RESEARCH ARTICLE

Investigation of the relationship between technology addiction and sleepiness among university students in health-related departments in Turkey

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Abstract

Objective: To investigate the relationship of internet and smartphone addiction levels of university students in health-related departments with their daily sleepiness, and to identify associated factors.

Method: The cross-sectional study was conducted from October 1 to November 30, 2019, at Gaziosmanpaşa University, Tokat, Turkey, and comprised students of either gender registered with the faculties of medicine, dentistry, and health sciences, as well as the vocational school of health services. The self-administered survey form comprised the short form of the Young's Internet Addiction Test, the short version of the Smartphone Addiction Scale and the Epworth Sleepiness Scale. Data was analysed using SPSS 20.

Results: Of the 640 subjects, 445(68.6%) were females and 204(31.4%) were males. Scores indicated a moderate level of addiction among the students along with excessive daytime sleepiness, showing a significant correlation between the two factors (p<0.001).

Conclusion: As the level of internet and smartphone addiction increased, the state of sleepiness also increased among the university students.

Keywords: Internet addiction, Smartphone addiction, Sleepiness, University students. (JPMA 72: .497; 2022)

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Introduction

Internet, one of the most important technological innovations of today, has been increasingly used by all members of society worldwide regardless of age, gender and geographical region. Internet use has an undeniable positive effect on our lives, but, when it is excessive and uncontrollable, it appears as an addiction that can lead to clinical problems.[1,2] Internet addiction is defined as a state of restlessness and discomfort caused by excessive and unrestricted desire, behaviour and anxiety related to internet access and computer use.[3] It is one of the rapidly growing addictive behaviours and a major public health problem affecting a great number of individuals worldwide.[4] University students are considered a vulnerable group in terms of internet addiction since they usually use the internet more for social purposes than the other age groups. Some authors have reported that students are more likely to sacrifice their hours of sleep, as the theoretical and practical courses in education programmes in health sciences departments, such as medicine, dentistry and nursing, are more intense than the others.[5]

Owing to their advanced functionality, smartphones offer applications for information, communication, entertainment and many other purposes, and have become indispensable in our daily lives. However, this indispensability has brought along an addiction problem.[6] Studies have shown that academic achievement, concentration, and memory proportionally decrease with the increase of time allocated to smartphones and internet during the day, Social and psychological problems, such as stress, anxiety and sleep disorders and physical symptoms as vision and musculoskeletal ailments, are developed..[7] In a study including medical faculty students, the duration of mobile phone use was significantly associated with the development of health problems, such as lack of concentration (47.6%), prolonged sleep in the form of sleepiness (13%), tingling sensation and numbness in the fingers (10%), anxiety (9.5%) and insomnia (2.5%).[8]

Sleep, one of the most essential components of a healthy life, is a complex physiological process. Adequate and good-quality sleep, which is one of the determinants of individuals' quality of life (WOL), is closely related to environmental, emotional, social life, and general health status.[9] One of the most important environmental factors of reduced sleep quality is excessive use of smartphones.[10] Many studies have demonstrated the relationship between excessive internet use and sleep disturbances, such as decreased sleep duration, insomnia, increased fatigue and daytime sleepiness.[11,12] However, medical faculty students experience intense stress during long study periods and are prone to sleep-deprivation.[13]

The current study was planned to investigate the relationship of internet and smartphone addiction with daytime sleepiness among university students studying in

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health-related departments, and to identify the associated factors.

Subjects and Methods

The cross-sectional study was conducted from October 1 to November 30, 2019, at Gaziosmanpaşa University in the Tokat province located in the Central Black Sea Region of Turkey. After approval from the institutional Faculty of Medicine ethics review committee, the sample size was calculated considering the input of a similar study[14] regarding the presumed maximum variability for the prevalence of internet addiction among university students (p=0.5) while keeping 95% level of confidence and 8% permissible error in the estimates. The sample was raised using simple random sampling technique proportionate to the size of each health-related department.

Those included were students of either gender who were registered with the faculties of medicine, dentistry, and health sciences, as well as with the Vocational School of Health Services (VSHS) during the academic year 2019-20, who had smartphones and volunteered to participate. Those who did not give consent and those without a smartphone were excluded.

After taking permission from the faculty heads and the VSHS director as well informed consent from the participants, data was collected using a self-administered standardised 28-item survey form designed in accordance with literature[4,6,8] about socio-demographic characteristics and internet and smartphone usage. Also included were the Short Form of Young's Internet Addiction Test (YIAT-SF), the Smartphone Addiction Scale-Short Version (SAS-SV) and the Epworth Sleepiness Scale (ESS).

The YIAT-SF is a 12-item scale which was later converted into short form[15] and scored on a 5-point Likert-type scale ranging from 1=never to 5=always. The Turkish version was generated[16] for both adolescents and university students, and the Cronbach's alpha coefficient of internal consistency was 0.91. There is no reverse-scored item in the scale. The scores range 12-60, and higher scores indicate an increased risk of internet addiction.[16]

The Turkish version of SAS-SV17 has Cronbach's alpha coefficient of internal consistency 0.867. The scale consists of 10 items and one dimension, and is scored on a 6-point Likert-type scale, ranging from 1 = strongly disagree to 6 = strongly agree. There is no reverse-scored item in the scale. The scores range 10-60, and higher scores indicate an increased risk of smartphone addiction.[17]

The ESS is an easy-to-apply, easy-to-evaluate, and widely-used tool consisting of eight items scored on a 4-point Likert-type scale, ranging from 0=never doze off to 3=always sleepy. The scores range 0-24, and higher scores indicate increased daytime sleepiness. Unlike other self-reported scales, it measures the general level of daytime sleepiness rather than evaluating sleep for special occasions and special time periods. The validity and reliability studies[18] in the Turkish population showed Cronbach's alpha coefficient of internal consistency to be ≥0.86. An ESS score of ≥11 indicates excessive daytime sleepiness and circadian rhythm change.

Data was analysed using SPSS 20. Descriptive data was expressed as mean±standard deviation (SD), or as frequencies and percentages, where applicable. Shapiro-Wilk's test was used to assess data normality. Independent sample t test and one-way analysis of variance (ANOVA) were used to compare the continuous normal data between and among groups. Pearson correlation analysis was used for correlation between the variables. P<0.05 was considered statistically significant.

Results

Of the 1,903 students available, 674(35.4%) were initially enrolled, but the study was completed by 649(96.3%). There were 445(68.6%) females and 204(31.4%) males. Of the total, 160(24.7%) were students of the medical faculty, 175(27%) the faculty of dentistry, 177(27.3%) the faculty of health sciences, and 137(21.1%) were from the VSHS. In addition, 121(18.6%) students were smokers, 80(12.3%) used alcohol, 605(93.2%) accessed internet mostly through the smartphones, 33(5.1%) through computers, and 11(1.7%) through tablets. Of the participants, 425(65.5%) had their own computer or tablet. The duration of weekday internet use was ≤1 hour in 82(12.6%) cases, 2-3 hours in 239(36.8%), 4-5 hours in 246(37.9%), and ≥6 hours in 82(12.6%). The duration of weekend internet use was ≤1 hour in 49(7.6%) cases, 2-3 hours in 124(19.1%), 4-5 hours in 308(47.5%), and 6 hours in 168(25.9%). The purpose of internet use was most commonly social media in 573(88.3%) cases, entertainment in 544(83.8%), lessons or homework in 347(53.5%), online shopping in 272(41.9%), news in 268(41.3%), e-mail services in 203(31.3%), online games in 155(23.9%), scientific research in 153(23.6%), and for other purposes in 28(4.3%). The duration of daily mobile phone use was ≤1 hour in 43(6.6%) cases, 2-3 hours in 254(39.1%), 4-5 hours in 256(39.4%), and ≥6 hours in 96(14.8%). A total of 110(16.9%) students had first purchased their own mobile phones when they were 10-12 years old, 438(67.5%) when they were 13-16 years old, and 101(15.6%) when they were ≥17 years old.

The mean YIAT-SF score was 28.99±8.76 (range: 12-60). There was a significant difference between the mean total YIAT-SF scores and gender (p=0.029), faculty (p<0.001),

living alone or with home mates status (p=0.018), maternal education status (p=0.013), paternal education status (p=0.003), smoking status (p=0.001), body mass index (BMI) (p=0.016), how the individual felt about his/her own health (p=0.041), academic performance (p<0.001), how the individual accessed the internet (p<0.001), duration of weekday daily internet use (p<0.001), duration of weekend daily internet use (p<0.001), availability of free wi-fi access (p=0.037), age at the first own mobile phone purchased (p<0.001), duration of daily mobile phone use (p<0.001) and purposes of using internet for most frequently social media (p=0.002), entertainment (p=0.048), online shopping (p=0.042), e-mail services (p<0.001), and online games (p<0.001).

The mean SAS-SV score was 29.27±11.33 (range: 10-60). There was a significant difference between the mean SAS-SV total scores and faculty (p<0.001), living alone or with home mates status (p=0.024), maternal education status (p=0.005), paternal education status (p=0.007), family income status (p=0.004), smoking status (p=0.008), BMI (p=0.038), academic performance (p=0.002), duration of

Table-1: Distribution of the students' mean scores obtained from YIAT, SAS and ESS scales according to some descriptive variables.

Variables	n (%)	YIAT		SAS		ESS	
		Mean±SD	*p*-value	Mean±SD	*p*-value	Mean±SD	*p*-value
Department							
Faculty of Medicine	160 (24.7)	32.33±9.47	<0.001	33.81±11.98	<0.001	7.81±3.25	<0.001
Faculty of Dentistry	175 (27.0)	27.5±7.44		27.23±9.93		6.78±4.05	
Faculty of Health Sciences	177 (27.3)	29.46±9.24		29.48±11.34		8.93±5.08	
Health Services Vocational School	137 (21.1)	26.4±7.53		26.28±10.6		6.89±4.29	
Place of residence							
Dormitory	384 (59.2)	29.27±8.51	0.582	29.58±11.47	0.124	7.82±4.43	0.024
Student house	142 (21.9)	28.8±8.96		30.01±11.65		7.99±4.13	
With his family and Other	123 (18.9)	28.36±9.32		27.42±10.36		6.7±4.06	
Student house							
Alone	39 (27.7)	31.74±10.32	0.018	33.69±12.88	0.024	8.54±4.62	0.371
With friends	103 (72.3)	27.78±8.16		28.76±10.85		7.84±3.91	
Maternal education							
Secondary school and less	416 (64.1)	28.35±8.19	0.013	28.32±10.78	0.005	7.66±4.19	0.909
High school and higher	233 (35.9)	30.14±9.61		30.95±12.08		7.62±4.55	
Paternal education							
Secondary school and less	243 (37.4)	27.68±7.84	0.003	27.70±10.82	0.007	7.65±4.43	0.963
High school and higher	406 (62.6)	29.78±9.19		30.20±11.53		7.64±4.26	
Family income status							
Less than expense income	74 (11.4)	28.64±7.73	0.148	28.97±11.56	0.004	8.39±4.13	0.174
Income is equal to expenses	489 (75.3)	28.74±8.78		28.65±11.14		7.47±4.39	
More than expense income	86 (13.3)	30.71±9.37		33.01±11.6		7.98±3.99	
Smoking							
No	528 (81.4)	28.47±8.59	0.001	28.7±11.17	0.008	7.54±4.31	0.199
Yes	121 (18.6)	31.27±9.16		31.74±11.71		8.1±4.33	
Alcohol use							
No	569 (87.7)	28.79±8.55	0.122	29.19±11.11	0.637	7.67±4.27	0.648
Yes	80 (12.3)	30.41±10.1		29.83±12.82		7.44±4.66	
Body Mass Index (kg/m^2)							
< 24.9 kg/m^2	516 (79.5)	28.57±8.60	0.016	28.80±11.24	0.038	7.62±4.29	0.747
≥ 25 kg/m^2	133 (20.5)	30.62±9.23		31.08±11.52		7.75±4.46	
How the individual felt for his/her own health							
Good	425 (65.5)	28.40±8.74	0.041	28.59±11.18	0.098	7.43±4.19	0.001
Medium	192 (29.6)	29.90±8.59		30.38±11.46		7.65±4.21	
Bad	32 (5.0)	31.41±9.49		31.53±12.02		10.44±5.68	
Academic performance							
Good	193 (29.7)	26.91±8.83	<0.001	27.36±11.0	0.002	6.84±4.22	0.008
Medium	387 (59.6)	29.41±8.45		29.58±11.24		8.01±4.26	
Bad	69 (10.6)	32.51±8.97		32.81±11.83		7.83±4.66	
Total	649 (100.0)	28.99±8.76		29.27±11.33		7.64±4.32	

YIAT: Young internet addiction test, SAS: Smartphone addiction scale, ESS: Epworth Sleepiness Scale, SD: Standard deviation.The significance test of the difference between the two means and one-way analysis of variance were used.

weekday daily internet use (p<0.001), duration of weekend daily internet use (p<0.001), availability of free wi-fi access (p=0.004) e-mail services (p<0.001), age at the first own mobile phone purchased (p<0.001), duration of daily mobile phone use (p<0.001), and purposes of using internet for most frequently social media (p<0.001), entertainment (p=0.033), online shopping (p<0.001), and e-mail services (p<0.001). However, there was no significant difference in other variables (p>0.05).

The mean ESS score was 7.64±4.32 (range: 0-24). A total of 498(76.7%) participants received ≤10 points, while 151(23.3%) received ≥11 points. A significant difference was found between the mean ESS score and faculty (p<0.001), place of residence (p=0.024), state or private dormitory status of residents (p<0.001), how the individual felt about his/her own health (p=0.001), academic performance (p=0.008), duration of weekday daily internet use (p<0.001), duration of weekend daily internet use (p=0.001), age at the first own mobile phone purchased (p=0.020), and duration of daily mobile phone use (p<0.001) (Tables 1-2).

There was a significant positive correlation of ESS scores

Table-2: Distribution of the students' mean scores obtained from YIAT, SAS and ESS scales regarding usage of internet and smartphones.

Variables		n (%)	YIAT		SAS		ESS	
			Mean±SD	*p*-value	Mean±SD	*p*-value	Mean±SD	*p*-value
Duration of weekday daily internet use								
One hour and less		82 (12.6)	26.23±8.28	<0.001	25.45±10.75	<0.001	7.24±3.9	0.001
Two or three hours		239 (36.8)	27.82±8.47		28.25±11.94		6.95±3.89	
Four and five hours		246 (37.9)	30.42±9.07		30.89±10.67		8.02±4.52	
Six or more hours		82 (12.6)	30.89±8.02		31.17±10.87		8.93±4.92	
Duration of weekend daily internet use								
One hour and less		49 (7.6)	25.04±7.67	<0.001	24.16±10.9	<0.001	6.51±3.53	0.002
Two or three hours		124 (19.1)	27.02±7.61		26.41±10.26		7.31±4.03	
Four and five hours		308 (47.5)	29.03±8.81		29.94±11.51		7.4±4.21	
Six or more hours		168 (25.9)	31.52±9.04		31.63±11.08		8.66±4.76	
Free wi-fi access								
Yes		540 (83.2)	29.31±8.93	0.037	29.84±11.6	0.004	7.71±4.38	0.379
No		109 (16.8)	27.39±7.7		26.44±9.44		7.31±3.98	
Purpose of the internet use								
Social media	Yes	573 (88.3)	29.38±8.8	0.002	29.92±11.24	<0.001	7.7±4.37	0.352
	No	76 (11.7)	26.07±7.96		24.33±10.84		7.21±3.89	
Entertainment	Yes	544 (83.8)	29.29±8.78	0.048	29.68±11.52	0.033	7.6±4.37	0.515
	No	105 (16.2)	27.45±8.56		27.1±10.08		7.9±4.07	
Lessons / homework	Yes	347 (53.5)	29.45±8.86	0.157	29.82±11.59	0.182	7.61±4.23	0.806
	No	302 (46.5)	28.47±8.63		28.63±11.01		7.69±4.43	
Online shopping	Yes	272 (41.9)	30.26±8.87	0.002	31.14±11.43	<0.001	7.99±4.25	0.081
	No	377 (58.1)	28.07±8.58		27.91±11.07		7.39±4.36	
News	Yes	268 (41.3)	29.71±9.01	0.081	29.45±11.47	0.731	7.67±4.31	0.892
	No	381 (58.7)	28.49±8.56		29.14±11.24		7.62±4.33	
E-mail services	Yes	203 (31.3)	31.64±9.33	<0.001	32.02±12.14	<0.001	7.35±3.86	0.242
	No	446 (68.7)	27.79±8.22		28.01±10.72		7.78±4.51	
Online game	Yes	155 (23.9)	32.1±9.13	<0.001	31.28±11.12	0.011	7.88±4.57	0.441
	No	494 (76.1)	28.02±8.42		28.63±11.33		7.57±4.24	
Scientific research	Yes	153 (23.6)	29.57±8.87	0.344	28.77±11.17	0.531	7.39±4.54	0.408
	No	496 (76.4)	28.81±8.73		29.42±11.39		7.72±4.25	
How old was the first own mobile phone purchased?								
10-12 years		110 (16.9)	26.08±7.17	<0.001	25.83±10.2	<0.001	6.79±3.98	0.020
13-16 years		438 (67.5)	29.91±9.23		30.48±11.76		7.96±4.41	
17-20 years		101 (15.6)	28.19±7.45		27.75±9.59		7.19±4.13	
Duration of daily mobile phone use								
One hour and less		43 (6.6)	26.4±9.92	<0.001	24.09±12.79	<0.001	7.3±2.33	<0.001
Two or three hours		254 (39.1)	27.27±8.54		26.1±9.72		7.3±3.96	
Four and five hours		256 (39.4)	29.85±8.27		31.71±11.41		7.38±4.1	
Six or more hours		96 (14.8)	32.43±8.82		33.44±11.38		9.42±5.32	
Total		649 (100)	28.99±8.76		29.27±11.33		7.64±4.32	

YIAT: Young internet addiction test, SAS: Smartphone addiction scale, ESS: Epworth Sleepiness Scale, SD: Standard deviation; Independent sample t test and one-way analysis of variance were used.

Table-3: Correlation between the students' YIAT, SAS and ESS scores (n = 649).

Variables		YIAT	SAS	ESS
YIAT	r	1	r=0.696*	r=0.435*
	p	.	***p*<0.001**	***p*<0.001**
SAS	r	r=0.696*	1	r=0.350*
	p	***p*<0.001**	.	***p*<0.001**
ESS	r	r=0.435*	r=0.350*	1
	p	***p*<0.001**	***p*<0.001**	

YIAT: Young internet addiction test, SAS: Smartphone addiction scale, ESS: Epworth Sleepiness Scale. *Pearson's correlation coefficient was used; umbers in bold represent significant results.

with YIAT-SF (r=0.435, $p<0.001$) and SAS-SV (r=0.350, $p<0.001$) scores (Table 3).

Discussion

Smartphones and the internet are extremely effective technological revolutions that consume most of our time. However, previous studies have shown that internet addiction is a serious public health problem, including depression, anxiety, aggression, low academic performance, cognitive impairment, bad eating habits, insomnia, visual and hearing impairment, social isolation, and smoking and alcohol use among university students. It increases the risk of causing negative mental, physical, social and economic consequences.[4] In addition, smartphones, which cause deceleration in melatonin secretion and disruption in circadian rhythm with the electromagnetic waves they emit, adversely affect the sleep health as the internet. It is also one of the hypotheses that those who have insomnia use more smartphones and the internet and, therefore, go into a vicious cycle.[19] The present study investigated the relationship between internet and smartphone addiction and sleepiness among university students studying in health sciences departments. The students received 28.99±8.76 points, which is considered as intermediate level in YIAT-SF. In a similar study,[20] the mean internet addiction test score was 27.3±19.9 among university students. In another study investigating the frequency of internet addiction among 552 university students studying in the departments of medicine, nursing, physiotherapy, and engineering, the majority of the students (64.31%) were moderate internet users.[14] According to the Young's original criteria, 2.54% of the students had severe internet addiction and 7.97% had moderate internet addiction.[15]

As with all addiction types, it is an indisputable fact that many personal and environmental factors have an impact on internet and smartphone addiction. The current explored various variables, and the fact that medical faculty students had higher rates of internet addiction than others, students whose parents were more educated and those who lived alone at home compared to others may suggest the relationship between higher economic and social status and internet addiction in the modern world. However, the association of other variables, such as smoking, high BMI, poor health status, low academic performance, and the absence of reading books outside the field that was noted in the current study deserves particular attention. This link is considered a vicious cycle, indicating the difficulty in defining and controlling the problem. In a study including adolescents, internet addiction of adolescents whose mothers were working was significantly higher and the active role of the mother in the control of internet use was emphasised.[21] In another study investigating the rates of internet addiction among 910 university students in Mersin, internet addiction rate was 2%.[22] The proportion of students with risky internet use was 20.9%, while the rate of students using the internet within normal limits was 77.1%. It was found that risky use was more common in males, indicating a significant difference ($p=0.001$). No significant difference was found in terms of age, marital status, financial income, alone / with home mate accommodation. The students used the internet ≥40 hours a week, and moderate internet users used the internet most frequently for 0-9 hours a week.

The current study found that the mean SAS-SV total score was 29.27±11.33 and the smartphone addiction was at a moderate level. Similar to internet addiction, a significant relationship was found between the daily phone usage time, students' faculties, living alone in student homes, high education level of parents, good family economic status, smoking status, high BMI, low academic performance, the absence of reading out of the field, daily internet usage on weekdays and / or weekends, the availability of free wi-fi, the status of using the internet most frequently for social media, entertainment, online shopping, e-mail, the age of the first owned mobile phone and smartphone addiction ($p<0.05$). In a study by Kumcağız et al.[7] in university students, gender did not have a significant relationship with smartphone addiction, while high education level of parents and good family economic status were significantly correlated with smartphone addiction, consistent with our study results. However, there are also studies showing higher smartphone addiction in females.[23-25]

In the study conducted by Chung et al.[6] among adolescents, low academic performance was significantly associated with smartphone addiction, consistent with our study. This finding indicates that associated variables, such as health status, academic achievement and BMI complicate the cause-effect relationship in a vicious cycle, and smartphone addiction is a very difficult public health problem to define and work on.

In the current study, the mean ESS total score was

7.64±4.32, indicating a low level of sleepiness. However, a positive correlation was found between the ESS scores and the YIAT-SF (r=0.435, p<0.001) and SAS-SV (r=0.350, p<0.001) scores. Internet addiction and smartphone addiction were found to increase sleepiness in students. In a study conducted in Iran, excessive internet and social media use with smartphones was associated with poor sleep quality among medical students.[13]

In the current study, 54.2% participants used smartphones for four hours or more during daytime. Considering the combination of smartphone addiction and sleepiness seen in the study, it suggests that the participants sacrificed their sleep time to compensate for this amount of daily loss of time. Similarly, a study by Mayda et al.[5] investigated the sleep quality of medical students, and found that more than half of the students had poor sleep quality, and students sacrificed their sleep time due to the intense and exhausting training programmes carried out in health sciences professions, such as medicine, nursing and pharmacy.

The current study was conducted in 2019. However, in the following period, the novel coronavirus disease 2019 (COVID-19) pandemic, which affected the whole world, emerged. During the pandemic, individuals had to spend their days at home for longer periods of time, keeping direct contact with a limited number of individuals. Practices such as working from home, distance education, online meetings, congresses, online shopping became much more important in social life and made their place in our lives indispensable. We believe that we would face health problems and variations related to internet and smartphone addiction in the near future, which are mentioned in many of studies cited above, and emphasised in the current study as well.

The main limitations of the current study are its cross-sectional and single-centre design in which the data of students in different departments related to health sciences in a single university were evaluated. Therefore, the results can be only generalised to the university where the study was conducted. Additionally, the assessment of internet and smartphone use patterns and sleepness relied on the students' self-reports. Therefore, the findings may under-estimate the true relationship between sleepiness and internet and smartphone addiction among the students and associated factors.

Further large-scale, prospective studies are needed to investigate the burden of other mental, psychological, and social problems and the consequences associated with them, and to gain a better understanding of the effects of internet and smartphone addiction on sleepiness.

Conclusion

Internet and smartphone addiction was found to be at a moderate level, and sleepiness was found to be at a low level among university students studying in health sciences departments. In addition, internet and phone addiction increased sleepiness and adversely affected the students.

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