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Research Article

Internet Addiction, Anxiety, and Salivary Cortisol Among Medical Students in Northern Iran in 2022

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Abstract

Background: The occurrence of extreme behaviors and their detrimental impacts, particularly Internet addiction (IA) among students, have drawn the attention of researchers in contrast to the positive uses of the internet.

Objectives: The purpose of this study was to evaluate the correlation between medical students' salivary cortisol levels, anxiety levels, and IA.

Methods: One hundred and ten (110) medical interns from Golestan University of Medical Sciences in Gorgan, Iran, participated in this descriptive, analytical, cross-sectional study. A checklist was used to obtain demographic data. Internet addiction was assessed using the Young Internet Addiction Test (IAT), while anxiety levels were assessed using the Hamilton Anxiety Rating Scale (HAM-A). Additionally, a saliva sample was taken early in the morning to examine the correlation between IA and salivary cortisol levels.

Results: The subjects' average age was 24.69 ± 1.18 years. The participants' salivary cortisol levels were 5.57 ± 3.20 µg/dL. There was a significant difference in the IAT score for IA between the male and female groups (50.42 ± 24.11 vs. 41.09 ± 22.36, respectively, P = 0.008). The following pupils were categorized as having mild, moderate, and severe IA: 54 (49.1%), 34 (30.9%), and 22 (20%). The male and female groups did not differ substantially in their anxiety Hamilton test scores (29.22 ± 10.95 vs. 28.05 ± 12.02, respectively, P = 0.682). A statistically significant difference was observed in the anxiety scores for mild, moderate, and severe IA categories (P = 0.035).

Conclusions: Nearly 20% of medical students suffer from severe IA. The study's conclusions demonstrated a significant correlation between higher levels of anxiety disorders and the intensity of IA.

Keywords: Internet Addiction, Anxiety Disorders, Salivary Cortisol Levels, Medical Student

1. Background

The World Wide Web is one of the most advanced, amazing, and widespread human achievements that has transformed human communication, economic, and social processes in the past decades. The internet has become an effective and inseparable tool in the lives of people of different ages and with different interests, and the number of its users increases every day (1). Iran is amongst the first twenty countries in the world in terms of the number of internet users (2) and the first country in the Middle East (3).

Even though the internet has supplied advantages, immoderate internet utilization is related to a psychiatric situation referred to as Internet addiction (IA) (4, 5). Internet addiction is similar to other addictions and is characterized by an incapability to prevent Internet users regardless of its negative effect on psychosocial operation (6, 7). Internet addiction is associated with anxiety, depression, attention deficit,

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and alcohol abuse. Studies reported that IA could adversely impact mental health, resulting in social isolation and loneliness and leading to complications in educational, psychological, and work-associated activities (7-9).

Young people, mostly students, have become the main users of the internet (4). University students, particularly medical sciences students, are susceptible to IA due to the growing use of the internet and technology for education and clinical care. Over the past several years, there has been a noticeable growth in internet usage, and medical students are among those who use it the most. Internet addiction is a result of the unlistable uses of the internet, which also bring with them the curse of excessive use (10). According to a systematic review in Iran, the prevalence of moderate levels of IA was 25.32%, and the severe level of IA was 4.67% (11). It was reported that there is a significant positive correlation between IA and academic procrastination in medical students (12). The students addicted to the internet had fewer complex practices and were less capable of processing information and controlling motivations (13).

Cortisol, also known as the stress hormone, is a defining indicator of stressful situations (14, 15). The hypothalamic-pituitary-adrenal (HPA) axis is activated in response to stress. Increased levels of stress and anxiety in the long term can affect the function of this axis and lead to increased blood cortisol levels (16). Studies have reported different results for the correlation between cortisol levels and IA rates (17-19).

2. Objectives

Since the use of the internet among medical students is high and because they will finally work in health care systems and their behavior's effect on the community health, then it is highly essential to understand precisely their level of IA and its impact on their mental health and performance to manage this issue. Thus, the purpose of this study was to examine IA in medical students and evaluate the association between IA and medical students' anxiety and salivary cortisol levels.

3. Methods

3.1. Research Design

Descriptive, analytical, and cross-sectional methodologies were used in the study's design and execution.

From May to November 2022, medical students at Golestan University of Medical Sciences in Gorgan, Iran, participated in the study.

3.2. Participants

In this study, medical students who were in the last two years of their studies (interns) and had access to the internet for at least the last three months were included. Incomplete completion of the questionnaires was considered as an exclusion criterion.

One hundred and fifty students were nominated for the study and had access to the internet for at least the last three months; 30 people did not consent to participate in the study. One hundred and twenty students were assessed, and the questionnaire of 10 people was incomplete and excluded from the study. Data of 110 students were evaluated and analyzed.

3.3. Study Size

The sample size in this study was calculated according to the Romigi et al. study (20). Considering the 95% confidence level and the type II error (β) was set at 0.20, corresponding to 80% statistical power and the expected correlation between IA and anxiety ($r = 0.27$) based on Romigi et al. (20) We employed convenience sampling. All eligible interns ($N = 150$) were invited; 110 participated.

3.4. Measurement

Sampling was done by considering the gender, level, and field of study ratios. Students who were Internet users and connected to the internet during the past three months were included in the study. Before filling out the questionnaires, the study's objectives were explained to the students. They could participate in the study voluntarily for ethical reasons, and they were assured that all information would remain confidential. To collect data, in addition to the demographic information questionnaire including age, gender, background, and field of study, Students' levels of IA were evaluated using the Young IAT, and their anxiety levels were evaluated using the Hamilton Anxiety Rating Scale (HAM-A).

Young IAT has 20 questions. The respondent must answer each question on a 6-point Likert scale, including never, rarely, sometimes, usually, often, and consistently, scored from zero to 5, respectively. The test scores range from zero to one hundred, with a score of zero to 39 indicating a mild IA, 40 to 69 indicating a moderate IA, and 70 to 100 indicating a severe IA. The validity and reliability of this questionnaire in Iran were evaluated by Alavi et al., and Cronbach's alpha was 0.88 (21).

The Hamilton Anxiety Rating Scale is a 14-item scale that assesses both physical and cognitive symptoms of anxiety. Each question is scored from zero to 4 on a 5-point Likert scale. Zero indicates its absence, and 4 indicates the severity of the same symptom in the patient. The overall test score indicates the severity of the anxiety. The validity of the Hamilton Anxiety Rating Scale was assessed by Hallit et al., and the Cronbach alpha was 0.921 (22).

In order to investigate the correlation between IA and salivary cortisol levels, Salivary cortisol was measured as a non-invasive biomarker reflecting free cortisol levels. It correlates strongly with serum cortisol (r = 0.85 - 0.95) (23) while avoiding venipuncture stress that could confound results. Morning sampling captured peak diurnal levels relevant to stress physiology. Saliva samples were collected in the study population using the non-stimulatory spitting method. In this method, the participants collected their saliva in a tube every sixty seconds without using any stimulant for 2 to 5 minutes. Samples were collected between 9 and 10 in the morning because blood and salivary cortisol levels are high in the cortisol cycle. The samples were sent to the laboratory immediately after collection, frozen at -20°C, and then centrifuged at 2500 rpm. Finally, saliva cortisol was measured using the enzyme-linked immunosorbent (ELISA) method (CORTISOL SALIVA 96 T ELISA measuring kits, produced by IBL Company), a competition-based solid phase ELISA test. The binding sites of the antibodies coated onto the wells are contested by a set amount of enzyme-labeled antigen and an undetermined amount of antigen found in the sample. To halt the competition reaction, the wells are cleaned after incubation. The amount of antigen in the sample is inversely correlated with the intensity of the produced color following the substrate reaction. The standard curve can be used directly to determine sample results.

3.5. Statistical Analysis

The data were entered into SPSS software version 20. The data are presented based on descriptive indicators such as mean, standard deviation, frequency, and percentage. Statistical analyses included: (1) Pearson correlation to examine linear correlation between continuous variables (IA scores, anxiety scores, salivary cortisol levels); (2) One-way ANOVA to compare anxiety scores across IA categories (mild/moderate/severe); (3) Independent samples t-tests and χ^2 tests to compare group differences.

Statistical significance was set at $\alpha = 0.05$.

4. Results

4.1. Descriptive Data

The mean ± SD age of the students was 24.69 ± 1.18 years, the minimum age was 23, and the maximum age was 31 years. Among participants, 58.2% were male, and 41.8% were female. 23.6% of the subjects were married. 79.1% of the students were natives (born/raised in Golestan Province), and 20.9% were non-natives of the province, of which 26.4% lived in dormitories. Based on the information extracted from the questionnaires, 35.5% and 29.1% of the study participants, respectively, reported a history of smoking (including cigarettes and hookah) and alcohol consumption. Demographic information is available in Table 1.

4.2. Outcome Data

The individuals' salivary cortisol level was (5.57 ± 3.20 µg/dL), which in males and females was (5.73 ± 3.47 µg/dL) and (5.35 ± 2.81 µg/dL), respectively. The difference was not statistically significant (P = 0.778).

The Young IAT score was (45.52 ± 23.74 µg/dL), which was (50.42± 24.11 µg/dL) and (41.09 ± 22.36 µg/dL) in the male and female, respectively. The difference was reported statistically significant (P = 0.008). On the other hand, 54 (49.1%), 34 (30.9%), and 22 students (20%) received the low, moderate, and severe IA classifications., respectively, with male to female ratio of 39.1% vs. 63% for mild addiction, 34.4% vs. 26.1% for moderate addiction and 26.6% vs. 10.9% for severe addiction, which was also statistically significant (P = 0.03).

Hamilton's anxiety rating scale was (11.36 ± 28.85 µg/dL), (29.22 ± 10.95 µg/dL), and (28.05 ± 12.02 µg/dL) in the males and females, respectively. The difference was not statistically significant (P = 0.682) (Table 1).

4.3. Main Results

The correlation between IA and anxiety and salivary cortisol levels:

According to statistical evaluations, there was a significant difference (P = 0.035) in the anxiety scores for the mild, moderate, and severe IA categories. With increasing IA, the anxiety score also showed higher values. On the other hand, laboratory levels of salivary cortisol did not show a significant difference between different levels of IA. Moreover, the rate of smoking and alcohol consumption in students with a higher level of IA was significantly higher (Table 2).

5. Discussion

Table 1. Demographic Characteristics of Participants by Internet Addiction Severity [a]

Variables	Total (N = 110)	Internet Addiction Severity			P-Value
		Mild (n = 54)	Moderate (n = 34)	Severe (n = 22)	
Sex					0.03
Male	64 (58.2)	25 (46.3)	22 (64.7)	17 (77.3)	
Female	46 (41.8)	29 (53.7)	12 (35.3)	5 (22.7)	
Native status					0.462 [b]
Native	87 (79.1)	43 (79.6)	27 (79.4)	17 (77.3)	
Non-native	23 (20.9)	11 (20.4)	7 (20.6)	5 (22.7)	
Marital status					0.692 [b]
Single	84 (76.4)	41 (75.9)	26 (76.5)	17 (77.3)	
Married	26 (23.6)	13 (24.1)	8 (23.5)	5 (22.7)	

[a] Values are as expressed as No. (%).

[b] Independent samples *t*-test was used for continuous variables; χ^2 test was used for categorical variables.

Table 2. Comparison of Anxiety, Salivary Cortisol Levels, and Substance Use by Internet Addiction Severity Level [a]

Variables	Internet Addiction Severity			P-Value [b]
	Mild (n = 54)	Moderate (n = 34)	Severe (n = 22)	
Anxiety score	26.11 ± 11.64	30.68 ± 11.12	32.77 ± 9.66	0.035
Salivary cortisol (μg/dL); mean ± SD	6.01 ± 3.33	5.12 ± 2.51	5.20 ± 3.80	0.377
Smoking history	13 (24.1)	13 (38.2)	13 (59.1)	0.014
Alcohol consumption	9 (16.7)	13 (38.2)	10 (45.5)	0.016

[a] Values are as expressed as No. (%) or mean ± SD..

[b] One-way ANOVA was used for continuous variables; χ^2 test for categorical variables.

In this study, the prevalence of IA and the association between IA and anxiety level and salivary cortisol levels were evaluated. According to this survey, 20% of medical students suffer from severe IA. According to the results of a meta-analysis, the global prevalence of IA in 31 countries was reported to be 6% of the general population (6). However, in another meta-analysis study, it was shown that the Compared to the general population, medical students had an almost five-fold higher frequency of IA. This rate was reported to be close to 28% in medical students (24). In a study in Nepal, the rate of IA among medical students was 21% (25). According to a study in Mexico by Capetillo-Ventura and Juárez-Treviño, the percentage of IA in medical students was 8.2% (26). In a study by Pal in India on medical students, the prevalence of IA was defined to be 56.5%, and the rate of mild and moderate addiction were respectively 42.9% and 13.6% (27). As medical students enter the workforce, the increasing rate of IA is a serious worry. Because IA is linked to cognitive decline (20) it may have an impact on patient safety (6). A medical student's ability to focus during study sessions may be impacted by such a disease (28). Numerous reasons can be put forward to justify the greater IA is common in medical students. First, according to the access hypothesis, medical students are more susceptible to IA because they frequently utilize the internet to look for medical material and take part in online learning and evaluation (29). Second, medical students may be attracted to the internet's virtual reality to escape the stressful academic environment (30). Third, IA may persist if people use the internet as a coping mechanism for depressive or stressful mental states (31). Although the use of the internet for educational purposes was more common in the study group than in the general population, in some studies, the use of web-based educational programs was not associated with IA (32, 33). Certain psychological and cognitive risk factors, including social anxiety and depression, may increase the risk of IA (32, 34). Psychological stress is higher among medical students than in other fields (35). A study conducted in Saudi Arabia showed a very high level of depression, anxiety, and stress among medical students (36).

The present study results showed that higher degrees of IA were associated with increased levels of anxiety. The findings of our study showed that the more severe the rate of IA, the higher the mean anxiety score of the subjects. On the other hand, the rate of IA in males was also significantly higher than the females. However, there was no statistically significant difference between males and females regarding anxiety. In Priyanka and Pal's study, male sex was significantly associated with IA in medical students ($\beta = -0.143$, $P = 0.038$) (27). In a study by Soltani and Baghaie-Fard, there was a significant association between IA and anxiety symptoms in social interactions. Due to the higher correlation coefficient in females, females have a more significant positive correlation (37). Capetillo-Ventura and Juárez-Treviño reported that IA had a significant correlation with anxiety and insomnia ($rs = 0.219$, $P < 0.001$) (26).

The result of the present study showed no significant association between IA and salivary cortisol levels. While we found no IA-cortisol association, salivary cortisol assessment provides crucial pathophysiological insights. Its non-invasive nature enables feasible stress biomarker measurement in student populations. Our null finding aligns with Bibbey et al. (17), suggesting IA may influence stress pathways through non-HPA mechanisms requiring further investigation.

Numerous studies have shown that stress activates the HPA axis, increases total cortisol levels, and increases cortisol awakening response (CAR). However, it has been hypothesized that the HPA axis responds to stress with temporal hyperactivity, but when stress continues, the HPA axis becomes inactive. Low urinary cortisol levels in adults with chronic depression was observed in another study. Thus, while cortisol may increase during acute anxiety, the HPA axis responds to a chronic disorder by lowering cortisol levels. This shift from HPA axis hyperactivity may be due to increased sensitivity to negative feedback from circulating cortisol.

On the other hand, due to the nature of the medical field, the subjects in this study do not have a circadian rhythm similar to the general population. Their biological body hours are different from the general population due to duty and night waking to provide services. Disturbances in the hours of sleep and wakefulness, by affecting the HPA axis, can lead to changes in morning salivary cortisol levels and therefore can justify the results of this study.

5.1. Conclusion

This study shows that the Nearly 20% of intern medical students suffer from severe IA. However, a recent study's results confirm the significant association between higher levels of anxiety problems and the severity of IA. But no statistically significant correlation was found between the salivary cortisol levels of the subjects and the severity of IA. Due to Given the significant incidence of IA, medical school administrators and instructors ought to recognize and refer medical students who suffer from this addiction for treatment.

5.2. Limitations

The main limitation of the present study was the single-center design and the short study period. On the other hand, due to the occurrence of the COVID-19 pandemic, the cooperation of individuals to participate in the study has decreased, which has made the sampling process longer and more complex. The limited sample size and type of study and the lack of use of more specialized anxiety questionnaires such as GAD and Panic were other limitations. Use of psychotropic medications (e.g., antidepressants) was not assessed, which may confound anxiety and cortisol measures. Also, cortisol sampling wasn't standardized relative to night shifts. Future studies should control for duty schedules affecting HPA axis function.

Footnotes

AI Use Disclosure: The authors declare that no generative AI tools were used in the creation of this article.

Authors' Contribution: M.S and N.Sh, design and supervision on writing and writing discussion; A.H, literature review, and data collection; A.R, writing the introduction, method, and result, as well as the laboratory analysis; A.V, statistical and laboratory analysis.

Conflict of Interests Statement: The authors declare no conflict of interests

Data Availability: The dataset presented in this study is available upon reasonable request from the corresponding author. The data are not publicly available due to ethical restrictions related to participant confidentiality and the terms of informed consent

Ethical Approval: The study was approved by the Golestan University of Medical Sciences (IR.GOUMS.REC.1400.255).

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Informed Consent: All participants were informed that participation is voluntary and reassured that responses would remain confidential. Informed written consent was also obtained from all participants filling in the questionnaires. Participants may withdraw from the trial at any point without any penalty and will not receive compensation for taking part. In the study, personal information about participants collected during the consent/data collection processes are stored securely

References

1. Mihajlov M, Vejmelka L. Internet Addiction: A Review of the First Twenty Years. *Psychiatr Danub*. 2017;**29**(3):260-72. https://doi.org/10.24869/psyd.2017.260.
2. Internet World Stats. *Top 20 countries with the highest number of internet users 2019*. Internet World Stats; 2019, [cited 2025]. Available from: https://www.internetworldstats.com/top20.
3. Statista. *Number of Internet Users in the Middle East as of April 2019, by Country (in Millions)*. Statista; 2019, [cited 2025]. Available from: https://w.statista.co/statistics/603061/number-of-internet-users-in-middle-east-countries/.
4. Widyanto L, Griffiths M. 'Internet Addiction': A Critical Review. *Int J Ment Health Addict*. 2006;**4**(1):31-51. https://doi.org/10.1007/s11469-006-9009-9.
5. Pies R. Should DSM-V Designate "Internet Addiction" a Mental Disorder? *Psychiatry (Edgmont)*. 2009;**6**(2):31-7. [PubMed ID: 19724746]. [PubMed Central ID: PMC2719452].
6. Cheng C, Li AY. Internet Addiction Prevalence and Quality of (Real) Life: A Meta-Analysis of 31 Nations Across Seven World Regions. *Cyberpsychol Behav Soc Netw*. 2014;**17**(12):755-60. [PubMed ID: 25489876]. [PubMed Central ID: PMC4267764]. https://doi.org/10.1089/cyber.2014.0317.
7. Ho RC, Zhang MW, Tsang TY, Toh AH, Pan F, Lu Y, et al. The association between internet addiction and psychiatric co-morbidity: a meta-analysis. *BMC Psychiatry*. 2014;**14**(1). [PubMed ID: 24947851]. [PubMed Central ID: PMC4082374]. https://doi.org/10.1186/1471-244x-14-183.
8. Tran BX, Huong LT, Hinh ND, Nguyen LH, Le BN, Nong VM, et al. A study on the influence of internet addiction and online interpersonal influences on health-related quality of life in young Vietnamese. *BMC Public Health*. 2017;**17**(1). [PubMed ID: 28143462]. [PubMed Central ID: PMC5282902]. https://doi.org/10.1186/s12889-016-3983-z.
9. Moody EJ. Internet Use and Its Relationship to Loneliness. *Cyberpsychol Behav*. 2001;**4**(3):393-401. [PubMed ID: 11710265]. https://doi.org/10.1089/109493101300210303.
10. Deb N, Roy P. Internet addiction, depression, anxiety and stress among first year medical students after COVID-19 lockdown: A cross sectional study in West Bengal, India. *J Family Med Prim Care*. 2022;**11**(10):6402-6. [PubMed ID: 36618151]. [PubMed Central ID: PMC9810868]. https://doi.org/10.4103/jfmpc.jfmpc_809_22.
11. Zafari H, Rafiemanesh H, Balouchi A. Internet addiction among Iranian medical students: a systematic review. *Med Sci*. 2018;**22**(94):518-24.
12. Hayat AA, Kojuri J, Amini M. Academic procrastination of medical students: The role of Internet addiction. *J Adv Med Educ Prof*. 2020;**8**(2):83-9. [PubMed ID: 32426392]. [PubMed Central ID: PMC7188941]. https://doi.org/10.30476/JAMP.2020.85000.1159.
13. Miles J, Dong G, Lu Q, Zhou H, Zhao X. Precursor or Sequela: Pathological Disorders in People with Internet Addiction Disorder. *PLoS ONE*. 2011;**6**(2). [PubMed ID: 21358822]. [PubMed Central ID: PMC3040174]. https://doi.org/10.1371/journal.pone.0014703.
14. Rödström P, Jontell M, Hakeberg M, Berggren U, Lindstedt G. Erosive oral lichen planus and salivary cortisol. *J Oral Pathol Med*. 2001;**30**(5):257-63. [PubMed ID: 11334460]. https://doi.org/10.1034/j.1600-0714.2001.300501.x.
15. Jones DA, Rollman GB, Brooke RI. The cortisol response to psychological stress in temporomandibular dysfunction. *Pain*. 1997;**72**(1):171-82. [PubMed ID: 9272801]. https://doi.org/10.1016/s0304-3959(97)00035-3.
16. Kudielka BM, Buske-Kirschbaum A, Hellhammer DH, Kirschbaum C. HPA axis responses to laboratory psychosocial stress in healthy elderly adults, younger adults, and children: impact of age and gender. *Psychoneuroendocrinology*. 2004;**29**(1):83-98. [PubMed ID: 14575731]. https://doi.org/10.1016/s0306-4530(02)00146-4.
17. Bibbey A, Phillips AC, Ginty AT, Carroll D. Problematic Internet use, excessive alcohol consumption, their comorbidity and cardiovascular and cortisol reactions to acute psychological stress in a student population. *J Behav Addict*. 2015;**4**(2):44-52. [PubMed ID: 26014670]. [PubMed Central ID: PMC4500884]. https://doi.org/10.1556/2006.4.2015.006.
18. Kim N, Kim MJ, Hughes TL, Kwak H, Kong ID. Relationships of internet gaming reasons to biological indicators and risk of internet gaming addiction in Korean adolescent male game users. *BMC Psychiatry*. 2020;**20**(1):341. [PubMed ID: 32605550]. [PubMed Central ID: PMC7329533]. https://doi.org/10.1186/s12888-020-02714-w.
19. Kim EH, Kim NH. Comparison of Stress Level and HPA axis Activity of Internet Game Addiction vs. Non-addiction in Adolescents. *J Korean Biol Nurs Sci*. 2013;**15**(4):173-83. https://doi.org/10.7586/jkbns.2013.15.4.173.
20. Romigi A, Younes F, Halawi G, Jabbour H, El Osta N, Karam L, et al. Internet Addiction and Relationships with Insomnia, Anxiety, Depression, Stress and Self-Esteem in University Students: A Cross-Sectional Designed Study. *Plos One*. 2016;**11**(9). [PubMed ID: 27618306]. [PubMed Central ID: PMC5019372]. https://doi.org/10.1371/journal.pone.0161126.
21. Alavi SS, Eslami M, Maracy MR, Najafi M, Jannatifard F, Rezapour H. [Psychometric properties of Young internet addiction test]. *J Behav Sci*. 2010;**4**(3):183-9. FA.
22. Hallit S, Haddad C, Hallit R, Akel M, Obeid S, Haddad G, et al. Validation of the Hamilton Anxiety Rating Scale and State Trait Anxiety Inventory A and B in Arabic among the Lebanese population. *Clin Epidemiol Glob Health*. 2020;**8**(4):1104-9. https://doi.org/10.1016/j.cegh.2020.03.028.
23. Hellhammer DH, Wüst S, Kudielka BM. Salivary cortisol as a biomarker in stress research. *Psychoneuroendocrinology*. 2009;**34**(2):163-71. [PubMed ID: 19095358]. https://doi.org/10.1016/j.psyneuen.2008.10.026.
24. Zhang MW, Lim RB, Lee C, Ho RC. Prevalence of Internet Addiction in Medical Students: a Meta-analysis. *Acad Psychiatry*. 2017;**42**(1):88-93. [PubMed ID: 28849574]. https://doi.org/10.1007/s40596-017-0794-1.
25. Upadhayay N, Guragain S. Internet use and its addiction level in medical students. *Adv Med Educ Pract*. 2017;**8**:641-7. [PubMed ID: 28989293]. [PubMed Central ID: PMC5624599]. https://doi.org/10.2147/amep.S142199.
26. Capetillo-Ventura N, Juárez-Treviño M. Internet addiction in university medical students. *Med Univer*. 2015;**17**(67):88-93. https://doi.org/10.1016/j.rmu.2015.02.003.

27. Pal RK; Priyanka. Internet Addiction and the Pattern of Internet Use among Under Graduate Medical Students: A Cross- Sectional Study from North India. *J Community Health Re*. 2022;**10**(4):328-36. https://doi.org/10.18502/jchr.v10i4.8338.
28. Carr N. *The Shallows: What the Internet Is Doing to Our Brains*. New York, USA: W. W. Norton & Company; 2011.
29. Fatehi F, Monajemi A, Sadeghi A, Mojtahedzadeh R, Mirzazadeh A. Quality of Life in Medical Students With Internet Addiction. *Acta Med Iran*. 2016;**54**(10):662-6. [PubMed ID: 27888595].
30. Zhang MW, Ho RC. Smartphone applications for immersive virtual reality therapy for internet addiction and internet gaming disorder. *Technol Health Care*. 2017;**25**(2):367-72. [PubMed ID: 27911347]. https://doi.org/10.3233/thc-161282.
31. Weinstein AM, Li W, O'Brien JE, Snyder SM, Howard MO. Characteristics of Internet Addiction/Pathological Internet Use in U.S. University Students: A Qualitative-Method Investigation. *Plos One*. 2015;**10**(2). [PubMed ID: 25647224]. [PubMed Central ID: PMC4315426]. https://doi.org/10.1371/journal.pone.0117372.
32. Machimbarrena J, González-Cabrera J, Ortega-Barón J, Beranuy-Fargues M, Álvarez-Bardón A, Tejero B. Profiles of Problematic Internet Use and Its Impact on Adolescents' Health-Related Quality of Life. *International Journal of Environmental Research and Public Health*. 2019;**16**(20). [PubMed ID: 31614899]. [PubMed Central ID: PMC6843246]. https://doi.org/10.3390/ijerph16203877.
33. Muñoz-Miralles R, Ortega-González R, López-Morón M, Batalla-Martínez C, Manresa JM, Montellà-Jordana N, et al. The problematic use of Information and Communication Technologies (ICT) in adolescents by the cross sectional JOITIC study. *BMC Pediatr*. 2016;**16**(1). [PubMed ID: 27550020]. [PubMed Central ID: PMC4994264]. https://doi.org/10.1186/s12887-016-0674-y.
34. Wegmann E, Brand M. Internet-Communication Disorder: It's a Matter of Social Aspects, Coping, and Internet-Use Expectancies. *Front Psychol*. 2016;**7**:1747. [PubMed ID: 27891107]. [PubMed Central ID: PMC5102883]. https://doi.org/10.3389/fpsyg.2016.01747.
35. Javaeed A, Zafar MB, Iqbal M, Ghauri SK. Correlation between Internet addiction, depression, anxiety and stress among undergraduate medical students in Azad Kashmir. *Pak J Med Sci*. 2019;**35**(2). [PubMed ID: 27891107]. [PubMed Central ID: PMC6500801]. https://doi.org/10.12669/pjms.35.2.169.
36. Afsar N, Kulsoom B. Stress, anxiety, and depression among medical students in a multiethnic setting. *Neuropsychiatr Dis Treat*. 2015;**11**:1713-22. [PubMed ID: 26213470]. [PubMed Central ID: PMC4509544]. https://doi.org/10.2147/ndt.S83577.
37. Soltani E, Baghaie-Fard H. [Evaluating the Relationship between Internet Addiction with Social Interactions Anxiety and Coping Strategies among Shiraz Medical Science University Students in 2018-2019]. *Sadra Med Sci J*. 2020;**8**(4):429-42. FA.