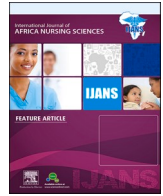


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Insomnia thresholds and associated factors among Omani university students

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ABSTRACT

Background: Insomnia is the most predominant sleep disorder affecting the general population and is a significant health concern.

Objective: The aim of this study was to explore the prevalence and predictors of insomnia among Omani university students.

Methods: A cross-sectional descriptive design was used. Six hundred and thirty-two university students were recruited through convenience sampling and completed four self-reported surveys: (1) Depression, Anxiety and Stress scale; (2) Smartphone Addiction scale; (3) Insomnia Severity Index, and (4) demographics sheets, accessed through the Google Forms link posted on Twitter.

Results: Almost two thirds of the participants suffered from insomnia, of whom a third part suffered from sub-threshold insomnia, another third had moderate insomnia, and a tenth part suffered from severe insomnia. A multivariate regression analysis revealed that age, preparing for exams, smartphone addiction, and stress were significant associated factors of insomnia.

Conclusion: Although the study identified high level of insomnia and significant associations between insomnia and exam preparation, smartphone addiction, and stress; insomnia is a far more complex phenomenon. We therefore recommend further studies to follow up the development of this population and to identify actions to combat this high level of insomnia. Nurses, public health workers, health coaches, and other clinically active professionals could collaborate to build programs to promote healthy use of smartphones in young individuals in order to combat insomnia.

1. Introduction

Insomnia is the most predominant sleep disorder affecting the general population and is a significant health concern. It is a chronic condition characterized by difficulty falling asleep, increased occurrence of awakenings, trouble going back to sleep and waking up earlier than desired (American Psychiatric Association [APA], 2021). Insomnia may

also mean that the individual experiences poor quality or non-restorative sleep, described as feeling unrested or tired on waking up despite having sufficient opportunity for sleep, and resulting in daytime impairment (APA, 2021; Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008). In short, insomnia affects both the quantity and the quality of sleep of the individual, consequently having negative effects on daytime functioning.

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Several studies in different countries have established the various levels of prevalence of insomnia among university students. Low prevalence affecting <20% of the student population is noted in Lebanon, Italy, and Poland (Choueiry et al., 2016; Gianfredi et al., 2018; Średniawa et al., 2019). Moderate prevalence ranging from 20 to 40% is seen in the USA, Jordan, Saudi Arabia, Norway and China (Alqudah, Balousha, Al-Shboul, Al-Dwairi, Alfaqih, & Alzoubi, 2019; Alsaggaf, Wali, Merdad, & Merdad, 2016; Khader et al., 2020; Li et al., 2017). Remarkably high prevalence is recorded in Canada, Ethiopia and Hong Kong with 50–70% of the students suffering from insomnia (Haile, Alemu, & Habtewold, 2017; Sing & Wong, 2010; Walsh, Rodriguez, Repa, King, & Garland, 2020). Moreover, a dramatic rise in insomnia, from 22.6% in 2010 to 31% in 2018, was recorded among students in Norway (Sivertsen et al., 2019). Alarmingly, a systematic review reveals that the prevalence of insomnia among university students is more than 100% higher than in the general population (Jiang et al., 2015). Findings concerning differences in the prevalence of insomnia by gender or year of study are inconclusive, although Gianfredi et al. (2018) note its prevalence among students over the age of 30, and others that it is more common among females (Lemma, Gelaye, Berhane, Worku, & Williams, 2012; Sing & Wong, 2010; Sivertsen et al., 2019). Meanwhile, one study indicates that occurrence is higher among males (Gianfredi et al., 2018), another (Lemma et al., 2012) that it is more prevalent among second- and third-year students, and one that it is significantly higher among first-year students (Choueiry et al., 2016).

Several factors related to insomnia have been identified. A majority of young people develop insomnia during their university study (Walsh et al., 2020), probably because of the high level of stress common among university students (Alsaggaf et al., 2016). Students with average to high levels of stress experience poorer quality of sleep and are three times more likely to experience pronounced daytime drowsiness (Alsaggaf et al., 2016; Lemma et al., 2012), with many of them taking naps during the day to compensate (Lemma et al., 2012). As they juggle multiple demanding tasks, students' perceived poor quality of life adds up to their sleep problems (Gianfredi et al., 2018). Another factor that may contribute to sleep disturbances among students is their use of gadgets. Students are heavy users of smartphones, laptops or computers and most use these devices after lights out at night (Walsh et al., 2020). Admittedly, a sizeable proportion of the students believe that this use at bedtime interrupts their sleep pattern; and those who use these devices for a longer duration experience more clinical symptoms of insomnia (Walsh et al., 2020). In addition, students' addiction to the internet and online social networking is positively correlated to insomnia, depression (Li et al., 2017; Younes et al., 2016), anxiety, stress, and lower self-esteem (Younes et al., 2016). Other demographic and lifestyle factors are associated with insomnia. Single students are at a higher risk of insomnia than married or divorced students (Haile et al., 2017). Students in the field of humanities and social sciences are four times more likely to suffer from insomnia than students in the field of natural and computational sciences (Haile et al., 2017). Students who drink alcohol, who suffer from headache or backache, fever, or mental conditions are at a higher risk of insomnia (Haile et al., 2017). Interestingly, students who have little spiritual belief are almost four times more likely to have insomnia than those who worship regularly (Haile et al., 2017). Students' eating habits and lifestyle impact their sleep patterns. Drinking caffeinated beverages late in the afternoon (Gianfredi et al., 2018) and high sugar and low dairy product intake are significantly associated with sleep disturbances (Ramón-Arbués & JM, 2019).

Evidence shows a complex and far-reaching negative impact of insomnia among university students. Students with insomnia experience insufficient sleeping hours (Alqudah et al., 2019; Alsaggaf et al., 2016) and poor quality of sleep (Alsaggaf et al., 2016; Choueiry et al., 2016), which eventually leads to excessive daytime sleepiness (Chan et al., 2020; Gianfredi et al., 2018) and daytime dysfunction which may range from one to three times a week (Sing & Wong, 2010).

Consequently, students who have insomnia might be less optimistic,

have higher levels of stress (Średniawa et al., 2019), anxiety, depression, and suicidal ideation (Chan et al., 2020; Khader et al., 2020; Walsh et al., 2020). Moreover, insomnia has a detrimental effect on students' academic progress and success. Students suffering from insomnia have poorer academic performance (Gianfredi et al., 2018), lower cumulative grade point averages (cGPA) (Haile et al., 2017), and a higher risk of failing examinations and completing assignments (Vedaa, Erevik, Hysing, Hayley, & Sivertsen, 2019).

Within the Middle East context, there is a dearth of studies investigating the predictors of insomnia, especially in Oman. Insomnia may be more prevalent among university students than other members of the general population. This may largely be attributable to the pressures and demands of their studies that produce high levels of stress, as well as their excessive use of electronic devices. The negative effect of insomnia is all-encompassing as it transcends their physical and mental health, general wellbeing, level of efficiency and productivity, leading to deleterious academic performance and progress. This may significantly impair their future. Therefore, as insomnia among Omani university students requires urgent attention, this study aims to explore its prevalence and predictors among this group. The results will be a significant addition to the available body of literature and form the basis for immediate planning and interventions to reduce insomnia and its impact among university students.

2. Materials and methods

2.1. Design

A cross-sectional descriptive study was used.

2.2. Sample, sampling, and study setting

A convenience sampling technique was used to recruit university students who are: (1) able to read and write the English language; (2) registered in the university; and (3) undergraduates.

Slovin's formula ($n = N/(1 + N e^2)$, where n = Number of samples, N = Total population and e = margin of error, (0.05) was used to determine the sample size. 18,000 students are registered at the Sultan Qaboos University (Sultan Qaboos University. (2017), 2017), so $n = 18000/(1 + 18000 * (0.05)^2) = 391$ university students were required to participate in the study.

2.3. Data collection

Data were collected from 6 to 8 January 2021, from students at Sultan Qaboos University, the only public university in Oman, which accepts students from all over the country. The research team posted a tweet on Twitter in a group consisting of 3000 of university students belonging to different disciplines. The tweet included some information about the study and a link to the survey. A total of 631 students completed the survey a response rate of 21.0%. Due to difficulties in tracing the number of students who saw the survey, it was difficult to calculate the actual response rate.

2.4. Ethical considerations

Ethical approval was obtained from the Ethics Committee in the College of Nursing at Sultan Qaboos University 26th of October 2020 (CON/NF/2020/29). The researchers adhered to the Helsinki Declaration's ethical principles and permission to use the surveys was obtained from the responsible researchers.

2.5. Measurements

2.5.1. The outcome variable: Insomnia

To assess the nature, severity, and effect of insomnia over two weeks,

the English version of the Insomnia Severity Index scale (ISI) was used. The survey was designed by Charles Morin and consists of 7 items with responses measured on a 5-point Likert scale (e.g., 0 = no problem; 4 = very severe problem), yielding complete scores ranging from 0 to 28 (Morin, 1993). The total score is interpreted as follows: absence of insomnia (0–7); sub-threshold insomnia (8–14); moderate insomnia (15–21); and severe insomnia (22–28). The original Cronbach's α was 0.90 (Veigar & Hussain, 2017), and in the current study 0.839.

2.5.2. The explanatory variables: demographics, depression, anxiety, stress, and smartphone addiction.

2.5.2.1. Demographics. Participants were requested to provide information about their age, gender, marital status, cumulative GPA, parents' level of education and place of living, using the demographics sheet.

2.5.2.2. Depression, anxiety and stress. These were measured using the English version of the Depression Anxiety Stress Scale (DASS), a valid and reliable tool (Cronbach's alpha between 0.85 and 0.81) and available in the public domain. The survey was developed by researchers at the University of New South Wales in Australia and consists of 42 items. Each item is measured on a 4-point Likert scale in which 0 represents does not apply to me at all and 3 applies to me very much or most of the time (Lovibond & Lovibond, 1995). The independent constructs depression, anxiety and stress are each measured by 14 items. In the current study, the alpha coefficient value was found to be 0.97.

2.5.2.3. Smartphone addiction. The English version of the Smartphone Addiction Scale (SAS) was developed by Kwon, Kim, Cho, and Yang (2013) to assess smartphone addiction. It consists of 33 items with a 6-point scale (e.g., 1 = strongly disagree and 6 = strongly agree). To calculate the overall score, the items were summed to yield a total score, ranging from 33 to 198, with higher scores indicating more serious smartphone addiction. The original Cronbach's alpha was 0.967 (Kwon et al., 2013) and in the current study it was found to be 0.957.

2.6. Data analysis

The responses were collected using Google Forms, which were downloaded as CSV files and exported to SPSS Version 21.0 to be managed. Mean and standard deviation were used to describe the continuous variables. Categorical variables were described using frequencies and percentages. Independent t tests and ANOVA were performed to test for significant differences in means between demographics and insomnia severity. Pearson correlation was used to test the relationship between continuous variables like depression, anxiety, internet use and insomnia severity. Multiple linear regression was used to explore the significant predictors of insomnia among Omani university students.

3. Results

A total of 632 students participated in the study, with a mean age of 21.53 years (SD = 1.68) and cumulative GPA of 2.77 (SD = 0.41). More than 50% of students were male, 88% were single and 50.6% lived on campus. Sixty one percent of students were preparing for exams during the study survey and 74.4% reported being stressed. Students reported spending 6.08 h per day using their smartphone; 65% tended to use the phone more during stressful periods. On the other hand, 55.2% of students reported that using the smartphone during exam periods increased their stress. The total number of students who suffer from insomnia was 503 (79.3%) of whom 225 (35.6%) suffered from sub-threshold insomnia, 206 (32.6%) moderate insomnia and 70 (11.1%) severe insomnia. The higher insomnia scores were significantly associated with preparing for exams ($t(628) = -3.847; p < 0.001$); feeling stressed

related to study ($t(628) = -5.050; p < 0.001$); and using the phone more during stressful periods ($t(628) = -4.493; p < 0.001$). See Table 1

A two-tailed Pearson test of significance indicated insomnia was significantly and moderately correlated with participants' smartphone addiction ($r = 0.533, p < 0.001$), depression ($r = 0.401, p < 0.001$), anxiety ($r = 0.407, p < 0.001$), and stress levels ($r = 0.436, p < 0.001$). However, an inverse significant weak correlation was found between insomnia and cumulative GPA ($r = -0.140, p < 0.05$). See Table 2.

A multiple linear regression model was conducted to identify associated factors with insomnia. The final model was significant compared with the constant ($F(10, 618) = 29.6, p < 0.001$). R^2 and adjusted R^2 of the final model were 0.345 and = 0.334, respectively. Insomnia was significantly associated with age, preparing for the exam, smart phone addiction and stress. See Table 3.

4. Discussion

The level of insomnia among university students was significantly associated with socio-demographics, academic-related factors, and their psychological status. At the demographic level, as students get older, their insomnia significantly increases. At the academic level, those preparing for exams during the study survey reported higher insomnia scores than those who were not. At the psychological level, higher insomnia scores were significantly associated with higher scores of smartphone addiction and high stress levels.

The main prevalence of insomnia in our population was 79.3%. Our findings seem to be in line with those reported from other countries in the region. For example, a most recent study conducted in Jordan reported that 60.6% of university students suffered from insomnia (Alkhatatbeh, Khwaileh, & Abdul-Razzak, 2020). Similarly, the prevalence of insomnia could be as high as 69% among Malaysian students (Abdalqader, Ariffin, Ghazi, AboBakr, & Fadzil, 2018). Although this study's prevalence is high, it is not comparable with findings from other countries including Norway 30.5% (Sivertsen et al., 2019; Vedaa et al., 2019); Iran 9.79% (Vand, Gharraee, Farid, & Bandi, 2014), and the USA 12% (Gaultney, 2010). It seems there is a difference in the prevalence of insomnia between different countries or cultures. Insomnia is a complex phenomenon in which physical, psychological, socio-economic, and cultural factors are involved (Blank et al., 2015; Donskoy & Loghmanee, 2018; Riemann, Krone, Wulff, & Nissen, 2020). Another explanation is that this study was conducted during the time of COVID-19 when students were uncertain about their future and were exposed to unfamiliar online learning. Many students, overwhelmed by the academic demands and spent extended periods of time on their computers or smartphones during the night, which may have interrupted their circadian rhythm. With respect to the previous findings, studies conducted in eastern countries were based on small samples compared to the nationwide studies conducted in western contexts. Thus, a nation-wide study is needed to examine the prevalence among the young Omani population. In addition, this high prevalence of insomnia in our population could motivate the need for clinical interventions targeting young adults before they show clinical symptoms.

Another important finding of this study is the significant and positive association between insomnia and smartphone addiction. Similar results were found in previous research (Al Battashi et al., 2020; Çağan & Koca, 2020; Nursalam, Octavia, Tristiana, & Efendi, 2019). Use of the smartphone for over five hours a day was found to be significantly associated with both shorter sleeping duration and bad quality of sleep (Alosaimi, Alyahya, Alshahwan, Al Mahyijari, & Shaik, 2016; Liu et al., 2019; Tamura, Nishida, Tsuji, & Sakakibara, 2017). The crucial issue is that the level of smartphone use is very high among university students (Alsayed, Bano, & Alnajjar, 2020), affecting the prevalence of insomnia in the same group. University students use smartphones to access their online educational platforms, communicate with each other using different social media platforms, access education-related documents, and read their emails (Alsayed et al., 2020). Overall, the negative effect

Table 1
Descriptive and bivariate statistics of insomnia with respect to participants' characteristics (N = 632).

Characteristic	Total sample (N = 632) n (%)	Insomnia (Mean = 13.49, SD = 6.31)			
		Mean (SD)	t/F	df	p-value
Gender			0.489	628	0.625
Male	372 (58.9)	13.66 (6.19)			
Female	260 (41.1)	13.40 (6.38)			
Marital status			2.420	2: 627	0.090
Married	55 (8.7)	13.11 (6.26)			
Single	555 (88)	13.63 (6.35)			
Divorced	20 (3.2)	10.55 (4.92)			
Mother's education level			2.135	3: 626	0.095
Illiterate or elementary school	217 (34.3)	12.73 (6.2)			
Junior high school	131 (20.7)	13.95 (6.3)			
Senior high school	147 (23.3)	14.27 (6.4)			
University level or above	137 (21.7)	13.5 (6.3)			
Father's education level			1.215	3: 626	0.304
Illiterate or elementary school	173 (27.4)	12.78 (6.2)			
Junior high school	132 (20.9)	13.58 (6.0)			
Senior high school	167 (26.4)	14.06 (6.9)			
College or university level or above	160 (25.3)	13.67 (6.2)			
Place of living			-0.542	628	0.588
Inside campus	320 (50.6)	13.35 (6.35)			
Outside campus	312 (49.4)	13.63 (6.28)			
Preparing for exam at the time of study survey			-3.847	628	<0.001
No	246 (38.9)	12.29 (6.40)			
Yes	386 (61.1)	14.26 (6.15)			
Feelings of stress related to studies			-5.050	628	<0.001
No	162 (25.6)	11.37 (5.76)			
Yes	470 (74.4)	14.22 (6.34)			
More use of phone during stress periods			-4.493	628	<0.001
No	221 (35)	11.96 (5.80)			
Yes	411 (65)	14.30 (6.44)			
Smartphone use increases stress during exams			-3.253	628	0.001
No	283 (44.8)	12.58 (6.102)			
Yes	349 (55.2)	14.22 (6.40)			
prevalence of insomnia					
Normal	129 (20.4)				

Table 1 (continued)

Characteristic	Total sample (N = 632) n (%)	Insomnia (Mean = 13.49, SD = 6.31)			
		Mean (SD)	t/F	df	p-value
Sub-threshold insomnia	225 (35.6)				
Moderate insomnia	206 (32.6)				
Severe insomnia	70 (11.1)				

Table 2
Correlation between insomnia and study variables.

	Overall		Correlation with Insomnia	
	Mean (SD)	Range	r	p-value
Age	21.53 (1.68)	18–26	0.026	0.460
cGPA	2.77 (0.41)	1.45 – 3.69	-0.140	0.041
Hours of sleep per day	6.93 (1.52)	5–11	0.041	0.672
Hours using smartphone per day	6.08 (2.30)	2–12	0.017	< 0.001
Smartphone addiction	113.76 (34.08)	43–198	0.533	< 0.001
Depression	19.69 (11.03)	0–42	0.401	< 0.001
Anxiety	19.33 (10.15)	1–42	0.407	< 0.001
Stress	21.25 (10.17)	0–42	0.436	< 0.001

of smartphone use not only leads to insomnia but also to a lack of energy, and adopting unhealthy lifestyles (Alosaimi et al., 2016). Hence, for future studies, aspects related to time and frequency of smartphone use should be considered since these factors were found to be significantly correlated with insomnia. Furthermore, the prevailing utilization of smartphones in academic settings and in teaching/learning activities should be a main target in clinical interventions run by student health centers and primary health nurses. The primary prevention is essential in the case of young healthy populations before they develop addiction with the ill-health related.

The present study further showed that students with higher insomnia scores were under the stress of exam preparation. The quality and duration of sleep have a tendency to deteriorate during exam periods and improve after the exams (Campbell, Soenens, Beyers, & Vansteenkiste, 2018; Zunhammer, Eichhammer, & Busch, 2014). This is expected as students spend their night studying during the exams. For example, there is evidence that final-year students who sit more exams and undertake more academic work are commonly suffering from sleeping problems (Zhai, Gao, & Wang, 2018). To double the problem, during the current study the number of students using their smartphones ($M = 113$) was higher than the second quartile, indicating addiction to smartphone use. This significantly contributed to the levels of insomnia in this population. Furthermore, the data collection took place during the COVID-19 lockdown and the students relied on their smartphones for their classes and to complete their exams. A recent study showed that during the COVID-19 pandemic, students who engaged with online teaching and completed their exams electronically experienced high levels of stress and insomnia (Elsalem et al., 2020). However, exam preparation should not rely on screen use, and communication with students during stressful periods should only be carried out during working hours. Further, aspects related to academic studies such as communication time and channels should be incorporated into educational interventions for this age group to ensure positive and healthy use of smartphones and to prevent insomnia during stressful periods like exams.

An interesting finding of this study is that higher stress periods were associated with higher levels of insomnia. A recent study conducted in

Table 3
Factors associated with insomnia among university students (N = 632).

Predictors	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval	
	B	SE	β	t	P	Lower Bound	Upper Bound
Constant	-10.277	4.019		-2.557	0.011	-18.169	-2.386
Age	0.282	0.134	0.072	2.097	0.036	0.018	0.545
Women relative to men	1.180	0.613	0.089	1.926	0.055	-0.023	2.383
Living outside versus on campus	0.728	0.571	0.058	1.276	0.202	-0.393	1.849
Hours using smartphone per day	0.088	0.088	0.033	0.997	0.319	-0.086	0.262
Preparing for exam	0.908	0.437	0.070	2.075	0.038	0.049	1.767
Feelings of stress related to study	0.993	0.506	0.069	1.962	0.050	-0.001	1.987
Smartphone addiction	0.076	0.007	0.410	10.621	<0.001	0.062	0.090
Depression	-0.034	0.043	-0.059	-0.782	0.434	-0.119	0.051
Anxiety	0.041	0.046	0.065	0.886	0.376	-0.049	0.131
Stress	0.135	0.044	0.217	3.058	0.002	0.048	0.221

Model's F-test = 29.6, significance test < 0.001, $R^2 = 0.345$, adjusted $R^2 = 0.334$.

Oman among university students reported that the students who suffered from severe to extremely severe stress also exhibited symptoms of insomnia (Al Battashi et al., 2020; Albasheer et al., 2020; Średniawa et al., 2019). Several studies found that university students suffer from a high level of stress (Al Omari, Al Sabei, Al Rawajfah, Abu Sharour, Aljohani, Alomari, Shkman, Al Dameery, Saifan, & Al Zubidi, 2020; Chan & Sun, 2020). There is a need to reduce or control the level of stress among university students through providing an appropriate academic advisory service and clinical psychological counselling whenever they need it. Encouraging students to participate in extra-curricular activities like joining a sports team or painting will help them to control and reduce their level of stress.

The current study's significant associations between insomnia, age, smartphone addiction, and preparing for exams can all be discussed from the perspective of stress-inducing factors. Stress may be related to environmental (exam preparation), or behavioral factors (smartphone use). A literature review identified a global occurrence of impaired sleep patterns among teenagers (Hale, Li, Hartstein, & LeBourgeois, 2019) while most recent scientific evidence show significant association between insomnia and late adolescence (Locsin & Salvador, 2021; Amicucci, Salfi, D'Atri, Viselli, & Ferrara, 2021). The researchers concluded that healthy sleep was directly or indirectly affected by psychosocial and behavioral outcomes related to screen use. Therefore, the importance of education in the healthy use of smartphones cannot be overemphasized. Nurses, public health workers, health coaches, and many other clinically active professionals could collaborate to build such an educational material or program to promote healthy use of smartphones in young individuals.

The study has some limitations, predominantly the inability to generalize the findings to other populations given the methodology we applied, although it might be possible to confirm that our findings were comparable with existing data from neighboring populations. An inherent other limitation of the cross-sectional study design is that causality cannot be established; a longitudinal approach is therefore recommended.

5. Conclusions

The prevalence of insomnia was high among Omani students. Decision makers should pay insomnia more attention among this group, and universities should endorse policies to periodically screen them for signs and symptoms of insomnia. Although the study identified significant associations between insomnia and exam preparation, smartphone addiction, and stress; insomnia is a far more complex phenomenon. The findings highlighted the importance of incorporating these variables in any intervention program that aims to reduce the prevalence of this health concern. Further studies are required to follow up the development of this population and to identify actions to combat this high level of insomnia. We also recommend that policy makers pay special

attention to the addictive behavioral use of smartphones.

5.1. Relevance to clinical practice

Clinical interventions targeting young individuals could benefit from the findings of the current study. The broadened utilization and dependency on the electronic devices in teaching/learning environments as well as in young populations in general should be a major target for all clinical interventions. In addition, interprofessional teams including public health nurses, school health nurses/teams, and educational settings are highly recommended to set and test effective strategies to combat the high prevalence of risk behaviors such as smartphone addiction.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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