

## Research Report

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# Health-related quality of life, Mediterranean diet, physical activity and socioeconomic factors of Greek adolescents during COVID-19: A cross sectional study

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### Abstract.

**BACKGROUND:** Health related quality of life of the adolescents during quarantine and social isolation potentially decreases, with significant alteration on physical activities and nutrition behaviour.

**OBJECTIVE:** The present study investigates the relationship between Greek adolescents' health related quality of life and socioeconomic factors, lifestyle and dietary characteristics, along with their adherence to the Mediterranean Diet immediately after the lockdown period in Greece.

**METHODS:** A total sample of 459 students aged 12–16 years old were recruited from secondary schools in the area of Athens. The KIDSCREEN-27 questionnaire for children and adolescents, the KIDMED test, the Godin and Shephard Leisure Time Physical Activity Questionnaire and the Family Affluence Scale III, were used for the statistical analysis. *T*-tests, Kruskal Wallis, Chi-square, Anova tests and multiple regression analyses were employed.

**RESULTS:** Econometric analysis reveals that adolescents' health related quality of life is higher among boys, adolescents who live with both parents, tend to sleep more during night and do not spend many hours on screen viewing. Also, adolescents with higher family affluence level, being physically active and with a high adherence to the Mediterranean Diet have higher health related quality of life.

**CONCLUSIONS:** Adolescents' adherence to the Mediterranean Diet, physical activity, socioeconomic characteristics and life style behaviors are highly correlated with perceived health related quality of life during COVID-19 period.

Keywords: KIDSCREEN-27, KIDMED test, SES, Mediterranean diet, Adolescents, COVID-19

## 1. Introduction

Health Related Quality of Life (HRQoL) provides insight about physical, psychological, emotional and social dimensions of peoples' well-being and is an important descriptor of perceived health [1, 2]. The evaluation and the improvement of health of children and adolescents is a very important public health issue as it impacts on

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well-being and health later in life [3]. Especially during the past years, the pandemic of COVID-19 had a severe psychological impact on the general population [4]. Due to tremendous changes in human lifestyle, studies reported worse perceived health for children and adolescents [5]. Focusing on adolescents, studies have found a negative association between COVID-19 and several mental health conditions such as depressive symptoms, feelings of greater loneliness [6], increased state of anxiety [7] lower level of psychological wellbeing [8] or decreased level of life satisfaction [9]. Furthermore, during the pandemic children and adolescents are more likely to have poor nutrition and reduce physical activity [10] with children from poorer families being more vulnerable.

This article investigates the potential relationships between HRQoL and aspects of adolescents everyday life. This includes physical activity or sedentary habits, sleep patterns, eating behavior, Adherence to the Mediterranean Diet (AMD) and Body Mass Index (BMI) in a period of school closures, nationwide lockdown and quarantine measures. On our knowledge, this is the first study conducted in Greece, investigating the HRQoL and the relation to AMD of adolescents during COVID-19.

As far as nutrition is concerned, studies have shown that healthier dietary choices of adolescents have a positive effect on their perceived HRQoL [11]. A diet high in sugar and fat can be a risk factor for physical and psychological health, leading to severe health problems [12, 13]. Previous studies suggest that overweight and obese, children and adolescents report lower HRQoL compared to those of normal weight [14, 15]. On top of this, according to Schwimmer et al., severely obese children and adolescents, are more likely to have lower HRQoL than healthy adolescents, reaching values similar for youth with cancer [16]. On the other hand, the high AMD characterized by the wide consumption of olive oil (as the main added lipid), whole grains, fresh fruit and vegetable, the weekly consumption of dairy products, fish, legume, poultry, nuts and low consumption of red meat and sweets, is positively correlated to HRQoL in adults [17–20] and adolescents [21–25].

The discussion in relevant literature demonstrates limited empirical evidence regarding the relationship between the levels of HRQoL and AMD in Greece [21, 23]. Thus, it is of high importance for researchers to focus on the correlation between perceived HRQoL of adolescents and AMD. Nonetheless, this is the first study conducted in Greece, investigating the HRQoL and the relation to AMD of adolescents during COVID-19 pandemic. To fill the mentioned gap, this study is original research aiming to investigate the HRQoL of Greek adolescents and analyze whether a higher AMD can be correlated with a better self-perceived health. It also considers COVID-19 and pandemic's policy measures, such as lockdown and quarantine, which changed the habits of adolescents. It investigates whether the isolation and the social distancing has decreased physical activity and diet quality, whilst providing more analytical and parametrical results for the scientific society.

More specifically, this study examines the Mediterranean diet-health status relationship, exploring possible relations between the level of physical activities and quality of life amid adolescents. Furthermore, it analyzes the impact of adolescents socioeconomic status on HRQoL, investigating the effectiveness of a series of policies towards a better lifestyle. These policies focus on changing physical activity, nutrition behavior and AMD.

## 2. Methodological approach

### 2.1. Sampling and participants

In this cross-sectional research study 459 adolescents (47.1% boys; 52.9% girls) participated. They were aged between 12–16 years, attending schools throughout the Attica region. The research took place during May–June 2021.<sup>1</sup> A proportionate random stratified sampling method according to students' population of

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<sup>1</sup> Sample size calculation was based on the following statistics: margin of error = 5%, confidence level = 95%, population size = 109,400 students and response distribution = 50%. 383 or more individuals are needed to have a confidence level of 95% that the real value is within  $\pm 5\%$  of the measured/surveyed value. 600 questionnaires were distributed with 76.5% acceptance rate.

secondary education of the school year 2018/ 2019 in Attica (Hellenic Statistical Authority), was employed and questionnaires were distributed in 7 public high schools in the Attica area.<sup>2</sup> The participation in the study was voluntary and took place during school hours. Prior to this, informed consent forms signed from the corresponding parent or guardian were collected. All participants received explanation of the purpose of the study and were reassured for the confidentiality of their answers (according to GDPR). Beforehand they were given written and oral instructions for filling in the questionnaire. The main investigator (S.P.) was present in the classroom in order to provide guidance during the completion of the questionnaires, which lasted approximately 30 minutes. The research was approved by the West Attica University Research Ethics Committee (18092- 03/03/2021) and the Institute of Educational Policy of Greece (59235/2021).

## 2.2. Measures

A structured questionnaire was developed for the study. We evaluated self-reported anthropometric data and used the International Obesity Task Force (IOTF) cut off points to categorize the adolescents into four groups, underweight normal, overweight and obese. Perceived HRQoL was assessed by the KIDSCREEN-27 questionnaire for children and adolescents. The adolescents also completed the KIDMED test and the Godin and Shephard Leisure Time Physical Activity Questionnaire (GSLTPAQ). To evaluate the socioeconomic status (SES) the Family Affluence Scale (FAS) III was used.

All the mentioned instruments are reliable and validated for the Greek population or different countries and are widely applied in research studies [26–29]. Also, a collaboration form for the use of the questionnaires was signed for the KIDSCREEN and the FAS III between The KIDSCREEN Group Europe and the University of Mental Health, Neurosciences and Precision Medicine, Research Institute Costas Stefanis. Finally, KIDMED and GSLTPAQ questionnaires were translated into the Greek language using the forward- backward translation method. The questionnaire included general background questions about adolescent demographic and anthropometric parameters, sedentary and physical activities, eating behavior, life style characteristics and sleep patterns. The questionnaires were first piloted using a group of 50 pupils in order to identify any ambiguous questions.

The HRQoL was assessed using the KIDSCREEN-27 questioner for children and adolescents [30] measuring 5 HRQoL dimensions: physical well-being (5 questions), psychological well-being (7 questions), autonomy and parent relations (7 questions), social support and peers (4 questions) and school environment (4 questions). These five dimensions provide insights for children and adolescents in relation to physical activities, fitness, health, satisfaction and positive feelings, the interaction with their parents and peers, the autonomy they have based on their perception, the satisfaction they gain with their financial resources, their social relations and finally, their feelings about school and their learning process. Higher score indicates better self-perceived HRQoL.

AMD was assessed using the KIDMED test [31] which classifies individuals into three categories on the KIDMED index -low, medium and optimal adherence to MD-, based on their YES or NO answers to 16 questions. Twelve of the questions with positive connotation to the Mediterranean Diet (MD) are assigned with +1 and four of them with negative connotation are assigned with -1. In case the individual's total score is higher than 8, the responder has an optimal MD. In case it is between 4 and 7, improvements need to be made to reach the MD patterns. In case the score is less than 3 the diet's quality is very low.

The level of Physical Activity (PA) was assessed using the Godin and Shephard Leisure Time Physical Activity Questionnaire [32], based on self-reported weekly PA frequencies. The leisure activity score is based on the sum of the weekly frequencies of strenuous, moderate and mild activities multiplied by 9, 5 and 3 respectively. The

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<sup>2</sup> Probability proportional to size (PPS) sampling was applied. The sampling of schools was stratified by region, proportionally to the total number of adolescences attending these schools. Following this procedure, an appropriate number of schools were randomly selected from each one of these regions. The selection of school was based on the division of seven (7) mainland regions of Attica (West Attica, East Attica, North Athens, South Athens, Central Athens, Piraeus, West Athens).

adolescents were classified into three categories: active with a score of more than 24 units, moderately active with a score between 14 and 23 units and insufficiently active with a score less than 14 units.

Finally, the FAS III [28], implemented by the World Health Organization's (WHO) Health Behaviour in the School-aged Children (HBSC) 2017/ 2018 study, was used to estimate adolescents socioeconomic assets. The FAS III includes 6 questions about material assets in the household such as owning a family car/ van/ truck (with responses no, one, two or more), having an own bedroom (no, yes), number of bathrooms (none, one, two, more than two), having a dishwasher (no, yes), number of computers in the household (none, one, two, more than two) and finally, the frequency of family travel abroad for holiday/vacation during the past year (not at all, once, twice, more than twice). According to their affluence score, adolescents were classified into three categories, low affluence (20%), medium (60%) and high (20%) [33].

The anthropometric questions involved data about gender, age, height and weight. The BMI ( $\text{kg}/\text{m}^2$ ) was calculated according to the participants self-reported data about their weight and height. Greek adolescents were categorized accordingly as underweight normal weight, overweight and obese following the IOTF sex- and age-specific BMI cut- off points [34, 35].

### 2.3. Statistical and econometric analysis

Due to the sampling procedure described above, the present data yields robust estimates in this study. Descriptive statistics were performed using frequencies (N), percentages, means and standard deviations. Cronbach's alpha coefficient was used to measure internal consistency. The normality assumption of the sample seemed to be reasonable because of sample size and of the low values of skewness and kurtosis coefficients ( $<|1|$ ) [36], except the distributions by weight categories where Kruskal Wallis tests were employed for estimating the statistically significant differences between several groups of adolescents. For the statistical and econometric analyses, first of all the correlation coefficient was determined with possible associations between total HRQoL score along with the aforementioned five dimensions and BMI, AMD, PA, family affluence and other lifestyle variables. Secondly, *T*-test, Anova and Kruskal Wallis tests were employed for estimating the statistically significant differences between several groups of adolescents. Thirdly, Chi-square and multiple linear regression analysis were performed to study the effect of demographic, socioeconomic parameters and AMD on adolescent's HRQoL. More specifically, the following equation was estimated:

$$HRQoL_i = a_i + b_i X_i + e_i$$

Where  $HRQoL_i$  is the total score of KIDSCREEN-27 for each individual,  $a_i$  is the constant term,  $X_i$  is the vector of socioeconomic and anthropometric characteristics,  $b_i$  is the estimated coefficient for each independent variable and  $e_i$  is the error term for the estimated regression.<sup>3</sup>

## 3. Results

### 3.1. Sample characteristics

The following table (Table 1) presents the sample characteristics in total and by gender.

The sample consists of 241 girls (52.9%) and 215 boys (47.1%). The majority of girls indicate that they read around 2–3 hours per day while boys read less (41.4% read around 1 hour per day) and used screens more (31.7% ~ around 2–3h per day). Also, one in four boys go out for a walk almost every day but this applies to only 13.8% of the girls. Regarding their nutrition habits, around 11% of the adolescents consume breakfast with their families everyday, while more than 54% consume lunch and around 51% consume dinner together. Out of the

<sup>3</sup> Statistical analyses were carried out using STATA 16.

Table 1  
Sample characteristics

Variables	Total N	Boys N	Girls N	P-value *
Reading				0.030
Not at all	19 (4.2)	12 (5.7)	7 (2.9)	
Around 1 h	162 (35.8)	87 (41.4)	75 (31.3)	
Around 2–3 h	21 (44.5)	83 (39.5)	117 (48.8)	
Around 4 h	42 (9.39)	20 (9.5)	22 (9.2)	
More than 4 h	28 (6.19)	8 (3.8)	19 (7.9)	
Screen viewing				0.070
Not at all	11 (2.4)	6 (2.9)	5 (2.1)	
Around 1 h	76 (16.9)	20 (20.7)	32 (13.3)	
Around 2–3 h	141 (31.3)	66 (31.7)	75 (31.3)	
Around 4 h	102 (22.7)	36 (17.3)	65 (27.1)	
More than 4 h	120 (26.7)	57 (27.4)	63 (26.3)	
Going out				0.002
Never	6 (1.3)	3 (1.5)	3 (1.3)	
Once per month	24 (5.4)	10 (4.8)	14 (5.9)	
1–2 times per week	220 (49.1)	82 (39.6)	136 (56.9)	
3–5 times per week	111 (24.8)	58 (28.8)	53 (22.2)	
Almost every day	87 (19.4)	54 (26.1)	33 (13.8)	
Consuming breakfast with family				0.897
Never	168 (37.8)	86 (41.2)	82 (35.0)	
Sometimes	138 (31.0)	63 (30.1)	74 (31.6)	
Every day	50 (11.2)	27 (12.9)	22 (9.4)	
Only weekends	89 (20)	33 (15.8)	56 (23.9)	
Consuming lunch with family				0.570
Never	23 (5.1)	15 (7.1)	8 (3.4)	
Sometimes	120 (26.6)	50 (23.6)	69 (29.1)	
Every day	243 (53.9)	119 (56.1)	123 (51.9)	
Only weekends	65 (14.4)	28 (13.2)	37 (15.6)	
Consuming dinner with family				0.321
Never	47 (10.5)	17 (8.1)	30 (12.7)	
Sometimes	151 (33.6)	68 (32.2)	83 (35.2)	
Every day	228 (50.8)	114 (54.0)	112 (47.5)	
Only weekends	23 (5.1)	12 (5.7)	11 (4.7)	
Consume breakfast				0.810
Never	37 (8.1)	20 (9.4)	17 (7.1)	
Sometimes	149 (32.7)	71 (33.2)	78 (32.7)	
Every day	218 (47.8)	100 (46.7)	115 (48.1)	
Only weekends	52 (11.4)	23 (10.8)	29 (12.1)	
Weight categories				0.110
Underweight	29 (7.1)	15 (7.6)	14 (6.5)	
Normal weight	297 (72.3)	132 (67.0)	165 (77.1)	
Overweight	60 (14.6)	34 (17.3)	26 (12.2)	
Obese	25 (6.1)	16 (8.1)	9 (4.2)	
KIDMED index				0.280
Low AMD	110 (25.5)	54 (27.3)	56 (24.1)	
Medium AMD	245 (56.7)	104 (52.5)	139 (59.9)	
High AMD	77 (17.8)	40 (20.2)	37 (16.0)	
Variables	Mean (SD)	Boys N	Girls N	P-value *
Age	13.74 (0.98)	13.67 (0.96)	13.80 (0.99)	0.170
BMI	20.49 (3.47)	20.52 (3.44)	20.46 (3.50)	0.870

Notes: The Chi-square test was used to calculate the *p*-value for the qualitative variables. Abbreviations: N Number of observations, AMD Adherence to the Mediterranean Diet, BMI Body Mass Index. \*T-student test was used to calculate the *p*-value for the quantitative variables.

total sample 72.3% of the adolescents were of normal weight, 14.6% were overweight and 6.1% were obese. Boys were found to be overweight (17.3%) and obese (8.1%) in higher rates comparing to girls (12.2% and 4.2% respectively). Also, a low presence of 17.8% of the adolescents were found to have high AMD, 56.7% had medium adherence and 25.5% low AMD. A greater percentage of girls, compared to boys, had medium AMD.

### 3.2. KIDSCREEN-27 reliability tests and scores

The value of the Cronbach's alpha for KIDSCREEN-27 was higher than 0.7 in each dimension showing acceptable reliability. In particular, it was found  $\alpha = 0.75$  for physical health,  $\alpha = 0.71$  for psychological well-being,  $\alpha = 0.74$  for parent relations and autonomy,  $\alpha = 0.79$  for social support and peers and  $\alpha = 0.78$  for school environment while the mean test scale was  $\alpha = 0.79$ . Regarding the estimated scores of KIDSCREEN-27, the following Table 2 presents mean scores and standard deviations of the selected anthropometric characteristics, PA, the family affluence and the AMD for each KIDSCREEN dimension. Furthermore, *T*-test, Anova and Kruskal Wallis comparison tests are employed for two-group and more than two-groups.

Significant differences between gender were observed. Boys scored higher in almost every KIDSCREEN dimension except from school environment ( $p$ -value=0.86) and social support and peers ( $p$ -value=0.19). In particular, boys scored significantly higher in physical health ( $p$ -value <0.001), psychological well-being ( $p$ -value <0.001), parent relations and autonomy ( $p$ -value <0.01) and total KIDSCREEN score ( $p$ -value <0.001).

Adolescents who are physically more active have better scores in total KIDSCREEN score ( $p$ -value <0.1) and in some dimensions compared to moderately and insufficiently active individuals. In particular, physically more active adolescents scored significantly higher in physical health, than moderately active and insufficiently active as can be expected ( $p$ -value <0.001). However, a statistically significant difference was not found in the rest of the KIDSCREEN dimensions between active, moderately or insufficiently active respondents (all estimated  $p$ -values are greater than 0.05).

Regarding socioeconomic characteristics, it was found that adolescents with higher SES seem to have higher scores in physical health, parent relations, autonomy, social support and peers' dimensions. More specifically, adolescents with a high family affluence scored significantly higher in physical health than adolescents with a low FAS score ( $p$ -value <0.1). Regarding parent relations and autonomy, adolescents with a high affluence present a higher score than adolescents with medium and low affluence ( $p$ -value <0.001). Simultaneously, adolescents with medium affluence have also a higher score in social support and peers' dimension than adolescents with a lower level of affluence ( $p$ -value <0.1).

Regarding their diet, adolescents with a higher AMD also have a higher score in all KIDSCREEN dimensions apart from social support and peers' dimension. In particular, adolescents with optimal adherence or medium adherence have a higher score than adolescents with a low adherence in physical health ( $p$ -value <0.001), in parent relations and autonomy ( $p$ -value <0.001) and school environment ( $p$ -value <0.001). Also, adolescents with optimal adherence have a higher score than adolescents with a medium or low adherence in psychological well-being ( $p$ -value <0.001). Weight categories seems to insignificantly affect the level of KIDSCREEN dimensions except physical activity in which obese adolescents emerge a lower level of score ( $p$ -value <0.05).

### 3.3. Econometric analysis results

#### 3.3.1. Correlations

Table 3 presents the correlations for boys and girls respectively. Only pairwise correlations that are statistically significant at 5% level are presented whereas NS cells indicate correlations that were found non statistically significant. PA was found to be positively associated with social support and peers for boys, psychological well-being for girls and physical health and school environment for both boys and girls. Family affluence level is positively correlated with physical health for boys but regarding parent relations and autonomy for both boys

Table 2

Descriptive statistics (Panel A) and mean comparison tests (Panel B) results of the selected anthropometric characteristics, PA, the family affluence and the AMD for each KIDSCREEN dimension

KIDSCREEN-27		Physical Health	Psychological well-being	Parent relations and autonomy	Social support and peers	School environment	Total score
Panel A		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Gender	Male	48.55 (10.50)	48.14 (11.28)	48.36 (9.97)	49.67 (11.73)	45.41 (8.74)	48.12 (7.98)
	Female	43.83 (8.18)	42.10 (9.82)	45.88 (8.31)	48.18 (11.57)	45.52 (8.97)	45.14 (6.84)
GSLTPAQ index	Insufficiently Active	40.82 (9.75)	43.1 (10.16)	46.06 (6.81)	47.27 (12.85)	43.37 (8.30)	44.30 (6.81)
	Moderately Active	43.12 (8.13)	43.00 (10.94)	46.10 (7.12)	47.31 (12.54)	45.25 (10.33)	44.94 (6.90)
	Active	46.97 (9.38)	45.11 (10.44)	47.44 (9.60)	49.44 (11.40)	45.83 (8.54)	46.99 (7.50)
FAS index	Low Affluence	44.93 (10.12)	44.17 (11.29)	44.22 (8.75)	46.62 (13.03)	45.08 (9.38)	44.89 (7.58)
	Medium Affluence	45.77 (9.04)	44.42 (10.46)	46.93 (8.43)	49.08 (11.34)	45.71 (8.48)	46.47 (7.20)
	High Affluence	48.67 (10.43)	46.97 (12.58)	50.94 (12.09)	51.84 (10.97)	45.36 (9.58)	48.75 (8.69)
KIDMED index	Low adherence	42.63 (9.79)	40.94 (10.61)	43.99 (8.92)	47.29 (12.76)	41.62 (8.82)	43.35 (7.73)
	Medium adherence	46.74 (9.00)	45.40 (10.33)	47.48 (9.08)	49.27 (11.30)	46.62 (8.57)	47.18 (6.99)
	Optimal adherence	48.45 (10.25)	49.22 (11.81)	49.70 (9.50)	50.23 (11.18)	48.20 (8.04)	49.16 (7.65)
Weight	Normal weight	46.88 (9.55)	44.69 (10.78)	47.00 (8.86)	49.06 (11.56)	45.43 (8.76)	46.64 (7.36)
	Overweight	45.06 (9.61)	45.63 (12.65)	47.80 (10.12)	48.66 (10.35)	45.74 (9.34)	46.43 (7.90)
	Obese	42.43 (9.66)	45.13 (12.14)	45.66 (8.06)	50.37 (11.46)	44.66 (7.91)	45.45 (8.11)
Panel B		Physical Health	Psychological well-being	Parent relations and autonomy	Social support and peers	School environment	Total score
Gender		[0.000]	[0.000]	[0.005]	[0.191]	[0.897]	[0.000]
GSLTPAQ index		[0.000]	[0.591]	[0.886]	[0.309]	[0.266]	[0.072]
FAS index		[0.069]	[0.135]	[0.001]	[0.053]	[0.637]	[0.007]
KIDMED index		[0.000]	[0.000]	[0.000]	[0.251]	[0.000]	[0.000]
Weight categories		[0.029]	[0.842]	[0.611]	[0.697]	[0.856]	[0.678]

Notes: T student tests for 2 groups and ANOVA and Kruskal Wallis comparison tests for more than two groups were employed. Standard deviations are presented in parentheses. P-values are presented in brackets. Abbreviations: GSLTPAQ Godin and Shephard Leisure Time Physical Activity Questionnaire, FAS Family Affluence Scale.

and girls. AMD is also positively correlated with almost all KIDSCREEN dimensions, as anticipated, both for boys and girls except for social support and peers for girls. Additionally, it was found that weight categories is negatively associated with physical health only for girls, while age was also negatively correlated with physical health, psychological well-being, parent relations and autonomy and social support and peers only for girls.

Moreover, it is of high interest to estimate correlations between several sociodemographic characteristics and HRQoL. In particular, as provided in Table 3, adolescents who spend more time reading and go out for a walk more frequently, seem to have a higher HRQoL. In addition, having meals with parents and consuming breakfast every morning is a positive parameter of HRQoL. On the contrary, more screen viewing is negatively associated with several dimensions of HRQoL.

Table 3  
Correlation coefficients matrix between the selected parameters of health-related quality of life of adolescents

KIDSCREEN-27	Boys					Girls				
	Physical health	Psychological well-being	Parent relations and autonomy	Social support and peers	School environment	Physical health	Psychological well-being	Parent relations and autonomy	Social support and peers	School environment
GSLTPAQ score	0.325	NS	NS	0.212	0.157	0.450	0.146	NS	NS	0.184
FAS score	0.173	NS	0.227	NS	NS	NS	NS	0.181	NS	NS
KIDMED score	0.209	0.303	0.250	0.165	0.351	0.335	0.281	0.224	NS	0.293
Reading	NS	NS	NS	NS	0.286	0.257	NS	NS	NS	0.421
Screen viewing	NS	-0.197	NS	NS	-0.153	-0.309	-0.173	NS	NS	-0.426
Going out	0.244	0.221	0.177	0.302	NS	0.174	0.171	0.213	0.245	NS
Consuming breakfast with family	NS	0.278	0.244	0.196	0.282	0.312	0.314	0.279	NS	0.282
Consuming lunch with family	NS	NS	NS	NS	NS	NS	0.190	0.228	NS	0.247
Consuming afternoon snack with family	NS	0.245	0.156	NS	NS	0.234	0.322	0.319	0.138	0.259
Consuming dinner with family	NS	0.221	0.146	NS	NS	0.245	0.187	0.287	0.201	0.192
Consuming breakfast	0.187	0.275	0.180	NS	0.272	0.245	0.182	0.179	NS	0.214
BMI	NS	NS	NS	NS	NS	-0.253	NS	NS	NS	NS
Age	NS	NS	NS	NS	NS	-0.196	-0.230	-0.138	-0.201	NS

Notes: All presented pairwise correlations are statistically significant at 5% level. NS indicate correlations that were found non statistically significant. Abbreviations: GSLTPAQ Godin and Shephard Leisure Time Physical Activity Questionnaire, FAS Family Affluence Scale, BMI Body Mass Index.



Table 4  
Multiple regression analysis results

	KIDSCREEN- 27 total score	Physical health	Psychological well-being	Parent relations and autonomy	Social support and peers	School environment
Gender (boys = 1; girls = 0)	0.087*** (5.36)	0.104*** (5.23)	0.175*** (6.45)	0.081*** (4.19)	0.075** (2.50)	0.015 (0.69)
Ln FAS score	0.076*** (3.00)	0.065** (2.10)	0.070* (1.66)	0.123*** (4.14)	0.105** (2.28)	0.011 (0.34)
Ln KIDMED score	0.045*** (2.72)	0.027 (1.31)	0.070** (2.51)	0.057*** (2.92)	0.053* (1.74)	0.056** (2.57)
Ln GSLTPAQ score	0.028** (2.10)	0.093*** (5.65)	0.012 (0.53)	-0.006 (-0.41)	0.013 (0.51)	0.030* (1.72)
Screen viewing	-0.019** (-2.43)	-0.035*** (-3.78)	-0.031** (-2.40)	-0.007 (-0.75)	0.021 (1.47)	-0.039*** (-3.84)
Live with both parents	0.041* (1.66)	0.012 (0.40)	0.052 (1.27)	0.048* (1.66)	0.013 (0.29)	0.061* (1.89)
Night sleep duration	0.153*** (3.37)	0.047 (0.85)	0.389*** (5.10)	0.053 (0.97)	0.095 (1.13)	0.306*** (5.10)
Cons	3.196*** (27.16)	3.284*** (22.58)	2.686*** (13.57)	3.373*** (24.01)	3.223*** (14.86)	3.048*** (19.63)
No of obs.	319	330	326	326	327	328
R-sq.	0.220	0.236	0.236	0.127	0.037	0.205

Notes: T-tests in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Abbreviations: Ln Natural logarithm, GSLTPAQ Godin and Shephard Leisure Time Physical Activity Questionnaire, FAS Family Affluence Scale.

### 3.3.2. Multiple regression analysis

Table 4 presents the empirical results based on the multiple linear regression analysis.

Table 4 reveals the associations that were found empirically between KIDSCREEN-27 total score and the five dimensions, the FAS score, the KIDMED score, the GSLTPAQ score and other control variables such as gender, screen viewing, night sleep duration and living with both parents.

Gender was found to be a statistically significant parameter of HRQoL within this study. In particular, the coefficient of the gender variable was estimated highly significant in all models, except school environment KIDSCREEN dimension. That result indicates that boys have a significantly higher total KIDSCREEN score and a higher score in all dimensions except from school environment. This means that according to our sample, boys have a better perceived HRQoL than girls. In regard to PA, the benefits of physical activity, beyond physical health, contributes to both mental and psychological health. In our study adolescents who exercise more have a much higher HRQoL in contrast with adolescents who do not engage in physical activities. In particular, these adolescents have a significantly higher total KIDSCREEN score, a higher score in physical health ( $P < 0.01$ ) as expected, as well as a higher score for school environment ( $P > 0.1$ ). Adolescents with a higher SES have a higher HRQoL by around 0.08% on average across all estimated models. This means that an increase in FAS score by 1% leads to around 0.08% increase in HRQoL. Adolescents with a high family affluence have a significantly higher total KIDSCREEN score and a higher score in all dimensions except from school environment. Regarding their dietary habits, it was found that adolescents with a higher AMD have a significantly higher total KIDSCREEN score and in particular a higher score in all dimensions except from physical health.

Additionally, some lifestyle characteristics are related to HRQoL. More screen time for adolescents (tv, dvd, smart phone, tablet, pc etc. to communicate, play games, use of the internet) lead to a significantly lower

total KIDSCREEN score and especially lower score in physical health, psychological well-being and school environment. On the contrary, living with both parents and more night sleep duration have a positive effect on the adolescents' HRQoL. Adolescents who live with both parents have a significantly higher total KIDSCREEN score, a higher score in parents' relation, autonomy and in school environment. Also, adolescents who sleep more hours during night have a significantly higher total KIDSCREEN score, a higher score in psychological well-being and school environment. Contrary to some previous studies [14–16], in our study there was no association between BMI and self-reported HRQoL.

#### 4. Discussion

The study's empirical results indicate that SES, gender lifestyle, family characteristics and diet quality seem to play a significant role for a better perceived HRQoL among adolescents. Especially nowadays, where the COVID-19 pandemic crisis has had a severe impact on adolescents' life and their behavioral adaptation, with quarantine and social distancing, the investigation of HRQoL parameters becomes particularly interesting. As the nexus between self-reported HRQoL, AMD, physical activity and socioeconomic characteristics for adolescents have been assessed, this study could provide the foundation for drawing policy implications addressing families and policymakers.

Based on the empirical findings, gender differences exist in HRQoL with boys having a higher KIDSCREEN score than girls, a fact that has also been underlined in several previous studies [37–39]. Furthermore, similarly to other findings, higher physical activity [15, 22, 24, 38, 40, 41], higher family affluence [30, 37, 38], more night sleep duration [41] and living with both parents [42] seem to have a positive effect on adolescents' HRQoL. On the contrary, the results of this study, also in accordance with previous studies [40, 41], revealed that more screen time for adolescents is negatively associated with adolescents' quality of life.

Additionally, this research highlighted the significant correlation between AMD and adolescent's HRQoL. The MD is regarded as one of the healthiest diet plans with many health benefits. In adolescents, the MD plays a significant role in lowering the risk of metabolic syndrome [43] and overweight/ obesity [44, 45]. With the existing findings we can assume that a higher AMD can also benefit adolescent's perceived health, psychological well-being, adolescents' satisfaction from life, family, school environment and peers.

Policy measures with respect to health-related quality of life of adolescents may include systematic promotion of a healthier lifestyle from both families/ households and society/ schools through settling healthier habits for the family members and through educational programs. Parents and guardians in accordance with schools, could promote more physical activity, less use of popular electronic devices and more night sleep, promoting healthier habits. Giving awareness that the MD could lead to a better quality of life and could reflect in a better general health status, it is very important for every age group, especially for the youth, to adhere to this diet model.

Nonetheless, empirical inferences should be interpreted with caution. Initially, they rely on self-reported data that cannot be confirmed and validated. Additionally, although this research study followed specific statistically valid sample size criteria, it is highly recommended, for future studies, to proceed to an estimation of the range of each school in comparison with each other. Further research should be based on datasets containing more information on various household aspects such as financial and dwelling characteristics which are difficult to obtain from adolescents. In addition, future studies that can collect more data over a longer period of time would present the opportunity for alternative, complementary, and more advanced econometric specifications.

#### 5. Concluding remarks

In this study the correlation between adolescents' perceived HRQoL and AMD was investigated for the first time in Greece during the COVID-19 pandemic. The research analyzed whether a higher AMD can be

correlated with a better self-perceived health. The investigation took place during COVID-19 and pandemic's policy measures, such as lockdown and quarantine, which changed the adolescent's habits, also correlating these habits to the overall health quality of life.

The empirical findings of the present study reveal that a higher adherence to the Mediterranean Diet seems to positively affect health related quality of life amid adolescents. The Mediterranean Diet health benefits are well known, and during this study confirmed and highlighted. Adhering to this diet, adolescents perceive their health better. Also, boys, adolescents living with both parents, being physically more active and having a higher socioeconomic status are positively related to health-related quality of life. On the contrary, less sleep, more use of electronical devices and screen viewing lead significantly to lower health related quality of life.

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### **Authors' contribution**

All authors have contributed equally in conception, performance of work, interpretation of data and writing the article. Also, all authors had access to the data, read and approved the final manuscript.

### **Declarations**

The authors declare that they have no competing financial interests or personal relationships that might influence the work reported in this paper.

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