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Abstract

Background: The Mediterranean diet serves as a proxy of a high-quality diet. Although several factors are known to affect a child's ability to follow a high-quality diet, no prospective data are available on factors that influence adherence to a Mediterranean diet among children. Our objective was to investigate the association of Mediterranean diet adherence with eating behaviors, lifestyle habits, and maternal education in a prospective cohort of children.

Methods The present prospective cohort analysis included 1639 children aged 8 to 10 years. The study was carried out during two academic years, 2012/2014, with an average follow-up of 15 months. Eating behaviors, physical activity, and adherence to Mediterranean diet were estimated by the Dutch Eating Behavior Questionnaire for Children, the Physical Activity Questionnaire for Children, and the KIDMED index, respectively.

Results Multivariate linear regression analysis adjusted for sex, age, maternal education, baseline adherence to the Mediterranean diet, and intervention group revealed a significant ($p<0.01$) inverse association of external eating and screen time with adherence to the Mediterranean diet at follow-up (mean of 15 months). The opposite association was found for meal frequency and physical activity ($p< 0.02$). A high level of maternal education increased the odds of a child's high adherence to the Mediterranean diet (OR=1.56 CI 1.13; 2.14) compared to peers whose mothers had only a primary education.

Conclusions

Screen time, physical activity, meal frequency, and external eating predict adherence to the Mediterranean diet independently of baseline diet quality. Maternal education level is an important prospective determinant for the adherence to the Mediterranean diet.

Keywords

Eating behaviors; Mediterranean diet; Socioeconomic status.

Abbreviations

DEBQ-C: Dutch Eating Behavior Questionnaire for Children; HEI: Healthy Eating index; PA: physical activity; PAQ-C: Physical Activity Questionnaire for Children; POIBC study: Spanish acronym for Prevention of Childhood Obesity: a community-based model;

1. Introduction

Healthy eating and lifestyle habits are essential to the health and well-being of children. A relationship has been observed between poor diet quality in children and cardiovascular risk factors such as obesity [1], high cholesterol [2] and high blood pressure [3]. Childhood obesity and diet quality is strongly influenced by a number of factors such as socioeconomic status and lifestyle behaviors including physical activity, sedentary behaviors, screen time (e.g., television, computers, smartphones), sleep duration, and eating habits (e.g., skipping meals, consuming sweets and fatty foods) [4–7].

The classical Mediterranean diet serves as a proxy of a high-quality diet in Mediterranean countries [8,9]. It consists of generous consumption of fruits, vegetables, whole grains, legumes, increased consumption of fish and nuts, and liberal use of olive oil in food preparation. In children, following a Mediterranean dietary pattern promotes good health by decreasing cardiovascular [10,11] and metabolic syndrome risk factors [12,13]. Despite mounting evidence of these health benefits, one third of children in Spain do not consume any amount of fruits or vegetables on a daily basis [14]. Moreover, average reported rates of daily fruit and vegetables intake in children decreased from 76.5% in 2003 to 64.4% in 2012 [14]. Overall adherence to a Mediterranean diet is declining among children and adolescents in Mediterranean countries [15,16]. A number of factors influence diet quality among Spanish children. Arriscado et. al. found that adherence to a Mediterranean diet differs according to the type of school attended and the child's nationality and socioeconomic status[4]. In addition, the amount of physical activity and screen time influence children's dietary patterns [17,18]. Eating habits and behaviors also have an impact on children's diet quality, such as eating fewer than three meals per day [19], eating

more meals away from home [20], and eating in response to negative emotions [21]. However, most of the evidence is based on cross-sectional studies.

Therefore, the present study aimed to investigate prospectively the association between adherence to the Mediterranean diet and lifestyle factors, eating behaviors, and maternal education in Spanish children aged 8 to 10 years.

2. Methods

Study design and participants

This study was a prospective cohort analysis within the framework of the POIBC study (Spanish acronym for Prevention of Childhood Obesity: a community-based model). The complete protocol of the POIBC study has been reported elsewhere [22]. In brief, this was a parallel intervention study to determine the effect of the THAO-Child Health Program [23], a Spanish Community Based Intervention on weight management, physical activity, quality of life, diet, sleep quality, and behaviors. The study recruited 2249 children aged 8 to 10 years to participate in an intervene//tion that was carried out during two academic years (2012/2014) with a mean follow-up of 15 months. After excluding missing data on emotional, restrained, and external eating, 1639 participants remained in the analysis.

Ethics committee approval

The study was approved by the local Ethics Committee (CEIC-PSMAR, Barcelona, Spain). Parental written consent was obtained on behalf of each of the children.

Adherence to the Mediterranean diet

Adherence to the Mediterranean diet was estimated by the KIDMED index, derived from a 16-item questionnaire with a dichotomous (yes/no) response format developed in 2004 [24]. This questionnaire shows good reliability and construct validity [25-27]. The KIDMED index was created specifically to estimate levels of adherence to the Mediterranean diet in children and young adults, based on the principles that sustain the Mediterranean dietary pattern and those that undermine it. Four items denoting lower adherence were assigned a value of -1 [Goes more than once a week to a fast-food restaurant; skips breakfast; has commercially baked goods or pastries for breakfast; takes sweets and candy several times every day] and the 12 items related to higher adherence were scored +1 [Takes a (serving/piece of) fruit or fruit juice every day; has a second (serving/piece of) fruit every day; regularly has fresh or cooked vegetables once a day; has fresh or cooked vegetables more than once a day; consumes fish regularly; likes pulses and eats them more than once a week; consumes pasta or rice almost every day (5 or more times per week); has cereals or grains (bread, etc.) for breakfast; consumes nuts regularly (at least 2–3 times per week); uses olive oil at home; has a dairy product for breakfast (yoghurt, milk, etc.); takes two yoghurts and/or some cheese (40 g) daily]. Individual scores on the 16 binary questions of the KIDMED index ranged from -4 to 12 points, with the higher total scores indicating greater adherence to the Mediterranean diet. The overall adherence to the Mediterranean diet was considered as a continuous variable and was included as the dependent variable in multiple linear regression analysis (Table 5) and in the generalized equation model (Table 3). To facilitate comparison of these data with findings from other studies, Table 1 presents descriptive data showing additionally KIDMED index scores by category (poor= $\leq$3 points, medium = 4-7 points, and high = $\geq$8 points adherence).

Assessment of eating behaviors

Eating behaviors were determined by the validated [28] Dutch Eating Behavior Questionnaire for Children (DEBQ-C) for use with Spanish children [29] . The DEBQ-C is adapted to age (7 to 12 years old) and assesses three behaviors: External Eating, Emotional Eating, and Restrained Eating. It is a self-administered questionnaire composed of 20 Likert-type questions. The DEBQ-C had a structured multi open response format. Each of the DEBQ-C items has 3 possible answers (1 = "no", 2 = "sometimes", 3 = "yes"), grouped in 3 scales: "emotional eating", which included 7 questions (numbered 2, 3, 9, 12, 15, 17, 19), "restrained eating", which included 7 items (numbered 4, 6, 8, 11, 14, 16, 18), and "external eating", including 6 items (numbered 1, 5, 7, 10, 13, 20). A higher sum score indicates a higher tendency for the specific type of eating behavior.

Assessment of physical activity

Level of physical activity (PA) was assessed by the Physical Activity Questionnaire for Children (PAQ-C). The PAQ-C has nine items asking about activities of the last 7 days and provides a summary PA score [30]. The PAQ-C has been validated in various studies [30-33]. This questionnaire shows good content validity, and moderate reliability and construct validity [30-33]. The PAQ-C had a structured multi open response format. The first of the nine PAQ-C items asks for the weekly frequency (no, 1-2, 3-4, 5-6, 7 times or more) of 22 leisure and sport activities. The frequencies were scored from 1 (for no activity) to 5 (for 7 times or more). The mean of all activity frequencies was calculated for PAQ-C item 1. The remaining 8 PAQ-C items ask for activities conducted at a specific time of the day (e.g., recess, lunchtime, after school). Each item is scored between 1 (low) and 5 (high physical activity). The mean score of all items constitutes the overall PAQ score

Meal frequency

Questions on meal frequency were adapted from the lifestyle questionnaire of the enKid study (34). The following eating occasions were used to define a meal: breakfast (in the morning), 1st snack (mid-morning), lunch (mid-day), 2nd snack (afternoon snack), and dinner (evening). Meal frequency was determined based on 3 possible answers (1 = "no", 2 = "sometimes", 3 = "yes"), to the question if they regularly have breakfast, a mid-morning snack, lunch, an afternoon snack, and dinner. Responses were coded dichotomously: “No” and “sometimes” as 0 and “yes” as 1. Coding for the 5 meal occasions constitutes the meal frequency score, which can range from 0 to 5.

Screen time

Screen time, including television viewing, computer use (games and internet), and console games, was measured by questions on screen time-based sedentary behaviour adapted from the HELENA study’s questionnaire (35). Children were asked how much time they habitually spend on television viewing, computer use, and console games during the week (Monday to Friday) and on weekends (Saturday and Sunday). There were six response options: a) none at all, b) less than 30 minutes per day, c) at least 30 and less than 60 minutes per day, d) at least 60 and less than 120 minutes per day, e) at least 120 minutes and less than 180 minutes per day, and f) more than 180 minutes per day. The average time of categories was calculated as a) 0 minutes, b) 15 minutes, c) 45 minutes, d) 90 minutes, e) 150 minutes, and f) 240 minutes. Total weekly screen time was calculated by the mean time in each of the 3 selected categories and applying this formula:

[(weekdays × 5) + (weekend × 2)]/7.

Other variables

Maternal education level was categorized into 5 levels: i) no schooling, ii) primary school, iii) secondary school, iv) technical or other university degree, and v) higher (graduate-level) university degree.

Statistical analysis

Pearson correlation coefficients were used to assess the associations among exposure variables.

The chi-square test was used to determine secular changes (% change) in dichotomous variables between baseline, coded as 0, and follow-up, coded as 1, for each component of the KIDMED index. Logistic regression models were fitted to test secular trends, independent variable (i.e., change from baseline (0) to follow-up (1) in proportions of the binary outcomes on the 16 items from the KIDMED index), adjusting for confounding variables (sex, age, intervention group, physical activity, screen-time, meal frequency, maternal education, and external, emotional, and restrained eating). Generalized estimating equation models were used to assess the time trend of adherence to the Mediterranean diet, measured by the KIDMED index (continuous variable), adjusted for age, sex, intervention group, maternal education, physical activity, meal frequency, screen time, and external, emotional, and restrained eating.

Linear regression analysis was used to determine the prospective association of KIDMED index score with eating behaviors, eating habits, screen time, and physical activity. The dependent variable of these models was the KIDMED index (outcome). The exposure variables –physical activity, meal frequency, screen time, and restraint, emotional, and external eating– were all included as the independent variables in these models. Final

models were additionally adjusted (co-variables). All models were adjusted for sex, age, intervention group, and maternal education. The final prospective analysis was further adjusted for baseline adherence to the Mediterranean diet.

The association between maternal education level and the KIDMED index had an non-linear shape. Therefore, logistic regression was performed to assess the prospective association between maternal education and adherence to the Mediterranean diet. Models were adjusted for sex, age, intervention group, physical activity, screen time, meal frequency, and emotional, external, and restrained eating. The final prospective analysis was additionally adjusted for baseline adherence to the Mediterranean diet.

Associations were considered significant if $P < 0.05$. The SPSS for Windows version 18 (SPSS, Inc., Chicago, IL, United States) was used for all statistical analysis.

3. Results

Table 1 presents descriptive characteristics of the participants. The mean age was 10.1 (SD 0.6) years.

Participants excluded due to missing exposure or outcome variables did not differ significantly from those included in this cohort analysis in key baseline characteristics (Table 2)

Adherence to the Mediterranean diet decreased during the follow-up period of approximately 2 years (Table 3). Significant unfavorable changes in specific dietary habits were observed for the daily consumption of a second fruit serving (from 46.9% to 41.9%), a

second vegetable serving (from 25.6% to 20.9%), and yogurt or cheese consumption (from 73.7% to 69.9%). Additionally, the proportion of children who skipped breakfast and ate at least once a week in fast-food restaurants increased from 4.9% to 6.8% and 19.2% to 28.4%, respectively. The only positive change reported was a significant increase in use of olive oil, from 89.2% to 92.3%.

Table 4 shows the correlations among exposure variables. Correlations ranged from -0.006 (emotional eating/physical activity) to 0.390 (emotional eating/external eating)

At baseline, adherence to the Mediterranean diet was positively associated with physically active, meal frequency and restrained eating adjusted for age, sex, intervention group, and maternal education. The opposite was true for screen time, emotional eating, and external eating (p for all associations < 0.001).
In a prospective analysis adjusted for age, sex, intervention group, and maternal education, positive predictors of adherence to the Mediterranean diet included physical activity, meal frequency, and external eating. The opposite was true for external eating and screen time (Table 5).

After additional adjustment for baseline adherence to the Mediterranean diet, an increase of 1 unit in the external eating score and 100 minutes in screen time were prospectively associated with a decrease in the Mediterranean diet score at follow-up of 0.49 and 0.20 units, respectively ($p < 0.001$). In contrast, the Mediterranean diet score increased by 0.23 units at follow-up in the case of an increase of 1 unit in physical activity score or 1 meal frequency ($p < 0.001$)

Logistic regression modelling adjusted for sex, age, and intervention group showed that mothers having higher education levels was predictive for high adherence to the Mediterranean diet (Table 6). Children of university-educated mothers showed 78% higher odds of high adherence to the Mediterranean diet, compared to children whose mothers had only a primary education. This association was somewhat attenuated, but still significant, after further adjustment for baseline adherence to the Mediterranean diet.

4. Discussion

This prospective study aimed to assess the association between adherence to a healthy Mediterranean diet and lifestyle factors, eating behaviors, and maternal education. The main finding was that higher levels of physical activity and meal frequency, and low screen time, and external eating were associated with higher adherence to the Mediterranean diet independently of baseline diet quality. Furthermore, greater maternal education was predictive for higher adherence to the Mediterranean diet of their children.

Adherence to a Mediterranean diet has a positive impact on children's lifestyle [36]. Several cross-sectional studies have found a relation between physical activity level and adherence to a Mediterranean diet [4,17,37,38,39]. Although Ozen et al. found no association between adherence and physical activity in Balearic Islands adolescents [40]. Cross-sectional studies showed that less time spent in sedentary behaviors, such as screen time, was associated with better Mediterranean diet adherence [38, 41,42]. In a recent study in Catalan adolescents, adherence to a Mediterranean diet was positively associated with physical activity and low screen time, and particularly with the leisure time

adolescents spent on computers during weekdays [7]. These findings were in line with the cross-sectional and prospective results of the present study.

Studies suggest that dietary patterns established during childhood and adolescence persist into adulthood [43]. To our knowledge, our work is the first prospective study to examine associations between eating behaviors and diet quality in Spanish children. We found that increasing meal frequency predicted good diet quality. This result is aligned with a study done in elementary school-age children and adolescents, where meal frequency was positively associated with total HEI-2005 score [19].

The results of the present study showed that lower scores of external eating behavior predicted a higher adherence to the Mediterranean diet after 15 months of follow-up. The positive influence of parents and other individual factors could explain this association. Parents more aware about the importance of healthy eating are less likely to permit unhealthy external cues during childhood and early adolescence [44]. Between 8 and 12 years of age, eating behaviors are usually still regulated by parents, especially by those parents that are more focused on their child's education. More aware parents tend to promote a better diet quality and have more frequent family meals, where healthy eating behaviors are usually promoted and maladaptive external eating behaviors could be addressed [45] . Items with a positive score in the external eating scale, such as a desire to eat when passing a snack bar or feeling attracted by fast food restaurants, are more commonly selected by children with poor diet quality because they encourage more frequent consumption of sweet and/or savory snack-food [46]. This kind of desires or attractions tend to result in unhealthy eating behaviors like eating sweets, snacks, or fast

288 food when parents are more indulgent or permissive and children have less clear limits of
289 permitted and non-permitted eating behaviors.

290 Another field of scientific evidence has studied the association between eating behaviors
291 and other health outcomes such as stress. A longitudinal study found that higher levels of
292 stress in children aged 5-12 years old is associated with increased external eating and
293 facilitates behaviors like eating in absence of hunger [47]. Moreover, stress and other
294 negative health outcomes in children is widely associated with a neglectful parent
295 educational model [48], a parental style that may not establish limits regarding eating
296 behaviors and consequently be promote a poor diet quality during childhood. Stress is also
297 broadly associated with other emotional unbalancing, like low self-esteem –also associated
298 with a lower diet quality [49] .

299 In contrast, emotional and restrained eating behaviors are not significantly associated to
300 Mediterranean diet adherence. External eating is the behavior most likely to be controlled
301 by parents who determine the foods that can be selected; therefore, parenting style could
302 play an important role in the observed association with adherence to the Mediterranean
303 Diet. In contrast, the emotional and restrained eating scales evaluate more individual
304 behaviors. Children included in the study were younger than 12 years, an age group with a
305 low level of individual autonomy in food intake responding to emotional and restrained
306 feelings. The mean age of the studied population could explain the null association of
307 emotional and restrained eating with diet quality and the significant association with
308 external eating, as some studies in adolescent [50] or adult [51] populations have found a
309 significant association.

Parental education level is considered as a socioeconomic factor that influences youth adherence to a Mediterranean [7,13,17] diet, and diet quality in general [39]. Several cross-sectional studies in Spanish children and adolescents showed lower adherence to the Mediterranean diet in families with less favorable socioeconomic status. [7,13,17]. In the present study, children whose mothers had a university degree had 1.6 higher odds of prospectively high adherence to the Mediterranean diet. This association might be partially explained by the economic level of the family, which can lead to better access to healthy food choices [52]. In a recently publication from our group, we found that families with higher educational level spend more money for food and concomitantly showed a higher adherence to the Mediterranean diet [53] . In addition, a high maternal educational level implies better nutritional knowledge, food choices, and parenting practices [54].

4.1 Strengths and limitations

Data on adherence to the Mediterranean diet, dietary behavior, and other lifestyle variables were recorded by questionnaires and therefore prone to the inherent limitations of self-reported data, such as memory bias, misunderstanding, and social desirability. At about 8 years of age, children have the cognitive skills to self-report health data [56], and several questionnaires, including those used in the present study, have been designed and validated to collect these data from children aged 8 years and older [57]. Our study had a high percentage of participants near 8 years old, which could be a limitation because more than 30 minutes was usually invested in answering all the questionnaires; the attention span could be shorter at this age than for older children more used to invest time in reading. Additionally, cognitive skills of children aged 8 to 10 are not fully developed, which could have a stronger effect on response accuracy of self-reported data, compared to adults.

A total of 2250 families were recruited for POIBC, a community-based intervention study. In the present study, a prospective cohort analysis within the POIBC framework, we included 1639 children with complete exposure and outcome data. POIBC participants excluded due to missing exposure or outcome variables (37.2% non-response) did not differ significantly from those included in this cohort analysis in key baseline characteristics: age, sex, weight, adherence to the Mediterranean diet, physical activity, screen time, and mother's educational level. Given the similarities between the groups, the benefits of a complete dataset for exposure and outcome analysis outweigh the potential impact on the findings of a relatively high non-response rate.

5. Conclusion

In conclusion, less screen time, higher level of physical activity, higher meal frequency, and a lower external eating behavior were prospectively associated with high adherence to the Mediterranean diet independently of baseline diet quality. Additionally, higher maternal education was predictive of a healthy diet.

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Table 1. Characteristics of the study population (n=1639)

Age (years)	10.1±0.62
Boys (%)	51.8 (849)
Maternal education (%)	
- University	29.4 (482)
- Secondary school	47.8 (784)
- Primary school	22.8 (373)
KIDMED index (unit)[a]	6.8±2.4; -3/12
High KIDMED index (%)[b]	40.4 (662)
Medium KIDMED index (%)[c]	50.0 (819)
Low KIDMED index (%)[d]	9.6 (158)
Emotional eating (unit)[a]	1.26±0.40; 1/3
Restrained eating (unit)[a]	2.00±0.38; 1/3
External eating (unit)[a]	1.80±0.51; 1/3
Physical activity (unit)[a]	2.98±0.74; 1.00/4.98
Screen time (min/d)	90 (49;165)
Meal frequency	3.3±0.8

[a] Scores included minimum and maximum values. [b] KIDMED index ≤3;

[c] KIDMED index 4-7; [d] KIDMED index ≥8.

Values are expressed as mean (standard deviation) or median (interquartile range) or proportion (n) .

Table 2. Characteristics of participants included in this study versus those excluded due to missing variables

	Included n= 1639	Excluded = 611	p
Age (years)	10.2±0.62	10.1±0.56	0.15
Boys (%)	51.8 (849)	52.0 (363)	0.66
Weight (kg)	37.5±8.5	38.2±8.9	0.06
Maternal education (%)[a]	29.4 (482)	31.7 (131)	0.33
KIDMED index (unit)	6.8±2.4	6.9±2.7	0.60
Physical activity (unit)	2.98±0.74	2.90±0.70	0.25
Screen time (min/d)	90 (49;165)	83.5 (45;171)	0.94

[a] University degree

Values are expressed as mean (standard deviation) or median (interquartile range) or proportion (n) .

Chi-squared and independent samples t-test for categorical and normal distributed continuous variables respectively. Mann-Whitney U test for non-parametric variables.

Table 3. Secular trends of adherence to the Mediterranean diet of Spanish children between 2011/2012 and 2013/2014[a]

Items of the KIDMED index	2011/12 (n = 1639)	2013/14 (n = 1639)	OR (95%CI)[b]	p value
Takes a fruit or fruit juice every day	70.0 (1147)	67.7 (1110)	0.90 (0.77;1.05)	0.168
Has a second fruit every day	46.9 (769)	41.9 (687)	0.80 (0.70; 0.93)	0.003
Has fresh or cooked vegetables regularly once a day	59.9 (981)	59.2 (971)	0.97 (0.84; 1.12)	0.691
Has fresh or cooked vegetables more than once a day	25.6 (419)	20.9 (343)	0.77 (0.65; 0.90)	0.002
Consumes fish regularly (at least 2–3 times/week)	66.6 (1092)	68.9(1130)	1.11 (0.97; 1.20)	0.137
Eats >1 meal/week in fast food restaurants (hamburger)	19.2 (314)	28.4 (465)	1.73 (1.46; 2.04)	<0.001
Likes pulses and eats them more than once a week	63.9 (1048)	65.5 (1073)	1.07 (0.92; 1.24)	0.374
Consumes pasta or rice at least 5 days per week	51.5 (844)	49.2 (807)	0.92 (0.80; 1.05)	0.205
Has cereals or grains (bread, etc.) for breakfast	69.1 (1132)	68.4 (1121)	0.97 (0.83; 1.13)	0.674
Consumes nuts regularly (at least 2–3 times/week)	45.8 (750)	43.4 (712)	0.91 (0.79; 1.05)	0.179
Uses olive oil at home	89.3 (1464)	92.3 (1512)	1.43 (1.13; 1.82)	0.004
Skips breakfast	4.9 (81)	6.8 (111)	1.41 (1.05; 1.91)	0.024
Has a dairy product for breakfast (yoghurt, milk, etc.)	84.1 (1178)	86.2 (1413)	1.18 (0.97; 1.44)	0.091
Has commercially baked goods or pastries for breakfast	22.4 (367)	20.1 (329)	0.86 (0.73; 1.03)	0.096

Takes 2 cups of yoghurts and/or some cheese (40 g) daily	73.7 (1208)	69.9 (1145)	0.83 (0.71; 0.96)	0.015
Takes sweets and candy several times every day	17.5(287)	16.8 (275)	0.95 (0.78; 1.15)	0.590
			B coefficient (95%CI)[c]	
Average scoring for the KIDMED index	6.8 (6.7;6.9)	6.6 (6.5;6.7)	0.96 (0.72; 0.97)	<0.001

[a] Variables are expressed as proportion (n) and mean (95% confidence interval)

[b] Logistic regression adjusted for age, gender, intervention group, physical activity, screen time, meal frequency, maternal education, and external, emotional, and restrained eating was used to determine the odds of secular changes of dichotomous outcomes .

[c] Generalized estimating equation models adjusted for age, gender, intervention group, physical activity, screen time, meal frequency, maternal education, and external, emotional, and restrained eating were used to assess the time trend for continuous variables.

Table 4. Pearson correlation coefficients among exposure variables

	Emotional eating	Restrained eating	External eating	Physical activity	Screen time	Meal frequency
Emotional eating	1	0.043	0.390**	-0.006	0.133**	-0.035
Restrained eating	0.043	1	0.008	0.098**	-0.063*	0.012
External eating	0.390**	0.008	1	-0.045	0.198**	-0.017
Physical activity	-0.006	0.098**	-0.045	1	0.084**	-0.021
Screen time	0.133**	-0.063*	0.198**	0.084**	1	-0.008
Meal frequency	-0.035	0.012	-0.017	-0.021	-0.008	1

* $p < 0.05$

** $p<0.001$

Table 5. Association of adherence to the Mediterranean diet (KIDMED index score) with eating behaviors and lifestyle habits in children (n=1639) [a]

	β coefficient	95 % confidence interval	*p*
Model 1[b]			
Emotional eating (unit)	0.066	-0.240;0.373	0.672
Restrained eating (unit)	0.223	-0.074;0.521	0.141
External eating (unit)	-0.765	-1.006;-0.524	<0.001
Physical activity (unit)	0.470	0.313;0.628	<0.001
Screen time (min/d)	-0.003	-0.004;-0.002	<0.001
Meal frequency	0.250	0.107;0.392	0.001
Model 2[c]			
Emotional eating (unit)	0.113	-0.172;0.398	0.437
Restrained eating (unit)	0.057	-0.221;0.334	0.689
External eating (unit)	-0.486	-0.713;-0.258	<0.001
Physical activity (unit)	0.227	0.077;0.376	0.003
Screen time (min/d)	-0.002	-0.003;-0.001	0.001
Meal frequency	0.165	0.032;0.299	0.015

[a] Multiple linear regression analysis with KIDMED index at follow-up as the dependent variable and screen time, meal frequency, physical activity, and emotional, restraint, and external eating as the exposure variables at baseline. All exposure variables were simultaneously included in models 1 and 2.

[b] Model 1 adjusted for age, sex, intervention group, and maternal education.

[c] Model 2 adjusted for age, sex, intervention group, maternal education, and baseline adherence to Mediterranean diet.

Table 6. Multiple logistic regression models of the relationship between maternal education and high adherence to Mediterranean diet[a]

	n	OR (95% CI)
Model 1[b]		
- Primary education (reference group)	482	1
- Secondary education	784	1.21 (0.92; 1.60)
- University education	373	1.78 (1.32; 2.41)
p for linear trend		<0.001
Model 2[c]		
- Primary education (reference group)	482	1
- Secondary education	784	1.20 (0.90; 1.59)
- University education	373	1.56 (1.11; 2.14)
p for linear trend		0.005

[a] High adherence to the Mediterranean diet: KIDMED index ≥ 8

[b] Module adjusted for age, gender, and intervention group

[c] Module adjusted for age, gender, intervention group, physical activity, screen time, meal frequency, and external, emotional, and restrained eating age, sex, intervention group, and baseline adherence to Mediterranean diet.