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Original Article

Internet addiction increases poor sleep quality among high school students

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Abstract

Objective: Good sleep quality is important for human health. Internet addiction can disrupt sleep quality. The purpose of this study was to investigate the relationship between the use of online communication tools, internet addiction and poor sleep quality. **Methods:** This cross-sectional study was conducted in Mersin in 2016. The universe of the research consisted of 55043 high school students. Based on minimum sampling, it was planned to include 1110 people in the study, but in actuality, 1061 people participated. Descriptive statistics, chi-square, t test, Mann Whitney U, Binary Logistic Regression analysis and Classification and Regression Tree analysis were employed during the data processing. **Results:** A total of 1061 students, of which 531 (50.0%) were females, participated in the research, with an average age of 16.6±1.2 years. Out of all the participants, 65.6% had personal computers, 87.0% had personal mobile phones and 90.4% of these participants had access to the Internet via their mobile phones. Among all, 58.6% were found to be suffering from poor sleep quality. Studied factors like internet addiction (OR=2.31), being female (OR=1.95) and having conflict with parents due to excessive internet use (OR=1.95) were found to be the contributing factors which diminished sleep quality. Furthermore, it has been shown in the classification and regression tree analyses that internet addiction is the most significant determinant of poor sleep quality. **Conclusion:** The co-occurrence of prevalent poor sleep quality and internet addiction among the participants of the study may be a strong evidence of the link between internet addiction and poor sleep quality.

Keywords: Internet, addiction, sleep, adolescence

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İnternet bağımlılığı lise öğrencilerinde kötü uyku kalitesini artırıyor

Özet

Amaç: İyi uyku kalitesi insan sağlığı için önemlidir. İnternet bağımlılığı uyku kalitesini bozabilir. Bu çalışmanın amacı online iletişim ve internet bağımlılığı ile kötü uyku kaitesi arasındaki ilişkiyi araştırmaktır. **Gereç ve yöntem:** Kesitsel tipte planlanan bu çalışma 2016 yılında Mersin'de yapıldı. Araştırma evrenini 55043 lise öğrencisi oluşturmaktadır. Minimum örnekleme hesabıyla çalışmaya 1100 kişi alınması planlandı, çalışmaya 1061 kişi katıldı. Veri analizinde tanımlayıcı istatistikler, ki-kare, Kolmogorov-Smirnow test, Mann Whitney U, Binary Logistic Regresyon analizi ve Classification and Regression Tree analysis kullanıldı. **Bulgular:** Çalışmaya 531'i (%50.0) kadın ve yaş ortalaması 16.6±1.2 olan 1061 öğrenci katıldı. Çalışmaya katılanların %65.6'sının kendine ait bilgisayarı, %87.0'ının kendine ait cep telefonu ve cep telefonu olanların %90.4'ünün cep telefonundan internete bağlandığı tespit edildi. Öğrencilerin %58.6'sında kötü uyku kalitesi tespit edildi. Kötü uyku kalitesini internet bağımlılığı (OR=2.31), kız (OR=1.95) ve aile ilişkilerinin kötü olmasının (OR=1.95) artırdığı tespit edildi. Ayrıca classification and regression tree analizinde de internet bağımlılığının kötü uyku kalitesini en fazla artıran factor olduğu saptandı. **Sonuç:** Çalışmaya katılanlar arasında kötü uyku kalitesi ve internet bağımlılığının yaygın olarak birlikte olması, internet bağımlılığı ile kötü uyku kalitesi arasındaki ilişkinin güçlü bir kanıtı olabilir.

Anahtar kelimeler: İnternet, bağımlılık, uyku, ergen

Introduction

Sleep can be defined as a state of unconsciousness during which the perception of sensory and other types of stimuli are diminished. In order to maintain a good mental health, a healthy sleep is mandatory for every person.[1-3]

Insomnia is a health issue that interrupts the continuity of normal life and can lead to other problems. A wide spectrum of cognitive problems and a nervous temperament are likely to appear after a long sleepless term. Individuals suffering with insomnia often encounter problems like difficulty in perception and memory, difficulty in learning and a decreased sense of risk perception. Furthermore, sleeplessness can increase the risk of cardiovascular diseases, diabetes, cancer and can even result in death.[3-5]

In the last quarter century, communicating and playing games via the internet, along with mobile phones, have caused the emergence of a problem that is defined as internet addiction or problematic internet use, symptoms for which include: the desire to extend the time spent on the internet, dreaming about networking, spending more time than planned online and the emergence of other physical, psychological or social problems.[6] The studies in the literature report that internet addiction among teenagers and the intense use of online communication tools adversely affect sleep quality.[7-9] A study conducted in China notes that students with internet addiction had 1.73 times greater poor sleep quality than others.[10] A study from Korea reported a strong correlation between the intense use of internet and being in a daydream, as well as having other sleeping problems in a given population of college students.[11] Similarly, another report showed a relationship between poor sleep and internet addiction among a group of Chinese children aged 10-20.[10]

A domestic study showed that high school students graded with the highest level of internet addiction went to bed at

later times, required a greater time to fall asleep, struggled with continuous sleep, woke up more often at night and felt more sleeplessness during the day when compared to their counterparts.[12] Lastly, another Turkish study also confirmed the relationship between internet addiction and poor sleep quality.[13]

Despite several studies pointing out the relationship between internet addiction and poor sleep quality among teenagers, scientific records are far from the desired levels. The research on the relationship between Internet addiction, use of online communication tools, and poor sleep quality in Turkey is limited. High school students form the largest risk group. This study aims to investigate the effects of online communication tools and internet addiction among high school students and their sleep quality. To this end, poor sleep quality prevalence among high school students and its associated risk factors are investigated.

Methods

Ethics approval for this cross-sectional study was received from the Mersin University Social Sciences and Ethics Committee. The data was accumulated between the 15th of February and the 15th of March in 2016, during a specialist thesis entitled"*Research on the Quality of Sleep of High School Students in Mersin, in Relation to the Use of Virtual Communication Tools and Internet Addiction*".

The population of the study was comprised of a number of 114 registered high school students among the 55043 in the Mersin central district. The minimum sample size was calculated to be 1047 (n=55043, 50% prevalence, ±3 error, 95% CI). Thus, a total number of 1100 individuals were recruited into the study. A multistage and stratified systematic sampling method was employed to determine the individuals during the recruitment phase.

Stratification was formed in terms of the district, school type and level of the classes. Based on weighting, 550 students were included from vocational high schools (50.0%), 450 from general high schools (41.0%) and 100 from private high schools (9.0%) into the study. Among the total of 13 schools, 4 of them were general, 7 were vocational and 2 were private high schools. These schools were randomly chosen from the school list of Mersin city. The classes were also randomly included in the study by picking up from every branch, plus every student from the selected class were recruited for the study.

Two tracts were used for the collection of the data. The initial tract collected data on the socio-demographic features of the students and their families, and features of online communication tools and the way they were used. The second tract was the Pittsburh Sleep Quality Index (PSQI) which was used for measuring the sleep quality of the participants. The scale was developed by Buysse et all[14] for the evaluation of sleep quality. The Turkish validity and reliability of this scale was established by Ağargün et all[15] in 1996. Based on this scale, having 5 PSQI points in total is defined as *Poor sleep quality***.** In the third part, Internet Addiction Scale (IAS) was used. The Turkish validity and reliability of the scale, firstly developed by Griffiths[16], was confirmed by Canan[17]. A scale point equaling 81 or above is defined as having *Internet addiction*. The validity and reliability of the Turkish versions of the scales have been reported.[16,17] The revision of the data form was made after the pilot study.

Poor sleep quality was the dependent variable and the students and their parents' socio-demographic characteristics, the students' Internet addiction, and having and using online communication were the independent variables. The data regarding online communication tools were determined using numbers and items as follows: the number of computers, mobile phones, having access to the Internet from mobile phones, having access to the Internet at home, duration of mobile phone use, locations of Internet outside of the house and social media applications access.

The data were collected by the researcher physician, who went to the

schools and classrooms identified using the sampling method, and then informed the students about the study. Two students did not want to be included in the study. The other 1092 students (99.3%) agreed to participate and were given socio-demographic information forms. The students completed the forms themselves; however, 31 of the forms which lacked necessary information or were completed carelessly were excluded. In total, 1061 forms were evaluated.

The following descriptive statistics were used for the data summary. Whether continuous variables matched normal distribution was determined by the Kolmogorov-Smirnov test. The Chi-square test was used for the comparison of categorical variables: gender, own computer of student, own mobile phone of student, person who lives with and parent education. The t test and Mann Whitney U significance tests were used for the comparison of continuous variables: age, number of siblings, number of in home living, family income, weekly allowance, duration of internet usage and duration of mobile phone talking. Independent variables that had lower p values than 0.20 in univariate analyses were used in Binary Logistic Regression analyses using the Backward:LR method for the determination of risk factors for poor sleep quality. Then, classification and Regression Tree (CART) analyses was used to identify the variables that were sufficient for judging the sleep quality as poor or not poor. Statistical level of significance was accepted as $p \leq 0.05$.

Results

531 female (50.0%) and 530 male (50.0%) students were included in the study, a total of 106 participants1. The mean age of the students was 16.2±1.2. Amongst all, 90.7% of the students were found to be living with their parents and a further 70.3% of them had their own rooms at home (Table 1).

Table 2 shows that 65.6% of the students had their own computers, while 87.0% of them had their own mobile phones. 90.4% of the mobile phone owners were *online* through their devices. 234 of the participant students (22.1%) were found to be internet addicts (Table 2).

Table 1. The socio demographic variables of student and parents

Variables		n	%
Gender (n=1061)	Male	530	50.0
	Female	531	50.0
School group (n=1061)	General high school	516	48.6
	Vocational high school	545	51.4
School type (n=1061)	State high school	950	89.5
	Private high school	111	10.5
Class (n=1061)	Nine	309	29.1
	Ten	271	25.5
	Eleven	291	27.5
	Twelve	190	17.9
Own room in your home (n=1051)	Yes	739	70.3
	No	312	29.7
Who do you live with (n=1060)	Parents	961	90.7
	Other	99	9.3
Mother education (n=1053)	Middle school and under	700	65.0
	High school and above	353	35.0
Father education (n=1052)	Middle school and under	599	56.9
	High school and above	453	43.1

Table 2. Online communication tools in home and internet addiction of the student

Variables		n	%
In home*	TV	1048	98.8
	Computer	866	81.6
	Tablet computer	576	54.3
	Game console	167	15.7
Own computer of student (n=1045)	Yes	686	65.6
	No	359	34.4
Own mobile phone of student (n=1059)	Yes	921	87.0
	No	138	13.0
Internet access from mobile phone (n=918)	Yes	830	90.4
	No	88	9.6
Internet access from home (n=1058)	Yes	766	73.3
	No	282	26.7
Internet addiction (n=1061)	Yes	234	22.1
	No	827	77.9

* This question has been answered multiple times

It was found that 622 of the participant (58.6%) had poor sleep quality. It was also estimated that this ratio was 53.6% for male and 63.7% for female students, respectively and the difference was statistically significant (p=0.001).

The scores of poor sleep quality were high among female students, those who had Internet addiction, those whose Internet use was not restricted at home, and those who did not have conflicts with parents about Internet use. There were also significant differences between the scores (Table 3). The mean scores for durations of daily Internet use, watching TV, talking on the phone, the number of SMS and communication tools of those who had poor sleep quality were higher and the difference was statistically significant (Table 4).

The independent variables that were found as statistically significant or had a p value below 0.20 in univariate analysis (age, gender, territory of the school, aim of internet use, internet addiction, the forbiddance put on the internet use by the family, the conflict within the family due to internet use, duration of daily internet use, TV watching, speaking on the phone, number of texts sent, number of communication applications) were analysed further with the Binary Logistic Regression Model. As a result of this analysis, it was determined that poor sleep quality increases by 2.31 times with internet addiction, 1.95 times in females, 1.08 times for an hour spent on internet, 1.95 times by having often or regular conflicts with family due to internet use and 1.17 times by age growth (Table 5).

CART analysis was used to determine the most important variables to impact poor sleep quality. As seen in the optimal classification tree model, it was confirmed that internet addiction is the most influential variable to lead to poor sleep quality. Students who had internet addictions and had a weekly allowance of more than 43.5 TL were determined as the second influential variable. In our study, estimation possibility of optimal classification tree model was calculated as 65.0% and evaluated as “average” (Figure 1).

Table 3. Categorical variables associated with poor sleep quality

Variables		Poor Sleep Quality: Yes n	Yes %*	No n	No %*	Total n	Total %**	p
Gender	Male	284	53.6	246	46.4	530	50.0	**<0.001**
	Female	338	63.7	193	36.3	531	50.0	
School district	Yenişehir	182	55.3	147	44.7	329	31.0	**<0.01**
	Akdeniz	190	57.1	143	42.9	333	31.4	
	Toroslar	116	56.3	90	43.7	206	19.4	
	Mezitli	134	69.4	59	30.6	193	18.2	
Purpose of internet usage	Only courses/research	29	60.4	19	39.6	48	4.6	**<0.001**
	Course and other aims	325	54.7	269	45.3	594	56.7	
	Others	263	64.8	143	35.2	406	38.7	
Internet addiction	Yes	187	79.9	47	20.1	234	22.1	**<0.05**
	No	435	52.6	392	47.4	827	77.9	
Restriction internet usage of parent	Yes	166	55.0	136	45.0	302	39.5	**<0.05**
	No	293	63.3	170	36.7	463	60.5	
Conflict over parental use of the internet	Never	112	47.9	122	52.1	234	22.1	**<0.001** [1]
	Rarely	193	56.9	146	43.1	339	32.3	
	Sometimes	188	61.8	116	38.2	304	29.0	
	Often	64	64.0	36	36.0	100	9.5	
	Always	58	79.5	15	20.5	73	7.0	

*: Row percentage **: Column percentage, [1] Chi Square for trend

Table 4. Continuous variables associated with poor sleep quality

Variables	Poor Sleep Quality: Yes n	Yes Median (Min-Max)	No n	No Median (Min-Max)	p
Age (year)	622	17 (14-21)	439	17 (14-20)	>0.05*
Duration of internet usage (hours/day)	560	2.5 (0-13)	386	2 (0-15)	**<0.001***
Duration TV watching (hours/day)	613	2 (0-10)	432	2 (0-10)	**<0.05***
Duration of mobile phone talking (minute/day)	524	20 (1-300)	368	15 (1-300)	**<0.01***
SMS count fron mbile phone (number/day)	516	100 (0-5000)	350	50 (0-5000)	**<0.01***
Number of communication applications	612	1 (0-7)	425	1 (0-5)	**<0.05***

*Mann Whitney U test

Table 5. Risk factors of poor sleep quality

Variables	Exp (B)	%95 CI	p
Internet addiction			
Yes	2.31	1.48-3.59	**<0.001**
No	1.00		
Gender			
Female	1.95	1.40-2.72	**<0.001**
Male	1.00		
School district			
Mezitli	1.86	1.19-2.90	**0.006**
Akdeniz	0.85	0.56-1.28	0.438
Toroslar	0.95	0.60-1.51	0.829
Yenişehir	1.00		
Duration of internet access (hour/day)	1.08	1.01-1.16	**0.021**
Conflict due to internet use in the family			
Often or always	1.95	1.10-3.42	**0.021**
Rarely or sometimes	1.37	0.90-2.06	0.136
Never	1.00		
Age	1.17	1.02-1.34	**0.025**

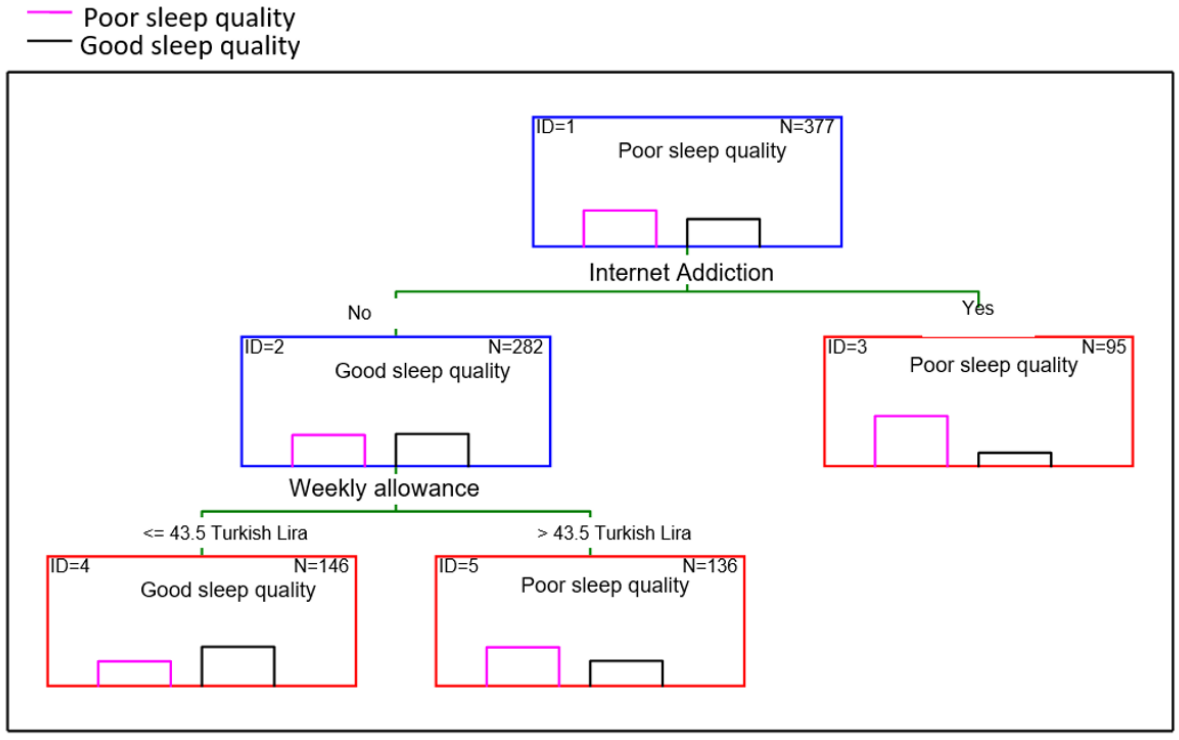

Figure 1. The best classification tree model for determining poor sleep quality

Discussion

More than half (58.6%) of the participants had poor sleep quality, and it was more prevalent among female students (63.7%) than their male counterparts (53.6%). It was found that the risk factor which increased poor sleep quality the most was Internet addiction, which was followed by being female and having frequent conflicts with parents due to Internet use.

Our study showed that 58.6% of the students had poor sleep quality. The incidence of poor sleep quality was reported to be around 33.3% and 71.4% in earlier studies in the literature.[18-24] Based on these, our findings can be considered at the level of a medium high group. These results show that poor sleep quality in students is a wide-spectrum health problem. As sleep quality is a vital factor and a significant indicator of the health status of an individual and environmental factors, the underlying factors must be well taken care of in order to reach rational solutions. While the occurrence of high level of poor sleep quality in our study was partly related to the socio-cultural and economic dynamics, it might also be tightly connected with the online communication tools and internet abuse. In that sense, we assume that output of the current study could be a significant value in the related literature.

There are some studies in the literature examining the relationship between internet addiction and sleep quality. A study on college students in Taiwan showed that poor sleep quality occurred 1.4 times greater in the students with internet addiction relative to the students without internet addiction.[25] Another study reported that there was a positive correlation between internet addiction and poor sleep quality in students in Canada.[26] Again a study conducted on college students found that students with sleep disorders have a higher average of internet addiction scale grade.[13] Similarly in our study, students with internet addiction as compared to non-addicts had 2.31 times greater poor sleep quality. According to the CART analysis, internet addiction was found to be the most influential factor in terms of classifying students with poor sleep quality (among the variables examined). The results of the study showed that internet addiction was a significant risk factor in terms of poor sleep quality. The time spent in front of any kind of screen may adversely affect the process of a person's preparation for sleep. The light and sound coming from screens of tools like computers, tablets and mobile phones may keep an individual awake and affect the hormone oscillations that are instrumental to sleep. This process can disrupt an individual's sleep rhythm, delay his or her transition to sleep, decrease the time left for sleep and ruin the sleep quality by causing breaks during the sleep.

The gender factor on sleep quality was also examined in a few previous studies. A study from China showed that females had a 1.27 time greater risk of having poor sleep quality as compared to males in the same studied population.[27] Another study reported a statistically significant ratio of poor sleep quality in high school students with 34.1% for female students, and 24.5% for male students in Konya, Turkey.[28] With a finding that female students are at a 1.95 time greater risk of sleep disturbance, our study in consistent with the established literature. One explanation for such a phenomenon could be that females are tasked with house-related works more often than males, even during childhood years. Likely a greater pressure exerted by their families, along with biological and hormonal differences, may result in female students experiencing poorer sleep quality when compared to their male counterparts.

Studies accumulated based on the connection between the sleep quality of students and their relationship with their parents are also present. One study showed that the worse family relationships are, the poorer the sleep quality of the child will be.[27] Another one in Taiwan showed that high school students reporting conflict with their families had a 1.3 times greater chance of sleep disturbance as compared to the non-family-conflicted students.[29] A study from Ankara, reported that negative relationship with parents is positively related to poor sleep quality.[30] These

studies clearly display that having problems with family has an adverse impact on sleep quality. However, none of these studies remark or expand upon the reasons behind the negative relationship between the students and their families.[27-30] Our study on the other hand, showed that students who argued with their parents over their use of internet had a 1.9 time greater chance of having poor sleep quality. Additionally, having conflicts with one's parents about internet use can be counted as a sign of being a problematic internet user. The adverse effects of problematic internet use on sleep quality has been given in several reports, including our study.

As a consequence, poor sleep quality among the high school students in our city was detected to be at a quite high level (58.6%). Internet addiction was shown to be the cardinal factor on negative sleep quality.

In conclusion, the detection of such students with poor sleep quality by their teachers and parents is fundamental in addressing the issue. Furthermore, based on our study, female and/or older students, those having higher weekly allowances or conflicts with their parents about the use of internet, as well as internet addictions, are counted in the risky group. Therefore, those students should be given priority.

It is recommended that students with internet addiction are identified and given guidance services. It is recommended that physical and social environments be provided in order to ensure that internet and virtual communication tools are used for academic aims more often and individuals focus on their real-life relationships more than virtual relations in their social lives. In order to reach this goal, it is recommended that families, school management and teachers work in collaboration.

Limitations of the study: The main limitation was that the study was conducted exclusively in high schools in the city center. Therefore, the findings regarding the prevalence of poor sleep quality and its relationship to Internet addiction cannot be generalized to students outside of the city center who were not evaluated.

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Author contribution:

Fazıl Koças: Planning, data collection, analysis and interpretation of the study

Tayyar Şaşmaz: Planning, analysis and interpretation of the study

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