

A public health view and comparison between online and on-campus learning to evaluate sleep and mental health among undergraduate students

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ABSTRACT

Background: The COVID-19 pandemic changed people's lives. The majority had to adapt to working online including students. The shift to online learning caused serious sleep and mental health issues among students. This study aimed to examine the variations between the prevalence of sleep and mental health problems among undergraduate students during the periods of online learning and on-campus learning. **Method:** An online survey was distributed to medical students in Saudi Arabia. **Results:** A total of 110 participated in the study (age = 21 ± 1.4 years). The on-campus anxiety (8.2 ± 6.3) was significantly higher than online anxiety (5.5 ± 5.1). On-campus daytime sleepiness (8.5 ± 4) was significantly higher when compared to online daytime sleepiness (6.7 ± 4.6). Although not significant, the on-campus stress (7.7 ± 5.7) and insomnia (12 ± 7.3) were higher than online stress (6.9 ± 5.5) and insomnia (11.5 ± 6). The online depression (6.6 ± 5.7) was higher than the mean on-campus depression (5.8 ± 5.4). A significant strong positive correlation was found between on-campus anxiety and on-campus stress. A significant moderate positive correlation was detected between on-campus anxiety and on-campus daytime sleepiness. A weak but significant correlation was found between on-campus anxiety and on-campus insomnia. On-campus anxiety was significantly predicted by the following model, which included on-campus stress, insomnia, and daytime sleepiness ($P < .001$). **Conclusion:** Medical students reported lower anxiety, daytime sleepiness, stress, and insomnia during their online learning compared to on-campus learning. Only depression was higher during online learning compared to on-campus learning.

Keywords: Anxiety, depression, insomnia, on-campus study, online study, stress

Introduction

Since COVID-19 was declared a pandemic by the World Health Organization (WHO) in early 2020, life around the world has been changed significantly.^[1] New policies and rules have been introduced by governments, and societies are trying to adapt to life during and post-COVID-19.^[2] Therefore, schools and

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businesses all over the world have had to adapt to new types of learning and working. Globally, over 1.2 billion children were out of the classroom, and many professionals have had to work remotely.^[3]

Undergraduate medical students, in addition to their stressful lives, are likely to experience a higher burden of sleep and/or mental health issues, especially during this difficult time.^[4,5] As reported in China, the UK, and Germany, student's stress levels and mental health have been negatively affected since the pandemic started.^[6-8] A survey of 324 college students in India between November and December 2020 suggested that 28.7% had moderate to severe depression, and 51.5% had mild to severe anxiety.^[9] Another report found that the COVID-19 pandemic has resulted in poorer sleep patterns among students worldwide.^[10] Another report found that students reported poorer sleep quality and high levels of insomnia symptoms while studying online.^[9] Other than sleep and mental health, a study by Cellini found that online studies generally yielded worse student performance than in-person and that the.^[11] New evidence from 2020 also suggests that the switch to online studies during the pandemic led to declines in academic performance.^[11] Generally, college students not only reported worse sleep and mental health outcomes but also a decline in their academic performance.

It is vital to assess the outcomes of online/flexible learning as a factor that contributes to sleep and/or mental health burden, as Saudi Arabia was one of few countries that started online classes soon after the WHO declared the state of a pandemic. It is important to assess students' perspectives on this unique delivery of science and if the online classes affected their sleep or mental health. To date, no studies in Saudi Arabia investigated whether remote/online learning affected university students' sleep or mental health when compared to face-to-face/on-campus learning. This is highly important, as sleep and mental health are factors that directly affect academic performance. Studying undergraduate medical students will help tackle any possible issues and will also help control any health challenges they encounter as early as possible. The aim of this study is to subjectively assess differences between the prevalence of sleep disturbances and mental health concerns among undergraduate medical students during online and on-campus learning and to further test the association between sleep and mental health. We hypothesize that the prevalence of sleep and mental health disturbances will be higher during remote/online learning.

Method

An anonymous survey used to answer the research question. Microsoft Forms was used as an online platform to collect the data from the participants. This online survey required 10 minutes to be completed. This custom survey contained three parts, starting with demographics, sleep, and mental health sections. Data regarding online learning was collected retrospectively using the same survey. Participants answered questions regarding mental health and sleep twice, with clear

instructions written before each section in big and bold font about the actual timing (during online learning and during on-campus learning). The study was approved by the ethical committee at the institute.

Materials

A short demographic section will collect the general information (e.g. age, gender, and body mass index (BMI)). Sleep disturbances were investigated using the Insomnia Severity Index (ISI) and Epworth Sleepiness Scale.^[12,13] The mental health was assessed using the Depression, Anxiety, and Stress Scale (DASS-21).^[14]

Participants

Undergraduate medical students from a local university in Western Saudi Arabia that is located in one of its major cities were invited to participate in this study. Students consented to participate in this study online via an invitation link, and only those who consented were taken to the survey page. To meet requirements of *post hoc* power analysis, the study needed at least 100 students to get enough statistical power at the level of .80.^[15]

Statistical analysis

Data obtained from the survey was analyzed using SPSS version 27 (Statistical Package for the Social Sciences-27). The data were analyzed using Chi-Square, *t*-test, correlation coefficient, and stepwise linear regression.

Results

This study included 110 participants with a mean age of 21 years (SD = 1.4 years), and all participants were males. The mean BMI was 24.4 (SD = 5.4). When asked about COVID-19 history, 42.7% (n = 47) said "no," 23.8% (n = 26) said "yes," and 33.6% (n = 37) said "yes" they know someone who had it.

When asked to rate their experience of online and on-campus study modes, a significantly higher proportion chose "excellent" during online mode (45.5%) when compared to on-campus mode (20%) [Table 1].

The mean on-campus anxiety (M = 8.2/SD = 6.3) was significantly higher than the mean online anxiety (M = 5.5/SD = 5.1). Additionally, average on-campus daytime sleepiness (M = 8.5/SD = 4) was significantly higher when compared to average

Table 1: A comparison between self-rated study experience between online and on-campus

Self-rated study experience	Online % (n)	On-campus % (n)
Excellent	45.5% (50)*	20% (22)
Good	22% (25)	35% (39)
Fair	21% (23)	32% (35)
Poor	3.6% (4)	5.5% (6)
Bad	7.2% (8)	7.2% (8)

Note, *P<0.001

online daytime sleepiness ($M = 6.7/SD = 4.6$). Although not significant, the mean on-campus stress ($M = 7.7/SD = 5.7$) and insomnia ($M = 12/SD = 7.3$) were higher than the mean online stress ($M = 6.9/SD = 5.5$) and insomnia ($M = 11.5/SD = 6$). The mean online depression ($M = 6.6/SD = 5.7$) was higher than the mean on-campus depression ($M = 5.8/SD = 5.4$) [Table 2, Figure 1].

A significant strong positive correlation was found between on-campus anxiety and on-campus stress ($R = 0.55/p < .001$). A significant moderate positive correlation was detected between on-campus anxiety and on-campus daytime sleepiness ($R = 0.30/p < .05$). A weak but significant correlation was found between on-campus anxiety and on-campus insomnia ($R = 0.22/p < .05$). There was a weak

correlation between on-campus anxiety and on-campus depression ($R = 0.17$) [Table 3].

On-campus anxiety was significantly predicted by the following model, which included on-campus stress, insomnia, and daytime sleepiness ($P < .001$) [Table 4].

Discussion

The COVID-19 pandemic had numerous negative effects on various aspects of life. Countries around the world had to impose emergency lockdowns to minimize the spread of the virus. Like many others, traditional higher education institutions had to switch from traditional learning methods to online learning methods. This has not only disrupted the process of

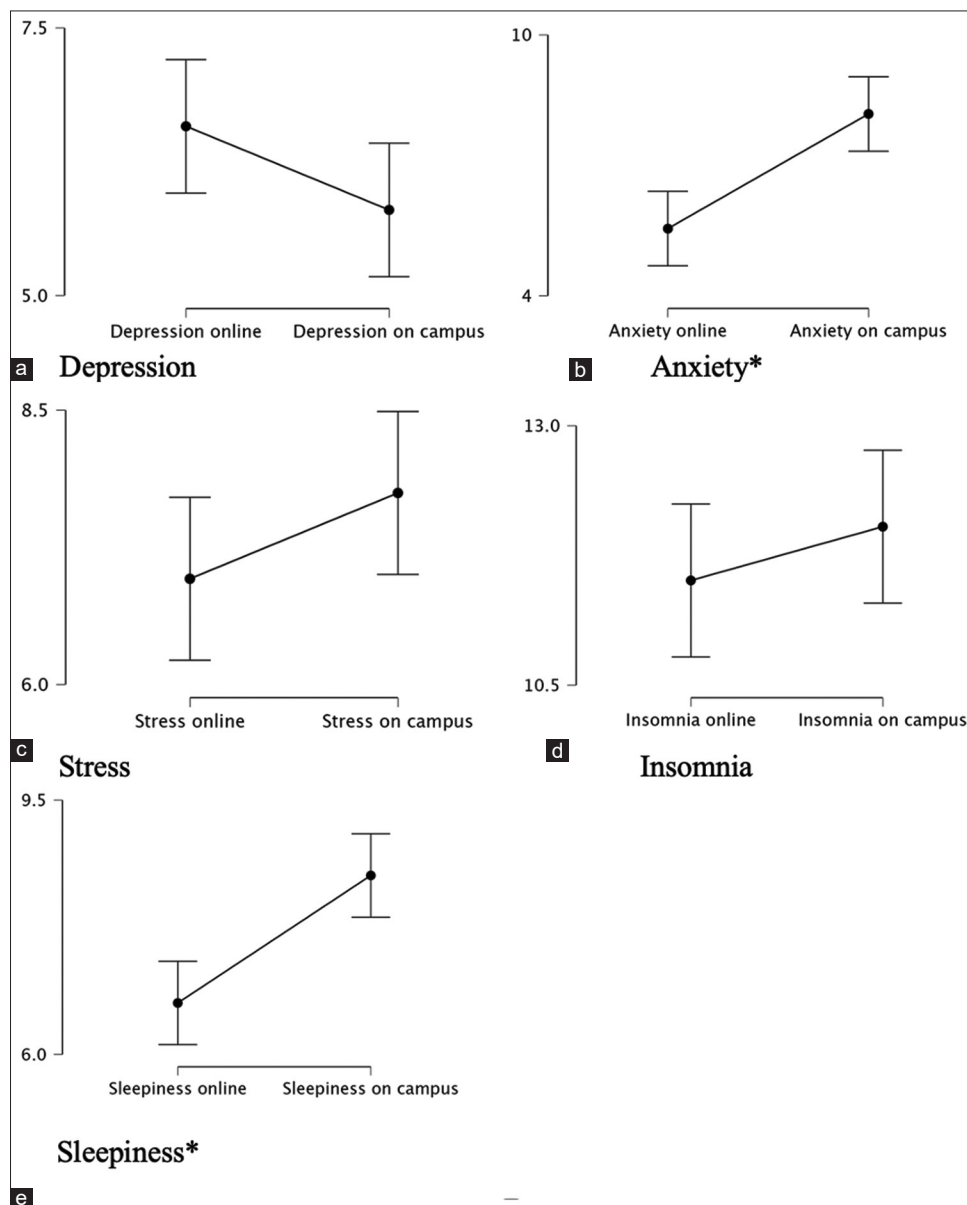


Figure 1: Shows the variation between (a) depression, (b) anxiety, (c) stress, (d) insomnia, and (e) sleepiness when measured during two different time points (online and on-campus)

Table 2: A comparison between the continuous variables of the study

Variable	Online M (SD)	On-campus M (SD)	t (df), P
Depression	6.6 (5.7)	5.8 (5.4)	t (110)=1.75, P=0.082
Anxiety	5.5 (5.1)	8.2 (6.3)	t (110)=-4.31, P<0.001
Stress	6.9 (5.5)	7.7 (5.7)	t (110)=-1.47, P=0.143
Insomnia	11.5 (6)	12 (7.3)	t (110)=-0.98, P=0.327
Sleepiness	6.7 (4.6)	8.5 (4)	t (110)=-4.28, P<0.001

Note, *P<0.001

Table 3: The correlation between on-campus anxiety and study variables

Variable	Anxiety (on-campus) (R values)
Sleepiness (on-campus)	0.30*
Insomnia (on-campus)	0.22*
Stress (on-campus)	0.55**
Depression (on-campus)	0.17

Note. *P<0.05, **P<0.001

Table 4: Stepwise linear regression predictors of anxiety (on-campus)

Variable	B	SE B	β
Constant	27.24	3	
Stress	0.61	0.09	0.55**
Insomnia	-0.09	0.08	-0.11
Sleepiness	0.29	0.13	0.18*
Adjusted R ²	0.32		
F	18.13		

Note. *P<0.05, **P<0.001, B=Unstandardized regression coefficient, SE=Standard error, β=Standardized regression coefficient. All variables within the model were measured as (on-campus)

education and fundamentally changed its teaching and assessment techniques but has also impacted students' learning experience and their health and well-being. This cross-sectional study aimed to investigate and compare the prevalence of certain mental health issues and some associated factors among undergraduate medical students in traditional and e-learning. The results of this study indicated that when comparing students in traditional learning versus e-learning, they had (i) a significantly better experience, (ii) significantly lower levels of anxiousness and depression, (iii) significantly lower levels of daytime sleepiness, and (iv) although not significant, lower levels of stress and insomnia. Also, the results indicate that anxiety was predicted by stress, insomnia, and sleepiness.

The results showed that students preferred e-learning versus traditional learning. People's preferences in general depend on certain factors that usually influence their experiences and eventually determine whether they like something or not. Previous studies have indicated that students disliked e-learning due to factors such as the lack of (i) access to the internet, (ii) proper contact with other students and instructors, (iii) learning in labs and clinics, and (vi) effective technology and e-learning platforms.^[16-18] Previous studies have also indicated that students enjoyed e-learning, which could be attributed to factors such as (i)

the absence of space and time barriers (everything is available with the touch of a button), (ii) the independence and motivation of self-education, (iii) the presence of a balance between studying, personal, and family life, and (vi) the absence of extra-costs (i.e. transport).^[19,20] It is important to note that Saudi Arabia is a developing country that has high-speed broadband and top-tier educational platforms such as Blackboard. Hence, students were able to overcome the issues raised by students who disliked e-learning from other countries and enjoy the benefits associated with it.

Also, the results showed that students experienced lower levels of anxiety, stress, sleepiness, and insomnia in e-learning compared to traditional learning. Previous studies have reported increased levels of stress^[21] and anxiety^[22] in e-learning. However, to our knowledge, no studies have investigated the relationship between sleepiness and insomnia and e-learning. Nevertheless, some studies reported issues with sleeping disturbances in general during e-learning.^[23,24] The occurrence of anxiety, stress, sleepiness, and insomnia among students during e-learning could have been attributed to their concerns regarding (i) their academic performance, (ii) being infected with COVID-19, and (iii) the uncertainty associated with the situation.^[24] Interestingly, similar to our findings, McLafferty *et al.*, 2021 reported decreased levels of anxiety in a sample of university students from The Republic of Ireland and Northern Ireland.^[25] Also, Bolatov *et al.*,^[20] 2021 reported similar findings in a sample of university medical students from the Republic of Kazakhstan. The lower levels of anxiety, stress, sleepiness, and insomnia found during e-learning in our sample confirm our previous findings; students preferred e-learning compared to traditional learning. It also highlights the consequences of traditional learning on students' mental health and well-being due to (i) the lack of flexibility (students can listen to recorded lectures anytime), (ii) the uneasiness (students have to go through traffic on a daily basis), and (iii) the high cost (students have to pay higher tuition fees and other things to like transportation and accommodation).^[19,20,26]

Moreover, the results highlighted one of the main issues associated with e-learning: the risk of developing depression. A plethora of studies have reported that e-learning gave rise to mental health issues such as depression, which could be attributed to the changes associated with the lockdown and the emotional, social, and financial impacts that followed.^[22,24,27,28]

Most importantly, the results show that via stepwise linear regression, traditional learning-associated anxiety was significantly predicted by stress, insomnia, and daytime sleepiness. It is important to note that all the previous variables (stress/anxiety and insomnia/sleepiness) explain each other in the regression because they are all mental health outcomes. Nevertheless, several studies reported the possible presence of a relationship between anxiety and stress and sleep disturbances.^[29-36] In fact, the highest comorbidity of sleeping problems/insomnia has been found to be GAD (generalized anxiety disorder).^[36,37]

Given the importance of students' sleep quality and mental health, more needs to be done to address their concerns and prevent the occurrence of sleep disturbances and mental health problems. Attention must first be given to the mode of study; in the case of this project, students were found to be more comfortable with e-learning compared to traditional learning, while in other countries, especially those with limited resources, it was the opposite. There should be an integration of psychosocial and mental health intervention programs with students' educational programs. Also, university staff should allocate time and provide support and assistance to those who need it. Of course, more attention should be given to those pre-existing issues.

Even though our findings highlight (i) the prevalence of sleep disturbances and mental health issues associated with education, (ii) compare the aforementioned issues in e-learning with traditional learning, and (iii) explore the relationship between certain mental health outcomes in e-learning and traditional learning, a few limitations do exist. First, the study did not take into consideration differences in gender (only male participants). Second, the convenience sampling method and nature of the recruitment process do not allow for generalizing the results and could be affected by selection bias. Third, the study's cross-sectional design does not allow for making causal inferences. Fourth, it did not examine the factors that affect sleep quality and mental health in the study sample. Finally, the study depended on the self-reporting of data, which might affect the accuracy of the statistical relationships found.

Conclusion

The current study investigated the presence of sleep disturbances and mental health issues among university students in e-learning and traditional learning. The results indicated that students were suffering from depression in e-learning. However, other outcomes such as anxiety, stress, sleepiness, and insomnia were all found to be decreased in e-learning. This highlights the advantages and disadvantages of both e-learning and traditional learning. Therefore, there is a need for detailed research that examines both study modes and aims to find the perfect balance in which issues such as sleep disturbances and mental health problems are minimized as much as possible.

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Conflicts of interest

The authors declare no conflict of interest that the manuscript has been read and approved by all the authors, that the

requirements for authorship, as stated earlier in this document, have been met, and that each author believes that the manuscript represents honest work.

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