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RESEARCH ARTICLE

Exploring Associations between Internet Addiction, Depressive Symptoms, and Sleep Disturbance among Saudi Nursing Students

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Abstract:

Background:

Excessive internet usage is a worldwide problematic issue among young adults and college students. Previous studies showed that Saudi young adults are involved in this problem.

Objectives:

To determine the prevalence of Internet Addiction (IA), and to find out its relation with depressive symptoms, sleep quality, and demographic variables.

Methods:

This study used a cross-sectional design. Data were collected from 341 nursing students in Saudi Arabia using three scales: Young's Internet Addiction Test, Central Epidemiologic Scale for Depression and Pittsburgh Sleep Quality Index.

Results:

The results showed that 35.1% of students were suffering from frequent problems and 0.9% were suffering from significant problems due to heavy internet usage. The correlation results found a positive moderate correlation between IA and depression ($r = 0.401$, $p < 0.001$) and a positive weak correlation with sleep quality ($r = 0.196$, $p = 0.002$). Sleeping and depression were weakly correlated ($r = 0.274$, $p < 0.001$). Regression analysis revealed that IA was associated with: smoking status, high family income, duration of usage (3-6 hours and >6 hours), and depressive symptoms. The depressive level was associated with duration of usage (>6 hours), students' grading point average (GPA), IA, and sleep quality. Sleep quality was found to be associated with duration of usage (>6 hours) and having depressive symptoms.

Conclusion:

The findings illustrate the need for proper management of internet usage, as well as developing plans to avoid the negative consequences of internet addiction on psychological wellbeing by incorporating nursing education programs about appropriate internet usage.

Keywords: Addiction, Depression , Depressive symptoms, Internet, Sleep quality .

1. INTRODUCTION

The proliferation of Information & Communication Technology (ICT) and internet access worldwide since the 1990s has resulted in a technological revolution affecting all aspects of life. The advent of smartphones and ubiquitous internet usage from the 2000s has led to the emergence of the unhealthy phenomenon of Internet Addiction (IA). IA is defined as excessive usage of the internet characterized by spending long periods online, probably accompanied by physical, behavioural, and psychosocial negative consequences [1]. In terms of the diagnostic criterion for how much internet use constitutes an addiction, a commonly accepted definition is six hours of daily usage for non-essential purposes over at least three months [2].

Recently, IA was classified as one of the mental disorders

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in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), in the third section of 'internet use and gaming disorder' [3]. Excessive internet usage could lead to a non-chemical type of addiction called IA, which is also called problematic internet use, excessive internet use, or pathological internet use [2]. IA consists of at least three subtypes: excessive gaming, sexual preoccupation, and messaging. These subtypes have the same pathological characteristics:

- Heavy usage, accompanied by a neglect of basic drives and loss of sense of time.
- Withdrawal symptoms, such as anger, tension, and depression when the internet is inaccessible.
- Tolerance symptoms (the need to spend more hours online).
- Negative consequences, including social isolation, fatigue, and poor achievement [1].

IA undoubtedly negatively affects users' psychological health and well-being [4]. Previous researchers proved that there is a relationship between IA and well-known psycho-logical problems, such as anxiety and attention deficit symptoms [5], dissociative symptoms [6], shyness [7], and personality and self-esteem problems [8]. Among students, studies found that excessive internet usage tends to be strongly linked with depression [9, 10], as well as sleeping problems [11, 12]. Many studies on IA were conducted using Young's Internet Addiction Scale [13], developed by Kimberly Young in 1998 [14]. Its results among students showed some alarming numbers. For example, in Japan, about 4% of students were found to have severe IA, while 59% had possible addiction [15]. In Spain, excessive internet usage was reported to be about 10% [16], while in Greece it was 35% [17], and it was 15% in Taiwan [18].

In Saudi Arabia, more than 18% of young adults are using the internet excessively-more than eight hours daily, according to the Communication and Information Technology Comm-ission [19]. However, few studies have been conducted to explore the prevalence and impacts of excessive internet usage among college students in Saudi Arabia. This study addresses this research gap by exploring the prevalence of IA and its relationship with depression and sleep disturbance among nursing students in Imam Abdulrahman bin Faisal University in Saudi Arabia.

The current study hypothesized the existence of an interchangeable relationship between depression and poor sleep quality, on the one hand, and excessive internet use on the other, among nursing college students. Thus, the aims of the study are:

- To determine the prevalence of IA among nursing students.
- To find out the relationship between IA, depression level, and sleep quality.
- To evaluate the differences in relation to demographic variables.

2. METHODOLOGY

2.1. Study Design and Setting

A cross-sectional correlational design was used to collect research data. Students were recruited from the College of Nursing at Imam Abdulrahman bin Faisal University in the Eastern Region of Saudi Arabia. The college offers an under-graduate program leading to a Bachelor of Science in Nursing degree (BSN), in addition to a parallel nursing Program. Students must pass four academic years and the following internship year to graduate with a BSN. The Grading Point Average (GPA) system used in the university is a five-point grading scale, with a maximum of 5.0.

2.2. SAMPLING AND DATA COLLECTION

The target population was all nursing students in the College, with students from the second to fifth years (the latter of which is the internship year). The needed number of participants was 250, based on the formula of estimating the prevalence of IA among nursing students with a precision of 5%. However, because the prevalence was unknown, the value of 50% was proposed. The confidence interval was 95% and the total population was 620, however participants were recruited using a systematic technique sampling (interval sampling) method by selecting every 2nd student as a fixed interval, from a pre-generated list of each enrolment year's student provided by the Registration Department of the College. Three hundred forty-one students were selected as a final sample size to avoid any data collection problems, such as incomplete surveys and missing data.

2.3. Instruments

A socio-demographic form was used to collect basic demographic data (age, gender, marital status, and level of education), and other questions regarding the use of the internet such as duration, purposes, time and method of access. Three self-rating scales were used to collect the data, as explained below.

2.3.1. Internet Addiction

Internet addiction was evaluated using the Arabic version of the Internet Addiction Test (A-IAT). The original scale was developed by Kimberly Young in 1996, structured on the criteria of DSM-IV pathological gambling disorder [20]. Later, Young extended the test by increasing the number of items to 20 (from the original eight) [14]. IAT consists of 20 items answered with a five-point Likert-type scale, ranging from 0 "never" to 5 "always". The scoring ranges from 20 to 100, with higher scores indicating a greater likelihood that the individual has IA. Therefore, a score of 70 and above indicates IA, 40 to 69 indicates possible addiction, and less than 40 indicates no addiction [14]. The Arabic version of Young's test showed good psychometric properties, with excellent internal consis-tency reliability, with a Cronbach's alpha of 0.921 [21].

2.3.2. Depression Level

The Arabic version of the Central Epidemiologic Scale for Depression (A-CES-D) was used to measure depression levels

among students. The scale was developed by Radolff in 1977, consisting of 20 items answered with a three-point Likert-type scale ranging from 0 to 3, with higher scores indicating more depressive symptoms, with a cut-off point of 16 [22]. The Arabic version has been tested for psychometric properties, showing good validity and high internal consistency and reliability in many studies [23, 24], with a Cronbach's alpha ranging from 0.83 to 0.88.

2.3.3. Sleep Quality Index

The Arabic Pittsburgh Sleep Quality Index (A-PSQI) scale was used to evaluate the quality of sleep. The original PSQI was developed by Buysse *et al*. It contains 19 Likert-type items covering seven sleep components: quality, latency, duration and disturbances of sleep, habitual sleep efficiency, use of sleep medications, and daytime dysfunction. The sum of scores for these seven components gives a global score that ranges between 0 and 21, with higher scores indicating poorer quality sleep, with a cut-off point of 5 [25]. A-PSQI has been tested psychometrically among Arabic language speakers, with a Cronbach's alpha of 0.74, and a correlation between the components and the global PSQI ranging from 0.25 to 0.49, with internal consistency reliability of 0.65 [26].

2.4. Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of the Deanship of Scientific Research (DSR) at the University of Dammam, where the research was carried out. In addition, eligible participants completed an informed consent form with a full understanding of the study process and goals, as well as their rights to anonymity, voluntary participation, and freedom of withdrawal from the study at any time, without any responsibility or accountability, or impacts on their statutory rights.

2.5. Data Analysis

The collected data was analysed using SPSS version 22. Descriptive statistics including mean, standard deviation, frequency, and percentage were used to present the socio-demographic data of participants and prevalence of IA, as well as to describe their level of depression and sleep quality. Pearson's bivariate and multivariate statistical analysis and multiple linear regression tests were used to explore the relationships between demographic variables and IA, level of depression, and quality of sleep.

3. RESULTS

3.1. Sample Characteristics and Pattern of Internet Usage

A total sample of 341 undergraduate students was surveyed, of whom 58.9% were female, 68.0% were single, and 88.6% were non-smokers. The majority were under-graduate level (74.0%), living with their family (79.2%), and had a family income of between 10-20,000 SAR (48.5%). About 64.0% of the students used the internet for the first time when aged 10-17 years old, 45.9% of them used the internet to access social media through their laptop or mobile (88.0%), and more than half (54.7%) used the using internet 3-6 hours daily. The mean age of the students was 22.9 (4.6), and their GPA was 4.0 (0.51) (Table **1**).

3.2. Internet Usage

The Cronbach's alpha value for the A-IAT was 0.748, suggesting a satisfactory level of construct validity and internal consistency. More than half of the participants were average online users (59.6%) with an internet addiction level ranging from 20 to 49. On the other hand, 35.1% have frequent problems, and 0.9% of them had an internet addiction score from 80 to 100 (Table **2**).

Table 1. Demographic characteristics of the student (n=341).

-	-	**Number**	**%**
Gender	Male	140	41.1
-	Female	201	58.9
-	-	-	-
Marital Status	Single	232	68.0
-	Married	109	32.0
-	-	-	-
Smoking *	Yes	34	9.9
-	No	303	88.6
-	-	-	-
Education level *	Undergraduate	251	74.0
-	Parallel Nursing Program	89	26.0
-	-	-	-
Residence	with Family	271	79.2
-	With friend	22	6.4
-	Alone	48	14.0
-	-	-	-
Family Income (SAR) *	< 10,000	99	28.9
-	10,000-20,000	166	48.5
-	>20,000	53	15.5

(Table 1) contd.....

-	-	Number	%
-	-	-	-
First time usage *	< 10 Years	66	19.3
-	10-17 Years	219	64.0
-	> 17 Years	53	15.5
-	-	-	-
Purposes of use	Emails	22	6.4
-	Social Media	157	45.9
-	Scientific	24	7.0
-	All	131	38.3
-	-	-	-
Access Methods *	Laptop or/mobile	301	88.0
-	Desktop	34	9.9
-	-	-	-
Duration of Net usage/day	≤ 2 Hours	37	10.8
-	3-6 Hours	187	54.7
-	> 6 hours	118	34.5
-	-	-	-
-	Mean (SD)	Minimum	Maximum
Age	22.9 (4.6)	18.0	37.0
GPA	4.00 (0.51)	2.8	4.9

* missing values

Table 2. Internet addiction among nursing students.

-	IAT Score	Frequency	Percent
Average online User	20-49	204	59.6
Occasionally or frequent problems because of internet	50-79	120	35.1
Significant Problem	80-100	3	0.9

3.3. Level of Depression

The Cronbach's alpha value for A-CES-D was 0.871. The results showed that about two-thirds of students (62.6%) experienced none to mild depressive symptoms. Only 17.3% of them had severe depressive symptoms (Table **3**).

Table 3. Depression levels among nursing students.

-	CES-D Score	Frequency	Percent
Non to mild Depressive symptom	0-16	214	62.6
Moderate Depressive symptom	16-23	68	19.9
Severe Depressive symptom	24-60	59	17.3

3.4. Sleep Quality

The Cronbach's alpha value A-PSQI was = 0.522. Surprisingly, more than two-third of the students (69.9%) experienced poor sleep quality and 30.1% reported good sleep quality (Table **4**).

Table 4. Quality of sleep among nursing students.

-	Frequency	Percent
Poor sleep Quality	239	69.9
Good Sleep Quality	103	30.1

3.5. Internet Addiction, Depression, and Sleep Quality Relationships

Pearson's correlation was applied to determine the relationships between IA, depression, and quality of sleep. There was a positive moderate correlation between IA and depression, ($r = 0.401$, $p < 0.001$), and a positive weak correlation between AI and quality of sleep ($r = 0.196$, $p < 0.001$). In addition, there was a positive weak correlation bet-ween the quality of sleep and depression ($r = 0.274$, $p < 0.001$), as summarized in Table **5**.

Table 5. Pearson correlation coefficient between Internet addiction, depression symptoms, and quality of sleep.

-	Internet addiction	depression symptoms	quality of sleep
Internet Addiction	1	-	-
Depression Symptom	.401**	1	-
Sleep Quality	.196**	.274**	1

** $P < 0.001$

3.6. Multivariate Analysis of Factors Associated with IA, Depressive Symptoms, and Sleep Quality

The results from multivariable linear regression showed that IA was associated with smoking status, family income (over 20,000 SAR), duration of usage (3-6 hours and >6 hours) and depressive symptoms. The depressive level was associated with duration of usage for more than 6 hours, GPA, IA, and sleep quality. Sleep quality was found to be associated with duration of usage for more than 6 hours, and having depressive symptoms (Table **6**).

IA was higher among non-smokers (b = 6.54, 95% CI: 0.10-12.89, $p < 0.05$). Compared with families having an income of less than 10,000 SAR, families with higher incomes (> 20,000 SAR) were more likely to have IA (b = 6.12, 95%

Cl: 0.55-11.69, *p* < 0.05). Moreover, the duration of use was highly significant for IA for 3-6 hours (b = 6.62, 95% CI: 0.36-12.88, *p* < 0.05), and for more than 6 hours (b = 15.42, 95% CI: 8.75, 22.10, *p* < 0.05). Additionally, IA was associated with depression level (b = 0.6, 95% CI: 0.41-0.80, *p* < 0.05).

Depression level was higher among those using the internet for more than six hours (b = 3.00, 95% CI: 0.66-5.33, *p* < 0.05), and lower with increased GPA level (b = -3.00, 95% CI: -5.65, -0.35, *p* < 0.05). Students with high IA (b = 0.27, 95% CI: 0.19-0.71, *p* < 0.05) and sleep quality (b = 0.76, 95% CI: 0.27-1.25, *p* < 0.05) had more depressive symptoms.

Poor sleep quality was found among those using the internet for more than six hours (b = 0.82, 95% CI: 0.11-1.54, *p* < 0.05) and students with depressive symptoms (b = 0.07, 95% CI: 0.04-0.11, *p* < 0.05).

4. DISCUSSION

The rapid growth and increased use of the internet have become apparent worldwide, resulting in positive and negative effects on users. Internet use provides benefits such as improved communication, learning, and opportunities for interactivity [27]. However, some individuals (particularly adolescents), due to uncontrolled use of this technology, experience various health problems, such as depression and poor sleep quality [28]. This study highlighted a high prevalence of IA, and it was found to be a predictor of depressive symptoms and poor sleep quality among undergraduate students, consistent with previous studies [12, 29, 30]. In China, a study of the effects of insomnia as a mediator on problematic internet use and depression found that a high prevalence of IA and networking addiction was associated with a high risk of depression, which stemmed from direct and indirect insomnia [12]. This finding suggests that there are strong correlations between sleeping problems, IA, and depression.

In addition, the current study showed that internet usage was prevalent among undergraduate students, both males and females, of different ages and income levels. This means that internet users have different sociodemographic characteristics, which suggests that the behaviour and reasons for internet use go beyond the demographic structure of the population [31]. In this study, there was no relationship between gender and IA. Conversely, a study targeted to identifying gender differences in the relationship between IA and depression found that females were more likely to develop depressive symptoms from IA [32]. This finding suggests that the relationship between IA and depression may depend to some extent on gender, because of the differences between men's and women's behavioural patterns in general, and the ways in which they use the internet itself.

Consequently, this study highlighted specific demographic characteristics related to IA among undergraduate students, such as their habits, incomes, and GPAs. Furthermore, active smokers were more addicted to the internet than non-smokers. In addition, students whose family incomes were greater than 20,000 SAR were more addicted to internet usage than those with family incomes of 10,000 to 20,000 SAR. Finally, students with higher GPAs exhibited fewer depressive symptoms than those with lower GPAs. These variables may correlate with the ways in which the internet is used, as alluded to for gender. People have different reasons for using the internet, including digital communication (*e.g.*, emails and chats), digital social inclusion (*e.g.*, social media and current events), and learning (*e.g.*, scientific reasons and research).

Table 6. Multiple linear regression of students' characteristics with Internet addiction, depression symptoms and sleep quality.

-	Internet Addiction		Depressive Symptom		Sleep Quality	
-	**B**	**95% Cl**	**B**	**95% Cl**	**B**	**95% Cl**
Gender (reference: male)	-3.51	-8.36, 1.34	-2.53	-6.72, -0.16	-0.42	-1.33, 0.50
Marital Status (reference: Single)	3.85	-1.50, 9.21	3.27	-0.37, 6.89	0.87	-0.11, 1.85
Smoking (reference: Yes)	6.54 *	0.10, 12.89	1.46	-3.02, 5.93	1.17	-0.07, 2.40
Education (reference: B.S.N)	2.55	-10.61, 15.71	-2.82	-11.72, 6.08	-0.68	-3.10, 1.74
Residence (reference: with family)	-	-	-	-	-	-
With Friend	1.24	-6.61, 9.10	-1.66	-6.97, 3.65	0.36	-1.08, 1.80
Alone	-2.24	-8.26, 3.79	1.17	-2.90, 5.24	-0.02	-1.12, 1.20
Income (reference:<10,000)	-	-	-	-	-	-
10-20K	2.38	-1.86, 6.61	0.29	-2.58, 3.15	0.12	-0.66, 0.90
> 20K	6.12*	0.55, 11.69	-0.96	-5.10, 3.20	0.3	-0.82, 1.42
Duration (reference: ≤2 hours)	-	-	-	-	-	-
3-6 hours	6.62*	0.36, 12.88	3.62	-1.31, 8.55	0.3	-1.04, 1.64
> 6 hours	15.42*	8.75, 22.10	3.00*	0.66, 5.33	0.82*	0.11, 1.54
Age	0.57	-0.70, 1.84	-0.01	-0.87, 0.85	0.02	-0.22, 0.25
GPA	0.1	-4.39, 4.59	-3.00*	-5.65, -0.35	0.21	-0.61, 1.04
Internet Adduction	-	-	0.27*	0.19, 0.71	0.01	-0.01, 0.04
Sleep Quality	0.36	-0.37, 1.10	0.76*	0.27, 1.25	-	-
Depressive symptoms	0.6*	0.41, 0.80	-	-	0.07*	0.04, 0.11

Stepwise Method Statistically * P < 0.05. b: Unstandardized Coefficients.

In this study, using social media was the chief reason cited for why people used the internet, and scientific purposes were the least cited reason (this is notable as the participants were nursing students, who might be expected to use the internet for their studies). These results are consistent with a study determining the level of social media addiction among young people in Turkey, which found that IA was a predictor of increased social media addiction [33]. This finding coincides with a study of the impacts of self-esteem, daily internet use, and social media addiction on adolescents' depression levels, which found that the majority of internet users, particularly those with low self-esteem, were also social media users, because they tended to avoid 'real' interactions by escaping to the virtual world [34].

In addition, this study showed that IA independently mediated the indirect effect of sleep quality (r = 0.196, *p* = 0.002) on depressive symptoms, and that sleep quality independently mediated the indirect effect of depressive symptoms (r = 0.401, *p* = 0.000) on IA. These two findings suggest that something besides depressive symptoms and poor sleep increases the risk of IA, and that IA and sleep quality are predictors of depressive symptoms. These findings coincide with a study exploring correlations between IA, sleep quality and depressive symptoms, which found that the three items mediated substantial portions of the indirect effects on each variable [28].

Moreover, this study's findings are consistent with those from a study of the association between suicide attempts and sleep among South Koreans [11]. According to the results, adults addicted to the internet had problems in maintaining good sleep quality, and poor sleep quality was significantly associated with lifetime suicide attempts. This finding suggests that uncontrolled IA can mediate the direct and indirect effects of poor sleep on depressive symptoms.

Furthermore, depressive symptoms related to IA were examined in past studies on adolescents and young adult groups, and the symptoms were either a consequence of IA or a predictor of IA. An examination of the effects and connection between IA and the development of depressive symptoms found that the association between IA and depressive symptoms was multifaceted [9], which means that depression can increase the risk of IA and that IA can predict the development of depressive symptoms and associated mental disorders [8]. Assessment of the prevalence of smartphone addiction symptoms in relation to the presence of depression or anxiety among Lebanese university students found that smartphone addiction stemming from behavioural addiction to internet gaming, communication, gambling, and excessive social media penetration not only decreased sleep quality but also increased vulnerability to depressive symptoms and associated mental health disorders, such as stress and anxiety [35].

LIMITATIONS

Using a correlational design in this study could be a limitation in measuring the prevalence of IA and its consequences for a single point in time. Additionally, the use of self-rating measurements to assess IA and depression can misreport actual prevalence. Moreover, suggesting a sample size of 50% of the total population could affect the generalizability of the results.

RECOMMENDATIONS

Developing a nursing education program about appropriate internet usage for nursing students would be advisable in order to increase awareness of the negative effects of heavy internet usage on students' psychological health. Moreover, directing awareness programs and workshops toward families is recommended in terms of community service projects by nursing students in order to maximise the implications of the current and previous studies' findings on the community wellbeing.

On the research side, conducting a longitudinal study focused on psychological correlates of heavy internet usage, as well as exploring more life aspects of internet users by using some specific tools on a larger population, would enrich the literature with more generalizable findings on IA impacts on students and communities.

CONCLUSION

The overall findings of this study suggest that IA has a moderate correlation with depression, and a weak correlation with sleep quality. Additionally, students with IA have higher depressive symptoms and have poorer sleep quality. Hence, the more often students access the internet, the more likely they are to attain depressive symptoms and to experience poor sleep. In consideration of the prevalence rate of excessive internet usage (determined to be among about a third of students), and its correlation with depressive symptoms and decreased sleep quality, it can be suggested that excessive internet use resulting in IA is a complementary behaviour that detracts from the development of depressive symptoms, ultimately leading to poor sleep quality.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The approval from the Institutional Review Board (IRB) at the University of Dammam, KSA (approval #: lR8- 2017- 04-091,) was obtained for the study.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures were followed in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

AVAILABILITY OF DATA AND MATERIALS

The data sets analyzed during the current study are available from the corresponding author M.A. upon request.

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None.

CONFLICT OF INTEREST

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