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Prevalence of depression, anxiety and stress among undergraduate medical students in Sudan

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Abstract
Stress associated with medical education, corre- lated with symptoms of depression and anxiety, has been involved in generating academic performance problems and thus, long-term consequences, such as poor quality of medical care. If anxiety and depression are proved to influence quality of academic achieve- ment, their prevention could lead to better outcomes also in the quality of medical care.
Aims: This study aims to measure the prevalence of depression, anxiety and stress among undergraduate medical students in Sudan.
Methadology: We recruited 201 undergraduate medical students in this study between May 2025 to September 2025, A cross sectional survey, a self-administered, pre-designed, pre-tested anonymous questionnaire (written by English and translated by Arabic) was distributed after obtaining an informed written consent for each participant. Information was collected on basic socio-demographic (like age, gender), and mental health (DASS-21 - Depression, Anxiety, and Stress Scale) + Pittsburgh sleep quality index (psQI).
Results: A survey of 202 individuals, focusing on demographics, mental health, and potential correlations between them. A significant majority (79%) of respondents fall within the 21-25 age range, suggesting the survey primarily targets young adults.
Conclusion: These findings suggest the necessity of coming up with prophylactic methods to prevent anxiety, depression and stress especially in final year medical students, as these prove to be factors that impede academic performance.

Keywords: Depression, anxiety, anxious, medical students, student doctors, medical school, medical education, prevalence of depression

Introduction

Medical education is an intensive and demanding process that places significant academic, emotional, and social demands on students. Throughout their training, medical students face numerous stressors, including long study hours, competitive environments, high-stakes examinations, and emotionally taxing clinical responsibilities. These challenges can severely impact students' mental health, leading to anxiety, depression, stress, burnout, and, in severe cases, suicidal ideation [1, 2].

Multiple studies have demonstrated that the prevalence of mental health disorders among medical students is higher than in the general population. For example, studies in Malaysia, Saudi Arabia, and Thailand have reported stress prevalence rates ranging from 31% to 61% [3, 5], while a Swedish study found that 12.9% of medical students had depressive symptoms and 2.7% had attempted suicide [1]. Despite these alarming figures, many students do not seek help due to stigma, lack of time, or insufficient access to mental health services [6].

The learning environment in many medical schools has been described as authoritarian, rigid, and highly competitive. Rather than fostering collaboration, such settings can exacerbate psychological strain. This stress often begins in undergraduate education but may persist through postgraduate training and into clinical practice, potentially impacting professional performance and patient care [7].

Psychological disorders such as depression and anxiety present with a range of symptoms. Depression can include feelings of hopelessness, low motivation, reduced concentration, insomnia, and suicidal thoughts. Anxiety manifests as excessive worry, physical tension, palpitations, and dizziness. Stress, though not a clinical diagnosis on its own, is a well-established trigger for both depression and anxiety. These disorders are common globally, but medical students are particularly vulnerable due to the nature of their training [8].

Globally, the prevalence of depression among medical students is estimated at 28%, with similarly high rates reported for anxiety and stress [2]. These mental health issues not only affect students' academic performance and personal well-being but may also have implications for future professional conduct and the safety of patients.

Given these concerns, this study was conducted to assess the prevalence and associated factors of depression, anxiety, and stress among undergraduate medical students in Sudan. Understanding these factors is a crucial first step toward developing targeted interventions and support systems to promote student well-being and academic success.

Literature review

In the current literature, anxiety among medical students is less studied than depression. A 2014 systematic review of the prevalence of anxiety among medical students outside of North America found a large range of prevalence between 7.7% and 65.5% across 11 studies [9]. The relatively small number of studies reviewed in Hope's study was due to the fact that it included medical students in Europe and English-

speaking countries outside North America. Anxiety in medical students warrants wider awareness and greater attention. It can negatively affect academic performance, dropout rates and professional development. Ultimately, it could also have implications for patient care since a previous study found that anxious medical students were less empathetic and less enthusiastic when caring for patients with chronic illness [10]. Quality of patient care suffers as doctors with anxiety tend to demonstrate poor work efficacy [11].

AD-7 [12], not more than 10% as screened by the BAI-21 [13] and not more than 25% as screened by

to the general population. There are many factors that can explain this. Medical schools preselect for

the HADS-A [14].

people who tend to be more neurotic and perfectionistic [15], and such personality traits predispose It is no surprise that medical students experience a much higher prevalence of anxiety compared

an individual to anxiety [16]. Anxiety can be precipitated in situations such as when self-set lofty to the general population. There are many factors that can explain this. Medical schools preselect for

goals by these ambitious medical students are not met. Other factors like academic workload [17], people who tend to be more neurotic and perfectionistic [18], and such personality traits predispose

consequent sleep deprivation [19], financial burden, exposure to deaths of patients [20] and an individual to anxiety. Anxiety can be precipitated in situations such as when self-set lofty

student abuse [21] have also been postulated to be possible reasons for medical students' high rate of goals by these ambitious medical students are not met. Other factors like academic workload [22],

anxiety. Medical schools can help medical students by addressing some of the modifiable factors listed

consequent sleep deprivation [23], financial burden [23], exposure to deaths of patients [24] and

above. For example, frequent reminders about sleep hygiene and its effect on mental health can be sent student abuse [25] have also been postulated to be possible reasons for medical students' high rate

through e-mails to students. School counsellors can check in with students identified to be financially

of anxiety. Medical schools can help medical students by addressing some of the modifiable factors

burdened (e.g., students on tuition loan or financial aid) on a frequent basis to find out if they require

listed above. For example, frequent reminders about sleep hygiene and its effect on mental health can

additional financial help. Medical schools should also have a robust and anonymized platform for

be sent through e-mails to students. School counsellors can check in with students identified to be

students to give feedback on abusive medical educators and readily provide psychological support to

financially burdened (e.g., students on tuition loan or financial aid) on a frequent basis to find out if

students affected.

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found that Middle Eastern and Asian medical students had the highest prevalence of anxiety. We

psychological support to students affected.

hypothesize that this could be due to the differing views and level of acceptance of people with mental When comparing the prevalence of anxiety in medical students among different continents, we

illness in different cultures. For instance, it has been described that people in the Middle East value found that Middle Eastern and Asian medical students had the highest prevalence of anxiety. We

'concealing emotion'. Sharing how one feels with another is uncommon in Middle Eastern cultures,

hypothesize that this could be due to the differing views and level of acceptance of people with

leading to stigmatization towards seeking help from a mental health professional [26]. In Asian mental illness in different cultures. For instance, it has been described that people in the Middle East

value 'concealing emotion'. Sharing how one feels with another is uncommon in Middle Eastern

cultures, being diagnosed with a mental illness is thought to reflect the patient's family weakness and is perceived to be shameful [27]. In contrast, it was found that people of Caucasian descent have a lower rate of stigmatization towards mental illness than other socio-cultural groups [28]. Hence, the leaders of medical schools have to take into consideration the unique sociocultural context in developing strategies to tackle anxiety among medical students.

Methadology

This study is a cross sectional, community-based study under the title "Prevalence of Depression, Anxiety, and stress among Sudanese undergraduate medical students", the study protocol was approved by research committee of AUW.

A cross sectional survey, a self-administered, pre-designed, pre-tested anonymous questionnaire (written by English and translated by Arabic) was distributed after obtaining an informed written consent for each participant. Information was collected on basic socio-demographic (like age, gender), and mental health (DASS-21 - Depression, Anxiety, and Stress Scale) + Pittsburgh sleep quality index (psQI).

data used to prepare this research were retrieved from MEDLINE (PubMed, Google scholar, Scopus and Science-Direct search) using the search terms "medical students " " anxiety " "depression " "stress " At a certain point, the descriptors used were crossed with each other.

A manual search of the literature references was conducted. The databases were consulted in the last 5 years and the research was conducted by two researchers independently and, then, compared to verify the similarity between the

The questionnaire contains 45 items and 202 samples were collected from under- graduate medical students in private and governmental universities located in Sudan. Data were analysed with SPSS v20.0 software. Continuous data were expressed in terms of mean and standard deviation, means were compared using student t test and ANOVA.

All authors involved in this review actively participated in the research process and the writing of the manuscript.

Results

This data represents a survey of 202 individuals, focusing on demographics, mental health, and potential correlations between them. The first section details the participants'

demographic characteristics. A significant majority (79%) of respondents fall within the 21-25 age range, suggesting the survey primarily targets young adults. Furthermore, there is a strong gender imbalance, with females comprising 82% of the participants. Most respondents are single (91%) and affiliated with either National Ribat University (56%) or a Governmental university (38%). The majority are in their 6th year of education (34%). This demographic information provides context for interpreting the mental health data. (Table 1)

The second section delves into the self-reported mental health levels of the participants. The data indicates a concerning prevalence of mental health challenges among the respondents. While 38% reported normal depression levels, a combined 61% experienced mild to extremely severe depression. Similarly, anxiety levels are high, with 65% reporting some level of anxiety. Stress levels appear slightly better, with 47% reporting normal levels, but still a significant 53% experiencing mild to severe stress. These findings suggest a potentially high-stress environment or underlying mental health concerns within the surveyed population. (Table 2)

The third section provides a more in-depth analysis of the relationship between demographics and depression levels. This table breaks down the prevalence of each depression level by age, gender, marital status, university, and year of education. While the p-values suggest that age is not a significant factor for depression, gender and marital status show potential correlations (p=0.11 and p=0.13 respectively). The "Extremely Severe" category for depression has a smaller sample size, potentially limiting the statistical power in that group. (Table 3)

The fourth section examines the relationship between demographics and stress levels. This table, similar to the depression analysis, cross-tabulates stress levels with age, gender, marital status, university, and year of education. Again, age doesn't appear to be a strong factor, but gender and marital status show potential correlations with stress levels (p=0.2 and p=0.6 respectively). The "Extremely Severe" category for stress has a very small sample size (N=1), significantly limiting any conclusions that can be drawn about this group. (Table 4)

Meanwhile, it reveals that most participants (37%) get 5 hours of sleep nightly. However, 10% of respondents reported waking up before 4:00 AM (<240 minutes), and roughly 15% get 4 hours of sleep or less per night.

(Table 5) reveals a significant prevalence of anxiety, with 34% experiencing normal levels, while 66% reported varying degrees of anxiety, from mild to extremely severe. While age doesn't appear to be a significant factor (p=0.6), potential correlations were observed with gender (p=0.5) and marital status (p=0.3), suggesting these factors may influence anxiety levels. The majority of respondents experiencing anxiety were female (78%), single (91%), and primarily associated with either Governmental or National Ribat University. Notably, a higher proportion of those reporting severe anxiety were in their 6th year of education. However, it's crucial to consider that small sample sizes in certain categories, particularly "Extremely Severe Anxiety," might limit the generalizability of these findings.

Table 1: Demographic Characteristics (Includes Age, Gender, Marital Status, University, Year in Education)

Characteristic	**N = 202**[1]
Age	
16-20	27 (13%)
21-25	160 (79%)
26-30	15 (7.4%)
Gender	
Female	166 (82%)
Male	36 (18%)
Marital status	
Betrothed	1 (0.5%)
engaged	1 (0.5%)
Engaged	1 (0.5%)
Engagement	1 (0.5%)
Married	14 (6.9%)
Single	184 (91%)
University	
Ahfad University for woman	7 (3.5%)
Governmental university	77 (38%)
National Ribat university	113 (56%)
Red Sea University	5 (2.5%)
Year in Education	
1st	8 (4.0%)
2nd	14 (6.9%)
3rd	42 (21%)
4th	37 (18%)
5th	29 (14%)
6th	68 (34%)
graduate	1 (0.5%)
Graduate	2 (1.0%)
Internship year	1 (0.5%)
[1]n (%)	

Table 2: Mental Health Levels (Includes Depression Levels, Anxiety Levels, Stress Levels)

Characteristic	**N = 202**[1]
Depression_Levels	
Normal	77 (38%)
Mild_Depression	21 (10%)
Moderate_Depression	40 (20%)
Severe_Depression	43 (21%)
Extremely_Severe_Depression	21 (10%)
Anxiety_Levels	
Normal	68 (35%)
Mild_Anxiety	42 (22%)
Moderate_Anxiety	27 (14%)
Severe_Anxiety	41 (21%)
Extremely_Severe_Anxiety	16 (8.2%)
Unknown	8
Stress_Levels	
Normal	95 (47%)
Mild_Stress	32 (16%)
Moderate_Stress	43 (21%)
Severe_Stress	31 (15%)
Extremely_Severe_Stress	1 (0.5%)
[1]n (%)	

Table 3: Depression Levels by Demographic Characteristic**s** (Cross-tabulation of

Characteristic	**Normal** N = 77[1]	**Mild_Depression** N = 21[1]	**Moderate_Depression** N = 40[1]	**Severe_Depression** N = 43[1]	****Extremely*Severe*Depression**** **N = 21**[1]	**p-value**[2]
age_categories						0.8
16-20	12 (16%)	3 (14%)	2 (5.0%)	6 (14%)	4 (19%)	

21-25	60 (78%)	16 (76%)	35 (88%)	33 (77%)	16 (76%)	
26-30	5 (6.5%)	2 (9.5%)	3 (7.5%)	4 (9.3%)	1 (4.8%)	
Gender						0.11
Female	58 (75%)	20 (95%)	32 (80%)	36 (84%)	20 (95%)	
Male	19 (25%)	1 (4.8%)	8 (20%)	7 (16%)	1 (4.8%)	
Marital status						0.13
Betrothed	0 (0%)	0 (0%)	0 (0%)	1 (2.3%)	0 (0%)	
engaged	0 (0%)	1 (4.8%)	0 (0%)	0 (0%)	0 (0%)	
Engaged	1 (1.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Engagement	0 (0%)	0 (0%)	1 (2.5%)	0 (0%)	0 (0%)	
Married	5 (6.5%)	2 (9.5%)	0 (0%)	4 (9.3%)	3 (14%)	
Single	71 (92%)	18 (86%)	39 (98%)	38 (88%)	18 (86%)	
University?						
Ahfad University for woman	3 (3.9%)	1 (4.8%)	2 (5.0%)	1 (2.3%)	0 (0%)	
Governmental university	35 (45%)	10 (48%)	14 (35%)	11 (26%)	7 (33%)	
National Ribat university	37 (48%)	10 (48%)	22 (55%)	30 (70%)	14 (67%)	
Red Sea University	2 (2.6%)	0 (0%)	2 (5.0%)	1 (2.3%)	0 (0%)	
Year in Eduaction						
1st	4 (5.2%)	0 (0%)	3 (7.5%)	1 (2.3%)	0 (0%)	
2nd	6 (7.8%)	0 (0%)	2 (5.0%)	3 (7.0%)	3 (14%)	
3rd	19 (25%)	4 (19%)	6 (15%)	8 (19%)	5 (24%)	
4th	16 (21%)	4 (19%)	6 (15%)	9 (21%)	2 (9.5%)	
5th	9 (12%)	4 (19%)	8 (20%)	5 (12%)	3 (14%)	
6th	22 (29%)	7 (33%)	15 (38%)	17 (40%)	7 (33%)	
graduate	0 (0%)	1 (4.8%)	0 (0%)	0 (0%)	0 (0%)	
Graduate	1 (1.3%)	0 (0%)	0 (0%)	0 (0%)	1 (4.8%)	
Internship year	0 (0%)	1 (4.8%)	0 (0%)	0 (0%)	0 (0%)	
[1]n (%)						
[2]Fisher's exact test						

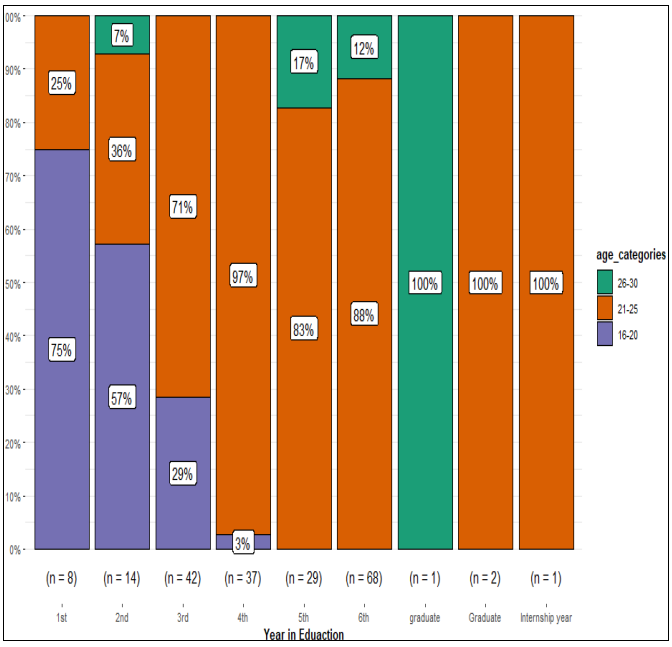
Table 4: Stress Levels by Demographic Characteristics (Cross-tabulation of Stress Levels with Age, Gender, Marital Status, University, Year in Education)

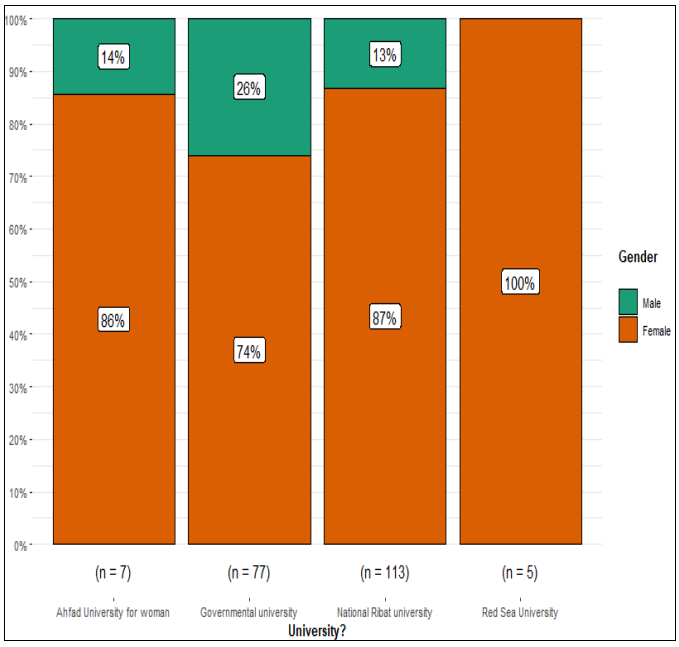
Characteristic	**Normal N = 95[1]**	**Mild_Stress N = 32[1]**	**Moderate_Stress N = 43[1]**	**Severe_Stress N = 31[1]**	****Extremely*Severe*Stress**** **N = 1[1]**	**p-value[2]**
age_categories						>0.9
16-20	13 (14%)	3 (9.4%)	7 (16%)	4 (13%)	0 (0%)	
21-25	75 (79%)	26 (81%)	33 (77%)	25 (81%)	1 (100%)	
26-30	7 (7.4%)	3 (9.4%)	3 (7.0%)	2 (6.5%)	0 (0%)	
Gender						0.2
Female	72 (76%)	28 (88%)	36 (84%)	29 (94%)	1 (100%)	
Male	23 (24%)	4 (13%)	7 (16%)	2 (6.5%)	0 (0%)	
Marital status						0.6
Betrothed	0 (0%)	0 (0%)	0 (0%)	1 (3.2%)	0 (0%)	
engaged	1 (1.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Engaged	1 (1.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Engagement	0 (0%)	0 (0%)	1 (2.3%)	0 (0%)	0 (0%)	
Married	6 (6.3%)	1 (3.1%)	3 (7.0%)	4 (13%)	0 (0%)	
Single	87 (92%)	31 (97%)	39 (91%)	26 (84%)	1 (100%)	
University?						
Ahfad University for woman	2 (2.1%)	3 (9.4%)	2 (4.7%)	0 (0%)	0 (0%)	
Governmental university	44 (46%)	9 (28%)	15 (35%)	8 (26%)	1 (100%)	
National Ribat university	47 (49%)	20 (63%)	25 (58%)	21 (68%)	0 (0%)	
Red Sea University	2 (2.1%)	0 (0%)	1 (2.3%)	2 (6.5%)	0 (0%)	
Year in Eduaction						
1st	5 (5.3%)	1 (3.1%)	1 (2.3%)	1 (3.2%)	0 (0%)	
2nd	6 (6.3%)	2 (6.3%)	3 (7.0%)	3 (9.7%)	0 (0%)	
3rd	22 (23%)	5 (16%)	8 (19%)	6 (19%)	1 (100%)	
4th	16 (17%)	9 (28%)	6 (14%)	6 (19%)	0 (0%)	
5th	11 (12%)	5 (16%)	9 (21%)	4 (13%)	0 (0%)	
6th	32 (34%)	10 (31%)	16 (37%)	10 (32%)	0 (0%)	
graduate	1 (1.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	

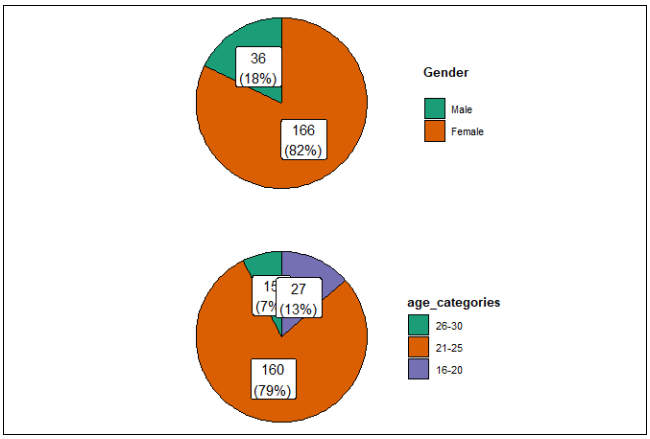
Graduate	1 (1.1%)	0 (0%)	0 (0%)	1 (3.2%)	0 (0%)	
Internship year	1 (1.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
[1]n (%)						
[2]Fisher's exact test						

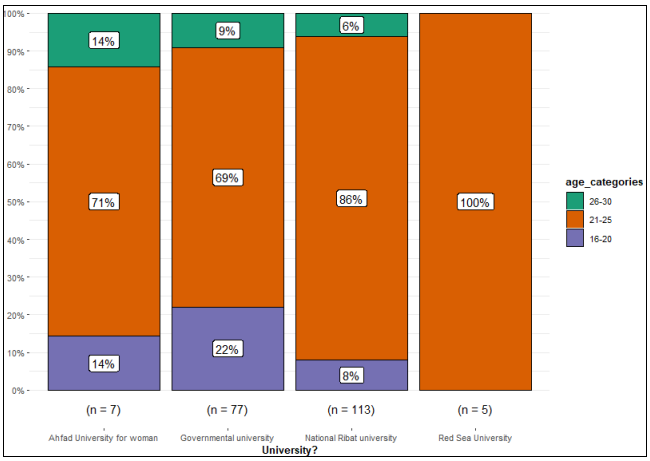
Table 5: Anxiety Levels by Demographic Characteristics

Characteristic	**Normal N = 68[1]**	**Mild_Anxiety N = 42[1]**	**Moderate_Anxiety N = 27[1]**	**Severe_Anxiety N = 41[1]**	****Extremely *Severe* Anxiety** N = 16[1]**	**p-value[2]**
age_categories						0.6
16-20	12 (18%)	2 (4.8%)	6 (22%)	5 (12%)	1 (6.3%)	
21-25	51 (75%)	37 (88%)	19 (70%)	33 (80%)	14 (88%)	
26-30	5 (7.4%)	3 (7.1%)	2 (7.4%)	3 (7.3%)	1 (6.3%)	
Gender						0.5
Female	53 (78%)	36 (86%)	21 (78%)	36 (88%)	15 (94%)	
Male	15 (22%)	6 (14%)	6 (22%)	5 (12%)	1 (6.3%)	
Marital status						0.3
Betrothed	0 (0%)	0 (0%)	1 (3.7%)	0 (0%)	0 (0%)	
engaged	1 (1.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Engaged	0 (0%)	1 (2.4%)	0 (0%)	0 (0%)	0 (0%)	
Engagement	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (6.3%)	
Married	5 (7.4%)	1 (2.4%)	3 (11%)	3 (7.3%)	2 (13%)	
Single	62 (91%)	40 (95%)	23 (85%)	38 (93%)	13 (81%)	
University?						
Ahfad University for woman	2 (2.9%)	2 (4.8%)	2 (7.4%)	0 (0%)	0 (0%)	
Governmental university	37 (54%)	13 (31%)	9 (33%)	11 (27%)	5 (31%)	
National Ribat university	28 (41%)	26 (62%)	15 (56%)	28 (68%)	11 (69%)	
Red Sea University	1 (1.5%)	1 (2.4%)	1 (3.7%)	2 (4.9%)	0 (0%)	
Year in Eduaction						
1st	4 (5.9%)	2 (4.8%)	2 (7.4%)	0 (0%)	0 (0%)	
2nd	5 (7.4%)	2 (4.8%)	3 (11%)	2 (4.9%)	2 (13%)	
3rd	18 (26%)	5 (12%)	7 (26%)	7 (17%)	3 (19%)	
4th	11 (16%)	10 (24%)	5 (19%)	9 (22%)	1 (6.3%)	
5th	11 (16%)	3 (7.1%)	5 (19%)	6 (15%)	3 (19%)	
6th	16 (24%)	20 (48%)	5 (19%)	17 (41%)	6 (38%)	
graduate	1 (1.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Graduate	1 (1.5%)	0 (0%)	0 (0%)	0 (0%)	1 (6.3%)	
Internship year	1 (1.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
[1]n (%)						
[2]Fisher's exact test						









Discussion

The prevalence of self-reported stress, anxiety, and depression among Sudanese undergraduate medical students was examined in this study, along with any possible relationships to lifestyle and demographic characteristics. Our results, which are consistent with other studies carried out in the area, present a troubling picture of the mental health situation in this population and highlight the pressing need for all-encompassing interventions. Given the high frequency of mental health issues, a multifaceted strategy that tackles the societal, academic, and personal elements causing student distress is required. We can help medical students overcome the obstacles of their rigorous academic path and create a more resilient healthcare workforce for the future by creating a supportive learning environment, making mental health services easily accessible, and raising awareness of mental health issues.

Our research revealed that among undergraduate medical students, self-reported mental health issues had been quite common. In particular, 53% of participants reported stress, 65% reported anxiety, and 61% reported depression of some kind. These numbers are consistent with a growing body of research showing the substantial mental health burden experienced by medical school students in Sudan; they are not isolated incidents. [29, 30, 31]. Dafaalla *et al*. (2016) [29] found that over 50% of Sudanese medical students experienced varying degrees of depression, anxiety, and stress, echoing our findings and reinforcing the urgency of addressing this issue. Furthermore, our results resonate with broader mental health trends observed in the general population, particularly during times of conflict or instability. Balla Ahmed *et al*. (2024) [30] reported even higher rates of depression (73%) and anxiety (57.3%) among citizens of Khartoum during the conflict in 2023, underscoring the effect of outside stressors on mental health. These results' consistency across various studies highlights the prevalence of mental health problems in this population and the necessity of focused interventions. The validity of our observations is strengthened by the convergence of findings across several studies using comparable methodologies, although our study, like many others examining this topic, relied on self-reported measures, which are naturally subject to biases like social desirability and recall bias. Potential relationships between gender and mental health outcomes—specifically, anxiety—were identified by our analysis. According to our data, female students had higher anxiety levels, which is in line with a large body of research showing that women are more susceptible to anxiety and depression. [27, 29, 30]. This gender disparity likely reflects a complex interplay of biological, psychological, and social factors. Hormonal fluctuations, differing coping mechanisms, and societal expectations can all contribute to the increased prevalence of anxiety and depression in women. Furthermore, gender-based violence, discrimination, and societal pressures can exacerbate these vulnerabilities. Mustafa *et al*. (2022) [30] highlighted the role of gender in shaping mental health experiences and help-seeking behaviors. Understanding these complex dynamics is crucial for developing gender-sensitive interventions that address the specific needs of female medical students.

The relationship between marital status and mental health appears more nuanced and context-dependent. While our study suggested higher anxiety levels in single individuals, other research has presented contrasting findings. Balla Ahmed *et al*. (2024) [28], For example, it was discovered that married people in Khartoum had higher anxiety levels during the conflict. This disparity emphasizes how crucial it is to take into account the particular context in which research is carried out. Married people may experience higher anxiety levels as a result of the additional duties and worries related to family and relationships during unstable or crisis situations. On the other hand, social isolation or a lack of support networks may cause single people to feel more anxious during times of relative stability. To completely understand the intricate relationship between marital status, environmental factors, and mental health outcomes, more research is required. Sixth-year medical students had a higher percentage of severe anxiety, according to our study. This finding is consistent with earlier studies. [27, 30] suggesting increased stress and anxiety in both younger and final-year students. The medical school journey is characterized by unique stressors at different stages. Younger students face the challenges of adapting to a new academic environment, demanding workloads, and the pressure to succeed. Final-year students, on the other hand, grapple with the anxieties of impending graduation, career choices, and high-stakes licensing examinations. Dafaalla *et al*. (2016) [27] attributed elevated stress and anxiety levels in these groups to transitional challenges and future uncertainties, while Mustafa *et al*. (2022) [31] highlighted the role of high-stakes examinations in contributing to higher distress. However, not all studies have found a clear association between academic year and mental health. A 2024 study [32] found no significant difference in stress levels between preclinical and clinical years. This discrepancy underscores the need for further research to fully elucidate the relationship between

academic progression and mental well-being in medical students. Qualitative studies exploring students' lived experiences could provide valuable insights into the specific stressors encountered at different stages of medical education.

Our study highlighted the significant impact of lifestyle factors on mental health. We found that 15% of participants reported insufficient sleep, a finding consistent with established literature linking sleep deprivation to poorer mental health outcomes [31]. Adequate sleep is essential for various physiological and psychological functions, and chronic sleep deprivation can disrupt these processes, increasing vulnerability to mental health challenges. Our findings emphasize the importance of promoting healthy sleep hygiene among medical students. Furthermore, our data suggested a potential link between financial stress and anxiety, a particularly pertinent issue in Sudan's challenging economic context. Financial constraints can significantly impact students' quality of life, limiting access to essential resources and contributing to increased anxiety [31]. Hammad Jaber Amin (2023) [32] specifically highlighted financial restrictions as a major factor impacting student quality of life and exacerbating anxiety. Finally, our results indicated a positive association between increased smart device use for entertainment and higher anxiety levels, corroborating findings in [31] that linked excessive screen time to heightened anxiety and perceived stress. The ubiquitous nature of technology in modern life necessitates a deeper understanding of its impact on mental health and the development of strategies for responsible technology use.

We should be aware of the limitations of our study. The cross-sectional design makes it impossible to establish causal relationships between variables, and the use of self-reported measures raises the possibility of response bias. Our findings cannot be applied to male medical students due to the sample's preponderance of females. Furthermore, our findings might not be as applicable in other contexts due to Sudan's unique sociopolitical and economic circumstances. Future studies should use qualitative data collection techniques to obtain a deeper understanding of students' lived experiences, use longitudinal designs to monitor mental health trajectories over time, and investigate the efficacy of focused interventions. Future studies can advance our understanding of student mental health and guide the creation of evidence-based practices by addressing these limitations and expanding on our findings support programs.

This study adds to the increasing amount of data showing that mental health issues are very common among Sudanese medical students. The results highlight the critical need for all-encompassing, multifaceted interventions that tackle the intricate interactions between societal, academic, and personal factors influencing students' well-being. Building a more resilient healthcare workforce requires promoting mental health awareness, offering easily accessible and culturally sensitive mental health services, and creating supportive learning environments. Future generations of healthcare professionals can flourish both personally and professionally if we prioritize the mental health of students.

Ethical consideration

- Ethical approval was obtained from Ahfad University for Women. Informed consent was collected from participants.
- Confidentiality was ensured by coding responses and omitting personal identifiers.

Conclusion

This study has provided a crucial lens through which to examine the mental health landscape of undergraduate medical students in Sudan. Our findings, echoing a growing chorus of concern from similar research, underscore the significant prevalence of self-reported depression, anxiety, and stress within this population. This is not merely a statistical observation but a call to action – a demand for comprehensive and sustained efforts to bolster the mental well-being of those who will shape the future of healthcare in Sudan. The challenges are multifaceted, encompassing individual vulnerabilities, academic pressures, sociocultural influences, and lifestyle factors. Addressing these challenges requires a multi-pronged approach that moves beyond simply acknowledging the problem to implementing concrete strategies that empower students to navigate the complexities of medical education and build resilience for a fulfilling and sustainable career in medicine.

Addressing these challenges requires a multi-pronged approach that moves beyond simply acknowledging the problem to implementing concrete strategies that empower students to navigate the complexities of medical education and build resilience for a fulfilling and sustainable career in medicine.

Our findings reveal a concerning reality: a substantial proportion of medical students are grappling with mental health challenges, often silently and without adequate support. The high prevalence of self-reported depression, anxiety, and stress underscores the vulnerability of this population and the potential long-term consequences for both individual well-being and the healthcare system as a whole. Ignoring these challenges is not an option. We must move beyond simply documenting the prevalence of mental health issues and focus on creating a supportive ecosystem that prioritizes student well-being

. A paradigm change is necessary to achieve this, shifting from a culture of stigma and silence to one that values open communication, early intervention, and easily accessible support. The need for gender-sensitive approaches to mental health support is underscored by the gender disparities found in our study, especially the higher prevalence of anxiety among female students. Establishing a fair and inclusive learning environment requires acknowledging and addressing the particular difficulties faced by female medical students, such as cultural expectations, possible discrimination, and the weight of multiple responsibilities. This may involve developing tailored support programs, promoting mentorship opportunities, and fostering open dialogue about the specific stressors faced by women in medical education.

The complex interplay between marital status and mental health, as revealed in our study and other research, underscores the importance of considering contextual factors when designing interventions. While our findings suggested higher anxiety levels in single individuals, other studies have pointed to increased anxiety among married individuals, particularly during times of conflict or instability. This apparent contradiction emphasizes the need for nuanced and context-specific approaches that recognize the diverse experiences and challenges faced by students based on their relationship status. Providing tailored support

that acknowledges these individual circumstances is crucial for ensuring the effectiveness of interventions.

The fact that sixth-year students were shown to have higher anxiety levels provides insight into the unique demands of various medical school phases. High-stakes exams, the shift to clinical practice, and concerns about future employment opportunities can all cause final-year students to experience more stress and anxiety. In order to create focused treatments that meet the particular needs of students at various stages of their medical journey, it is imperative to acknowledge these stage-specific difficulties. This could entail offering career counseling services, stress management classes, and mentorship programs to assist students in adjusting to these changes and developing coping skills.

Our study also highlighted the crucial role of lifestyle factors in influencing mental health. Insufficient sleep, financial stress, and excessive screen time were all associated with increased anxiety levels. Addressing these modifiable lifestyle factors through targeted interventions can significantly contribute to improving student well-being. Promoting healthy sleep habits, providing financial literacy workshops, and encouraging responsible technology use can empower students to take control of their own mental health and build resilience.

While our study provides valuable insights, it is important to acknowledge its limitations. The reliance on self-reported measures, the cross-sectional design, and the predominantly female sample may limit the generalizability of our findings. Future research employing longitudinal designs, incorporating qualitative data, and ensuring greater diversity in participant samples can build upon our findings and provide a more comprehensive understanding of the mental health landscape among medical students. Exploring the effectiveness of specific interventions, such as mindfulness-based stress reduction, cognitive behavioral therapy, and peer support groups, is also crucial for informing evidence-based strategies to promote student well-being.

In conclusion, this study serves as a powerful reminder of the importance of prioritizing mental health within medical education. The high prevalence of self-reported mental health challenges among undergraduate medical students in Sudan demands a concerted and sustained effort to create a supportive and inclusive learning environment. By implementing comprehensive, evidence-based interventions that address individual vulnerabilities, academic pressures, sociocultural influences, and lifestyle factors, we can empower medical students to thrive both personally and professionally. Investing in student well-being is not merely an act of compassion but a strategic imperative for building a robust and resilient healthcare workforce that is equipped to meet the future health needs of Sudan.

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