Time Spent on the Internet, Blood Pressure, and Loneliness in Adolescents: A Cross-Sectional Study

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ABSTRACT

Objective: The purpose of this study was to examine the relationship among the time spent on the internet, blood pressure values, and loneliness levels in adolescents.

Materials and Methods: The study was planned with an analytical cross-sectional approach in the Manisa province, Turkey. The study was conducted in five high schools in a Turkish city in 2016. The study was carried out with 686 high school students in the Manisa province, Turkey. Data collection tools used in the study were "personal information form", "height and blood pressure measurement form", and "UCLA loneliness scale."

Results: According to this study, 34.4% of participants were found to be excessively spending their time on the internet. The prevalence of hypertension and prehypertension in adolescents was found to be 10.3% and 5.4%, respectively. There was no relationship between the time spent on the internet and blood pressure levels of adolescents (p=0.751). However, there is a relationship between the time spent on the internet and loneliness levels of adolescents (p=0.041).

Conclusion: Particularly, integrating these dimensions of adolescent health into school guidance and psychological counseling units and primary health care services is considered to be important.

Keywords: Adolescent, school health services, loneliness, hypertension, internet

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INTRODUCTION

Adolescence is a unique and critical period of life, defined as the period from 10–19 years of age when rapid changes occur in an individual's life. The world now has more young people than ever before in the history. There are 7.2 billion people worldwide, and around 1.2 billion of these people are adolescents aged between 10 and 19 years. Adolescence covers the period when people become independent individuals, establish new relationships, develop social skills, and learn behaviors for the rest of their lives. In this period of neurological, physical, and emotional transition from childhood to adulthood, young people face a range of health risks (1–3). They are often exposed to many health risks such as injuries, malnutrition, addiction to tobacco, alcohol and drugs, video games, sexually transmitted diseases, or teenage pregnancy.

It is estimated that approximately one of five adolescents has mental health problems such as depression, anxiety, and tendency to suicide (1, 4). For example, 18.4% of children and adolescents aged 5–19 years were overweight or obese globally. Similarly, depressive disorder affects about 4%–5% of adolescents globally and may result in severe social impairment, increased substance use, or suicidal risk. The cumulative probability of depression rising from around 5% in early adolescence reaches as high as 20% by the end of that time (1, 5).

Among adolescence problems, it is reported that the prevalence of hypertension is increased especially in developing countries and the studies on early diagnosis of mild/asymptomatic cases are gaining importance. The studies reported that the prevalence of adolescence hypertension is estimated to be 2%–6% (6–8). Although it can be seen in almost every period of life, it is observed that the feeling of loneliness is more common in adolescence. When individuals need the support of a social group in which they are sincere, intimate, and secure, they can feel loneliness if they are not mature enough to establish appropriate social relations with others or if there is nobody who will meet it (9). An important issue in this period is the use of internet, the source of new and unknown threats. Internet access, which is the most popular and complex (sophisticated) mass media in today's world, may pose a danger to adolescents due to the easy access to the inappropriate content for that age group in the developmental period (10, 11). A European report released in 2012 concluded that around 70% of adolescents have access to internet at home and spend an average of two hours daily online (12). Christakis defined internet addiction as 21st century epidemic, highlighted specific populations that are at increased risk, and reported in several studies that excess internet usage is associated with psychological comorbidities including attention-deficit, depression, social isolation, musculoskeletal discomfort, and sleep problems (11, 13–15). In the literature,
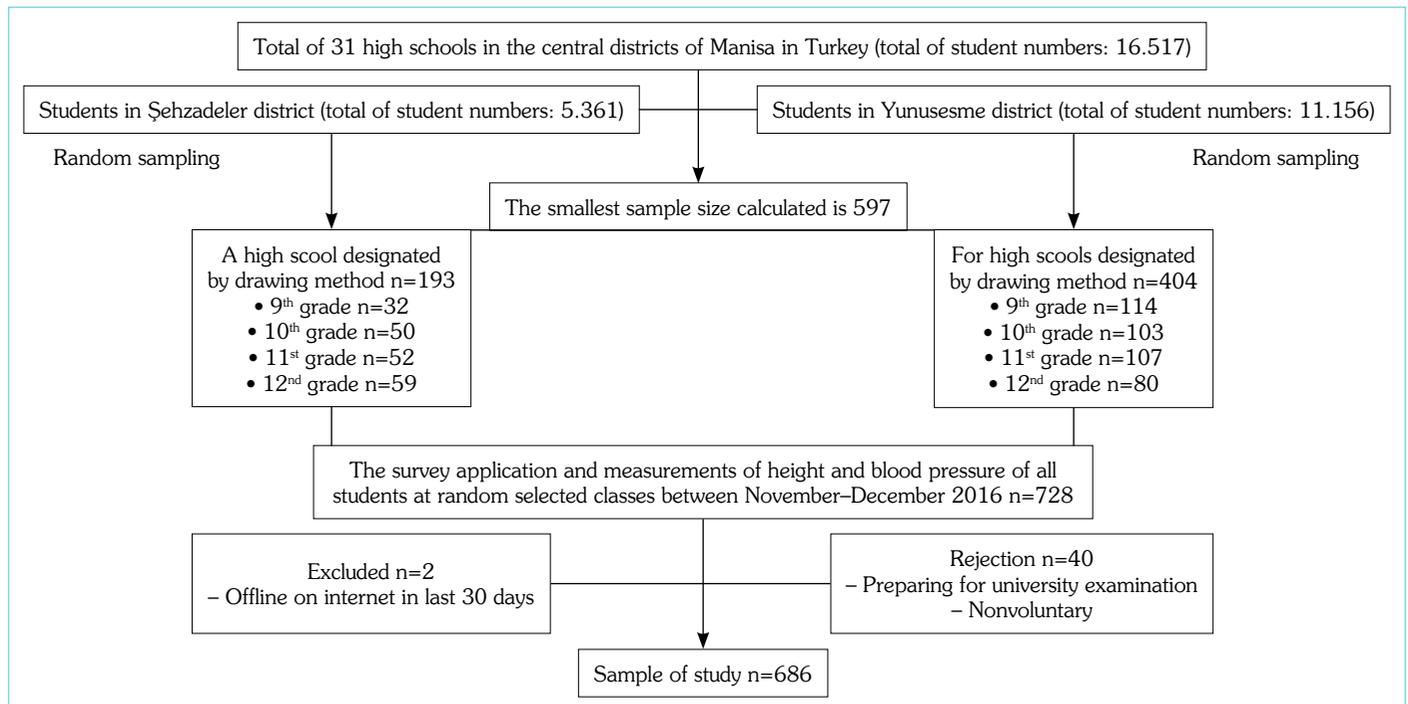
Figure 1. Flowchart showing the sample group and data collection process in the study

it is stated that heavy smartphone use, which is defined as using a smartphone more than three hours per weekday, can lead to poor physical (including vitality) and mental health (16). Results of the meta-analysis study conducted by Alimoradi, Lin, and Broström et al. revealed a significant risk in terms of sleep problems and a significant amount of reduced sleep duration among individuals addicted to the internet (15).

Therefore, the aim of this study, which was conducted to determine the effect of internet (implying a new transition potential in terms of human history) on adolescents, is to examine the relationship among blood pressure values, loneliness levels, and the time spent on internet in adolescents. The question of the study was determined as: "Is there a relation between blood pressure values and loneliness levels of adolescents and the time spent on internet?"

MATERIALS and METHODS

Study Design and Sample
The study was a cross-sectional analytical study. The population of the study consisted of students from 31 high schools in the central districts of the Manisa Province, Turkey. There are 24 public high schools in the Yunusemre district and 7 in the Şehzadeler district (totally 31 high schools) in Manisa. In the Manisa city center, the number of students in high school is 16,517 in the 2016–2017 academic year. The study sample was calculated by Epi Info 2000 program. The study data from Pesen Vural study performed in (11–16 years of age) students from two schools in Manisa were taken as a reference (the prevalence of systolic hypertension was 6.9%) (7). The smallest sample size, which has to be reached at the 95% confidence percentage and 0.02 deviation part, was found to be 597. The voluntary adolescents spending time on internet and studying at high schools in the city center of Manisa were included in the study.

After determining the smallest sample numbers from two districts by a stratified proportional sampling method, high schools were determined by drawing lots. Data were collected between November 25 and December 25, 2016, and 686 voluntary high school students were included in the study (n=686, Fig. 1).

Data Collection Ttools
Data collection tools used in the study are as follows:

Personal information form: A questionnaire form consisting of 22 descriptive questions was used to determine the age, sex, grade, frequency of internet use (online–offline status, average time on internet in last 30 days, etc.) of the adolescents and literature review was performed.

Height and blood pressure measurement form: The measurement of height was performed using a portable stadiometer. Blood pressure was measured from the same arm with the appropriate device for the adolescent individuals by taking three measurements with five-minute intervals. In the light of the studies in the literature, it was decided to measure three times between 09:00 AM and 11:00 AM (17).

UCLA loneliness scale: UCLA was developed by Russell, Peplau, and Ferguson (1978) and translated into Turkish by Yaparel in 1980. It aims to measure the loneliness, an important problem in social life with social and emotional dimensions in daily life. Then, Demir (1989) reviewed the translation of the scale and performed validity and reliability studies (18). The UCLA loneliness scale, which aims to determine the status and level of general loneliness of the individual, is a measurement tool consisting of 20 items, of which 10 are straight and 10 are inverse. It is a self-assessment scale with a four-point Likert type. The lowest score is 20 whereas the highest score is 80. A high total score indicates a high level of loneliness. The internal consistency coefficient of the scale is 0.96

and the test–retest correlation coefficient is 0.94. The internal consistency coefficient was calculated to be 0.70 in this study.

The study data was collected by researchers on face-to-face interviews with measurement techniques. The height was measured without shoes in standing position and recorded in the relevant part of the form. The blood pressure was measured every day on the same hours (between 9:00 AM and 11:00 AM) after the adolescent individual rested for five minutes and then three consecutive measurements were made and recorded in the data collection form (17).

The dependent variable of the study is the time spent on internet by adolescents. Independent variables of the study consist of blood pressure values, loneliness levels, and the descriptive characteristics of adolescents such as gender, age, family structure, and parental education level.

Data Analysis

The study data were evaluated in the Statistical Package for the Social Sciences (SPSS) 22.0 Windows program. Data about the time spent on the internet were assessed by internet usage categories recommended in the studies of Belanger, Akre, Berchtold, and Michaud and of Cassidy-Bushrow, Johnson, Peters, Burmeister, and Joseph (19, 20). Adolescents who use internet for two or more hours a day in every day of the week were classified as "heavy internet use group", who use for less than 2 hours a day in five or more days of the week were classified as "moderate internet use group", and who use for less than 2 hours in four or less days of the week were classified as "light internet use group". Data input for height was made by calculating percentiles by sex. When assessing the blood pressure measurements, by averaging three measurements, a single systolic and diastolic blood pressure value was obtained for each adolescent. The average of the three blood pressure values for each student was evaluated with percentile charts by age, gender, and height presented in the American National High Blood Pressure Educating Program Working Group report. Systolic and diastolic blood pressure percentile values of the adolescents were calculated. Blood pressure percentile values were classified as follows: below 90 percentile "normal", between 90 and 95 percentile "prehypertensive", and 95 percentile and above "hypertensive" (21).

The results of the study were presented by number and percentage distribution, arithmetic mean ($\bar{x}$), and standard deviation (sd) values. In the study, the Skewness and Kurtosis values were evaluated to assess whether the data showed normal distribution. Skewness is a measure of the asymmetry of the distribution of a variable. The skew value of a normal distribution is zero, usually implying symmetric distribution. A positive skew value indicates that the tail on the right side of the distribution is longer than the left side and the bulk of the values lie to the left of the mean. Kurtosis is a measure of the peakedness of a distribution. The excess kurtosis should be zero for a perfectly normal distribution. Distributions with a positive excess kurtosis are referred to as a leptokurtic distribution, meaning a high peak, and distributions with a negative excess kurtosis are called a platykurtic distribution, meaning a flat-topped curve. Normal distribution can be assessed with the absolute values of skewness and kurtosis in a sample of more than 300 without using z values (22). Application of the models of West et al. (23) revealed that the skewness coefficient absolute value for the loneliness score

was less than 3 (skewness=0.548) and the kurtosis coefficient absolute value was less than 7 (kurtosis= -1.646). Normal distribution criteria were met.

Statistical Analysis

Descriptive characteristics of adolescents by internet usage categories are presented in Table 1. The prevalence of heavy internet usage is higher in the longer male adolescents, living in nuclear family, having father with high school and above degree, and having a personal computer (p<0.05, Table 1). The aims of internet usage were as follows: the most common is following social media (82.4%) and the others include listening music 72.2%, doing homework 53.2%, live chat 36.0%, playing games 33.4%, e-mail check 9.5%, and others 6.4%.

The blood pressure values of the adolescents were as follows: 5.4% prehypertensive and 10.3% hypertensive. When the internet usage was evaluated, 34.4% constituted the heavy internet use group, 4.8% the moderate internet use group, and 60.8% the light internet use group. The lowest score on the UCLA loneliness scale was 25 and the highest was 68. When the average of total scores in the scale was evaluated ($\bar{x}$=39.1), the loneliness severity of adolescents was less than moderate (Table 2).

When blood pressure percentile values were assessed by internet usage categories, 33.8% of hypertensive adolescents constituted the heavy internet use group, 40.5% of prehypertensive ones constituted the heavy internet use group, and 34.1% of normal ones constituted the heavy internet use group. The difference between hypertension classification of blood pressure values and internet usage categories was not statistically significant (p=0.751, Table 3). When the distribution of the scores of the UCLA loneliness scale was evaluated by internet use categories of the adolescents in the study, the averages of loneliness score in the heavy internet use group and moderate internet use group were higher as compared to the light internet use group (p=0.041, Table 3).

DISCUSSION

The findings of the present study showed that the prevalence of adolescence hypertension was found to be 10.3%, and the prevalence of prehypertension was 5.4%. When the average of total scores of the UCLA loneliness scale was evaluated ($\bar{x}$=39.1), the loneliness severity of adolescents was less than moderate. When the internet usage was evaluated, 34.4% constituted the heavy internet use group, 4.8% the moderate internet use group, and 60.8% the light internet use group. The difference between hypertension classification of blood pressure values and internet usage categories was not statistically significant (p=0.751). The averages of loneliness score in the heavy internet use group and moderate internet use group were higher as compared to the light internet use group (p=0.041).

The prevalence of adolescence hypertension was found to be 10.3%, and the prevalence of prehypertension was 5.4%. In the sample with similar ages, the prevalence of hypertension was 3.5% in Manisa (n=11,551), and the prevalence of prehypertension was found to be 14.0% (8).

In another study, the prevalence of prehypertension was 11.2%,

Table 1. Descriptive characteristics of adolescents according to internet use categories (n=686)

Characteristics (n)		Internet use categories						p
		Heavy internet use group (≥2 hour/day, every day of the week)		Moderate internet use group (<2 hour/day and ≥5 days/week)		Light internet use group (<2 hour/day and ≤4 days/week)		
		n	%	n	%	n	%	
Gender								
Male	375	135	57.2	25	75.8	215	51.6	0.017
Female	311	101	42.8	8	24.2	202	48.4	
Age (year)		x̄±sd		x̄±sd		x̄±sd		
	686	15.8±0.9		15.9±0.8		15.8±1.0		0.658
Family structure								
Nuclear family	548	191	80.9	20	60.6	337	80.8	
Extended family	99	29	12.3	10	30.3	60	14.4	0.043
Fragmented family	39	16	6.8	3	9.1	20	4.8	
Education level of the mother								
Literate or not	57	18	7.6	7	21.2	37	7.7	
Primary school	405	134	56.8	19	57.6	252	60.4	0.054
High school or more	224	84	35.6	7	21.2	133	31.9	
Education level of the father								
Literate or not	23	7	3.0	3	9.1	13	3.1	
Primary school	343	95	40.3	20	60.6	228	54.7	0.001
High school or more	320	134	56.8	10	30.3	176	42.2	
Economic status perception of the family								
Expenditure less than income	57	17	7.2	1	3.0	39	9.4	
Equal income and expenditure	477	156	66.1	25	75.8	296	71.0	0.193
More income than expenditure	152	63	26.7	7	21.2	82	19.7	
History of hypertension in family								
Yes	112	41	17.4	3	9.1	68	16.3	
No	574	195	82.6	30	90.9	349	83.7	0.483
Regular sports activity*								
Yes	297	106	44.9	13	39.4	178	42.7	
No	389	130	55.1	20	60.6	239	57.3	0.771
Presence of sweating episodic activity of the adolescent* (at least once a week)**								
Yes	566	195	82.6	27	81.8	344	82.5	
No	120	41	17.4	6	18.2	73	17.5	0.993
		x̄±sd		x̄±sd		x̄±sd		
Height (cm)	686	168.4±8.3		167.4±7.2		166.2±9.1		0.006
Systolic blood pressure (mmHg)	686	116.3±12.5		118.1±11.6		115.2±11.8		0.250
Diastolic blood pressure (mmHg)	686	65.0±8.4		64.5±7.7		64.7±8.8		0.887
Possession of computer by adolescent								
Yes	494	189	80.1	14	42.4	291	69.8	
No	192	47	19.9	19	57.6	126	30.2	0.000
Possession of cell phone by adolescent								
Yes	653	229	97.0	29	87.9	395	94.7	
No	33	7	3.0	4	12.1	22	5.3	0.055
Total		**236**	**34.4**	**33**	**4.8**	**417**	**60.8**	

*Adolescents (n=297) who stated that they do regular sports activities have stated ¢activities such as football, basketball, volleyball, walking, fitness, defense sports, badminton, and dance. **Sweating episodic activity in the literature is questioned as Sweat episodes/week

Table 2. Blood pressure percentile values of the adolescents who formed the research group and their distribution by internet use categories and UCLA loneliness scale scores descriptive statistics (n=686)

Measurements	n	%
Blood pressure percentile values		
Normal		
(<90 percentile)	578	84.3
Prehypertensive		
(between 90 and 95 percentile)	37	5.4
Hypertensive		
(≥95 percentile)	71	10.3
Internet use categories		
Heavy internet use		
(≥2 h/day, everyd ay of the week)	236	34.4
Moderate internet use		
(<2 h/day and ≥5 days/week)	33	4.8
Light internet use		
(<2 h/day and ≤4 days/week)	417	60.8
	x̄±sd	
UCLA loneliness scale score	39.1±6.9	(Median: 38.0)

and the prevalence of hypertension was 2.6% (6). In a study in Texas on 6,790 adolescents, the prevalence of prehypertension was 9.4% and the prevalence of hypertension was 3.2% (24). In a study in America on adolescents (14–17 years old), the prevalence of increased blood pressure was 14.2% (20). The groups in three studies are similar to the sample of this study (6, 8, 20). However, it is noted in the domestic studies that the prevalence has increased in the 10 and 9-year period. In the current study, the prevalence of hypertension and prehypertension was found to be increased by 1.5% three years after the study of Cassidy-Bushrow et al. (20). It is stated in the literature that the risk of adolescence hypertension is higher in prehypertensive adolescents as compared to normoten-

sive ones (21). The increased prevalence of prehypertension and hypertension in the adolescence period highlights the importance of screening and follow-up studies.

The majority of adolescents belong to heavy and light internet use groups in the current study. In an abroad study, among adolescents, 40.5% constituted the heavy internet use group, 42% the moderate internet use group, and 17.5% the light internet use group (20). In Switzerland, among adolescents, 7.3% constituted the severe internet use group, 44.9% the moderate internet use group, and 31.4% the seldom internet use group (19). The distribution differences were expected due to the studies performed in different societies. In this study, 95.2% of adolescents have their own phone, and the most common reason for internet use was stated as social media (82.4%). The important point is that, as access becomes easier, adolescent individuals using internet do not become a problematic/pathological internet user over time. Excessive internet interest of adolescents may increase the risk of adverse effects such as problems including time management and health problems, disruption of interpersonal interactions. Besides, 82.5% of adolescents stated that they performed physical activity that sweats at least once a week, and 43.3% of them stated that they performed regular sportive activity. It is suggested that physical activity is not sufficient in this period, when the human body is most active, forming lifestyle habits in the future.

There are studies trying to show that internet usage in today's world may cause psychological effects as well as prehypertensive and hypertensive effects on adolescent individuals. In this study, the difference between blood pressure percentile values and internet usage categories was not statistically significant in the adolescents. In a study in America on adolescents (14–17 years old), the severe internet use group had higher blood pressure as compared to the mild internet use group (20). There are limited number of studies related to this issue in the literature; there is no clarity about the relationship or causality between internet use and blood pressure values. Therefore, there may be some unknown confounder factors affecting the results. For this reason, it is obvious that new studies are needed to verify/refuse the relationship between internet use and blood pressure values.

Table 3. Comparing blood pressure percentile values and UCLA loneliness scale scores according to the internet use categories of adolescents (n=686)

| Characteristics (n) | Internet use categories | | | | | | | | |
| | Heavy internet use group (≥2 hour/day, every day of the week) (a) | | Moderate internet use group (<2 hour/day and ≥5 days/week) (b) | | Light internet use group (<2 hour/day and ≤4 days/week) (c) | | Total | | |
	n	%	n	%	n	%	n	%	Statistical test
Blood pressure percentile value									
Hypertension	24	33.8	3	4.2	44	62.0	71	100.0	
Prehypertension	15	40.5	3	8.1	19	51.4	37	100.0	p=0.751
Normal	197	34.1	27	4.7	354	61.2	578	100.0	
UCLA loneliness scale scores	x̄±sd		x̄±sd		x̄±sd		x̄±sd		p=0.041
	39.9±8.0		40.0±7.5		38.5±6.1		39.1±6.9		Posthoc test* a=b>c

*Tukey's HSD test

The loneliness scores were statistically significantly higher in the heavy internet use group and moderate internet use group as compared to the light internet use group (p<0.05). In a study on university students, no significant difference was found between internet usage and loneliness levels (p=0.278), and because the frequent internet usage facilitates communication with their social circles and they can express themselves more easily, they could not determine their loneliness levels clearly (25). Sanders, Field, Diego, and Kaplan showed on the adolescents that there is a significant relationship between severe internet usage and loneliness (26). In a study on college students (n=910), internet was found to decrease real social relationships, and loneliness levels were higher in the people with problematic internet usage (27). The findings of the Gunuc and Dogan study revealed a medium level of negative relationship (r=0.37) between perceived social support and internet addiction. The adolescents spending time with their mothers had a higher level of perceived social support and a lower level of internet addiction (28). There are results similar to those study results; however, one study reported that the relationship between loneliness and internet usage is not correct and that social anxiety is a confounding variable (29). Upon the question of "is loneliness a symptom of internet addiction, or is internet addiction a symptom of loneliness?" Morahan-Martin stated that it is not possible to identify the direction of the association. The internet usage primarily replaces real life in social relations; therefore, the users get into this bad cycle (30). In this context, the importance of interpersonal relations can be emphasized in the adolescence.

Limitations

There were limitations in this study. A cross-sectional design was used for this study. Therefore, no causality could be concluded. In addition, the lack of use of standardized instruments was also within the limitation of the study. The variations in assessments of internet use could explain the discrepancy of results, because the validity and reliability of the questionnaire, which was utilized, were not provided with enough details. The declarations of the adolescent individuals were evaluated in terms of frequency of internet use. One limitation incurred by the study on adolescents could be the fact that the blood pressure was measured three times in one visit as blood pressure values just represent the current status. Besides, the other limitation may be that 40 senior students were not included in the study since they were preparing for university exams. Private high schools were not included in the study. The reason for the adolescents with higher blood pressure and heavier internet use might be linked with the mental health (anxiety). However, this study did not evaluate the anxiety, which is among the limitations of the current study. Contextual differences in social values and adolescent lifestyles may have also contributed to the extent of correlation between loneliness status and internet use.

CONCLUSION

In conclusion, 15.7% of adolescents are prehypertensive and hypertensive, their loneliness level is less than moderate, and about 1/3 of them are severe internet users. The study results replied the study question: there was an association between loneliness levels and time spent on internet; however, no association was found between blood pressure levels and time spent on the internet. It is important to measure blood pressure of adolescents routinely in primary health care institutions for early diagnosis. Projects may be developed for loneliness levels to provide a more active role in the guidance and psychological counseling unit at schools. It is important to guide the adolescents for regular physical activities and regular breaks between internet sessions on computers and smartphones (maximum 2 hours a day). At this point, the parents should be trained to play a role in controlling and limiting the time spent on internet at home. Besides, outpatient clinics for internet addiction may be put into service more extensively to help them. Likewise, taking history of internet usage is important for screening, examination, and health evaluations by primary care health professionals, school nurses, guide teachers, and pediatricians. The authors who will study this subject are recommended to collaborate with more authors in such complex research to improve future research. Because, future studies should contain loneliness measurements, internet addiction scales, and their results in multivariate analysis with a holistic approach in collaboration with different disciplines.

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