest parenting style reported (29.3%). Additionally, our results showed that girls reported more authoritative parenting (41%) while boys perceived a more authoritarian style (30.4%). This is in line with previous studies reporting that the parenting styles

applied to girls tend to be more authoritative and less authoritarian than those applied to boys [45]. One explanation could be related to boys having more behavior problem and consequently require stricter discipline [69]. Another possible explanation is that in some Lebanese families still, males are identified as head of the household and expected to have more responsibilities [70], subsequently parents may be exerting higher control.

Table IV. Multivariate analysis of parenting style (t2) with KIDMED and PA (t3) of Lebanese adolescents

Variables	KIDMED		Physical activity	
	β (95% CI)	P-value	β (95% CI)	P-value
Stepwise method				
Parenting style—authoritarian	-0.19 (-0.81; 0.41)	0.527	-267.14 (-980.35; 446.07)	0.462
Parenting style—neglectful	-0.84 (-1.53; -0.15)	0.017	-275.05 (-1090.94; 540.83)	0.508
Parenting style—permissive	-0.15 (-0.83; 0.53)	0.664	-1.289 (-795.95; 793.37)	0.997
Age	-0.33 (-0.65; 0.0001)	0.050	—	—
Gender (female)	—	—	-1244.09 (-1812.43; -675.77)	<0.0001
Type of school (private)	1.43 (0.92; 1.93)	<0.0001	—	—
Smoking	-1.08 (-1.80; -0.36)	<0.003	—	—

Outcome variables: KIDMED, PA. Results of the final models of stepwise linear regression analyses (only showing regression coefficients for the significant independent variables in each model). Imposed: parenting style (reference: authoritative). Association was significant: $P < 0.05$. Variables included in the model were: age, gender (reference: male), type of school (reference: public), religion (reference: Christian), mother education (reference: high educational level), father education (reference: high educational level), BMI (reference: not overweight), smoking (reference: no), alcohol (reference: no), physical activity, KIDMED, parenting style \times age and parenting style \times gender.

β , unstandardized coefficient; CI, confidence interval.

Regarding dietary behaviors, our findings support and extend those of past research showing an association between general parenting and adolescents eating behaviors. Adolescents who perceived their parents as authoritative, had higher adherence to the Mediterranean diet in comparison to adolescents who reported that their parents were neglectful. Importantly, this association held even after controlling for potential confounders such as socio-economical status. Our results are consistent with previous studies suggesting that a warm yet firm parental style (authoritative) is associated with positive eating behaviors namely higher fruit and vegetable intake [34, 71], lower junk food consumption and irregular meal eating [72], lower fat intake [37, 73], fewer unhealthy snacks and a more regular breakfast consumption [22]. Compared to authoritative parenting, adolescents of neglectful parents were less likely to adhere to the Mediterranean diet. It is noticeable from our findings that having parents who lack both parental control and warmth is a risk factor for an unhealthier eating pattern. In the present study, diet quality was measured by adherence to the Mediterranean diet. The Mediterranean diet is a healthy dietary pattern high in fruits, vegetables, whole grain cereals, fish and olive oil and consequently rich in fiber, healthy fat, antioxidants and

polyphenols with anti-inflammatory properties [74]. This eating pattern is known to contribute to good present and future health and have a protective effect against chronic diseases, certain types of cancer and neurodegenerative diseases [75]. The latter implies that parental styles are an important area of intervention when targeting eating behaviors of Lebanese adolescents such as increasing compliance to the Mediterranean diet. What's more, our results show an average adherence to the Mediterranean diet, Lebanon has in fact been found to be among the countries facing a nutrition transition toward Western diets [76], hence promoting positive parenting such as authoritative style is worthwhile considering for increasing adherence to the Mediterranean diet heritage.

Regarding health-risk behaviors, our findings show that parenting styles were only prospectively associated with adolescents' alcohol consumption. In the households with authoritative parents, the probability of adolescent drinking was lower than that of households of neglectful parents. This is in line with previous research; adolescents from authoritative households were less likely to report alcohol use [30, 77], whereas neglectful and permissive parenting were associated with greater risk of drinking [33, 78]. The protective effect of

authoritative parenting in relation to adolescent drinking pertains to the underlying characteristics of this style: Authoritative parents are involved in their children's life, consistently monitoring their activities while setting appropriate limits. Perceived parental monitoring and control have been inversely associated with substance and alcohol use [79, 80]. In addition, authoritative parents use open communication and reasoning when discussing rules and values with their children, which makes it easier for the child to acknowledge and accept their authority, in this case, parental authority regarding alcohol use [81, 82]. Jackson *et al.* [28] found that compared to adolescents from authoritative parents, adolescents with neglectful parents are less likely to acknowledge parental authority regarding substance use. Moreover, the authoritative parenting style fosters self-regulation skills, helping adolescents be less susceptible to peer influence, able to resist temptations and defer from harmful behavior such as drinking [83, 84]. Parents should thus be important targets in substance use prevention programs, particularly training in authoritative parenting can have a fundamental role in the prevention against alcohol consumption among Lebanese adolescents. Even though parenting style was not found to be significantly associated with adolescent smoking, what is worth noting is the reciprocal association between alcohol consumption and smoking; adolescents who reported drinking were more prone to report smoking and vice versa. In fact, the co-use of alcohol and smoking is well known [85], as such, interventions aiming at addressing alcohol use may concomitantly promote smoking cessation [86]. Furthermore, the high prevalence of alcohol drinking among adolescents is alarming and point to a rising public health concern. Previous research shows that 85% of Lebanese youth had their first drink before the age of 14 years and that alcohol drinking increased by 40% in less than a decade [87]. Lebanon lacks proper alcohol control policies and regulations. Enforcing a legal age for alcohol purchasing and drinking as well as decreasing alcohol marketing and affordability are needed to protect Lebanese adolescents' health.

Past literature suggests that authoritative parenting might serve as a protective factor against unhealthy behaviors [28–39]. This was partly confirmed in our case for alcohol consumption and eating behavior as this protective effect was only significant in comparison to neglectful parenting. This may be explained by the parenting dimensions underlying the styles. Parental styles can be placed on a continuum between responsiveness and demandingness based on how responsive and demanding parents are toward their children [26]. Authoritative parenting is characterized by being on the high end of both parenting behaviors (demandingness and responsiveness or warmth and control) creating a healthy balance. By contrast, neglectful parenting is low on both of these dimensions by being neither responsive nor demanding. Whereas permissive and authoritarian share only one of the desirable traits of authoritative parenting and lack the balance of the other trait placing them between the best (authoritative) and worst (neglectful) parenting styles. The latter might explain why in general better outcomes appear to result for children of authoritative parents, while neglectful parenting by lacking both desirable parenting characteristics is consistently associated with the worst outcomes [88, 89] and outcomes for children of indulgent and authoritarian fall somewhere between the two extremes [66].

With regards to PA, our study did not find an association between parenting styles and PA levels. In fact, research on PA and parenting styles have yielded mixed results. A previous review by Sleddens *et al.* [90], found that children raised by authoritative and nurturing parents were generally more physically active [37, 91]. Nonetheless, some studies found that permissive parenting was positively associated with child's PA [92] while other studies failed to find any association at all [38, 93–95].

The evidence regarding PA and parenting style is not conclusive and may differ depending on the method of measurements of PA (recall survey or accelerometer) and is influenced by the gender of the children and parents [96]. In a study by Schmitz *et al.* [97], maternal authoritativeness was

associated with PA in girls, whereas maternal non-authoritative style was associated with higher levels of PA among boys. Another study found that authoritative parenting was positively associated with PA in boys while an authoritarian style was associated with increased PA in girls [44]. Our findings of an absence of a significant association between parenting and PA is in line with previous research indicating that there is limited support that a specific parenting style is an important predictor of PA [96]. Parents might instead influence their children's activity levels through activity-related parenting practices such as modeling and parental reinforcement of PA [98]. However, too few studies were conducted to draw firm conclusions, hence the need for more longitudinal research using objective measurements for PA and taking account of the mediating role of parenting practices.

BMI and parenting styles were not significantly associated in this study. Past literature examining the latter association has produced conflicting results. Authoritative parenting is generally associated with a healthier weight [36, 38, 99]. Nevertheless, there is no consensus on which parenting style is associated with the greatest risk of obesity. Rhee *et al.* [36] found that children of authoritarian parents had the highest prevalence of overweight, whereas, Olvera and Power [39] found that children of permissive parents were more likely to be overweight, in contrast Humenikova and Gates [42] indicated that authoritative parenting was associated with higher BMI in a sample of Czech children. Our findings, however, are consistent with other studies, indicating a lack of association of parenting style to BMI [93, 98, 100–102]. There are several explanations to these equivocal findings. Parenting styles may vary across different cultural backgrounds; a specific parenting style may be viewed as normative in one culture as opposed to detrimental or less acceptable in another, consequently parenting style influence may differ according to the sample and cultural context [103, 104]. Additionally, it has been suggested that parenting styles may not influence adolescents' weight directly but rather influence domain-specific parenting practices such as food- or activity-related parenting

practices which in turn affects weight directly [105]. Lastly, several other factors need to be taken into consideration when studying weight such as psychological, hormonal, genetic and biological factors, thus the importance of including other confounding variables such as parents 'characteristics' (e.g. parents' BMI) [99, 106].

Strength and limitations

Several strengths exist in this study. First and to the best of our knowledge, this is the first study in Lebanon to prospectively examine the association of parenting styles with health behaviors and BMI of adolescents. Second, anthropometric data collection was objectively measured by trained dietitians using standardized techniques. Third, this study targeted an important age group, one that is at risk for increased engagement in risky behaviors. On the other hand, some limitations should be considered when interpreting the findings. Firstly, data were self-reported and thus respondent and information bias cannot be ruled out. Secondly, the use of FFQ might be limited by measurement errors, reliance upon memory and the pre-specified list of food items included [107]. In this study, to overcome the limitation imposed by the fixed food list, an open-ended question about 'other food consumed' was added at the end of the FFQ. In addition, the dietitians were present in the classroom with food models to assist participants in portion size estimation. Despite these limitations, FFQ remains one of the most widely tools used in epidemiological studies as it provides information of food intake over an extended period of time while having a lower respondent burden and being cost effective [108, 109]. Thirdly, an additional limitation was the relatively low retention rate (60.56%), yet our analysis showed that participants who dropped had similar baseline characteristics to those who completed the study. Fourthly, the sample was taken from only two geographical areas: Mount Lebanon and Beirut. Beirut is the capital and largest city in Lebanon and together with Mount Lebanon they have the highest concentration of people and are representative of the various religious and socio-demographic

societies in Lebanon. However, the sample is not on a national level limiting the generalizability of the findings. Finally, even though the study controlled for the influence of a variety of factors such as age, gender, type of school, parents' education and religion, we did not control for parental BMI. The potential influence of genetics is well known, having one obese parents increases the risk for obesity in the child [110], hence the need to consider parental weight status as well.

Conclusion and recommendations for future research

Even though it was suggested that with age the influence of parents decreases while peers become the reference group, however, our findings show that parents remain a major source of influence for Lebanese adolescents aged 15–18 years, especially in the Lebanese culture where family approval and opinion still matters. In this study, parents—and in particular their authoritative parenting style—significantly influenced two aspects of adolescents' lifestyle: a healthy diet and moderate/less alcohol consumption. Our results replicate previous findings about the protective effect of authoritative parenting on health risk behaviors and highlight the importance of targeting the home environment and accounting for parenting styles in interventions aiming at promoting healthier behaviors of adolescent. Specifically, interventions aiming at encouraging better adherence to the Mediterranean diet and awareness raising on alcohol consumption should be conducted among Lebanese youth. Such interventions may target positive parenting style strategies for improving Lebanese adolescents' eating and drinking behaviors. Parenting interventions have been proven to be successful and a promising approach for positively influencing several child outcomes among which health behaviors and obesity [111, 112].

Future research should be conducted on a more representative sample and for a longer duration. Future studies conducted on Lebanese adolescent may also want to examine the impact of e-cigarettes and other types of substance use such as marijuana and illicit drugs and their relation to parenting styles.

Furthermore, much of the existing research focused on either parenting style or parenting practices separately. Parenting style has been suggested to have a moderating role between parenting practices and health behaviors. Future research examining the interaction (moderation or mediation) of parenting style and parenting practices using a longitudinal design is needed. Cross-cultural research is also needed to ultimately yield a better understanding of the similarities and differences of parenting across different populations and tailor culturally appropriate interventions and guidelines accordingly.

Conflict of interest statement

None declared.

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