

# Mental Health Issues Among University Students with Sleep Disturbances: A Comprehensive Investigation

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## ABSTRACT

**Introduction:** University students encounter a variety of sleep problems which have an impact on their mental status. Previous studies have shown that sleep disorders might contribute to mental problems such as depression, anxiety, and stress. The aim of this study was to assess the prevalence of mental health illnesses among Saudi university students with sleep disorders and their associated predictors.

**Methods:** A cross-sectional study was conducted on undergraduate students through online screening surveys including the Epworth Sleepiness Scale to assess excessive daytime sleepiness, insomnia was measured using the Insomnia Severity Index, the Berlin questionnaire to examine obstructive sleep apnea (OSA). In regard, Restless Leg Syndrome was measured using Restless Legs Syndrome Rating. Mental health indicators including depression and anxiety were measured by Depression, Anxiety, and Stress (DASS-21).

**Results:** This is an online cross-sectional study that involved university students and was conducted between November 2022 and February 2023 in Saudi Arabia. A total of 393 students were involved in this study. The prevalence of depression, anxiety, and stress among university students with sleep disorders was 37.9%, 40.7%, and 19.6%, respectively. For depression, gender was not significantly associated ( $p=0.839$ ), while anxiety was significantly lower in males compared to females ( $OR=0.55$ ,  $p=0.004$ ). Nighttime sleeping was associated with significantly lower anxiety ( $OR=0.30$ ,  $p=0.009$ ). Restless leg syndrome was strongly associated with higher odds of depression, anxiety, and stress (all  $p<0.001$ ). Having a regular sleeping time was associated with higher odds of depression ( $p=0.003$ ) and stress ( $p=0.009$ ). Taking naps sometimes was associated with lower odds of depression ( $p=0.019$ ). Having comorbidities was associated with lower odds of anxiety ( $p=0.015$ ).

**Conclusion:** Our study shows that university students have a high percentage of sleep disorders, which are linked to depression, anxiety, and stress. Males have lesser anxiety than females. Nighttime sleep lowered anxiety, and naps reduced depression. Restless leg syndrome strongly predicted depression, anxiety, and stress. Our findings show that tailored therapies for student sleep disturbances are needed to improve mental health. Decision-makers should promote healthy sleep chorotype and provide more mental health care in universities. To further understand the complicated relationship between sleep, mental health, and school achievement, longitudinal study is needed.

**Keywords:** Prevalence – Sleep disorders – Mental – Saudi – University students

## INTRODUCTION

Sleep disorders are recognized as a significant global concern and affect considerable individuals<sup>1,2</sup>. Among diverse demographics, university students are at elevated risk for sleep disorders due to stress that results from increased academic demands among university students<sup>3</sup>. Several earlier studies have demonstrated that university students often do not sleep sufficiently, with less than 7 hours of sleep reported<sup>4-7</sup>. Among university students, the most frequently documented sleep disorders include obstructive sleep apnoea, circadian rhythm disorders, restless leg syndrome, and insomnia<sup>8-10</sup>. Furthermore, multiple prior research has demonstrated that insufficient sleep quality can negatively impact a student's academic performance, physical health, and emotional well-being<sup>11-15</sup>.

University students often have sleep problems along with various mental health issues, including anxiety and depression<sup>16</sup>. Mental health among college students is a major public health problem<sup>17</sup>. Prior research has shown that mental health problems (including stress,

anxiety, and depression) are prevalent among university students, affecting about 20% to 50% of students<sup>18-21</sup>, resulting in a decrease in academic performance and learning outcomes<sup>20</sup>. Previous studies indicated that is a bidirectional relationship between sleep disorders and mental health issues such as anxiety and depression. Sleep disorders were found to be prevalent among adults in Saudi Arabia<sup>22</sup>. Moreover, about 33% of the Saudi adult population suffers from a short duration of sleep<sup>23,24</sup>. A prior study showed that psychological distress issues were reported in 30% of university students in Saudi Arabia<sup>25</sup>. Because sleep disorders usually co-occur with depression, anxiety, and stress, in addition to the negative effects of sleep disorders and mental outcomes on individuals and their academic performance; early detection and prevention of these problems are essential to enhancing the quality of life for students. No previous studies in Saudi Arabia have examined these incorporated problems among university students. Thus, our study aims to identify the prevalence of depression, anxiety, and stress among Saudi university students with sleep disorders and their associated predictors.

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## METHODS

### Study design

This is an online cross-sectional study that involved university students and was conducted between November 2022 and February 2023 in Saudi Arabia.

### Study population

Undergraduate with sleep disorders students who are currently studying at universities in Saudi Arabia formed the study population. The inclusion criteria for this study were to be an undergraduate student with sleep disorder from any level of study and any field of study (whether medical or non-medical field), aged between 18 and 30 years, and to be a Saudi student. There was no restriction based on students' gender. The exclusion criterion was having a history of administration of sleep medications.

### Participants' recruitment

The convenience sampling technique was used to recruit the study sample. University students were recruited by sending an online survey to them via social media platforms (Facebook, LinkedIn, WhatsApp, and E-mail). A request to participate and a link to the survey were administered to the study participants. An informed consent form was provided to participants along with the online survey. The students were requested to provide electronic informed consent before participating in the survey. No personal information (such as a name or ID number) about the student was ever requested.

### Questionnaire tool

Participants were asked to answer sociodemographic questions about their age, gender, marital status, and their academic year. The cumulative grade point average (GPA) that each student currently has in their academic record was requested in order to analyze their academic performance. Besides, in order to confirm the diagnosis with sleep disorders, the study participants were requested to complete the Epworth Sleepiness Scale (ESS)<sup>26</sup>, the Insomnia Severity Index (ISS)<sup>27</sup>, and the Berlin questionnaire to examine their sleep problems<sup>28</sup>. In addition, the study participants were asked whether they have restless leg syndrome (RLS). To confirm sleep disorders using these tools, the ESS indicates excessive daytime sleepiness with a score of 10 or higher. The Insomnia Severity Index categorizes insomnia, with a score of 15 or higher. The Berlin Questionnaire assesses the risk of OSA, with high risk indicated if a participant scores positively in two or more categories (snoring, daytime sleepiness, and hypertension/obesity). Lastly, RLS is typically diagnosed based on clinical criteria, including an urge to move the legs, symptoms worse at rest and in the evening, and relief from movement. Besides, the questionnaire tool examined participants' sleep chorotype and type of shiftwork.

The ESS is an eight-item survey that asks participants to rate how likely it is that they would nod off if they were in various situations that are differentially soporific<sup>26</sup>. These situations include those in which the majority would be expected to nod off and others in which only the most sleep-deprived people would be expected to doze (for example, while sitting and talking with someone). On a scale ranging from zero (would never nod off) to three (high likelihood of nodding off), participants gave each item a rating. High reliability is present for this measure ( $\alpha=0.70$  in the present sample). The responses to the eight questions on the ESS were added to represent the individuals' degree of sleepiness; larger numbers represent more sleepiness. A total score lower than 10 reflects normal range of sleepiness, 11-14 reflects mild sleepiness, 15-17 reflects moderate sleepiness, and 18-24 reflects severe sleepiness.

The Insomnia Severity Index is a 7-item self-report questionnaire evaluates the type, severity, and effects of insomnia<sup>27</sup>. The dimensions assessed include severity of sleep onset, maintenance, as well as early morning awakening problems, sleep dissatisfaction, influence of sleep difficulties with daily activities, noticeability of the sleep disorders by others, and distress brought on by the sleep difficulties. Each question is rated on a 5-point Likert scale (0 = no difficulty; 4 = extremely severe problem), resulting in a total score that ranges from 0 to 28. There is no insomnia (0–7), sub-threshold insomnia (8–14), moderate insomnia (15–21), and severe insomnia (2–28) according to the total score. The reliability of this questionnaire in the current study sample was high ( $\alpha=0.69$ ).

Students who have obstructive sleep apnea (OSA) have been identified using the Berlin questionnaire<sup>28</sup>. Ten questions in three categories make up the self-administered survey. High risk in category one was characterized as persistent snoring symptoms in two or more snoring-related questions. For group two, high risk was characterized as ongoing drowsiness during the day, sleepy driving, or both. A history of hypertension or a body mass index (BMI) more than 30 kg/m<sup>2</sup> were both considered indicators of high risk in category three. The OSA high-risk participants were those who met the criteria for high risk in at least two out of three categories. The reliability of this questionnaire in the current study sample was good ( $\alpha=0.59$ ).

The DASS-21 is a 21-item self-report scale that assesses the intensity of depressive, anxiety, and stressful emotional states<sup>29</sup>. People rate the extent to which they think statements like "I couldn't seem to experience any positive feeling at all" apply to them using a Likert-type scale (0=Did not apply to me at all, 1=Applied to me to some degree, or some of the time, 2=Applied to me to a considerable degree, or a good part of the time, 3=Applied to me very much, or most of the time). Each scale has seven items, each of which is broken down into a subscale with a comparable set of questions to measure dysphoria, hopelessness, loss of interest, situational anxiety, plus nervous arousal. Each subscale has a top score of 42 that may be achieved. On the depression subscale, the threshold for mental disorders is 16 points or more. These characteristics increase the likelihood that a person would receive a diagnosis of mental disorders or an anxiety disorder. The depression subscale has normal (0–9), mild (10–13), moderate (14–20), severe (21–27), and extremely severe (28+) cutoff values. The reliability of this questionnaire in the current study sample was very high ( $\alpha=0.92$ ).

### Statistical analysis

The Statistical Package for the Social Sciences (SPSS), Version 29.0 (IBM Corp., Armonk, NY, USA) was used for all statistical analyses. For continuous data, means (standard deviation (SD)) were used. Frequencies and percentages were used to present categorical variables. Binary logistic regression analysis was used to identify predictors of severe to extremely severe mental health status. The cut-off points used to identify the dummy variable for the regression models were a score of 21 and above for depression sub-scale, 15 and above for anxiety sub-scale, and 26 and above for stress sub-scale. The odds ratio with 95% confidence interval were used to present the findings of the regression analysis. Multiple logistic regression analysis was used to adjust for the presence of multiple co-existed sleep disorders illnesses in order to examine the influence of each sleep disorder independently on the severity of different mental health issues. The results were deemed statistically significant at  $P < 0.05$  in all two-sided statistical analyses.

## RESULTS

### Characteristics of the study participants

A total of 393 students were involved in this study. Gender distribution shows that 154 (39.2%) participants were male, while 239 (60.8%) were female. The mean age was 20.9 years with a standard deviation of 1.9 years. Most participants were single (93.4%), followed by married (5.6%) and separated (1.0%). In terms of academic year, the distribution was as follows: first year (23.9%), second year (18.1%), third year (22.4%), fourth year (20.9%), and fifth year or higher (14.8%). Regarding sleep chorotype, 46.1% reported nighttime as their usual sleeping time, while 48.9% reported no specific time (circadian rhythm disorder). A minority reported using sleeping pills (14.8%), having restless leg syndrome (15.0%), having regular sleeping time (14.2%), and having comorbidities (14.2%). The majority reported taking a nap sometimes (30.8%), followed by daily (13.7%), and no nap (55.5%). Most participants reported working in shifts, either day and night-shifts (90.1%) or night-shift only (2.0%), with only 7.9% not working in shifts. For further details on the socio-demographic characteristics of the study participants refer to Table 1.

**Table 1.** Socio-demographic characteristics of the study participants

Socio-demographic characteristics	Total	
	Frequency	%
<b>Gender</b>		
Male	154	39.2%
Female	239	60.8%
<b>Age (years)</b>		
Mean ± SD	20.9 (1.9)	
<b>Marital status</b>		
Single	367	93.4%
Married	22	5.6%
Separated	4	1.0%
<b>Academic year</b>		
First year	94	23.9%
Second year	71	18.1%
Third year	88	22.4%
Fourth year	82	20.9%
Fifth year or higher	58	14.8%
<b>Usual sleeping time</b>		
Daytime	20	5.1%
Nighttime	181	46.1%
No specific time (circadian rhythm disorder)	192	48.9%
<b>Do you use sleeping pills?</b>		
Yes	58	14.8%
<b>Do you have restless leg syndrome?</b>		
Yes	59	15.0%
<b>Do you have regular sleeping time?</b>		
Yes	56	14.2%
<b>Do you take a nap usually?</b>		
Yes, sometimes	121	30.8%
Yes, daily	54	13.7%
No	218	55.5%
<b>Do you work in shifts?</b>		
Yes (day and night-shifts)	354	90.1%
Yes (Night-shift)	8	2.0%
No	31	7.9%
<b>Do you have comorbidities?</b>		
Yes	56	14.2%

In terms of the prevalence of different types of sleep disorders among the study population, the prevalence of insomnia, excessive daytime sleepiness, RLS, and OSA was 89.5%, 54.5%, 15.0%, and 8.1%, respectively.

### Prevalence and predictors of depression, anxiety, and stress among students with sleep disorders

Using the cut-off points of the DASS-21 scale, the prevalence of depression, anxiety, and stress among university students with sleep disorders was 37.9%, 40.7%, and 19.6%, respectively. Binary logistic regression analysis identified that for depression, gender was not significantly associated ( $p=0.839$ ), while anxiety was significantly lower in males compared to females ( $OR=0.55$ ,  $p=0.004$ ). Stress levels did not differ significantly by gender ( $p=0.369$ ). Among age categories, no significant associations were found for any of the mental health outcomes. Marital status also did not show significant associations. Nighttime sleeping was associated with significantly lower anxiety ( $OR=0.30$ ,  $p=0.009$ ), but not with depression or stress. Restless leg syndrome was strongly associated with higher odds of depression, anxiety, and stress (all  $p<0.001$ ). Having a regular sleeping time was associated with higher odds of depression ( $p=0.003$ ) and stress ( $p=0.009$ ), but not anxiety. Taking naps sometimes was associated with lower odds of depression ( $p=0.019$ ), but not anxiety or stress. Having comorbidities was associated with lower odds of anxiety ( $p=0.015$ ), but not depression or stress. Working in shifts did not show significant associations with any of the outcomes, Table 2.

### Sleep disorders and severity of mental health illnesses

Table 3 presents the association between sleep disorders and the likelihood of developing severe mental health illnesses. Insomnia and RLS were associated with a higher likelihood of developing severe depression, anxiety, and stress ( $p<0.01$ ). Excessive daytime sleepiness was associated with a higher likelihood of developing severe stress only ( $p<0.01$ ). On the other hand, there was no statistically significant association between OSA and the development of severe mental health illnesses.

The multiple logistic regression model adjusted for the presence of other co-existed sleep disorders in order to examine the influence of each sleep disorder independently on the severity of different mental health issues.

## DISCUSSION

The findings of this study highlight the prevalence of depression, anxiety, and stress among university students with sleep disorders. Previous studies in Saudi Arabia focused on the general public or medical students. Our study examined depression, anxiety, and stress among all university students with sleep disorders. According to our study, about 15% of students are affected by restless leg syndrome a movement disorder that causes discomfort and a tendency to move the legs and sometimes the neck and arms<sup>30</sup>. The severity of the syndrome varies from mild to severe<sup>31</sup>. However, it can considerably affect health and daily activities like work and learning<sup>32,33</sup>. Multiple prior research linked the elevated risk of cardiovascular diseases to restless leg syndrome<sup>34-40</sup>. In line with our findings, prior research found that 16.4% of Umm Al-Qura University medical students in Saudi Arabia have periodic limb movement disorder/restless leg syndrome<sup>41</sup>. That could be because restless leg syndrome is prevalent in Saudi Arabia<sup>42,43</sup>. Moreover, a previous study reported that the prevalence of primary restless leg syndrome among the middle-aged Saudi population was 64.1%, and of secondary restless leg syndrome was 35.9%<sup>44</sup>. These findings indicated the significant burden of sleep

**Table 2.** Predictors of depression, anxiety, and stress among students with sleep disorders

Socio-demographic characteristics	Odds ratio of severe to extremely severe depression (95% confidence interval)	P-value	Odds ratio of severe to extremely severe anxiety (95% confidence interval)	P-value	Odds ratio of severe to extremely severe stress (95% confidence interval)	P-value
<b>Gender</b>						
Female (Reference group)	1.00		1.00		1.00	
Male	0.96 (0.64-1.43)	0.839	0.55 (0.36-0.82)	0.004	0.79 (0.47-1.32)	0.369
<b>Age categories</b>						
Younger than 21 years (Reference group)	1.00		1.00		1.00	
21 years and older	0.87 (0.59-1.29)	0.872	1.07 (0.73-1.58)	0.718	0.87 (0.53-1.42)	0.576
<b>Marital status</b>						
Single (Reference group)	1.00		1.00		1.00	
Married	1.20 (0.53-2.72)	0.658	1.49 (0.67-3.29)	0.331	1.47 (0.59-3.78)	0.429
Separated	0.48 (0.05-4.34)	0.514	0.43 (0.05-3.91)	0.456	-	
<b>Academic year</b>						
First year (Reference group)	1.00		1.00		1.00	
Second year	0.96 (0.53-1.75)	0.897	1.23 (0.68-2.23)	0.493	1.16 (0.54-2.48)	0.711
Third year	0.76 (0.42-1.38)	0.368	1.05 (0.59-1.87)	0.861	0.81 (0.37-1.77)	0.598
Fourth year	0.80 (0.45-1.44)	0.458	1.20 (0.68-2.13)	0.529	1.45 (0.71-2.94)	0.307
Fifth year or higher	1.32 (0.70-2.47)	0.389	1.00 (0.52-1.90)	0.994	1.05 (0.46-2.40)	0.913
<b>Usual sleeping time</b>						
Daytime (Reference group)	1.00		1.00		1.00	
Nighttime	0.42 (0.17-1.05)	0.064	0.30 (0.12-0.74)	0.009	1.35 (0.30-6.11)	0.697
No specific time (circadian rhythm disorder)	1.08 (0.44-2.68)	0.863	0.60 (0.24-1.48)	0.266	2.86 (0.64-12.74)	0.167
<b>Do you have regular sleeping time?</b>						
No (Reference group)	1.00		1.00		1.00	
Yes	2.41 (1.36-4.28)	0.003	1.33 (0.80-2.20)	0.270	3.19 (1.34-7.61)	0.009
<b>Do you take a nap usually?</b>						
No (Reference group)	1.00		1.00		1.00	
Yes, daily	1.02 (0.55-1.91)	0.948	0.99 (0.53-1.85)	0.977	0.95 (0.44-2.08)	0.905
Yes, sometimes	0.60 (0.39-0.92)	0.019	0.71 (0.46-1.08)	0.111	0.74 (0.43-1.27)	0.274
<b>Do you work in shifts?</b>						
No (Reference group)	1.00		1.00		1.00	
Yes (Night-shift)	0.82 (0.21-3.22)	0.776	1.12 (0.31-4.04)	0.861	1.24 (0.26-5.96)	0.789
Yes (day and night-shifts)	1.04 (0.50-2.17)	0.909	0.80 (0.38-1.70)	0.568	1.29 (0.54-3.07)	0.573
<b>Do you have comorbidities?</b>						
No (Reference group)	1.00		1.00		1.00	
Yes	0.61 (0.35-1.04)	0.069	0.52 (0.30-0.88)	0.015	0.76 (0.39-1.49)	0.430

**Table 3.** Sleep disorders and severity of mental health illnesses

	Adjusted odds ratio of severe to extremely severe depression (95% confidence interval)	P-value	Adjusted odds ratio of severe to extremely severe anxiety (95% confidence interval)	P-value	Adjusted odds ratio of severe to extremely severe stress (95% confidence interval)	P-value
<b>Insomnia</b>						
No (Reference group)	1.00		1.00		1.00	
Yes	3.68 (1.96-6.92)	<0.001	3.01 (1.67-5.45)	<0.001	20.48 (2.79-150.28)	0.003
<b>Excessive daytime sleepiness</b>						
No (Reference group)	1.00		1.00		1.00	
Yes	1.49 (1.00-2.25)	0.055	1.50 (1.00-2.27)	0.055	2.11 (1.23-3.61)	0.007
<b>Restless leg syndrome</b>						
No (Reference group)	1.00		1.00		1.00	
Yes	2.47 (1.40-4.37)	0.002	5.87 (3.11-11.07)	<0.001	3.55 (1.92-6.55)	<0.001
<b>Obstructive sleep apnea</b>						
No (Reference group)	1.00		1.00		1.00	
Yes	0.61 (0.28-1.30)	0.196	0.62 (0.28-1.37)	0.238	0.69 (0.28-1.68)	0.413

disorders among the Saudi general population and university students, particularly restless leg syndrome. Thus, targeted interventions tailored to reducing and preventing this sleep disorder are needed.

Our results are comparable to previous studies in other regions. The percentage of students suffering from restless legs syndrome in our study is higher than in a prior study in Jordan, which found that 10.4% of medical students have periodic limb movement disorder/restless leg syndrome<sup>45</sup>. On the other hand, the percentage is lower than in two previous studies in Oman and Iraq, where a previous survey among medical university students in Iraq the prevalence of restless legs syndrome was 30.7%<sup>46</sup>, and it was 41.1% among university students in Oman<sup>47</sup>. These disparities in the prevalence of restless leg syndrome between countries can be attributed to the diverse designs used in the studies and the various demographics of the groups studied.

Moreover, our study indicated that only 14.2% of university students have regular sleeping time. Individuals whose sleep and wake times vary by approximately 2 to 4 hours are classified as irregular sleepers<sup>48</sup>. A previous study indicated that sleep deprivation due to irregular sleep patterns among students could be due to several factors, including difficulties associated with studying, the changing exposed environment, and decreased family maintenance<sup>49</sup>. Students carry more potential to have problems with mental tasks like memory retention and problem-solving and lower academic performance if they have irregular sleep patterns and problems with sleep<sup>50</sup>. Moreover, people who suffer from irregular sleep patterns and insufficient sleep are at raised risk of mortality and morbidity<sup>51-53</sup>. Our study results are consistent with extending evidence that irregular sleep patterns are common among university students globally<sup>54-57</sup>. These results highlight the requirement to implement educational activities and comprehensive strategies and approaches to increase awareness about the severe effects of irregular sleep patterns among university students and accordingly reduce this problem.

The results of this study indicate the spread of psychological disorders among university students with sleep disorders, as the prevalence of depression, anxiety, and stress was 37.9%, 40.7%, and 19.6%, respectively. These results are in line with an existing study that highlighted that college students with sleep disorders (poor sleep quality) were more likely to have mental health problems (stress, anxiety, and depression)<sup>2</sup>. These findings may underscore the significant international burden of mental health problems among university students with sleep disorders and emphasise the need for collaboration between researchers, healthcare providers, and educational and health institutions to develop appropriate approaches to lessen this concern.

Consistent with our results, two earlier studies among university students in Turkey and the United Arab Emirates found that anxiety was more prevalent among university students than depression and stress<sup>58,59</sup>. Additionally, mental health issues are common among university students globally; numerous prior studies have demonstrated a high prevalence of anxiety, depression, and stress among university students across various countries. For instance, previous studies in Saudi Arabia declared that a high percentage of healthcare, medical, and non-medical university students suffer from anxiety, stress, and depression<sup>60-62</sup>. In Malaysia, an earlier investigation indicates that the prevalence of moderate to very severe depression, anxiety, and stress among university students ranged from 44.6% to 66.2%<sup>63</sup>. About 70% of Chile's higher education students have anxiety, while depression and stress affect more than half of the sample<sup>64</sup>. In Tamale, around 58.0% and above of undergraduate nursing students showed moderate to very severe symptoms of depression, anxiety, and stress<sup>65</sup>. In Greece, students reported stress, anxiety, and depression levels ranging from

57.2% to 66.5%<sup>66</sup>. These findings highlight that universities should pay attention to mental health support services for their students to decrease these situations, improve their quality of life, and enhance academic performance. Still, the difference in mental issues prevalence in studies can be attributed to variations in the demographics of the target population.

Regarding the association between gender and mental health problems among university students with sleep disorders, our study found that anxiety was significantly lower in males compared to females (OR=0.55,  $p=0.004$ ), while gender was not significantly associated with depression ( $p=0.839$ ) and stress levels ( $p=0.369$ ). These findings indicate complex associations between gender and mental health problems among university students with sleep disorders. It also highlights the essence of utilising a comprehensive approach to understanding and dismissing the mental health conditions of those students and regarding gender-specific factors. The factors that contribute to these gender disparities must also be comprehended.

Align with our findings anxiety levels were significantly higher in females than males among healthcare, medical, and non-medical university students in Saudi Arabia<sup>60,62</sup> and among Ethiopian University students<sup>67</sup>. A prior systematic review and meta-analysis indicated that women have a higher prevalence of anxiety<sup>68</sup>. Very severe anxiety is higher among female Greek university students, with females considered to be a risk factor for it<sup>66</sup>. Gender was not significantly associated with depression levels among Malaysian university students<sup>63</sup> and with stress levels among Saudi Arabia university healthcare students<sup>60</sup>.

Contrary to our findings, the association between gender and anxiety levels was not significant among Malaysian university students<sup>63</sup>, among undergraduate Nursing university students in Tamale<sup>65</sup>. Females gender was significantly associated with depression among healthcare, medical, and non-medical university students in Saudi Arabia<sup>60,62</sup>, among public university students in Bangladesh<sup>69</sup>, among Ethiopian University students<sup>67</sup>, and undergraduate nursing university students in Tamale<sup>65</sup>. Females gender had significantly higher stress levels among university students in Lebanon<sup>70</sup>, in Ethiopia<sup>67</sup>, and among nursing university Students in Tamale<sup>65</sup>. Moreover, females are considered to be a risk factor for very severe depression and stress and mild to severe stress among Greek university students<sup>66</sup>. Finally, the differences in mental health issues between genders have been proposed to be due to different factors related to physiological, genetics, and environmental<sup>71-73</sup>.

Our study determined that there were no significant associations for any of the mental health outcomes among age categories. In addition, marital status also did not show significant associations. These results differ from the results of previous studies. For example, odds ratios indicate that stress, anxiety, and depression are more common among younger Greek university students<sup>66</sup>. Single students, mostly younger undergraduates, are at more elevated risk than married students<sup>66</sup>. In Tamale, nursing university students showed an extremely significant association between age, depression, anxiety, and stress<sup>65</sup>. The marital status of the students also showed a significant association with depression, anxiety, and stress. Compared to married students, exposure to extreme and severe depression, anxiety, and stress is more elevated among single students<sup>65</sup>. The difference in findings implies that the association between mental health outcomes and age or marital status may vary across students studied, culture, and community. These emphasise the necessity of considering these factors when managing university students' mental health outcomes.

Our study identified that regarding the academic year, there were no significant differences except for anxiety in the fourth year ( $p=0.529$ ). In contrast to our findings, in Tamale, nursing university students showed a significant association between years of study and depression, anxiety, and stress<sup>65</sup>. Besides, among Jordanian university students, the academic year is associated with symptoms of depression (older students often experience higher levels of depression than their younger peers)<sup>74</sup>. However, between different academic years among Sudanese medical students, no significant disparities were found in scores of depression<sup>75</sup>. Yet, statistically significant differences were observed in the levels of anxiety and stress between the different academy years, especially among those in middle years<sup>75</sup>. The reason for the difference in the relationship could be due to the difference in demographics of the students included in the studies. These results indicate the need to consider the challenges faced by university students at different stages of their education when planning targeted interventions to maintain students' mental health outcomes.

Our study identified that nighttime sleeping was associated with significantly lower anxiety ( $OR=0.30, p=0.009$ ), but not with depression or stress. In line with our findings, previous research found that lower sleep quality, insufficient sleep duration, persistently lower sleep duration, and late nighttime sleeping exhibited raised anxiety symptom levels and risks<sup>76,77</sup>. The complex nature of mental health outcomes among university students with sleep disorders may result in the lack of associations between nighttime sleep patterns and depression or stress. Further research is required to understand other factors that contribute to these findings.

Our study noted that restless leg syndrome was strongly associated with higher odds of depression, anxiety, and stress (all  $p<0.001$ ). These findings agree with existing research in Saudi Arabia, which found that restless leg syndrome is prevalent among grown-ups and frequently coupled with depression symptoms ranging from moderate to severe<sup>42</sup>. Research has confirmed the association between symptoms of mood and restless legs syndrome symptoms, although the cause-and-effect association is indistinct<sup>78</sup>. Epidemiological and clinical studies support the significant association between restless legs syndrome, anxiety, and depression<sup>79-84</sup>. These indicate that resting leg syndrome may be a significant risk factor for depression, anxiety, and stress. It also emphasises the need to develop comprehensive approaches aimed at achieving healthy sleep patterns and superior mental health well-being among university students.

Our study identified that taking naps sometimes was associated with lower odds of depression ( $p=0.019$ ), but not anxiety or stress. The observation that taking naps sometimes was associated with lower odds of depression suggests that naps may have advantages on mental health among university students with sleep disorders. In line with this suggestion, a prior study highlighted that taking a short nap can enhance cognitive functioning (like memory and alertness), mood, and motor skills<sup>85</sup>. In contrast, a prior meta-analysis implied that depression can be expected by daytime napping<sup>86</sup>. Still, the impact of daytime napping on depression could vary based on the experience of sleep for people, the pattern of naps, and the person's characteristics<sup>86</sup>.

Regarding our observation, there were no significant associations between taking naps and levels of anxiety or stress. This finding suggests that although short naps may provide some protective outcomes against depression, they may not have an equivalent effect on anxiety or stress levels among college students with sleep disorders. These may also be due to the multifaceted nature of mental health outcomes.

The findings of our study revealed that working in shifts did not show

significant associations with any of the mental outcomes (depression, anxiety, and stress). Suboptimal sleep can result from shift work, particularly among workers during night and evening shifts<sup>87</sup>. Healthcare professionals who work shifts in Saudi Arabia are associated with lower sleep quality<sup>88</sup>. Compared to day-shift workers healthcare professionals in Saudi Arabia, the quality of life is poorer among night-shift workers, notably regarding physical, social, and sleep outcomes<sup>89</sup>. A previous meta-analysis showed that shift workers were at tremendous poor mental health risk, particularly the manifestations of depression<sup>90</sup>. Shift work is continually connected with personal stress, insufficient earnings, and adverse environmental conditions, leading to inadequate lifestyles. However, factors such as social resources access and socioeconomic status influence the consequences of shift work<sup>91,92</sup>. The lack of significant associations between shift work and mental outcomes in our study could be due to 90.1% of participants confirming that they worked during day and night shifts, suggesting that the bulk of those working during the day shifts. Besides, other factors like coping strategies and social support may have lessened the harmful effects of shift work on mental health outcomes among university students.

The study findings found that insomnia and RLS were associated with a higher likelihood of developing severe depression, anxiety, and stress ( $p<0.01$ ). Excessive daytime sleepiness was associated with a higher likelihood of developing severe stress only ( $p<0.01$ ). Sleep disorders are an integral part of psychiatric disorders. The associations between sleep disorders including insomnia and other mental health conditions, are likely to reflect overlap in neurobiological, psychological, genetic, and environmental causes<sup>93</sup>. There is also strong evidence of a bidirectional association, with the predominant pathway linking sleep issues to the development of other mental health conditions<sup>93</sup>. Due to the elicitation of negative affect, emotional dysregulation, and hyperarousal, sleep disturbances may contribute to the development of mental health disorders. Of particular notice is the tight link between anxiety and insomnia. Additionally, there's an increased likelihood that other mental health symptoms exacerbate sleep disorders<sup>93</sup>.

The study findings with regards to the prevalence of stress, depression, and anxiety in university students with sleep disorders have several implications. In this study, the distribution of sleep chorotypes revealed a considerable proportion of university students with circadian rhythm disorders that may call for interventions related to normalizing their sleep timing. The low reported use of sleeping pills posits that interventions most probably will be non-pharmacological or, more likely, will be associated with a lack of knowledge of existing treatment options. The levels of depression, anxiety, and stress levels among these students are high levels that, in no doubt, call for addressing mental health in a university setting. Gender differences in the levels of anxiety also call for gender-specific interventions. The association of restless leg syndrome with the higher odds of experiencing mental health issues is a call for the need to look at the sleep disorders in a comprehensive way. Generally, these findings call for a multidisciplinary approach in supporting the mental health and well-being of university students with sleep disorders.

This study has limitations. The cross-sectional study design restricted the ability to examine causality across the study variables. The use of online survey might have affected the generalisability of our study findings as we might have missed some targeted study population who do not have access to online platforms. However, we believe that the possibility of this limitation is minimal as the targeted study population "university students" are one of the major users for social media platforms all over the world.

## CONCLUSION

**Our study highlights a concerning prevalence of sleeping disorders among university students, which are significantly associated with higher rates of depression, anxiety, and stress. Gender differences were observed, with males showing lower anxiety levels compared to females. However, age, marital status, and academic year did not significantly impact mental health outcomes. Notably, nighttime sleeping was associated with lower anxiety levels, and taking naps sometimes was linked to reduced depression. Restless leg syndrome emerged as a strong predictor of depression, anxiety, and stress. Our findings underscore the importance of addressing sleep disorders among students, suggesting the need for targeted interventions to improve mental health outcomes. Decision-makers should consider implementing strategies to promote healthy sleep chorotype and provide further mental health support services within university settings. Further research should explore these associations longitudinally to better understand the complex interplay between sleep, mental health, and academic performance among students.**

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