



The association between internet addiction, sleep quality, and health-related quality of life among Iranian medical students

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Abstract

Due to the increasing use of the internet in Iranian society, especially among students, and the importance of sleep quality (SQ) and quality of life (QOL), the present study examined the relationship between QOL, SQ, and internet addiction (IA) among medical science students. In the present descriptive-analytical study, the sample comprised Saveh University of Medical Sciences students who were studying in 2019. The survey included demographic information (i.e., age, gender, place of residence, field of study, semester, marital status, smoking status, daily exercise) and the 20-item Internet Addiction Test. From 285 distributed questionnaires, 279 individuals with a mean age of 21.01 years ($SD \pm 3.17$) completed the survey. Findings indicated that students with IA had higher mean scores on (i) all physical dimensions concerning QOL (except for the physical pain) and (ii) all psychological dimensions of QOL. The findings will help national health authorities and planners in Iran design appropriate and effective interventions to improve student health and prevent IA.

Keywords: internet addiction; sleep quality; quality of life; medical students

Introduction

The internet has become an integral part of most individual's daily activities and life, especially for students, and is an essential tool for social interaction and communication [1, 2]. Students may benefit from the internet for educational and academic purposes, such as searching the information in electronic databases, communicating with teachers and classmates, and attending online courses and learning activities. Furthermore, they may utilize the internet for communications and entertainment, leisure, and social media use [3]. Over the past decade, there has been a significant increase in worldwide research examining internet addiction (IA) due to numerous online applications and increasing reports of internet-related problematic behavior [4]. All online addictions whether it is generalized internet addiction or specific types of online addiction (e.g., online gaming addiction, online gambling addiction, social media addiction, etc.), all have common components including: (i) greater than normal usage, often related with a loss of sense of time or a negligence of basic drives; (ii) withdrawal, where feelings of anger, tension, and/or depression occur in the situations where individuals do not have online access; (c) tolerance, where individuals have the need for increasingly better computer equipment, better software, and/or a build up over time of daily online use time; and (d) adverse consequences, such as compromising occupation/education and relationships arguments, lying, social isolation, and fatigue [5]. Furthermore, IA is considered by many as a public health problem that can harm users' health and quality of life [6].

According to Douglas and colleagues [7], IA comprises the mandatory use of the internet, whereby if individuals are deprived of it, they become more irritable and show mood swings. IA also refers to too much use of the Internet in a way that other social activities are adversely affected, leading to loss of performance in different life aspects (i.e., occupational, educational, social,

professional, familial, financial, and/or psychological), and neglecting real-world relationships with family and friends [8]. The numbers of individuals with IA worldwide has been increasing especially students and young people [2]. In 2018, there were approximately four billion Internet users, most of whom were adolescents and young people [9].

Problematic internet use (PIU) has been reported to be 1.0-9.0% among European adolescents, 1.0-12.0% among Middle Eastern adolescents, and 2.0-18.0% among Asian adolescents [10]. In a meta-analysis by Zhang and colleagues [4], the prevalence rate of IA was 30.1% among 3651 medical students (the target population of the present study). In Iran (where the present study was carried out), Modara et al. [11] reported an IA prevalence rate of 20%. As aforementioned, IA is associated with negative consequences on the users' physical and mental health, and can have a detrimental effect on the quality of life, physical health, family life, and academic performance [12]. Individuals with IA typically spend too much time sitting in front of a computer, which can lead to being overweight and obesity [13], and can also suffer from severe psychological distress, including anxiety and depression [11]. Recent meta-analyses by Ho et al. [14] and Alimoradi et al. [9] indicated that IA is significantly associated with alcohol abuse, tobacco use, attention deficit, depression, anxiety, hyperactivity, insomnia, decreased sleep duration, and poor sleep quality.

Good sleep quality (SQ) is essential for individuals' health and quality of life (QOL) [15]. Sleep disorders are associated with complications including headaches, learning disabilities, memory impairment, aggressive behavior, and mental disorders [16, 17], as well as being associated with a higher risk of non-communicable diseases such as cardiovascular diseases and diabetes [18, 19]. A study by Cheng and Li reported that IA was inversely associated with QOL on both of its subjective (life satisfaction) and objective (environmental quality) indices [20].

Previous research has also shown that poor QOL among students negatively impacts on their learning [12, 21]. Due to the increasing use of the internet in the Iranian society, especially among students, and the importance of SQ and QOL for university medical students' personal and academic life, the present study investigated the relationship between the QOL, SQ and IA among Iranian medical students.

Methods

Design and sample

In the present study, the population comprised all Saveh University of Medical Sciences students who were studying in the academic year of 2019 (N=285). The inclusion criteria were being university medical students, having internet access, providing informed written consent to participate in the study, and having the ability to work on the internet. Samples were selected by the stratified method by gender and faculty. More specifically, first, the number of students per course and the gender ratio in the university were determined, and then the number of necessary students were randomly selected from the attendance list.

Measures

Demographic information: The survey included a number of demographic questions (i.e., age, gender, place of residence, field of study, semester, marital status, smoking status, daily exercise);

Internet Addiction Test (IAT): The IAT is a 20-item scale developed by Young [22]. It is a reliable and valid scale for assessing IA. The scale items are assessed on a five-point Likert scale from 1 (*rarely*) to 5 (*always*) with scores ranging from 20 to 100. Higher scores indicate greater dependence and addiction on the internet. Those scoring 20 to 49 are defined as normal users, 50

to 79 are defined as moderate addicts, and 80 to 100 are defined as severe addicts). In addition, scores <50 are classed as regular users and scores ≥ 50 are classed as having IA. The Iranian IAT was validated by Alavi et al. [23] and had very good reliability. In the present study, the Cronbach's alpha was 0.82.

Pittsburgh Sleep Quality Index (PSQI): The 19-item PSQI was developed by Buysse et al. [24] and has seven subscales (i.e., subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction). Most of the questions are multi-option, short, and easy to comprehend. Items are assessed from 0 to 3 (*never*=0, *less than once a week*=1: *once to twice a week*=2, three or more times a week= 3) and scores range from 0 to 21. Higher scores indicate poorer sleep quality, and scores above 5 indicate a significant sleep disorder. The Iranian version was validated by Moghaddam et al. [25] and had excellent reliability. In the present study, the Cronbach's alpha was 0.82.

Short-Form Health Survey (SF-12): The 12-item SF-12 was developed by Montazeri et al. [26] and comprises two subscales – the Physical Component Summary (PCS) and Mental Component Summary [27]. The PCS has eight items (includes physical functioning, role limitations due to physical problems, general health [GH], bodily pain [BP]), and MCS has four items (mental health [MH], vitality [VT], role limitations due to emotional problems, social functioning). Responses to items are given on 2- to 6-point scales and the range for raw scores for items range from 1 to 6. Raw scores may be converted to create eight scale scores each ranging from 0 to 100. The Iranian version was validated by Montazeri et al. [26] and the reliability for the PCS and MCS subscales was good. In the present study, the Cronbach's alpha was 0.77 for PCS and 0.79 for MCS.

Ethics

The Research Ethics Committee of the Saveh University of Medical Sciences approved the study (Number: IR.SAVEHUMS.REC139409). All students completed provided written informed consent. Participation in the study was voluntary, and participants were assured that all data were anonymous and confidential.

Statistical analysis

Data analysis included chi-squares, independent t-tests, ANOVA, and Pearson correlation coefficients performed on SPSS 18 software.

Results

Of the 285 distributed surveys, 279 individuals (35 males and 244 females) with a mean age of 21.01 years ($SD\pm 3.17$) completed them. A total of 170 individuals (60.9%) were regular users of the internet, 97 individuals were classed as having moderate IA (34.7%; 83 females and 14 males), and 12 individuals were classed as having severe IA (4.3%; 10 females and 2 males). Among the demographic variables, residing in student dormitories (as opposed to living with their family), and marital status (i.e., being single) had significant relationships with IA ($p<0.05$). The results also indicated that there was an association between low physical activity and high tobacco use with IA, but it was not significant (Table 1).

Table 2 shows that students with moderate to severe IA (i.e., scoring ≥ 50 out of 100 on the IAT) had poorer SQ on the PQSI ($p<0.001$). More specifically, the mean and standard deviation of the overall score of SQ was 10.89 out of 21 ($SD\pm 5.96$) among students with IA, and 7.20 ($SD\pm 4.29$) among students without IA. Furthermore, compared to students without IA, students with IA

had significantly higher scores of sleep disturbances ($p<0.001$), sleep duration ($p<0.05$), subjective sleep quality ($p<0.001$), sleep latency ($p<0.001$), and sleep efficiency ($p<0.001$).

The evaluation of the relationship of IA and QOL using independent t-tests indicated that the mean and standard deviation of overall quality of life was and 28.04 (out of 48) ($SD\pm 2.86$) and 30.16 ($SD\pm 2.52$) among students with and without IA, respectively ($p<0.001$). Students with IA had significantly higher mean scores on all physical dimensions of the QOL (all $p<0.001$; PCS: $p=0.012$), except for the physical pain, and all psychological dimensions of QOL (all $p<0.001$) (see Table 3).

Further analysis also showed that there was a positive and significant correlation between IA and all dimensions of the sleep quality, except for the daytime dysfunction (i.e., the higher the IA, the greater the sleep disorder). Furthermore, there was a negative and significant correlation between IA and all dimensions of the quality of life (PCS and MCS) (i.e., the higher the IA, the poorer quality of life ($p<0.01$)) (Tables 4 and 5) .

Discussion

The main focus of the present study was to determine the relationship between internet addiction (IA), quality of life (QOL) and sleep quality (SQ) among medical students. Based on the results, the moderate to severe prevalence rate of IA was 39% in students (4.3% for ‘severe internet addiction’). The prevalence rate was higher than previous Iranian studies. For instance, the prevalence rate of IA was 31.2% in a study by Langarizadeh et al. [29], 28.8% in a study by Nemati [30], 27.5%, in the Gorgich study [31], and 9.6% in the Bazrafshan et al. study [32]. In the meta-analysis by Modara et al. [11], the IA prevalence rate was 20% in Iran [16%-25% with a 95% confidence interval]. The IA prevalence rate is diverse among students from other countries. For

example, it was 32.2% in a meta-analysis by Zhang et al. [4], 29.0% by Son in Korea [33], and 18.2% by Kamal et al. in Egypt [34].

The high prevalence rate of moderate to severe IA in the present study may be due to the expansion of virtual networks such as *Telegram* over the past three years in Iran, as well as the industrial texture and lack of recreational facilities in a small town, (i.e., Saveh). Students, who are often from neighboring main cities such as Tehran and Qom and come to Saveh for study at university, use the internet and virtual networks for leisure time in their dormitories. Results showed that living in university dormitories (as opposed to living with family) was more associated with IA. However, the present authors suspect that the prevalence of IA in Iran is increasing, and that the differences in prevalence rates across countries due to (i) social and cultural factors and different countries using different instruments to assess IA and/or using different cut-off points with the same instrument (e.g., IAT) [24]. Therefore, each country should conduct surveys to assess IA at regular intervals [2]

Consistent with previous studies in this field [35, 36], the present study also highlighted the association of IA with poor SQ. Tsitsika et al. [37] researched seven European countries indicating that the prevalence of sleep problems was higher among students with IA, a finding which was also found in a recent meta-analysis [14]. Bhandari also reported that a relationship between IA and poor SQ among students [38]. This consistent finding among students is of concern, especially among medical sciences students, because their work deals with human lives.

Previous studies have consistently shown that poor SQ and IA among students has adverse effects on general health, daily life, academic performance, and communication with friends and family [39, 40]. Furthermore, IA can disrupt circadian rhythms which affect sleep time and duration, leading to fatigue and dysfunction[41]. A Korean study by Kim et al. [42] showed that

poor SQ was related to more severe IA and lifetime suicide attempts. Due to the close relationship between SQ and physical/mental performance, it is important to monitor students' sleep health status.

In the present study, there was a significant negative correlation between IA and QOL. Moreover, non-IA participants had higher scores of PCS and MCS in comparison to those with IA. The result was consistent with a study among Vietnamese students by Tran et al. [2] who reported that IA was associated with poor quality of life. Another similar study among Taiwanese students by Chern et al. [43] found that IA was negatively associated with all aspects of QOL. A meta-analysis by Cheng and Li of 80 studies from 30 countries also indicated that IA was inversely correlated with QOL [20]. The finding should be taken into consideration because previous studies have found that poor student QOL can negatively impact on learning motivation [21].

In the relationship between IA and socio-demographic factors, unlike most previous studies in Iran and Asia [44, 45] in which being male was a risk factor for IA, in the present study, gender had no significant relationship with IA. However, this may have been because there were very few males in the present study. In the present study, IA was higher among students who lived in dormitories. The finding is consistent with a study by Asiri et al. among Rasht students [46]. This was most probably due to the availability of computers and free internet access in dormitories, because other studies such as that by Tran et al. [2] have reported that the availability of computers and the internet at home is directly correlated with IA.

The results of the present study found a significant relationship between marital status and IA (i.e., the rate of IA was higher among single students). The finding is consistent with research by Ansari et al. [44]. Lower rates of IA among married individuals is likely because they spend less time on the internet due to their familial relationships and responsibilities. Davis also posited

that single individuals receive positive internal rewards such as competence and socialization emotion when connected to the internet, leading to more use of it [47].

This present study has several limitations. First, because the study was cross-sectional, the results are unable to show causal relationships between the variables. Second, use of self-report questionnaires that might be associated with potential biases such as social desirability bias and memory recall. Third, the sample was selected from one university and therefore results may not generalize to other university students both in and outside of Iran. Fourth, the presence of low physical activity and high tobacco use may also impact on health and sleep quality.

Conclusions

Findings in the present study indicated that moderate to severe IA is relatively common problem among Iranian students, and both sexes were at risk of IA. The present study helps better understand the relationship between IA, SQ, and QOL among students. The results will also help Iranian health authorities and planners design appropriate and effective interventions to improve student health and prevent IA. Further studies utilizing a larger sample size and more representative cohort studies are recommended to further identify causes of IA and its physical, psychological, and social consequences among students from other Iranian regions.

Abbreviations: Internet Addiction (IA); sleep quality (SQ); quality of life (QOL); physical component summary (PCS); mental component summary (29)

Ethics approval and consent to participate

Ethical approval was obtained from the Saveh University of Medical Sciences Ethics Committee (Number: IR.SAVEHUMS.REC139409). All participants were informed that their participation

was voluntary, that the procedure did not pose any potential risk, and that their identities and data would be strictly confidential and anonymous. Informed written consent was provided by all participants prior to taking part in the study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that there are no conflicts of interest. The corresponding author of this manuscript (BA) is a member of the editorial board (Associate Editor) of this journal.

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Authors contributions

Study concept and design MK and BA. Analysis and interpretation of data: FP and MRR. Drafting the manuscript: BA, FP, and MK. Critical revision of the manuscript: BA, MK and MDG. Final editing and re-write: MDG. All authors read and approved the final manuscript.

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Table 1. The association between internet addiction and the socio-demographic characteristics of the students.

	Internet addiction						p-value
	Normal (20-49)		Moderate (50-79)		Severe (80-100)		
	N	%	N	%	N	%	
Gender							
<i>Female</i>	151	61.8	83	34.1	10	4.1	0.673
<i>Male</i>	19	54.3	14	40	2	5.7	
Marital status							
<i>Single</i>	141	83	92	94.8	11	91.7	0.017
<i>Married</i>	29	17	5	5.2	1	8.3	
Current living location							
<i>Staying in dormitory</i>	130	76	85	87.6	11	91.7	0.051
<i>Living with family</i>	40	24	12	12.4	1	8.3	
Tobacco use							
<i>Yes</i>	13	7.6	6	6.2	3	25	0.073
<i>No</i>	157	92.4	91	93.8	9	75	
Physical activity							
<i>Yes</i>	61	35.9	26	26.8	1	8.3	0.064
<i>No</i>	109	64.1	71	73.2	11	91.7	
Mother's education							
<i>Illiterate/Elementary</i>	66	38.8	46	47.4	6	50	0.143
<i>Middle/ High school</i>	76	44.7	45	46.4	4	33.3	
<i>Academic</i>	28	16.5	6	6.2	2	16.7	
Father's education							
<i>Illiterate/Elementary</i>	68	40	34	35.1	2	16.7	0.357
<i>Middle/ High school</i>	61	35.9	43	44.3	7	58.3	
<i>Academic</i>	41	24.1	20	20.6	3	25	

Table 2. Comparison of sleep quality between participants with and without internet addiction

PSQI categories	With internet addiction		Without internet addiction		Total		<i>p</i> -value
	Mean	SD	Mean	SD	Mean	SD	
Subjective sleep quality	1.09	0.64	0.88	0.61	1.01	0.63	0.008
Sleep latency	2.57	1.61	1.70	1.29	2.23	1.56	0.001
Sleep duration	0.99	0.98	0.77	0.76	0.90	0.90	0.047
Habitual sleep efficiency	0.41	0.49	0.09	0.26	0.24	0.41	0.001
Sleep disturbances	1.27	0.48	0.92	0.37	1.09	0.46	0.001
Use of sleeping medication	0.08	0.33	0.07	0.35	0.08	0.34	0.783
Daytime dysfunction	0.61	0.93	0.45	0.84	0.54	0.89	0.150
Global PSQI index	10.89	5.96	7.20	4.29	9.43	5.65	0.001

Table 3. Comparison of quality of life between participants with and without internet addiction

	With internet addiction		Without internet addiction		Total		<i>p</i> -value
	Mean	SD	Mean	SD	Mean	SD	
Physical functioning	4.65	1.36	5.38	1.02	5.0	1.28	0.001
Role physical	3.88	1.31	4.37	0.79	4.15	1.06	0.001
General health	3.05	0.75	3.57	0.92	3.25	0.89	0.001
Bodily pain	3.34	0.90	3.52	1.0	3.45	0.96	0.133
Physical component summary	15.55	2.93	16.26	1.75	15.98	2.34	0.012
Mental health	2.11	1.05	2.88	1.19	2.60	1.20	0.001
Role emotional	2.75	1.19	3.35	1.17	3.13	1.22	0.001
Vitality	3.85	1.19	4.61	1.33	4.13	1.30	0.001
Social functioning	3.56	0.948	4.00	1.05	3.73	1.0	0.001
Mental component summary	12.90	2.11	13.70	1.86	13.36	2.01	0.001
Global quality of life	28.04	2.86	30.16	2.52	29.99	2.75	0.001

Table 4. Correlations between dimensions of sleep quality and internet addiction

Dimensions	1	2	3	4	5	6	7	8	9
1. Internet addiction	1								
2. Subjective sleep quality	0.38*	1							
3. Sleep latency	0.44*	0.41*	1						
4. Sleep duration	0.36*	0.31*	0.33*	1					
5. Habitual sleep efficiency	0.47*	0.52*	0.41*	0.29*	1				
6. Sleep disturbances	0.32*	0.28*	0.38*	0.26*	0.44*	1			
7. Use of sleeping medication	0.14*	0.20**	0.11*	0.10*	0.13*	0.39*	1		
8. Daytime dysfunction	0.23**	0.16*	0.19*	0.13*	0.34*	0.22*	0.12*	1	
9. Global PSQI index	0.45*	0.39*	0.35*	0.36*	0.45*	0.41*	0.30*	0.21*	1

*Correlation is significant at the 0.01 level (2-tailed).

**Correlation is significant at the 0.05 level (2-tailed).

Table 5. Correlations between dimensions of quality of life and internet addiction

Dimensions	1	2	3	4
1. Internet addiction	1			
2. Physical functioning	-0.33*	1		
3. Mental Component Summary	-0.41*	0.56*	1	
4. Global quality of life	-0.46*	0.76*	0.79*	1

*Correlation is significant at the $p < .01$ level (2-tailed).

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