



Depression, Anxiety, and Stress among Sudanese Medical Students during the COVID-19 Lockdown Period

Osama Gamal Nubi Mohamed¹, Esraa Gamal Nubi Mohamed², Rawan Ahmed¹, Lena Aburas³, Mohamed Ali¹, Hamdan Zaki Hamdan^{4,5*}

¹Department of Public Health, Faculty of Medicine, Al-Neelain University, Khartoum, Sudan; ²Department of Public Health, Faculty of Medicine, National University, Khartoum, Sudan; ³Department of Public Health, Faculty of Medicine, University of Medical Sciences and Technology (UMST), Khartoum, Sudan; ⁴Department of Basic Medical Sciences, Unaizah College of Medicine and Medical Sciences, Qassim University, Unaizah, Kingdom of Saudi Arabia; ⁵Department of Biochemistry and Molecular Biology, Al-Neelain University, Khartoum, Sudan

Abstract

BACKGROUND: The novel coronavirus disease-2019 (COVID-19) pandemic has imposed a compulsory lockdown that has led to the emergence of various types of psychological distress among medical students.

AIM: This study aimed to identify the determinants and the levels of depression, anxiety, and stress among Sudanese medical students during the COVID-19 lockdown period.

METHODS: A web-based cross-sectional study was conducted using an online questionnaire that contained the depression, anxiety, and stress scale (DASS-21).

RESULTS: A total of 1058 students responded and completed the questionnaire. The study sample consisted of 604 (57.1%) females, and the rest were male. The prevalence rates of depression, anxiety, and stress were 75%, 55.3%, and 51.8%, respectively. Binary logistic regression analysis revealed that depression, anxiety, and stress were significantly associated with the female gender (adjusted odds ratio [AOR] = 1.63, 95% confidence interval [CI] = 1.22–2.16) (AOR = 1.73, 95% CI = 1.35–2.22) (AOR = 1.36, 95% CI = 1.07–1.74) respectively. Depression and stress were significantly associated with students at the pre-clinical phase (AOR = 1.65, 95% CI = 1.24–2.20) (AOR = 1.43, 95% CI = 1.12–1.83), respectively. Anxiety was significantly associated with studying at a private university (AOR = 1.36, 95% CI = 1.05–1.76).

CONCLUSIONS: Female students in the pre-clinical phase had an increased risk of depression and stress. Female students attending a private university had an increased risk of anxiety. Depression, anxiety, and stress were highly prevalent among Sudanese medical students.

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***Correspondence:** Dr. Hamdan Zaki Hamdan, Department of Basic Medical Sciences, Unaizah College of Medicine and Medical Sciences, Qassim University, Unaizah, P. O. BOX. 12702, Kingdom of Saudi Arabia. E-mail: h.abualbasher@qu.edu.sa
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Introduction

The novel coronavirus (COVID-19) outbreak was first reported in Wuhan City, China, in December 2019 [1]. As of March 1, 2021, the confirmed cases peaked at 113,820,168, with 2,527,891 deaths across 223 countries [2]. Ten days later, the World Health Organization (WHO) declared the COVID-19 outbreak a global pandemic and recommended many precautions, including social distancing as the most powerful protective measure to contain the infection [1].

In Sudan, the first COVID-19 case was reported on March 13, 2020, in Khartoum, the country's capital, involving a man who had returned home in a flight from the United Arab Emirates (UAE). The government reacted by closing the airport on March 16, 2020, and all other entry points and imposing a curfew with a partial lockdown that included closures of schools and universities [3]. However, on March 28, community

transmission started, and more cases were reported. By April 1, 2020, the number of cases reached 30,404; therefore, a complete lockdown was set in place on April 13 [3].

Medical students are considered psychologically vulnerable to mental health disorders, such as depression, anxiety, and stress, due to the demanding nature of studying medicine and the emotional trauma facing them in clinical training [4]. In the COVID-19 era, the threatening situation of the pandemic itself, accompanied by the enforced social isolation that leads to the discontinuation of medical education activities, has put huge pressure on medical students and is considered an additional stressor for them [5], [6]. A recent study in Sudan's neighboring country, Egypt, shows that 75.2% of medical students have experienced depression during the lockdown period [7]. Another report about Malaysian medical students reveals that 44.6% express anxiety reactions [8]. In addition, many risk factors have been documented to increase the likelihood of psychological distress during the COVID-19

lockdown, such as female gender, younger age, studying in the pre-clinical phase, living alone, and receiving no psychological support [8], [9].

The depression, anxiety, and stress scale-21 (DASS-21) is considered a reliable and valid method for measuring levels of depression, anxiety, and stress, whether in clinical or non-clinical settings. Moreover, the DASS-21 provides quantitative and qualitative measures for the states of depression, anxiety, and stress [10], [11]. Although some studies have investigated the psychological determinants of the COVID-19 lockdown among medical students internationally [8], [9], [12], none has been conducted among sub-Saharan African medical students, including the Sudanese. Therefore, this study was conducted to investigate the possible determinants and levels of depression, anxiety, and stress during the COVID-19 lockdown among Sudanese medical students. The information obtained will be of significant value for the mental health units and student support administrations in universities to build strategies and establish and sustain methods of supporting the students' mental health during this pandemic and thereafter.

Methods

Study design and settings

This web-based descriptive study employed a cross-sectional design. It was conducted from April 1, 2020, to July 5, 2020, in parallel to the COVID-19 complete lockdown period in Sudan.

Sample size calculation

The sample size calculation was done using the following formula ($n = Z^2 p[1-p]/d^2$) and guided by the previously reported prevalence (53.4%) of depression among medical students in Sudan [13]. Where, n is the calculated sample size, p is the prevalence of depression in the previous report = 0.534, z is the confidence level used = 1.96, and d is the degree of precision = 0.05. Accordingly, the calculated sample size comprised 383 students. For a broader representation and generalizability of our results and considering the expected missing responses, we added 20% and came up with the minimum required sample size of 460 students. We invited a total of 1200 students to participate in this study, and 1058 completed the questionnaire successfully, equivalent to a response rate of 88.1%.

Questionnaire preparation and description

To address the study's objectives, we used a self-administered questionnaire that we

developed, guided by the previous studies [8], [9]. The questionnaire was tested on a pilot sample of 34 students to assess the acceptability and clarity of the terms and to estimate the required time to complete it. Their responses were not included in the final result. Minor corrections were introduced to the questionnaire, which was composed of two major sections. The first section inquired about sociodemographic data (age, gender, living arrangements, academic [pre-clinical or clinical] phase, and university type). The second section included the modified version of the DASS-21, which was used to measure the depression, anxiety, and stress levels among the students [10]. The modified DASS-21 is a 4-point Likert-type scale that measures the negative emotional states experienced in the previous week using 21 different questions. For each question, a maximum of 3 points is given, indicating a choice that applied to the respondent very much/most of the time, and a minimum of 0 points, indicating a choice that did not apply to the respondent at all. The total DASS-21 score is calculated by multiplying the sum of the subscale section by two. The scale scores are interpreted according to the cutoff values, classified by the developer into normal, mild, moderate, severe, and extremely severe symptoms. The cutoff points for the three subscales are as follows: Depression (normal = 0–9, mild = 10–13, moderate = 14–20, severe = 21–27, and extremely severe ≥ 28), anxiety (normal = 0–7, mild = 8–9, moderate = 10–14, severe = 15–19, and extremely severe ≥ 20), and stress (normal = 0–14, mild = 15–18, moderate = 19–25, severe = 26–33, and extremely severe ≥ 34). The DASS-21 is not a clinical diagnostic tool but a screening tool, yet its results' sensitivity and specificity are reported as 78–89% and 71–76%, respectively [14]. In this study, we used a validated Arabic-translated version of the scale [15]. Cronbach's alpha values were 87.6% for depression, 76.3% for anxiety, 88.1% for stress, and 93.0% overall for the 21 items of the DASS-21.

Data collection

The data were collected through a web-based questionnaire that was placed on Google Forms™ and distributed to the students through social media platforms, namely, WhatsApp, Telegram, Twitter, and Facebook. A convenience sample method was used, based on the investigators' connections. The cover page of the questionnaire mentioned the study's title and objectives, the estimated questionnaire completion duration, and the names of the investigators. It also clearly stated that participation was voluntary and the respondents would remain anonymous. The participants were required to check the tick box for providing consent before they started answering the questionnaire. The inclusion criteria for this study were (1) a medical student at either the pre-clinical or the clinical phase, (2) present in Sudan at the time of the data collection,

and (3) affiliated with any of the following universities: Al-Neelain University, University of Khartoum, National Ribat University, and National University.

Statistical analysis

The questionnaire data were later entered into Microsoft Excel™ 2016 for coding and editing and then imported to the Statistical Package for the Social Sciences V.25.0 (SPSS Inc., Chicago, IL, USA) program to perform statistical analysis. The DASS-21 scores were tested for normality using the Kolmogorov–Smirnov test and found to be non-normally distributed. Accordingly, the DASS-21 scores were expressed as median (25th–75th quartile). The categorical data were expressed as numbers (percentage). On the one hand, the Mann–Whitney U-test (Wilcoxon rank sum test) was used to compare the DASS-21-related scores between two categories, for example, gender (female and male), academic phase (clinical and pre-clinical), and university type (public and private). On the other hand, the Kruskal–Wallis H test was used to compare the DASS-21-related scores and multiple groups (e.g., living arrangement and study level, e.g., 1st year, 2nd year, etc.). To identify the factors associated with the dependent variables (depression, anxiety, and stress), binary logistic regression was applied. The independent variables (age, university type, academic level, academic phase, gender, living arrangement, and social support) were entered into the model if the p-value in the univariate analysis was <0.20. Odds ratios were expressed with their calculated 95% CI. The p-value was considered significant if it was <0.05.

Ethical statements

The study received ethical approval from the Al-Neelain University Ethics Review Board, and informed consent was obtained electronically from all participants. No personal data were included, and all participants were informed that filling in the questionnaire and participation in the study was voluntary.

Results

A total of 1058 medical students participated in this study. Females were predominant (n = 604 or 57.1%) over males (n = 454 or 42.9%). The students' mean (SD) age was 21.2 (2.0) years, ranging between 18 and 27 years, with 94.7% being under 25 years old. There were 572 (54.1%) students in the pre-clinical phase and 486 (45.9%) in the clinical phase. The majority (n = 632 or 59.7%) studied in public universities compared with 426 (40.3%) who attended private universities. Those

who lived with their family comprised 811 (76.6%) students followed by 161 (15.2%) who lived with friends and 86 (8.1%) who lived alone/had other arrangements (Table 1).

Table 1: Comparison of median (25th–75th quartile) scores of depression, anxiety, and stress based on student demographics, university, and gender

Factors	N (%)	Depression score	Anxiety score	Stress score
		Median (25 th –75 th quartile)		
Overall	1058 (100)	16 (8–24)	8 (4–14)	16 (8–22)
Age				
<25 years	919 (86.86)	16 (8–24)	8 (4–14)	16 (8–22)
≥25 years	138 (13.04)	16 (10–22)	8 (2–12)	16 (8–22)
p value		0.309	0.221	0.735
Gender				
Males	454 (42.9)	14 (8–22)	6 (4–12)	14 (7–22)
Females	604 (57.1)	18 (10–26)	8 (4–14)	16 (10–24)
p-value		0.017	<0.001	0.026
Academic phase				
Pre-clinical	572 (54.1)	18 (10–26)	9 (4–14)	16 (10–24)
Clinical	486 (45.9)	14 (8–22)	8 (4–12)	14 (8–22)
p value		0.001	<0.001	0.001
University				
Public university	632 (59.7)	16 (10–24)	7 (4–12)	16 (10–22)
Private university	426 (40.3)	16 (8–24)	9 (4–14)	16 (8–24)
p value		0.835	0.001	0.843
Living arrangement				
With family	811 (76.6)	16 (8–24)	8 (4–14)	16 (8–24)
With friends	161 (15.2)	15 (9–24)	8 (4–16)	16 (10–24)
Alone, others	86 (8.1)	16 (9–24)	8 (4–12)	14 (8–20)
p value		0.906	0.323	0.626

The analysis of depression severity revealed that 34.4% of the students had severe/extremely severe depression and 26.4% were moderately depressed. Regarding anxiety, 23.3% had moderate anxiety, while 20.5% reported having severe/extremely severe anxiety. As for stress, 20.5% indicated severe/extremely severe stress and 17.1% had moderate stress (Table 2). However, the median score (25th–75th quartile) for depression for all students was 16 (8–24), indicating moderate depression. The median scores (interquartile) were 8 (4–14) for anxiety and 16 (8–22) for stress, indicating mild levels in both categories (Table 1). Figure 1 shows the distribution of different degrees of (a) depression, (b) anxiety, and (c) stress between males and females who were at either the clinical or the pre-clinical phase of their studies.

Table 2: Depression, anxiety, and stress prevalence according to subscale

DASS-21 category	Depression, n (%)	Anxiety, n (%)	Stress, n (%)
Normal	265 (25.0)	473 (44.7)	510 (48.2)
Mild	152 (14.4)	122 (11.5)	151 (14.3)
Moderate	277 (26.4)	246 (23.3)	181 (17.1)
Severe	158 (14.9)	85 (8.0)	136 (12.9)
Extremely severe	206 (19.5)	132 (12.5)	80 (7.6)

When comparing the median (interquartile) levels of depression, anxiety, and stress between the respondents aged <25 years and those aged ≥25 years, no significant difference was observed. Females, compared with males, had significantly higher median scores (interquartile) for depression (18 [10–26] vs. 14 [8–22]; p = 0.017), anxiety (8 [4–14] vs. 6 [4–12]; p < 0.001), and stress (16 [10–24] vs. 14 [7–22]; p = 0.026). Likewise, students at the pre-clinical phase, compared with students at the clinical phase,

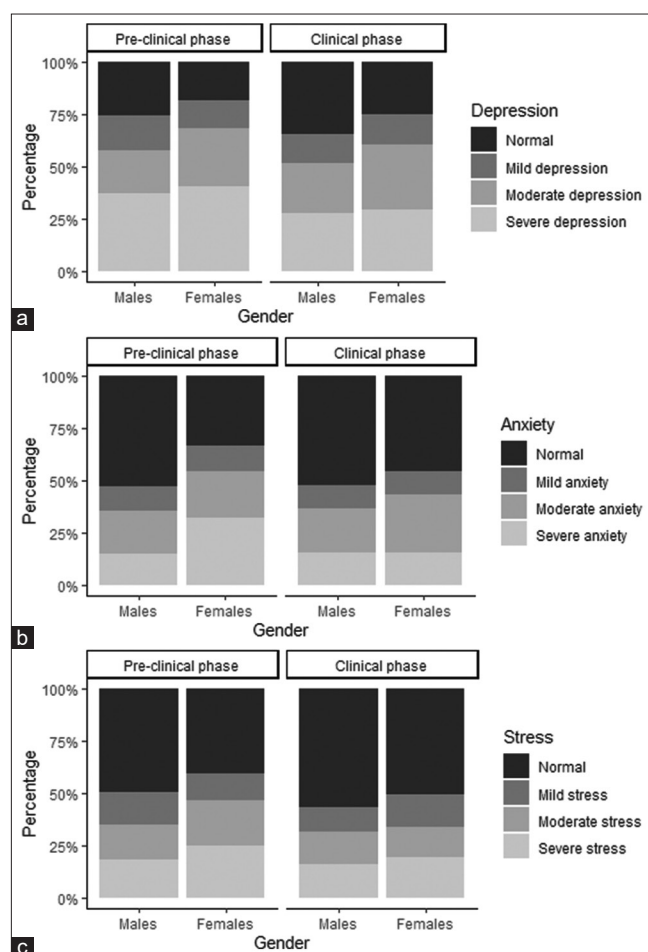


Figure 1: Distribution of psychological disorders (a) depression, (b) anxiety, and (c) stress based on gender among students studied in clinical and pre-clinical phase

had significantly higher median scores (interquartile) for depression (18 [10–26] vs. 14 [8–22]; $p = 0.001$), anxiety (9 [4–14] vs. 8 [4–12]; $p < 0.001$), and stress (16 [10–24] vs. 14 [8–22]; $p = 0.001$). Students who studied at private universities, compared with their peers at public universities, showed significantly higher median scores for anxiety (9 [4–14] vs. 7 [4–12]; $p = 0.001$), while these two student groups' median interquartile scores for depression and stress were comparable. No significant difference was observed in the median scores for depression, anxiety, and stress among students living with family or with friends or alone (Table 1).

Logistic regression analysis revealed that female gender (adjusted odds ratio [AOR] = 1.63, 95% CI = 1.22–2.16) and the pre-clinical phase of studies (AOR = 1.65, 95% CI = 1.24–2.20) were associated with depression among the medical students (Table 2). The factors associated with anxiety were female gender (AOR = 1.73, 95% CI = 1.35–2.22) and attendance at a private university (AOR = 1.36, 95% CI = 1.05–1.76). Female gender (AOR = 1.36, 95% CI = 1.07–1.74) and pre-clinical phase (AOR = 1.43, 95% CI = 1.12–1.83) were associated with stress among the medical students (Table 3).

Discussion

Published studies report that medical students in particular have an increased risk of mental health problems [16]. This is partially attributed to the challenging nature of medical education, with intense and overloaded courses delivered within a short period of time [17]. Their clinical training has exposed them to patients suffering from devastating diseases, and probably, they witnessed the death of at least one patient. Such academic pressure and traumatizing experiences may lead to numerous mental health problems, including anxiety, burnout, stress, and severe depression, which may lead to suicide attempts [18]. On top of these, the COVID-19 pandemic *per se* and the imposed protective measures, such as university closure and social distancing in public places, have added another factor that disrupts medical students' lives. In this study, we aimed to identify determinants and level of psychological distress during the lockdown period of COVID-19 pandemic on Sudanese medical students.

In this study, the prevalence rate of depression was 75.0%. This is similar or close to the figures reported in comparative studies conducted in Bangladesh and Egypt (76.1% and 70.5%, respectively) at the time of the COVID-19 lockdown [9,12]. In contrast, the prevalence rate found in our study is more than double the 36.0% reported in a study conducted among Malaysian medical students [8]. Notably, the prevalence of depression among medical students was reported to range between 1.4% and 73.5% before the COVID-19 pandemic [19], [20]. The Malaysian students who received family support reported a significantly lower depression score compared with those who lacked such support. Interestingly, only six of our respondents received family support. This study demonstrated that female medical students had a 1.63 times higher risk for depression compared with their male peers. This is almost the same as the figure (1.67) reported by Ghazawy *et al.* in Egypt [9]. While Islam *et al.* reported that the female gender significantly increased the overall DASS-21 score by 0.2, including the depression score [12], Kalok *et al.* found that gender was not significant in the Malaysian sample [8]. The predominance of the female gender in depression is multifactorial, due to the physiological and neurobiological differences that occur during the phase of puberty [21]. Our study showed that students in the pre-clinical phase had 1.65 times higher risk for depression compared with students in the clinical phase. This was also investigated by Kalok *et al.* who reported non-significant results [8]. It is worth mentioning that the pre-clinical phase is 2–3 years long and focuses on core basic science courses, which require intellectual skills. Moreover, the 1st year students may experience a stressful transition from the high school environment and lifestyle to a new college environment. This transition requires acquiring new learning, social, and time management skills [22]. Unsurprisingly, depression is more profound among pre-clinical students.

Table 3: Multivariate analysis of the factors associated with depression, anxiety, and stress among medical students during the COVID-19 lockdown period

Independent variables	Non-adjusted			Adjusted		
	OR	95% CI	P-value	OR	95% CI	p value
Dependent variable: Depression						
Gender						
Males	Reference	(1.22–2.15)	0.001	Reference	(1.22–2.16)	0.001
Females	1.54			1.63		
Academic phase						
Clinical	Reference	(1.25–2.34)	0.001	Reference	(1.24–2.20)	0.001
Pre-clinical	1.71			1.65		
Year of study						
1 st year	Reference	(0.74–1.77)	0.566			
Other years	1.13					
Dependent variable: Anxiety						
Gender						
Males	Reference	(1.35–2.22)	<0.001	Reference	(1.35–2.22)	<0.001
Females	1.73			1.73		
Type of university						
Public	Reference	(1.05–1.76)	0.019	Reference	(1.05–1.76)	0.019
Private	1.36			1.36		
Academic phase						
Clinical	Reference	(0.97–1.61)	0.080			
Pre-clinical	1.25					
Dependent variable: Stress						
Gender						
Males	Reference	(1.07–1.74)	0.012	Reference	(1.07–1.74)	0.012
Females	1.36			1.36		
Academic phase						
Clinical	Reference	(1.12–1.83)	0.003	Reference	(1.12–1.83)	0.003
Pre-clinical	1.43			1.43		

Our study's major finding is the prevalence of anxiety at 55.3%, in line with or close to the figures reported in the Egyptian and the Malaysian studies (53.6% and 44.6%, respectively) [8], [9] but far from the 71.5% reported in the Bangladeshi study [12]. Due to their moral and cultural beliefs, people from Middle Eastern and some Asian countries do not share their feelings with one another or even with their doctors, as they perceive such emotions as a sort of weakness or social stigma [23]. This may partially explain the high prevalence of anxiety observed in our study and the other studies [8], [9], [12]. A recent meta-analysis of eight different studies determined the pooled prevalence of anxiety among medical students during the COVID-19 pandemic to be 28.0% [24]. It is noteworthy that medical students are more prone to have anxiety disorders compared with their peers in other colleges [4]. Many stressors contribute to the emergence of anxiety disorders among medical students; for instance, the medical student personality, which is mostly described as neurotic and perfectionist, is characterized by a greater tendency to develop anxiety [25]. Perhaps, the indefinite delay in academic activity conflicted much with the medical student's personality. In our study, female students had a 1.73 times higher risk of developing anxiety compared with male students. Ghazawy *et al.* reported nearly the same figure (1.71) and, likewise, Islam *et al.* in Bangladesh and Soltan *et al.* in Egypt [7], [9], [12]. Others reported no association [8], [26]. We also found that students attending private universities experienced a 1.36 times higher risk of anxiety compared with students enrolled in public universities, which is supported by the findings of Inam *et al.* and Jadoon *et al.* [27], [28]. Medical students attending private universities think that they should devote more

effort and time to studying to obtain higher grades to meet their parents' expectations and justify the high tuition fees. Indefinite university closure imposed by the health authorities increases their anxiety by exacerbating their feeling of future uncertainty and may increase their student loans [29], [30].

We observed a high prevalence of stress among medical students, reaching 51.8%, slightly higher than the 47.8% reported by Ghazawy *et al.* [9], far from the 70.1% reported by Islam *et al.* [12], and almost double the 27.6% in the Malaysian study [8]. The female students in our study had significantly higher stress scores compared with their male peers. The multivariate analysis also revealed significant results, with females showing an increased risk of stress, 1.36 times higher than that of males. The female students in the study of Ghazawy *et al.* had an increased risk of stress, 1.81 times higher than that of their male peers [9]. Soltan *et al.* reported similar findings [7], while Kalok *et al.* noted no association [8]. The increased risk of stress among the female students in our study can be attributed to the fact that women are socially active, and social distancing as a protective measure leads to loneliness. One of the mechanisms for females to overcome stress is to express this feeling *in-person* to a close friend, which may not be possible during the COVID-19 lockdown [31]. We also found that pre-clinical students experienced stress 1.43 times higher than students in the clinical phase. In the early years of their education, medical students experience many stressors, such as the English language barrier, which is faced by medical students in Sudan and most Arabic countries. However, in the context of the COVID-19 pandemic, we believe that the major source of stress is the uncertainty of resuming academic activity [32].

Although many studies have investigated the psychological determinants of the lockdown period associated with protective measures against COVID-19 worldwide, all of the studies were conducted in South Asia, South America, the Middle East, and the Gulf region, none in sub-Saharan Africa [7], [8], [9], [12], [33], [34]. Therefore, this article adds to the local literature and presents data from sub-Saharan Africa for the 1st time.

Our study has a large sample size that represents the largest public and private universities in Sudan. However, for a better interpretation of our findings, some limitations need to be addressed. First, we used a self-administered structured questionnaire that was distributed during the lockdown and social distancing period using our connections through social media, so selection bias cannot be ruled out. Second, our study design is cross sectional; hence, causality cannot be deduced from our results. Third, the DASS-21 score is not the gold standard for assessing depression, anxiety, and stress. In addition, it is only a reflection of the respondents' mental condition during the week before the test. Therefore, further research that utilizes different study designs with a clinical assessment tool is needed.

Conclusions

The prevalence of depression, anxiety, and stress was high among Sudanese medical students during the COVID-19 lockdown period. Multivariate analysis showed that being female and students in the pre-clinical phase were significantly associated with higher risks of depression and stress. The female gender, the pre-clinical phase, and studying at a private university were risk factors for anxiety. Universities, whether public or private, highly need to strengthen their students' social support system to improve their well-being.

Data Availability

Authors confirm that they are ready to provide the study data and materials on reasonable request.

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Ethics Approvals and Consent to Participate

The study was received ethical clearance from the Al-Neelain University Research Ethics Committee. All participants provide online informed consent.

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