Internet use and its association to physical activity, nutrition habits, sense of loneliness, and self-efficacy in Greek adolescents: A multi-center, school-based, cross-sectional study

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ABSTRACT

INTRODUCTION Increasing reliance on the internet in adolescence has raised concerns regarding its potential impact on physical/psychological well-being. This study aimed to examine the prevalence and factors associated with internet addiction (IA) among high school students.

METHODS A school-based, multi-center, cross-sectional survey was conducted from November 2023 to April 2024 among 1727 first-year Lyceum students in Crete, Greece. The participating schools were selected using a random number generator, through a two-stage sampling procedure. Forty-two of the 69 Regions' high schools were selected and agreed to participate, targeting 3435 first-year high school students. The study sheet included a 25-item General Information Form along with items from the Greek versions of five scales: The Internet Addiction Test (IAT) scale was used and physical activity status (IPAQ), eating habits (KIDMED), sense of loneliness (UCLALS), and self-efficacy (GSE) were evaluated. Multivariate analysis was implemented to assess differences.

RESULTS Of the students, 60.4% were girls, 49.8% lived in households with ≥4 family members, 63.3% reported difficulty waking up in the morning, and 90.1% had internet access via a smartphone. The mean IAT score was low (38.1/100), while 45.3% exhibited mild addiction and 22.2% moderate-to-severe addiction. Higher IAT score was correlated with girls (r=0.100, p<0.001), difficulty falling asleep (r=0.188, p<0.001), and difficulty waking up in the morning (r=0.225, p<0.001). Students with moderate-to-severe IA, compared to those with mild or normal IA, had lower mean levels of physical activity (2747 vs 2997 and 3466 MET.min.wk-1, respectively; p-trend=0.001), adherence to Mediterranean diet (4.88 vs 5.20 and 5.62; p-trend<0.001), and self-efficacy (27.2 vs 28.0 and 29.3; p-trend<0.001), and higher sense of loneliness (45.5 vs 41.5 and 38.5; p-trend<0.001).

CONCLUSIONS Findings reveal notable patterns in internet usage and addiction among adolescents, shedding light on how certain behaviors and emotional states could influence internet dependence and reflecting significant bidirectional relationships with various lifestyle/psychological factors.

INTRODUCTION

Problematic internet use, also referred to as Internet addiction (IA) is described as excessive and inappropriate exposure to internet-related activities with addictive nature, such as gambling, gaming, shopping, pornography and social media[1]. It is defined by increasing use and a perceived failure to control internet use and the occurrence of negative, damaging consequences, in conjunction with the presence of obsessive thoughts or impulses related to the internet creating distress and disrupting daily life[2].

Key characteristics of IA include reduced in-person social interactions, neglect of work and responsibilities, a diminished interest in offline activities, and using the internet as a way to cope with emotional discomfort[3]. This behavior leads to some serious impairments in the family, social, educational, personal or other related contexts[4]. The effect of uncontrolled internet on both mental and physical health is issued as a worldwide public health problem attracting research and social attention[5,6].

Information and communications applications were increasingly used in the pandemic, being essential for economy viability and as an alternative work and education modality, or by offering some social interaction and entertainment, with the risk of a problematic use to be potentially high, especially among specific groups[7].

Adolescence is a life period of significant psychological development and change, and adolescents are particularly susceptible to excessive internet use[8]. Overuse of social media among adolescents has been recognized as a significant risk factor for depression, anxiety, isolation and low self-esteem[8]. Particularly in adolescents, previous studies have also reported a negative effect between IA and exercise, dietary habits and sleep or psychological well-being[9,10]. Specifically, extensive internet use may lead to increased physical inactivity, associated with a sedentary lifestyle and, consequently, may constitute a potential risk factor for being overweight/obese[11]. A significant positive correlation has been observed in children and adolescents between internet usage, weight gain, and obesity[9,11]. Additionally, sleep disturbances such as insomnia, excessive daytime sleepiness, and issues with sleep/wake patterns, along with increased frustration intolerance, aggressiveness, attention-deficit/hyperactivity disorder, smoking, and use of legal or illegal substances, should be seriously taken into consideration[12].

Given the alarming negative consequences of excessive internet use and the heightened vulnerability of adolescents to internet-related harm, a deeper understanding of the risk factors and other clinical associations of IA is essential to inform prevention and intervention strategies[13]. This study investigates the internet use and its association with lifestyle/psychological factors among adolescents.

METHODS

Study setting, design, and participants

This is a school-based, multi-center, cross-sectional study that was contacted in first-year high school students in the Region of Crete, Greece, from November 2023 to April 2024. Considering the proportionality of the population of the prefectures within the Region of Crete, the participating schools were selected using a random number generator, through a two-stage sampling procedure. Forty-two of the 69 Regions' high schools were selected and agreed to participate, targeting 3435 first-year high school students. In Greece, secondary education is mandatory until the age of 15 years, including three years of middle school that are followed by three additional years of education in high school. First-year high school students were approached as potential participants for this study, since the educational demands in the second and third year are usually high, due to preparation for higher education access national exams. Forty schools from 42 finally participated in the study. From a total of 1883 students who finally participated, 1727 fully completed mandatory domains (scales' scores) for the analysis. Some missing data on sociodemographic information may differ from totals.

Data collection procedure

Researchers primarily approached school administrative teaching personnel from each school, in order to offer information on study purpose and process. After sending an informative letter, parent/guardian informed consent was obtained to enable students to voluntarily and anonymously complete the paper-pencil study sheet. After a scheduled class session in the presence of a teacher and a researcher in order to provide further information, questionnaires were filled in and collected. No incentives were provided to increase participation.

Study sheet

The study sheet developed for this study included a 25-item General Information Form along with items from the Greek versions of five scales[14-22]; 15 items of the Internet Addiction Test (IAT-15), the International Physical Activity Questionnaire (IPAQ), the Mediterranean Diet Quality Index (KIDMED), the University of California Los Angeles Loneliness Scale (UCLALS), and the General Self-Efficacy Scale (GSE).

General Information Form

It consisted of 25 items, including demographic data (gender, nationality, number of family members in household), internet usage characteristics, and information regarding students' sleeping habits, learning patterns, and daily activities.

Internet Addiction Test

IAT is described as the instrument most frequently used to assess IA among adolescents[23,24]. An adapted, shortened version of the original 20-item scale was used, consisting of 15 items relevant to the target population and the remaining

five items were excluded (items 3, 4, 8, 12 and 15) due to lack of applicability. The replies are scored on a 6-point Likert scale as: 0 (not applicable), 1 (rarely), 2 (occasionally), 3 (frequently), 4 (often), and 5 (always). The overall scoring was determined by summing up the replies giving a score ranging from 0 to 75 and rescaled to 0–100 through a linear transformation (multiplying by 100/75 or 1.333) in order to meet the boundaries of the initial scale. Cutoff categories were also used as normal (0–30), mild (31–49), moderate (50–79), and severe addiction (80–100). Providing a Cronbach's alpha after a scale score adjustment for research context applicability is a methodological approach to confirm reliability[17]. In the current study, the consistency of IAT-15 was estimated by Cronbach's alpha and was acceptable (α=0.816).

International Physical Activity Questionnaire

The 7-item Greek version of International Physical Activity Questionnaire (IPAQ) was used to measure the participants' physical activity level[14,18]. It contains questions for participants to measure the days and minutes per day of participation in all types of vigorous, moderate and walking physical activity (PA) over the previous seven days. The PA score for each active, medium and ambulatory activity is measured and displayed in MET-minutes/week (MET.min. wk^{-1}) as a total PA rate, and participants are classified into three categories: low, medium and high PA.

Mediterranean Diet Quality Index - KIDMED

The dietary habits were evaluated using the updated 16-items KIDMED index of compliance to the Mediterranean diet in children and adolescents[15,21]. Four items indicate a negative connotation (consumption of fast food, baked goods, sweets and skipping breakfast), while the 12 remaining items indicate a positive connotation (consumption of olive oil, fish, fruit, etc.). A total score of ≤3 indicates that the Mediterranean diet is poorly followed, 4–7 medium adherence, and ≥8 high adherence[21].

UCLA Loneliness Scale

The 20-item University of California Los Angeles Loneliness Scale (UCLALS) was used to measure perceived or subjective feelings of loneliness[19,20]. The one-dimensional scale was based on a 4-point Likert scale (1= 'never' to 4 = 'always') assessing how often a person feels disconnected from others. The total UCLALS score is evaluated according to cutoff categories as: absence/low sense of loneliness (<28.0), moderate (28.0–43.0), and high (≥44.0).

General Self-Efficacy Scale

The 20-item General Self-Efficacy Scale (GSE) was utilized to evaluate optimistic self-confidence in dealing with various life challenges[16,22]. Every item is associated with a 4-point Likert scale (1= 'not at all true' to 4 = 'exactly true'). The overall score was calculated by summarizing the responses, giving a composite score ranging from 10 to 40, with higher ratings indicating better self-efficacy, and including participants with scores of 30.0 or higher.

Statistical analysis

Analysis was carried out using the SPSS v.25.0. Frequency distributions and measures of location and dispersion of characteristics of adolescents were calculated. IAT-15, IPAQ, KIDMED , UCLALS, and GSE scores were checked for normality using Blom's method (QQ-plot) as well as skewness coefficients. Based on slight asymmetry, Pearson's method was used to estimate correlations between characteristics or habits and scales while multivariate analysis of covariance was implemented to assess differences across IAT-15 level (normal, mild or moderate/severe). Covariates used were gender, difficulty in falling asleep, and difficulty in waking up in the morning, as shown in the univariate correlation analysis. Heterogeneity was tested by Levene's test and p-trend was estimated based on polynomial trend. The acceptable level of significance was set at $p<0.05$.

Ethical statement

For the conduct of this research, approval was granted by Research Ethics Committee of the University of Crete (REC-UOC, decision no: 140-22/09/2022). Additionally, access to 42 schools was granted by the Regional Directorate of Education of Crete (10556-03/11/2022; 7571-19/07/2023; 1413-12/02/2024). Completion of the questionnaires was voluntary and anonymous.

RESULTS

Of the 3435 students that were approached, 1727 (50.2%) participated from 40 daytime general high schools. About 60% were girls, 92.0% reported having Greek nationality, and 49.8% reported living in households with ≥4 family members (Table 1). Almost half the students (51.0%) attended schools in urban areas of Crete. Regarding daily habits, 22.4% reported difficulty falling asleep and 63.3% difficulty waking up in the morning, while the estimated mean duration of their nighttime sleep was 7.4 hours. Moreover, 64.5% reported walking with friends; mean daily walking time of 1.98 hours.

Regarding internet usage habits (Table 2), only three students (0.2%) stated they had no internet connection, and 90.1% connected by smartphone, 14.8% and/or by laptop, and only 1.8% by tablet. Almost two-thirds of students (61.0%) reported that they use the internet primarily for social media, followed by entertainment (24.4%). Most of the students (62.3%) had an average time between reconnections of 3.34 hours. When asked 'Have you tried not connecting to the internet for a while?', 56.0% of students answered 'yes', with 16.2% trying for <12 hours, and 22.9% for >1 week.

Table 3 presents the IAT-15, IPAQ, KIDMED, UCLALS, and GSE scores. The mean total IAT-15 score was 38.1/100 or low

mean level, while 32.5% of students demonstrated normal levels (no addiction), 45.3% mild, 21.7% moderate, and 0.5% severe addiction (boys 17.4%; girls 25.4%, p<0.001; not shown). Assessing the IPAQ, the mean METs were 3090 with a maximum of 28266 MET.min.wk^{-1}, whereas 41.3% of students presented a low level of physical activity, 11.0% moderate, and 47.7% high.

For the KIDMED, the mean score was 5.3/12 or medium to low adherence to the Mediterranean diet, while 24.2% of students were observed to have poor adherence, 56.6% medium, and only 19.2% high. Regarding the UCLALS, the mean score was 41.4/80 or a medium level sense of loneliness, with 6.9% of students having absence/low sense of loneliness, and 39.3% high. Finally, the mean GSE score was 28.3/80 or a low level of self-efficacy, while 67.3% of students were found to have low/moderate levels, and 32.7% better levels.

In Table 4, the univariate correlation coefficients of IAT-15 with descriptive characteristics or habits of 1727 adolescents, as well as with the IPAQ, KIDMED, UCLALS, and GSE are presented. Focusing on descriptive characteristics, a higher IAT-15 scale score was related with female adolescents (r=0.100, p<0.001), difficulty falling asleep (r=0.188, p<0.001), and difficulty waking up in the morning (r=0.225, p<0.001), and with fewer hours of nighttime sleep (r= -0.195, p<0.001). Higher IAT-15 scale scores also found to be correlated with lower IPAQ physical activity scores (r= -0.117, p<0.001), lower adherence to the Mediterranean diet (r= -0.199, p<0.001), higher loneliness (r= -0.331, p<0.001) and lower self-efficacy (r= -0.206, p<0.001).

Table 5 displays the changing IPAQ, KIDMED, UCLALS, and GSE scores across the levels of the IAT-15, adjusting for confounding factors. Students with moderate to severe IA,

Table 1. Descriptive characteristics and health habits of adolescents/high school students (1st grade) participating in the cross-sectional survey, Crete, Greece, November 2023 to April 2024 (N=1727)

Characteristics	Categories	n	%
Gender	Boys	684	39.6
	Girls	1043	60.4
Nationality (N=1701)	Greek	1564	92.0
	Other	136	8.0
Family members in household (N=1684)	1	31	1.8
	2	232	13.8
	3	582	34.6
	≥4	839	49.8
School area	Rural	847	49.0
	Urban	880	51.0
Difficulty falling asleep	No	1340	77.6
	Yes	386	22.4
Difficulty waking up in the morning	No	629	36.7
	Yes	1087	63.3
Nighttime sleep (hours) (N=1711), mean ± SD (range)		7.4 ± 1. 2 (1–13)	
Walking with friends (N=1717)	No	610	35.5
	Yes	1107	64.5
Daily walking (hours) (N=1480), mean (median)		1.98 (1.50)	

Table 2. Frequencies of internet use and practices of adolescents participating in the cross-sectional survey, Crete, Greece, November 2023 to April 2024 (N=1727)

Items	Categories	n	%
Preferred means of internet connection[a]	Smartphone	1556	90.1
	Laptop	256	14.8
	Tablet	31	1.8
	No internet connection	3	0.2
Purposes of internet usage[a]	Social media	1054	61.0
	Entertainment	421	24.4
	Communication	416	24.1
	Surfing	281	16.3
	Education/ information	164	9.5
	Work/ purchases	3	0.2
Awareness of time duration devoted to internet (N=1724)	No	650	37.7
	Yes	1074	62.3
Time intervals between reconnections to internet (hours), mean, (median) [range]		3.34 (3.00) [0.01–12.50]	
Have you tried not connecting to the internet for a while?	No	760	44.0
	Yes	967	56.0
If yes, for how long? (N=926)	<12 hours	150	16.2
	1–2 days	320	34.6
	1 week	244	26.3
	>1 week	212	22.9

a More than one answer occurred (multiple responses).

Table 3. Scores on the scales of IAT-15, IPAQ, KIDMED, UCLALS and GSE of adolescents participating in the cross-sectional survey, Crete, Greece, November 2023 to April 2024 (N=1727)

Scales	Mean	SD	Median	Min	Max	Skewness
IAT-15 levels and frequency of internet usage, n (%)	38.1	15.5	37.3	0.0	94.7	0.27
Normal (0–30)	561 (32.5)					
Mild (31–49)	782 (45.3)					
Moderate (50–79)	375 (21.7)					
Severe (80–100)	9 (0.5)					
IPAQ levels (MET.min.wk-1) and frequency of physical activity, n (%)	3090	3368	2026	0	28266	2.44
Low	714 (41.3)					
Moderate	190 (11.0)					
High	823 (47.7)					
KIDMED levels and frequency of adherence to Mediterranean diet, n (%)	5.3	2.5	5.0	-4	12	-0.08
Poor (≤3)	418 (24.2)					
Medium (4–7)	978 (56.6)					
High (≥8)	331 (19.2)					
UCLALS levels and frequency of sense of loneliness, n (%)	41.4	10.1	40.0	20	76	0.41
Absence/low sense (<28.0)	119 (6.9)					
Moderate (28.0–43.0)	930 (53.8)					
High (≥44.0)	678 (39.3)					
GSE levels and frequency of self-efficacy, n (%)	28.3	4.9	28.0	10	40	-0.27
Low/moderate (10–30)	162 (67.3)					
Better (31–40)	565 (32.7)					

IAT-15: Internet Addiction Test scale (higher score indicates higher addiction). IPAQ: International Physical Activity Questionnaire (higher score indicates higher level of PA). KIDMED: Mediterranean Diet Quality Index (higher scores indicate higher adherence to Mediterranean Diet). UCLALS: University of California Los Angeles Loneliness Scale (higher scores indicate higher sense of subjective loneliness). GSE: General Self-Efficacy Scale (higher scores indicate higher self-efficacy).

Table 4. Correlations between IAT-15 and descriptive characteristics or habits of adolescents, as well as with IPAQ, KIDMED, UCLALS and GSE of adolescents participating in the cross-sectional survey, Crete, Greece, November 2023 to April 2024 (N=1727)

	IAT-15	IPAQ	KIDMED	UCLALS	GSE
	Pearson's r				
IPAQ	-0.117*				
KIDMED	-0.199*	0.164*			
UCLAS	0.331*	-0.081*	-0.125*		
GSE	-0.206*	0.215*	0.218*	-0.324*	
Gender	0.100*	-0.250*	-0.096*	0.143*	-0.193*
Family members in household	0.027	0.077*	0.034	-0.011	-0.044
School area	0.035	0.047	-0.041	0.003	0.027
Difficulty falling asleep	0.188*	-0.020	-0.106*	0.224*	-0.104*
Difficulty waking up in the morning	0.225*	-0.028	-0.114*	0.074*	-0.068*
Nighttime sleep	-0.195*	0.077*	0.178*	-0.145*	0.072*
Walking with friends	-0.017	0.023	0.102*	-0.092*	0.076*
Daily walking	-0.038	0.106*	0.001	-0.032	0.025

IAT-15: Internet Addiction Test scale (higher score indicates higher addiction). IPAQ: International Physical Activity Questionnaire (higher score indicates higher level of PA). KIDMED: Mediterranean Diet Quality Index (higher scores indicate higher adherence to Mediterranean Diet). UCLALS: University of California Los Angeles Loneliness Scale (higher scores indicate higher sense of subjective loneliness). GSE: General Self-Efficacy Scale (higher scores indicate higher self-efficacy). *p<0.001.

Table 5. Changing score levels in IPAQ, KIDMED, UCLALS and GSE across IAT-15 scores of adolescents participating in the cross-sectional survey, Crete, Greece, November 2023 to April 2024 (N=1727)

	Levels of Internet Addiction				
	Normal (0–30)	Mild (31–49)	Moderate to Severe (50–100)		
	Mean (Stand. Error)			p	p-trend*
IPAQ	3466 (140)	2997 (117)	2747 (171)	0.003	0.001
KIDMED	5.62 (0.11)	5.20 (0.09)	4.88 (0.13)	<0.001	<0.001
UCLAS	38.5 (0.4)	41.5 (0.5)	45.5 (0.5)	<0.001	<0.001
GSE	29.3 (0.2)	28.0 (0.2)	27.2 (0.2)	<0.001	<0.001

IAT-15: Internet Addiction Test scale (higher score indicates higher addiction). IPAQ: International Physical Activity Questionnaire (higher score indicates higher level of PA). KIDMED: Mediterranean Diet Quality Index (higher scores indicate higher adherence to Mediterranean Diet). UCLALS: University of California Los Angeles Loneliness Scale (higher scores indicate higher sense of subjective loneliness). GSE: General Self-Efficacy Scale (higher scores indicate higher self-efficacy). Multivariate analysis of covariance. Covariates were: gender, difficulty falling asleep and difficulty waking up in the morning. Heterogeneity was tested by Levene's test. *p-trend: p-value for polynomial trend.

in contrast to those with mild or normal IA, were observed to have lower mean levels of physical activity or mean IPAQ score (2747 vs 2997 and 3466 MET.min.wk^{-1}, respectively; p=0.003; p-trend=0.001), adherence to Mediterranean diet (4.88 vs 5.20 and 5.62; p<0.001; p-trend<0.001), and self-efficacy (27.2 vs 28.0 and 29.3, p<0.001; p-trend<0.001), and higher mean levels of sense of loneliness (45.5 vs 41.5 and 38.5; p<0.001; p-trend<0.001).

DISCUSSION

This school-based, multi-center, cross-sectional study is the first to be conducted in the four provinces of Crete among high school students, revealing some unfavorable IA relationships with lifestyle habits/behavioral factors. It was found that: 1) approximately half of the students demonstrated mild IA and >20% moderate-to-severe IA, which was more prevalent in girls; 2) a higher IA score was related with difficulty falling asleep and difficulty waking up in the morning; 3) students with moderate-to-severe IA, in contrast to those with mild or normal IA, had lower mean levels of physical activity, adhesion to the Mediterranean diet, and self-efficacy, and a higher feeling of loneliness.

A recently published meta-analysis showed that 25% of the general population displayed at least one subtype of digital addiction (6.0% for game addiction, 27.0% for smartphone addiction), additionally noting that considerable variations occur according to region, financial level, gender or methodological issues[25]. Moreover, in up-to-date studies, a high prevalence of IA has been observed in adolescence, for example 29.6% in Qatar and 51.1% in Nepal[26,27]. Nevertheless, in the current study, 45.3% of high-school students were found to exhibit mild addiction, and 22.2% moderate to severe addiction. These results are consistent with prior studies which have shown that adolescents are particularly vulnerable to IA, often due to its role as both entertainment and a coping mechanism[28]. The fact that 60% of students reported a time interval between connections of about 3 hours during the day, although half of them tried to not connect for a while, highlights the need for continued attention to this issue.

Most high school students did not report serious sleep problems; however, a significant percentage mentioned waking up earlier than desired and not getting sufficient sleep (63.3%), which could potentially negatively impact their health and academic performance. This finding aligns with research indicating that internet-addicted adolescents experience significant disruptions in nighttime sleep quality and amplified daytime sleepiness. Excessive internet use, particularly during late hours, can interfere with sleep patterns, resulting in negative consequences like daytime fatigue and poor educational performance[29,30].

Moreover, in our study, female gender was found to be related with a higher IAT-15 score and a higher prevalence of IA relative to male counterparts. Previous research has thoroughly documented sex differences, showing conflicting results. While some studies have reported higher IA in males, who tend to have higher levels of preoccupation, earlier onset ages, and a significantly greater prevalence of addiction compared to females[31,32], IA is suggested to be higher in females[33], implying that female adolescents may be more susceptible to certain types of IA, particularly social media[28].

The current analysis also revealed that high school students with moderate-to-severe IA reported lower physical activity and compromised eating habits, highlighting the negative role of addictive internet use on other healthy behaviors[34]. Simultaneously, most high school students included in this study were found not to meet physical activity recommendations and followed a moderate quality diet (56.6%). Our findings suggest that IA may be negatively associated with the diet quality of adolescents, and this association could be explained by the hypothesis that IA may lead to unhealthy eating habits due to increased time

spent online and reduced nutritional attention. From this perspective, promoting balanced lifestyles and encouraging physical activity are crucial in efforts to reduce the risks of IA. An interesting study from New Zealand showed that a relationship was reported between health-promoting environments, the mix of health-promoting/health-constraining environments, and physical activity among adolescents, but not with their screen time spent[35], showing how complex this dimension is.

Finally, a significant proportion of high school students reported experiencing moderate (53.8%) to high levels (39.3%) of loneliness and low to moderate self-efficacy (67.3%). The association with loneliness could be interpreted based on the hypothesis that it leads to social isolation and withdrawal from real-life social interactions, contributing to an increased sense of loneliness and anger[36]. Individuals with low self-efficacy may be more prone to addictive behaviors, as they may struggle to manage stress and negative emotions, which probably makes them turn to the internet as an outlet. It is also possible that IA may trigger mechanisms that further diminish self-efficacy.

Strengths and limitations

This study is one of the few in Greece that delves into the relationship between IA and lifestyle/behavioral risk factors among adolescents. Our findings highlight the significant relationship of IA with other daily habits and behaviors. Nevertheless, given the nature of the study, response bias may have occurred due to the use of self-reported measures, although some of these were minimized by the anonymous completion of the study sheet. Using clinical interviews instead of or in addition to self-report questionnaires, would address the limitations of screening measures and ensure equal emphasis on addiction symptoms. Additionally, they would give students the chance to clarify the meaning of questions before providing an answer. However, for similar large research design studies, issues of feasibility and implementation do not allow extensive person-to-person investigation. Secondly, there is a possibility of selection bias; only adolescents who completed questionnaires were included, without researchers knowing why others did not respond or could respond. Also, the impact of the pandemic period, prevalence of social media usage, substitution of face-to-face social relations with digital ones, and collective attitude trends require further research, at a local level.

By skipping five questions from IAT, data comparison with other studies will be relative and this is another study limitation. During the study design preparation, these five items were perceived as not smoothly applicable for this study. There was no intention by the authors to suggest that the current version is another option for research in general. Additionally and based on the UCLA scale and current results, it is noted that meanings of loneliness may differ across generation.

Other limitations included general study questions constraining the depth of the interpretations. Information on the technological or learning skills of the adolescents was not collected. Such factors might have provided more elaborate explanations. Admittedly, while the relatively large number of participants and the recruitment of students from different school units involve some representativeness, sample heterogeneity may further limit any generalizability attempt. The collection of data on perceptions of high school students about IA and their daily habits and lifestyle choices might shed more light on the issue through a different perspective or methodology. Future qualitative research may enlighten phenomena of internet use and daily behaviors, by investigating aspects of causality or synergism.

CONCLUSIONS

This research contributes to the expanding literature on the subject on IA by identifying key behavioral, psychological, and demographic factors associated with IA in adolescents. The findings emphasize the shaping of a behavioral profile in which IA could lead to poor sleep quality, inadequate nutrition, lack of physical activity, and psychological strain. This underscores the urgent need for public health interventions to raise awareness among policymakers, the scientific community, and the academic field. Any prevention policy should be an integral part of health promotion discussion for the soon-to-be young adults and an emerging public health priority. Promoting the mental and social well-being of adolescents, encouraging healthy lifestyles, ensuring safe and responsible internet use, developing real social and self-efficacy skills, and preventing IA are crucial goals for safeguarding the health of future adults.

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DATA AVAILABILITY
The data supporting this research are available from the authors on reasonable request.

AUTHORS' CONTRIBUTIONS
EKS: conception and design. PV, AEM and EKS: data acquisition and tabulation. ML: data analysis. ML, AEM, EM, ES, AK, GP, AP, EK, IR, ZT, ES, NR and EKS: data interpretation. ML, NV, EM and IR: drafting of the manuscript. All authors contributed to the writing of the manuscript. EKS, PV, AEM, ES, AK, GP, AP, EK, ML, ZT, ES and NR: revision and editing of the manuscript for important intellectual content. All authors read and approved the final version of the manuscript.

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