Original Article

Effect of COVID-19 Anxiety on Internet Addiction of Medical Students: By Moderating Demographic Variables

Abstract

Background: Most medical students assist in providing services to patients with coronavirus disease (COVID-19). Therefore, promoting their mental health will increase care outcomes. Medical students may use the Internet more than other students. Therefore, the aim of this study was to determine the relationship between COVID-19 anxiety and Internet Addiction (IA) level among students of medical sciences. **Materials and Methods:** This cross-sectional study was conducted on about 710 medical students of Babol Medical Sciences University, Iran, from September 2020 to June 2021. The links of web-based tools were provided through virtual networks. Data were collected using a the Internet Addiction Test (IAT), and the COVID-19 Anxiety Scale (C-19AS). Data was analyzed using Structural Equation Modeling (SEM) in AMOS and SPSS software. **Results:** The results of the present study showed that the mean score of IA was 52.55 (18.31) and most students (41.1%) had moderate IA. The mean score of C-19AS was 18.97 (11.64) and most participants (40.7%) were normal and 30.6% of them had mild COVID-19 anxiety. There was a significant relationship between COVID-19 anxiety and IA ($r = 0.20$; $p < 0.001$). The variables of having a history of COVID-19, having a family history of COVID-19, and the amount of daily Internet use played a moderating role in the relationship between COVID-19 anxiety and IA. **Conclusions:** The results showed that the IA scores of most students were moderate and most of the students had normal COVID-19 anxiety. Moreover, the IA level increased with increase in COVID-19 anxiety.

Keywords: *Anxiety, COVID-19, internet addiction, medical student, mental health*

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Introduction

In response to the COVID-19 pandemic, significant measures were taken worldwide to reduce the spread of the virus in the form of lockdowns of educational institutions and social avenues and social distancing among people, these measures led to major changes in daily routine and activities of adolescents and adults and this in turn affected their psychological well-being.[1] Studies performed in China (Wuhan) showed that people experienced the consequences of lockdown measures, like living a sedentary life and problematic use of the Internet as a way of escapism from these stressful events. Although the Internet is useful, its problematic use usually results in undesirable consequences and even leads to a state of addiction.[2] Internet addiction (IA) is defined as "a kind of technology addiction and a behavioral addiction similar to a gambling habit".[3] However, the prevalence of problematic Internet use among college students has not been established, studies in the USA reported that 5-12% of university students in different colleges suffered from IA.[4] It was reported that students are more likely to develop IA during the COVID-19 outbreak.[1] This is due to reasons such as access to a smartphone and internet connection, access to university and home internet, features of youth, having social relationships with classmates or friends, high curiosity, compulsion to online submission of assignments, having more opportunities to use the Internet due to the lack of need to attend universities for theoretical courses and less parental control.[5]

As IA increases among university students especially after the occurrence of COVID-19 pandemic, its negative physical, mental, and social consequences increase and have deleterious effects on their life and psychological well-being.[6] Medical

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and healthcare students may use the Internet more than other students and be at higher risk of IA due to their evidence-based practices, access to medical and online databases, research and learning, control of patients in remote areas, and scientific and entertainment purposes.[7,8] Therefore, medical students show higher baseline rates of anxiety compared to the general population[9] and encounter various psychological problems such as depression and COVID-19 anxiety owing to the care services they provide to COVID-19 patients in clinical centers during practical and internship courses.[10,11]

According to a study conducted on 7,000 students in China during the COVID-19 outbreak, the most important cause of anxiety among students is the impact of the virus on their future education and employment status.[12] Differences were found by two studies that compared medical students to their non-medical peers during the confinement; one of them found medical students to be less likely than non-medical students to suffer from moderate anxiety[13] and the other one found lower anxiety levels in comparison to dental medicine students.[14] Many studies in Iran also showed that students suffered from COVID-19 anxiety.[15,16] Since IA is related to various psychological problems such as depression, anxiety, and interpersonal sensitivity,[17] it is necessary to identify the factors influencing it and take measures in this regard. Given the current crisis, a thorough understanding of the factors influencing IA is becoming increasingly critical for researchers, professionals, and mental health organizations to identify and apply effective strategies in this area.[18]

Many previous studies have focused on the psychological consequences of IA[19,20] in non-student target groups and have paid less attention to the relationship between psychosocial risk factors and IA and the effect of COVID-19 anxiety on IA.[21-23] Several studies have explored the relationship between demographic variables and IA, but none have examined the mediating role of these variables in the relationship between COVID-19 anxiety and IA. For instance, the study by Askarian *et al*.[24] revealed a significant relationship between age, average hours of internet use, depression, anxiety, stress, and the IA score ($p < 0.05$). However, no correlation was found between IA and GPA or the number of units passed ($p = 0.54$).[24] In the study by Sahraian and Piroozkhah, no relationship was identified between IA and the variables of age, gender, and marital status.[25]

The conceptual model of the study was drawn based on a review of the literature [Figure 1].[26-28]

Therefore, the present study was conducted to determine the prevalence of COVID-19 anxiety and IA and the impact of COVID-19 anxiety on IA level in students of Babol University of Medical Sciences, Iran, during the COVID-19 outbreak, and the mediating role of demographic variables in the relationship between COVID-19 anxiety and IA.

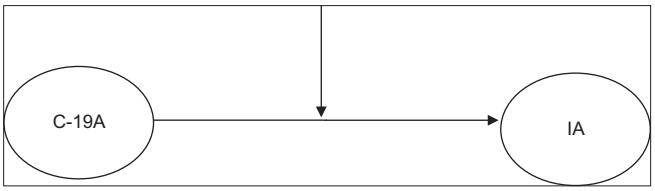

Figure 1: Conceptual model for the moderating role of demographic variables in the relationship between Internet addiction and COVID-19 anxiety

Materials and Methods

A descriptive cross-sectional design with Structural Equation Modeling (SEM) was adopted. This study was conducted on medical students, including those in nursing, midwifery, medicine, dentistry, pharmacology, public health, physiotherapy, environmental health, and occupational health at the B.S., M.S., PhD, and professional doctorate levels at Babol University of Medical Sciences for more than 2 academic semesters from September 2020 to June 2021.

This setting was chosen due to the researchers' access to the samples, limitations caused by the COVID-19 epidemic, and unification of the study group, taking into account the impact of the nature of different fields of study on the rate of COVID-19 anxiety and IA.

The statistical population of the present study included all students active in the social networks of Babol University of Medical Sciences ($n = 3500$).

A simple random sampling method was utilized. After obtaining permission and consulting the university's general education unit, the researcher (corresponding author) obtained the list of students' names by field and their contact numbers. Subsequently, the researcher employed the systematic random sampling method to select participants from this list. The inclusion criterion for this study was the completion of a consent form, which was distributed through virtual channels before sending out the research tools to the selected individuals. The exclusion criterion was a failure to complete the research tools.

The number of samples was estimated using the following formula.[28]

Alpha = 0.05, Power = 80%, $S = 18.31$ (pilot) and $d = 1.923$, 710 subjects were estimated.

After designing the web tools, the link was provided to the students through virtual networks (WhatsApp and Telegram). This method was chosen due to the traffic restrictions and prevention of the COVID-19 outbreak. The participants had to respond to all items to register the completed forms and send them to the researcher. Data were collected using a socio-demographic questionnaire, the Internet Addiction Test (IAT), and the COVID-19 Anxiety Scale (C-19AS).

Socio-Demographic Questionnaire included variables such as age, gender, education level, parents' occupation, having a history of COVID-19, having a family history of COVID-19, quarantine duration, purpose of Internet use, type of virtual networks used, and hours of Internet use. The Internet Addiction Test (IAT) was initially designed by Young in 1995.[29] The test consists of 20 items and each item is scored on a 5-point Likert scale (0 = Not Applicable, 1 = Rarely, 2 = Occasionally, 3 = Frequently, 4 = Often, 5 = Always). The IAT comprised 6 dimensions including salience (items 10, 12, 13, 15, and 19), excessive use (items 1, 2, 14, 18, and 20), neglect work (items 6, 8, and 9), anticipation (items 7, and 11), lack of control (items 5, 16, and 17), and neglect social life (items 3, and 4). The total IAT scores given by the examiner are for 20 answered items, and the maximum score is 100. The total scores of 0-30, 31-49, 50-79, and 80-100 indicate normal, low, moderate, and high levels of Internet use, respectively. A higher score represents a higher level of compulsivity and IA.[30] This test was localized in Iran by Alavi, and its reliability was $\alpha = 0.88$.[31] The COVID-19 Anxiety Scale (C-19AS) was designed and psychometrically tested for the first time in Iran by Alipour *et al*. in 2020.[28] The C-19AS had 18 items and 2 dimensions that measured psychological (items 1-9) and physical symptoms (items 10-18). The C-19AS was scored on a 4-point Likert scale (never = 1, sometimes = 2, most of the time = 3, and always = 4). The highest and lowest scores that respondents obtained from the C-19AS were 1 and 72, respectively. In the current study, the range of scores was divided into four levels. The total IA score of 1-18, 19-36, 37-54, and 55-72 illustrated normal (without C-19A), low, moderate, and high levels of COVID-19 anxiety, respectively. The reliability of this scale was confirmed by Alipour *et al*.[28] using Cronbach's alpha; Cronbach's α of the first factor, the second factor, and the whole scale was 0.879, 0.861, and 0.919, respectively.

Data were analyzed using descriptive statistics, statistical tests of Pearson correlation coefficient, logistic regression, and Covariance-based Structural Equation Modeling (CBSEM) with Maximum Likelihood (ML) method in AMOS software (version 26; IBM Corp., Armonk, NY, USA) and SPSS software (version 26; IBM Corp., Armonk, NY, USA). To investigate the moderating role of demographic variables, the multi-group analysis was used through a comparison test of structural weight models. Before using the structural equation method, the assumptions of this method were investigated. The univariate and multivariate distributions of the data were separately examined to investigate the normal distribution and outliers. The multivariate outliers, normal multivariate distribution, and multicollinearity were assessed using the Mahalanobis distance-squared method ($p < 0.001$), Mardia's coefficient (>20), and variance inflation factor, respectively. By fitting the logistic regression model to the observed data, the predictor variables were entered into the model as a block in 7 stages, and then, the model was fitted. The results indicated that the variables of daily Internet use, number of children, level of education, father's occupation, quarantine period, and COVID-19 anxiety affected IA levels.

The acceptable values for the indices were Parsimonious Comparative Fit Index (PCFI) and Parsimonious normed fit index (PNFI) > 0.5, Comparative Fit Index (CFI), Goodness-of-Fit Index (GFI) and Incremental Fit Index (IFI) > 0.9, Root mean square error of approximation (RMSEA) < 0.8, minimum discrepancy per degree of freedom (CMIN/DF) < 3, and good index < 5.

Ethics consideration

The present study was conducted after receiving permission from the Ethics Committee of Babol University of Medical Sciences with the ethical code of IR.MUBABOL.HRI.REC.1399.094. At the beginning of the study, participants were provided with the necessary information about voluntariness and non-coercion in answering the research instruments, non-disclosure of name and main characteristics, confidentiality of answers, manner of answering the instruments, honesty in answering, and help in conducting a valid research.

Results

The results of the present study showed that the mean age of the participants was 24.70 (6.24) years and their age range was 18–49 years. In total, 442 (62.3%) and 268 (37.7%) of them were women and men, respectively, and 69.9%, 76.9%, and 70.7% of students were single, childless, and bachelor's degree holders, respectively.

Moreover, the results indicated that 17% and 29.3% of students reported having a history of COVID-19 and having a family history of COVID-19, respectively. In addition, 39.4% of the participants were in quarantine for over 6 weeks. Mean daily internet use was 6.01 (2.97) hours.

Based on skewness and kurtosis indices, the normality of IA and COVID-19 anxiety variables was confirmed. The results demonstrated that there was a statistically significant relationship between all demographic variables (mother's occupation, purpose of Internet use, and age) except gender and IA ($p < 0.05$). Moreover, a statistically significant relationship was found between COVID-19 anxiety and all demographic variables except the mother's occupation and COVID-19 ($p < 0.05$) [Table 1].

The results of the present study revealed that the mean score of IA was 52.55 (18.31), and most students (41.1%) had moderate IA. In IA dimensions, the highest and lowest scores were related to salience [12.99 (5.20)] and anticipation [5.31 (2.17)], respectively. Furthermore, the mean score of COVID-19 anxiety was 18.97 (11.64), and 40.7% and 30.6% of the students had normal and low COVID-19 anxiety, respectively [Table 2].

The results of the Pearson correlation test suggested that COVID-19 anxiety (r = 0.21; p < 0.001) and the physical symptoms of COVID-19 anxiety (r = 0.31; p < 0.001) had a significant positive relationship with IA (p < 0.001). However, the results demonstrated that there was no significant relationship between IA and psychological symptoms of COVID-19 anxiety (p > 0.05). Logistic regression was used to investigate the predictive role of demographic variables and COVID-19 anxiety in IA levels among students. The likelihood ratio (LR) was used to enter the variables into the model. The results of the Hosmer-Lemeshow test (p = 0.019) represented the

Table 1: Demographic characteristics of Iranian students and their relationship with Internet addiction and COVID-19 anxiety (*n*=710)

Variables		Number (%)	Internet Addiction (IA)		COVID-19 anxiety	
			Mean (SD)	Test result	Mean (SD)	Test result
Gender	Female	442 (62.3)	51.96 (18.39)	*t*=−1.10	18.23 (11.47)	**t*=-2.16
	Male	268 (37.7)	53.52 (18.18)	*p*=0.271	20.18 (11.84)	*p*=0.031
Marital status	Single	496 (69.9)	50.20 (17.66)	*F*=16.56	17.43 (11.48)	**F*=15.19
	Married	190 (26.8)	57.01 (18.57)	*p*<0.001	22.74 (11.50)	*p*<0.001
	Divorced	24 (33)	65.66 (18.19)		20.87 (9.08)	
Number of children	Childless	546 (769)	62.17 (20.67)	*F*=19.70	18.72 (12.18)	*F*=17.90
	1–2	62 (8.8)	49.54 (17.67)	*p*<0.001	17.19 (11.11)	*p*<0.001
	> 2	102 (14.3)	56.24 (17.30)		22.97 (11.70)	
Education level	Associate	64 (9)	64.92 (20.17)	*F*=24.60	17.06 (1216)	*F*=16.37
	Bachelor's	502 (70.7)	49.05 (17.28)	*p*<0.001	17.59 (11.47)	*p*<0.001
	Master's	93 (13.1)	59.97 (15.99)		25.97 (9.17)	
	PhD Professional PhD and PhD	51 (7.2)	57.86 (18.14)		22.13 (11.71)	
Father's occupation	Employment	130 (18.3)	52.18 (20.76)	*F*=3.80	16.13 (10.97)	*F*=5.05
	Self-employment	366 (51.5)	51.04 (17.99)	*p*=0.023	19.35 (11.73)	*p*=0.007
	Retired	214 (30.2)	55.35 (16.98)		20.05 (11.68)	
Mother's occupation	Housewife	486 (68.9)	52.20 (18.48)	*F*=0.40	18.97 (11.76)	*F*=0.10
	Employment	105 (14.8)	54.08 (17.73)	*p*=0.764	18.61 (11.63)	*p*=0.958
	Self-employment	65 (9.1)	51.87 (17.33)		18.93 (11.51)	
	Retired	51 (7.2)	53.56 (19.34)		19.72 (10.98)	
Quarantine period (week)	< 1	55 (7.7)	56.65 (23.50)	*F*=5.50	12.40 (9.57)	*F*=8.35
	1-2	69 (9.7)	58.05 (20.14)	*p*<0.001	16.72 (10.98)	*p*<0.001
	3-4	117 (16.6)	52.50 (17.61)		20.13 (11.13	
	5-6	189 (26.6)	54.54 (17.13)		21.69 (11.73)	
	> 6	280 (39.4)	49.06 (17.15)		18.49 (11.47)	
Having a history of COVID-19	Yes	121 (17)	60.49 (20.59)	*t*=5.34	20.30 (12.61)	*t*=0.00
	No	589 (83)	50.91 (17.38)	*p*<0.001	18.70 (11.43)	*p*=0.168
Having a family history of COVID-19	Yes	208 (29.3)	60.35 (18.75)	*t*=7.59	21.11 (11.75)	*t*=3.17
	No	502 (70.7)	49.31 (17.13)	*p*<0.001	18.08 (11.50)	*p*=0.002
Purpose of internet use	Entertainment	177 (24.9)	53.22 (21.34)	*F*=1./45	14.88 (10.04)	*F*=7.90
	Occupational	52 (7.4)	56.96 (20.83)	*p*=0.195	19.94 (10.96)	*p*<0.001
	Message	54 (7.6)	54.44 (16.74)		21.09 (10.92)	
	News	34 (4.8)	53.35 (17.65)		21.82 (12.27)	
	Assignment	54 (7.6)	50.51 (16.81)		17.85 (10.38)	
	All of them	142 (20)	53.45 (14.85)		23.13 (12.13)	
	Others	197 (27.7)	50.03 (17.69)		18.63 (12.05)	
Type of virtual network	Telegram	91 (12.8)	51.30 (22.25)	*F*=7.25	13.53 (9.20)	*F*=13.35
	WhatsApp	132 (18.6)	50.35 (18.04)	*p*<0.001	17.53 (10.05)	*p*<0.001
	Instagram	69 (9.7)	44.73 (14.41)		16.59 (11.02)	
	All of them	418 (58.9)	54.80 (17.61)		21.01 (12.18)	
Mean±SD		24.70 (6.24)		***r*=0.07	*r*=0.12	
Age (year): Mean (SD)				*p*=0.074	*p*<0.001	
Mean (SD)		6.01 (2.97)		*r*=0.26	*r*=−0./21	
Amount of daily Internet use: Mean (SD)				*p*<0.001	*p*<0.001	

F*: Analysis of variance,*t*: Independent *t*,**** r*: Pearson correlation coefficient

accuracy of model fitting. The results showed that with an increase in daily internet use and COVID-19 anxiety scores, the probability of IA in students increased by 19.7% and 5.5%, respectively. The probability of IA in students with 1-2 children was 49.8% lower than that in those without children; in addition, in bachelor's students, it was 66.5% lower than that in associate students. The probability of IA in students with retired fathers was 68% higher than in students with self-employed fathers. The probability of IA was 52.4% lower in students who were in quarantine for over 6 weeks than in those quarantined for less than 1 week [Table 3].

The fitness of the proposed model was evaluated based on the introduced fit indices. As CMIN/DF was less than 5 and RMSEA was less than 0.1, the fitness of the proposed model was confirmed.

To improve the fitness of the proposed model, in the next step, the model was modified by drawing a correlation between the errors [Table 4]. The results of the structural model displayed that COVID-19 anxiety had a positive and significant effect on students' IA ($\beta = 0.38$; $p < 0.001$) [Figure 2].

The path coefficient of COVID-19 anxiety on IA levels in terms of demographic variables is presented in Table 5. Considering the amount of chi-square-difference, DF, and level of significance, the results indicated that the variables of having a history of COVID-19 ($p = 0.012$; $\Delta\chi^2$ (2) = 8.90), family history of COVID-19 ($p = 0.038$; $\Delta\chi^2$ (2) = 6.54) and daily Internet use ($p = 0.022$; $\Delta\chi^2$ (2) =7.63) had a moderating role in the relationship between COVID-19 anxiety and IA. Therefore, a significant difference was found between the structural weight estimation of the two groups of mentioned variables.

Table 2: Frequency distribution, mean and standard deviation of IA and COVID-19 anxiety in Iranian students (*n*=710)

Variables	Mean (SD)	Mix-Min	Level			
			Normal *n* (%)	Low *n* (%)	Moderate *n* (%)	High *n* (%)
IA						
Salience	12.99 (5.20)	5–25	77 (10.8)	278 (39.2)	243 (34.2)	112 (15.8)
Excessive Use	13.58 (4.81)	5–25	49 (6.9)	238 (33.5)	318 (44.8)	105 (14.8)
Neglect Work	7.58 (3.51)	3–15	94 (13.2)	304 (42.8)	187 (26.4)	125 (17.6)
Anticipation	5/31 (2.17)	2–10	65 (9.2)	325 (45.8)	193 (27.1)	127 (17.9)
Lack of Control	8.1 (33.02)	3–15	64 (9)	215 (30.2)	344 (48.5)	87 (12.3)
Neglect Social Life	4.94 (2.44)	2–10	147 (20.7)	262 (36.9)	143 (20.1)	158 (22.3)
Total	52.55 (18.31)	20–100	108 (15.2)	207 (29.2)	349 (49.1)	46 (6.5)
COVID-19 anxiety						
Mental symptoms	11.99 (5.83)	0–27	127 (17.9)	287 (40.4)	250 (35.2)	46 (6.5)
Physical symptoms	6.97 (7.08)	0–27	404 (56.9)	123 (17.3)	171 (24.1)	12 (1.7)
Total	18.97 (11.64)	0–54	289 (40.7)	217 (30.6)	184 (25.9)	20 (2.8)

Table 3: Results of fitting logistic regression model (seventh step)

Variables	Coefficient	Standard error	OR (95%CI)	*p*
Daily internet use	0.180	0.031	1.19 (1.13-1.27)	<0.001
Number of children (Reference=no children)				0.041
1–2	0.69–	0.33	0.50 (0.26-0.97)	0.039
>2	0.32–	0.37	0.72 (0.35-1.50)	0.390
Education level (Reference=Associate)				<0.001
Bachelor's degree	1.10–	0.33	0.33 (0.17-0.64)	<0.001
Master's degree	0.43–	0.43	0.65 (0.28-1.51)	0.320
PhD	0.21–	0.48	0.80 (0.31-2.06)	0.657
Father's occupation (Reference=self-employment)				0.045
Employment	0.05	0.23	1.05 (0.66-1.68)	0.828
Retired	0.12	0.21	1.68 (1.10-2.55)	0.014
Quarantine period (Reference ≤1 week)				0.014
1–2	0.16	0.41	1.17 (0.51-2.65)	0.702
3–4	0.1–	0.39	0.88 (0.41-1.89)	0.761
5–6	0.33–	0.37	0.72 (0.35-1.49)	0.376
>6	0.74–	0.36	0.47 (0.24-0.95)	0.037
COVID-19 anxiety	0.05	0.00	1.05 (1.03-1.07)	<0.001
Fixed	−0.49	0.52	0.61	0.349

Table 4: Fit indicators of the proposed and final model

Fit indicators of the model	χ^2 (df)	*p*	*CMIN/DF	**RMSEA	*****PNFI	$$CFI	***PCFI	$IFI	****GFI
Proposed model	60.8 (20)	<0.001	0.04	0.08	0.61	0.86	0.61	0.86	0.80
Modified model	3.39 (14)	<0.001	2.24	0.06	0.56	0.93	0.56	0.93	0.91

*CMIN/DF: Chi-square/degree-of-freedom ratio; **RMSEA: Root Mean Square Error of Approximation; ***PCFI: Parsimonious Comparative Fit Index; ****GFI: Goodness of Fit Index; *****PNFI: Parsimonious Normed Fit Index; $ IFI: Incremental Fit Index; $ $ CFI: Comparative Fit Index

Table 5: Direct path coefficients by moderating demographic variables

Variables		Standard beta Coefficient	Standard error	Critical ratio	*p*	$x^2\Delta$	Δdf	*p*
Gender	Male	0.40	0.14	7.19	<0.001	3.72	2	0.156
	Female	0.24	0.13	5.19	<0.001			
Marital status	Single	0.31	0.63	1.59	0.113	0.12	2	0.944
	Married	0.30	0.10	8.26	<0.001			
Number of children	≤2	0.25	0.12	5.81	<0.001	0.97	2	0.617
	>2	0.37	0.16	5.73	<0.001			
Education level	Bachelor's degree and lower	0.26	0.11	6.56	<0.001	3.49	2	0.175
	Master's degree and higher	0.29	0.20	3.66	<0.001			
Father's occupation	Retired	0.35	0.15	5.48	<0.001	0.08	2	0.959
	Self-employment	0.28	0.12	6.46	<0.001			
Quarantine period (week)	≤6	0.32	0.12	7.05	<0.001	4.29	2	0.117
	>6	0.24	0.15	4.20	<0.001			
Having a history of COVID-19	Yes	-0.03	0.26	-0.43	0.667	8.90	2	0.012
	No	0.35	0.10	9.20	<0.001			
Having a family history of COVID-19	Yes	0.12	0.18	1.20	0.072	6.54	2	0.038
	No	0.34	0.10	8.02	<0.001			
Daily Internet use (hour)	≤3	0.29	0.34	3.62	<0.001	7.63	2	0.022
	>3	0.28	0.10	6.91	<0.001			

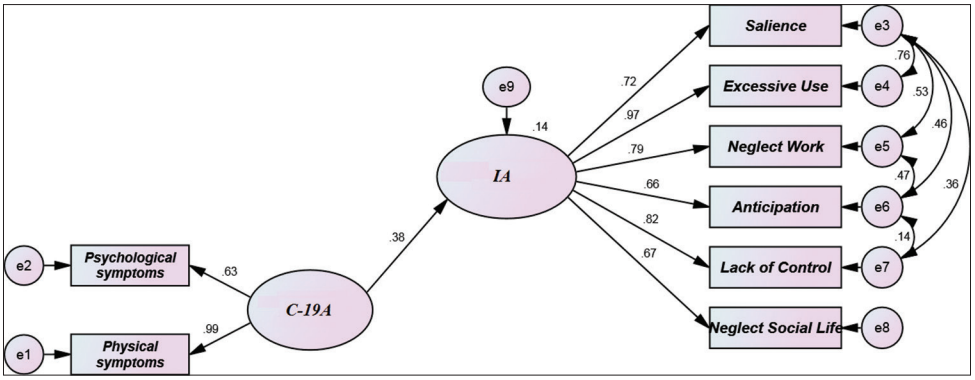

Figure 2: Standard coefficient of the final model of the structural relationship between COVID-19 anxiety and Internet addiction in students

In other words, the two groups of the mentioned variables had different regression weights [Table 5].

The results demonstrated that the relationship between COVID-19 anxiety and IA was higher in students with COVID-19 than in those without COVID-19. Moreover, the results revealed higher changes in IA level in students without COVID-19 as a result of an increase in COVID-19 anxiety [Figure 3].

The results exhibited that the relationship between COVID-19 anxiety and IA was higher in the families of students with a positive history of COVID-19 than in those with a negative history of COVID-19. Furthermore, the changes in IA level were higher in the families of the students without COVID-19 with an increase in COVID-19 anxiety [Figure 4].

The relationship between COVID-19 anxiety and IA was higher in students with more than 3 hours of Internet use per day than in those with less than 3 hours per day. In addition, the results illustrated that with an increase in COVID-19 anxiety, the changes in IA levels were high in both groups [Figure 5].

Discussion

The aim of this study was to determine the moderating role of demographic variables in the relationship between COVID-19 anxiety and IA among students of Babol University of Medical Sciences during the COVID-19 outbreak. The results suggested that the IA scores of most students were moderate. Furthermore, the findings of other studies illustrated the incidence of IA in students during the COVID-19 epidemic.[32,33] Eidi and Delam have stated that during the COVID-19 epidemic, the incidence of IA can increase, thus increasing psychological problems and disorders.[34] Moreover, the prevalence of IA was high in students of Babol University of Medical Sciences before the COVID-19 outbreak[24,35] Investigating the possibility of high-risk behaviors such as IA can lead to effective and timely measures by mental health service providers in communities and universities.

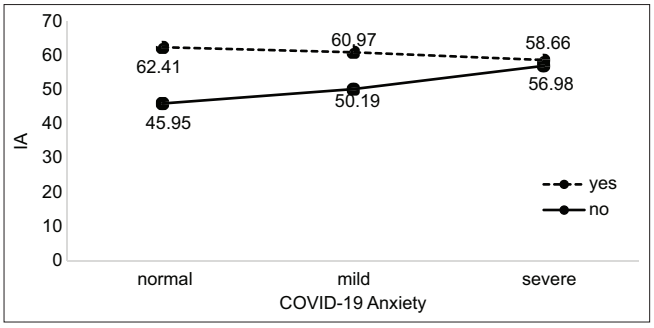

Figure 3: Interaction of COVID-19 anxiety and history of COVID-19 with Internet addiction level in Iranian students

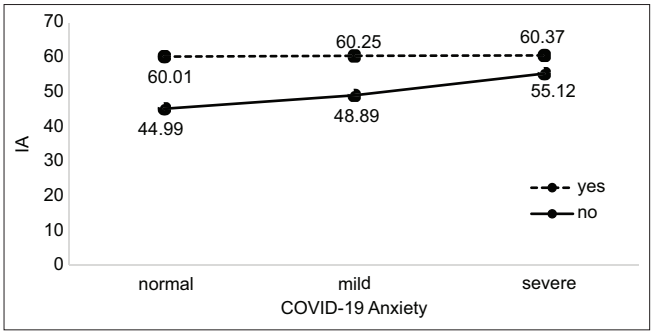

Figure 4: Interaction of COVID-19 anxiety and family history of COVID-19 with Internet addiction level in Iranian students

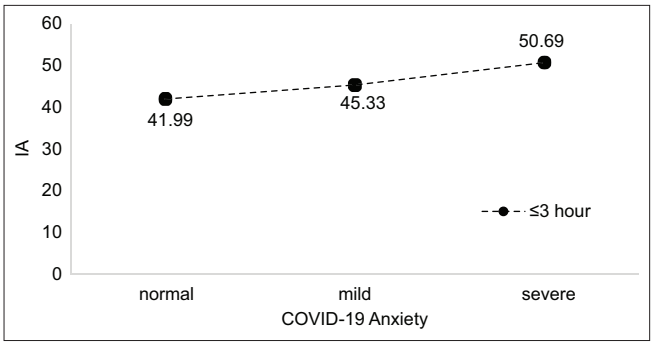

Figure 5: Interaction of COVID-19 anxiety and amount of daily Internet use with Internet addiction level in Iranian students

The results showed that, among the IA dimensions, the highest score of students was related to the salience dimension. Higher scores in this dimension indicated that the students felt more compelled to stay online, hid their behavior from others, and may have neglected other activities or relationships in order to stay online longer. Moreover, high scores in this dimension illustrated that students used the Internet as a kind of mental escape from distributing thoughts and might feel bored, empty, or joyless without the Internet.[30] Nevertheless, the results of the study by Fathi *et al*.[32] demonstrated that lack of control had the highest average among the IA dimensions. The difference between the findings of the present study and those of Fathi *et al*.[32] may be due to the differences in the target group, time of the study, and methods of the studies.

The results of the present study showed that the scores of most participants in COVID-19 anxiety were at the normal level. This obtained finding may be because of the acceptance of the nature of the fields of studies related to medical sciences by the students, increased health knowledge of the students according to the fields of studies associated with the medical sciences, experience of caring for patients with COVID-19, and the time interval between the sampling time and onset of the COVID-19 pandemic in Iran. Nakhostin-Ansari *et al*.[36] evaluated the anxiety level of Iranian medical students 2 months after the onset of the COVID-19 pandemic using the Beck Anxiety Inventory (BAI). They concluded that most of the students had no anxiety. The difference between this finding and that of the current study might be related to the differences in anxiety measurement tools and the timing of the studies.

The results of the Pearson correlation test showed that with an increase in COVID-19 anxiety, the probability of IA escalated in Iranian students. In explanation of this relationship, it can be said that at that time, the fifth wave of COVID-19 was starting, and the possibility of the presence of students in clinical centers for practical courses and care of COVID-19 patients, especially for first-time students was a cause for concern among them. Uncertainty about COVID-19 and their academic future, changes in behavioral habits due to long-term quarantine at home, and fear of non-compliance with face-to-face training programs were causing more students to develop COVID-19 anxiety. The results of several studies have illustrated that fear and COVID-19 anxiety are associated with IA disorder.[35,37,38]

Other findings showed that having a history of COVID-19, having a family history of COVID-19, and the amount of daily Internet use played a moderating role in the relationship between COVID-19 anxiety and IA. Rahmani *et al*.,[16] Nakhostin-Ansari *et al*.,[36] and Bo *et al*.[39] demonstrated in their studies that the average level of

anxiety and psychological subscales in individuals with a history of coronavirus infection was higher than that in other students.[16,36,39] Rahmani *et al*.[16] found that the psychological scale was nearly the same in the two groups with/without a history of infection and death of a family member due to COVID-19. Mulyadi *et al*.[40] emphasized the relationship between the amount of Internet use and coronavirus anxiety. Priego-Parra *et al*.[5] suggested that individuals who actively seek news and information about the coronavirus on the Internet may experience higher levels of anxiety and stress. Consequently, individuals addicted to the Internet may experience higher levels of stress and anxiety.[41] The limitations of this study included the lack of possibility of tracking the prevalence of IA and comparing the data of the present study with previous data, failure to assess the prevalence of IA and COVID-19 anxiety among students in different semesters or fields of study, sampling at a public university, failure to evaluate the prevalence of IA due to the clinical signs, factors related to lack of consideration of families such as socioeconomic status and place of residence.

Conclusion

The results showed that the IA scores of most students were moderate, and the probability of IA increased in them with an increase in COVID-19 anxiety. Periodic assessments to diagnose IA can lead to effective and timely measures for students through mental health service systems in communities and universities. The provision of distance education and psychological counseling to students to increase their adaptation level, especially in students who have a history of COVID-19 and a family history of COVID-19 can return them to social and academic activities and prepare them for increased social interactions.

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Conflicts of interest

Nothing to declare.

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