Original Research

Examining the Relationship between Sleep Quality and Academic Performance with the Degree of Dependence on Smartphone during the Coronavirus Pandemic

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Received: 29 Nov. 2021 Accepted: 21 Jan. 2022

Abstract

Background and Objective: After the outbreak of the coronavirus disease 2019 (COVID-19) pandemic in Iran, to prevent the spread of coronavirus, it was decided for classes to be held virtually. Even though this decision reduced the spread of the virus, the students were exposed to smartphone addiction, which is believed to have high comorbidity with psychological problems. The current study aims to examine the relationship between sleep quality and academic performance with the degree of dependence on smartphone during the COVID-19 pandemic.

Materials and Methods: The current research was a cross-sectional study with 254 adolescent students participating in virtual classes. This study was conducted in 2020-2021. The participants filled out the following questionnaires online: Pittsburgh Sleep Quality Index (PSQI), smartphone addiction scale (SAS), and Educational Performance Test (EPT). The data were analyzed using SPSS software, descriptive statistics [frequency, pearson correlation, mean, standard deviation (SD)], and inferential statistics (simultaneous regression) ($P < 0.05$).

Results: There was a significant correlation between components of addiction to the Internet and the study's variables. The results of correlation analysis showed that there was a significant correlation between Internet addiction and academic performance (Pearson correlation = -0.57, P = 0.01) and between Internet addiction and sleep quality (Pearson correlation = 0.47, P = 0.01).

Conclusion: According to the results, it can be concluded that after the COVID-19 pandemic and virtual education, Internet addiction could be a risk factor for decreasing sleep quality and academic performance in students.

Keywords: Internet addiction disorder; Sleep quality; Academic performance

Citation: Alinezhad E, Moradi S, Nemati Z, Mohammadi Golestani F, Rajabi F, Alimehdi M. **Examining the Relationship between Sleep Quality and Academic Performance with the Degree of Dependence on Smartphone during the Coronavirus Pandemic.** J Sleep Sci 2022; 7(1-2): 22-27.

Introduction

Coronavirus was first identified in Wuhan, China, in 2019, and then it rapidly spread across the globe. The prevalence and death toll of this virus was so high that the World Health Organization (WHO) announced it as a health crisis on January 30th, 2020 (1). For this reason, in 2020, the government of Iran mandated staying home for students and creating virtual classes for schools. Therefore, during the coronavirus disease 2019 (COVID-19) pandemic, the Internet was

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utilized for accommodating various needs including communication, education, entertainment, searching for information, etc. (2). Although virtual education is a beneficial method against the spread of COVID-19, excessive use of smartphones could result in psychological problems (3). Smartphone addiction is a particular behavioral addiction to smartphone overuse; as a result, one's physical, psychological, and social functions are impaired (3). The main symptoms of this addiction include being obsessed with smartphones (craving), spending considerable periods using a smartphone (tolerance), and feeling anxious in the absence of a smartphone (restlessness) (4). Various studies have demonstrated that addiction to smartphones can cause psychological problems such as psychiatric symptoms, sleep disorders, obesity, and poor academic performance (2, 5). There have been concerns regarding the possible consequences of post-COVID-19 lifestyles which are believed to contribute to substance abuse and other reinforcing behaviors namely gambling, online games, and excessive Internet and social media use. For instance, in their study, Sun et al. reported increased dependence on the Internet by 46.8% of the participants, and elevated Internet use during the pandemic by 16.6% (6).

In addition to higher rates of smartphone addiction, populations in various investigations have reported lower sleep quality after the outbreak of COVID-19. A study conducted by Zhang et al. revealed that COVID-19 survivors were negatively influenced in terms of sleep quality (7). In this regard, Pieh et al. concluded that 18.6% of youths underwent insomnia during the pandemic (8). Furthermore, some investigations indicated that individuals from the United States of America (USA) and Europe tended to postpone their sleep during the pandemic and sleep longer than usual (9). Although various studies have been carried out on the psychological problems resulting from the pandemic among adults, little has been investigated in the younger population. Also, according to previous studies, after the spread of the virus and the rise in the popularity of virtual education, smartphone addiction started to grow (3). On the other hand, different findings have demonstrated links between smartphone addiction and psychological problems. Thirdly, since the students have continued their educational purposes through online classes using smartphones, they have been exposed to smartphone addiction. Despite the increase in Internet addiction among students and its impact on their mental health after the spread of the coronavirus, limited cohesive studies have examined the relationship between sleep quality and academic performance with the degree of dependence on smartphone during the COVID-19 pandemic. Thus, the current study examined the relationship between sleep quality and academic performance with dependence on smartphone.

Materials and Methods

Procedure: Based on its aim, the current study is categorized as applied research and methodologically, it is descriptive. The participants were all adolescent Iranian students benefiting from online teaching. Considering the absence of students in the schools, the school administrators used online surveys to collect data. The sample size was calculated based on Morgan and Krejcie table (10), which included 186 people. Considering the possibility of dropping, 254 subjects were selected. Convenience sampling was applied. The participants included the students of Tehran, Iran. After coordinating with the school principals and talking to the parents of the students about the goals of the research, a questionnaire link was sent to them. Due to the spread of the coronavirus, compliance with social distancing, and online teaching of the students, the questionnaires were sent to the subjects via social media. The participants completed the questionnaires via social media applications such as Telegram, WhatsApp, and Instagram. On Instagram, the link to the questionnaire has been placed on a page, and the page address has been sent to the students. At first, the researchers provided a brief introduction to the purpose of the research. Afterward, the participants responded to an item regarding their informed consent for participating in the study, and finally, they filled out the questionnaires. The inclusion criteria were: being able to read and write (literacy), participating in virtual classes using smartphones, not suffering from severe mental illnesses, not having a history of mental retardation, informed consent to fill out the questionnaire, being at least 13 years old, and having no record of drug abuse through the last year. The exclusion criteria were: suffering from severe mental illnesses such as bipolar disorder and schizophrenia, having sleep problems due to physical problems, suffering from acute physical diseases, and having no drug abuse. To consider ethical principles, all subjects' information was kept

confidential. Before completing the questionnaires, they completed the informed consent form.

Measurements

Pittsburgh Sleep Quality Index (PSQI): This questionnaire examines sleep quality during the last four weeks, and it takes 5-10 minutes to be filled out. Consisting of seven subscales, this measurement provides a general score ranging from 0 to 21. Scores below and higher than five indicate standard and poor quality of sleep, respectively. The results of Buysse et al. study showed that score of 5 had a diagnostic sensitivity of 89.6% and a specificity of 86.5%. Its internal consistency was good (Chronbach's alpha = 0.89) (11). The reliability and validity of this questionnaire and its sensitivity to the evaluation of sleep quality have been reported in several studies (Chronbach's alpha = 0.84, correlation coefficient = 0.88) (12).

Smartphone addiction scale (SAS): This 20-item questionnaire was developed by Koo to assess and score deprivation tolerance, life disturbance, and persistence. General scores less than 63, between 63 to 70, and higher than 70 indicate medium dependence, severe dependence, and smartphone addiction, respectively. The scale consists of three subscales of deprivation, life disturbance, and force-persist. The reliability of this measure has been examined via Chronbach's alpha = 0.92 (13). The convergent validity and reliability of this scale were reported 0.65 and 0.71, respectively (14).

Pham-Taylor Educational Performance Questionnaire (EPT): Consisting of 48 items and validated for the assessment of academic performance in Iran, EPT is derived from the investigations of Pham and Taylor (15). They have reported that the validity and reliability of this questionnaire were equal to 0.78 and 0.88, respectively (15). The questionnaire was completed by the students. Scores less than 120 represent low performance, while scores between 120 to 144 and higher than 145 indicate medium and good academic performance, respectively. The convergent validity and reliability of this scale were reported 0.76 and 0.84, respectively (16).

The data were analyzed using SPSS software (version 25, IBM Corporation, Armonk, NY, USA). The findings were reported using descriptive and inferential analyses. Descriptive statistics indexes included information on percentage, frequency, mean, and standard deviation (SD) and inferential statistics covered correlation and simultaneous regression analysis.

Results

Initially, the research variables were compared based on demographic variables. The results revealed no significant relationship between the demographic variables and non-demographic ones. The results have been shown in table 1.

Table 1. The characteristics of the participants

Parameter	n (%)	Total sleep quality (mean ± SD)	P-value
Gender			
Boy	101 (49.74)	6.61 ± 3.45	0.65
Girl	123 (51.79)	6.15 ± 3.88	
Graduation			
Secondary school			
Second grade	25 (11.16)	6.95 ± 3.24	
Third grade	63 (28.12)	6.87 ± 3.57	
High school			0.46
First grade	65 (29.01)	6.40 ± 2.36	
Second grade	63 (28.12)	7.07 ± 3.74	
Third grade	8 (3.57)	8.30 ± 3.57	

SD: Standard deviation

The study population consisted of 254 students, 117 boys (46.06%) and 137 girls (55.04%), with a mean age of 16.03, ranging from 13 to 17 years old. After data collection, 30 questionnaires were excluded for being incompletely filled out or containing outliers; therefore, the final analysis was done on 224 questionnaires (Table 2). They were excluded from the analysis because they did not complete most of the items.

Results showed that there was a significant difference in variables between the two groups according to optimal sleep quality and poor sleep quality.

Table 2. Frequency and percentage of the variables in terms of sleep quality

Variable	Group	n (%)	PSQI > 5 (n = 116) [n (%)]	PSQI < 5 (n = 108) [n (%)]	P-value
SAS	Mild	79 (43.32)	30 (69.48)	49 (69.89)	0.01
	Moderate	114 (39.39)	61 (26.76)	53 (26.88)	
	Severe	31 (7.57)	25 (6.06)	6 (3.22)	
EPT	Weak	35 (54.04)	27 (21.17)	8 (68.81)	0.01
	Moderate	135 (21.21)	80 (25.75)	55 (33.33)	
	Good	55 (7.07)	10 (4.54)	45 (5.37)	

SAS: Smartphone addiction scale; EPT: Educational Performance Questionnaire; PSQI: Pittsburgh Sleep Quality Index

Table 3. Correlation of research variables

Variable	Sleep quality	SAS	Life disturbance	Deprivation	Persistence	Academic performance
Sleep quality	1					
SAS	0.47*	1				
Life disturbance	0.31*	0.76*	1			
Deprivation	0.43*	0.76*	0.35*	1		
Force-persist	0.35*	0.50*	0.27*	0.20*	1	
Academic performance	-0.80*	-0.56*	-0.34*	-0.20*	-0.37*	1

*P < 0.05
SAS: Smartphone addiction scale

Besides, the correlation of research variables is reported in table 3. As the results show, there was a significant correlation between the research variables.

Simultaneous regression analysis was run to predict sleep quality. Sleep quality was included in the model as a dependent variable and the subscales of the SAS (deprivation, life disturbance, and force-persist) were entered into the model as the predictor variables. The result showed that the total model was significant (adjusted $R^2 = 0.24$, $F = 19.04$, $P = 0.01$). The results are depicted in table 4.

Table 4. Predicting the quality of sleep based on the smartphone addiction scale (SAS)

Model	Standardized beta	T	P-value
Constant		-4.246	0.01
Life disturbance	0.34	5.527	0.01
Deprivation	0.12	1.749	0.03
Persistence	0.21	3.484	0.01

P < 0.05

The coefficients of determination for each model component showed that all the variables of smartphone addiction could predict sleep quality.

Moreover, to predict academic performance, simultaneous regression analysis was used, with academic performance being the dependent variable and smartphone addiction components (deprivation, life disturbance, and force-persist) as predictor variables. The findings indicated that the total model was significant (adjusted $R^2 = 0.35$, $F = 31.87$, $P = 0.01$). The results are shown in table 5.

Table 5. Predicting academic performance based on the smartphone addiction scale (SAS)

Model	Standardized beta	T	P-value
Constant		14.566	0.01
Deprivation	-0.12	-2.051	0.04
Life disturbance	-0.44	-7.575	0.01
Persistence	-0.24	-4.620	0.01

P < 0.05

The coefficients of determination for each component of the model revealed that the variables of life disturbance, deprivation, and persistence could predict academic performance.

Discussion

The current study has been conducted to examine the relationship between sleep quality and academic performance with the degree of dependence on smartphone among adolescent students of virtual classes held during COVID-19 pandemic. Findings demonstrated that smartphone addiction had a significant correlation with the low quality of sleep among these students. In line with these findings, other studies have reported correlations between smartphone addiction and insufficient sleep quality (17-19). To explain these findings, it could be stated that compared to the past, after the pandemic, students have started to spend more time using the Internet and less time sleeping (2), as a result of which their sleep quality has reduced. On the other hand, a large body of research has indicated elevated levels of anxiety in populations that are afraid of getting infected with COVID-19. Increased anxiety is associated with excessive smartphone and Internet use; due to their fear of infection, many individuals tend to spend long hours searching for the symptoms of coronavirus on the Internet (20). Such behavioral tendencies lead to problematic use of smartphones and poor sleep quality. Furthermore, people who use their smartphones and the Internet excessively, suffer from more psychological problems such as depression, stress, and anxiety, all of which are correlated with sleep problems.

Another finding of the current investigation was the correlation between smartphone addiction and poor academic performance. Similarly, other research articles have reported that Internet addiction and low academic performance are related to each other (21-23). Because the standardized beta of life disturbance is higher than other smartphone addiction components, it could be concluded that the students who are heavily dependent on their

cell phones are so involved in subjects other than education that they perform poorly in academic settings. On the other hand, smartphone dependence is accompanied by psychological problems such as anxiety and stress, which affect daily life destructively (17). Moreover, the other possibility is that due to the lack of real interaction and the restrictions caused by the pandemic, virtual teaching cannot be as effective as regular teaching, in which students participate in person.

According to the aforementioned repercussions and to decrease smartphone dependence-related problems, it is recommended that the users and families use a monitoring system to devote suitable periods to using smartphones during the day or keep them out of reach when they are not needed. Despite the statistical support behind our findings, some limitations might decrease the generalizability of our results. First, the participants were adolescent students; thus, the results cannot be generalized to other populations such as university students and children. Second, although Internet addiction could significantly predict sleep quality and academic performance, the degrees of sleep quality and academic performance were 0.24 and 0.35, respectively, and other predictors are yet unknown. The sample of this study included the general population and generalizing the findings to the clinical populations should be done cautiously. Considering these limitations, it is suggested that future investigations employ other social groups and find other possible sources to predict low sleep quality and weak academic performance.

Conclusion

The current findings indicated that smartphone dependence led to poor sleep quality and weak academic performance. Virtual teaching could expose the students not only to smartphone dependence but consequently to poor sleep quality and weak academic performance. Therefore, educating the users and families in terms of optimal use of smartphones and the Internet and preventing heavy reliance on them are critical issues for psychologists to consider.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

We are grateful to all students who participated in this study, especially teachers who taught students during the COVID-19 pandemic. We wish health for them.

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