

# Assessing Anxiety and Depression Among Students Post-COVID-19: Exploring Associating Factors

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**Background:** The COVID-19 pandemic has had a large impact on global mental health including anxiety and depression rates, many factors affected the vulnerability to these psychological conditions amongst university students.

**Aim:** To explore the level of anxiety and depression of university students living in Jordan.

**Methods:** A cross-sectional study design was conducted in which an electronic survey was created and distributed, university students residing in Jordan participated in the study.

**Results:** A total of 1241 students were enrolled in the study. The mean anxiety score among males and females was (9.68 (SD = 4.10)) and (10.46 (SD = 4.14)), respectively. 42.1% of males had “abnormal” anxiety score compared to 48.4% females. The mean depression score among males (7.77 (SD = 4.31)) was similar to that for the females (7.64 (SD = 4.14)), and 26.0% of the males had “abnormal” depression score compared to 22.6% of the females. Factors affecting anxiety scores included younger age, being a female, taking medication/s, or drinking two cups of coffee or more a day.

**Conclusion:** With 46% and 24% of students suffering from abnormal anxiety and depression respectively, it is important for education policy makers to take immediate measures to allocate students in need of psychological assessment and help to deliver suitable interventions.

**Keywords:** anxiety, depression, students, Jordan, psychological assessment

## Introduction

Coronavirus disease 2019 (COVID-19) is a viral respiratory disease caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that primarily spreads via inhalation of respiratory droplets or direct contact with contaminated surfaces.<sup>1</sup> During the last few years, the pandemic has led to a significant global crisis owing to the rapid spread and high morbidity and mortality rates of the COVID-19 virus.<sup>2</sup> As such, the World Health Organization (WHO) declared the COVID-19 outbreak as a global pandemic on March 11, 2020.<sup>3</sup> Until October 26, 2022, there were 633,963,548 reported cases and 6,586,483 reported deaths worldwide.<sup>4</sup> The symptoms of COVID-19 vary depending on the viral load<sup>5</sup> and vaccination status of patients,<sup>6</sup> ranging from asymptomatic to mild, moderate, or severe symptoms; such symptoms either self-resolve or require hospitalization and monitoring.

Several interventions have been implemented to limit the spread and rise of COVID-19 cases, such as travel restrictions, border measures, social distancing, use of masks, isolation and quarantine, and various mobility and lockdown strategies which effectively decreased COVID-19 cases.<sup>7</sup> However, although quarantine deemed an effective way in reducing the spread of the virus globally,<sup>8</sup> and health-care professionals worldwide were aware about route of transmission and clinical symptoms,<sup>9,10</sup> several significant negative economic, social, and psychological impacts caused as a consequence.<sup>11</sup> As a result, people faced a myriad of challenges and issues, including psychological pressure.<sup>12,13</sup>

It is now well documented that the COVID-19 pandemic has had a large and uneven impact on global mental health.<sup>14</sup> According to studies conducted at the start of the lockdown due to COVID-19 pandemic, stress directly related to the viral infection, in addition to concerns about the disruptions that affected the health-care services and employment contributed to psychological anguish.<sup>15–17</sup> Post-traumatic stress disorder (PTSD) symptoms, stress, anxiety, and depressive symptoms were among of the common psychological effects of the pandemic. The risk of contracting the virus, the type of daily living restrictions, patient's gender, COVID-19 information-seeking behavior, educational level, income level, and age of patients, were all personal and contextual factors that affected the vulnerability to and severity of these psychological issues in different population segments.<sup>18,19</sup>

One of the fundamental elements of a community that deserves to receive proper attention during this pandemic is university students.<sup>20</sup> Higher education students tended to experience various psychological difficulties because of the significant changes in the teaching and learning methods that took place during the pandemic.<sup>18,19,21</sup> Many universities throughout the world have transferred their courses online to maintain their academic routines after lengthy lockdowns and school closures. As most students have goals and aspirations for the future, these conditions have had an unparalleled impact on them. Students' lives and education were severely disrupted during the pandemic, which has made their futures even more uncertain, leading to heightened stress.<sup>18,19</sup>

Numerous researches have examined the pandemic's effects on university students' mental health and the factors associated with higher levels of distress. For example, 195 undergraduate students from one university in the United States of America who participated in an interview survey about the COVID-19 pandemic acknowledged the negative effects and the urgent need for developing interventions and preventive techniques.<sup>22</sup> Another study of 162 undergraduate students found high levels of mental health distress, with depression being associated with difficulties focusing on academic work, job loss, and higher levels of anxiety in students seeking more information on COVID-19.<sup>23</sup> High levels of depression were also reported in a July 2020 online survey of 255 students at a university in Hong Kong, and depressive symptoms were found to exist and adversely correlated with perceived availability of peer support.<sup>24</sup> Another online study conducted in February 2020 involving 11,787 Chinese college students revealed that the prevalence rates of depression and anxiety symptoms were 25.9% and 17.8%, respectively.<sup>25</sup>

A cross-sectional online survey conducted in December 2020 at a nursing college attached to a tertiary care teaching hospital in North India involving 251 bachelor's degree in nursing showed that coronavirus pandemic caused significant distress among nursing students.<sup>26</sup> Being able to minimize the anxiety and depression symptoms among university students, it would be essential to assess their mental health condition and possible ways to mitigate such symptoms. No previous study has assessed the rate of anxiety and depression amongst students in Jordan post COVID-19 pandemic and changes that took place in the tertiary education process.

This study was designed to analyze the level of anxiety and depression of university students living in Jordan in relation to the learning process changes that happened post the COVID-19 pandemic.

## Methods

### Study Design and Participants

The study objectives were addressed through an observational cross-sectional study design. Data collection took place from the 29th of June to the 12th of September 2022, in which an open survey was open for every visitor of the site. The electronic survey was created and distributed using the Google Forms platform. The target population were tertiary education students in Amman, Jordan. A convenience sample of students were involved in the study. The initial contact with the potential participants was through email while allowing web-based data entry and CHERRIES guidelines.<sup>27</sup> The survey was posted on the website. Content of the website was not prepared to preselect the respondents or influence the results. Respondents were able to review and change their answers through a back button. The timeframe that was used as a cut-off point was given and described why.

To be eligible, students had to be residing in Jordan, over the age of 18, and enrolled in a Jordanian university, including both private and public universities. Potential participants were informed that their participation is entirely voluntary and do not pose any risk to them. The study aim was clarified in the introduction of the survey, and students

were requested to approve an electronic informed consent before filling out the study survey. A statement of survey anonymity, voluntary participation, and the right to submit their response whenever they wished were all included in the electronic informed consent. No names, personal information, or other identifiers of the participants were gathered, in order to preserve the respondents' anonymity. In addition, purpose of the study, length of the survey (five minutes) was stated, and the fact that data provided would be stored in a password protected computer that is only accessed by the primary researcher for the purpose of analysis were all stated up front before the student proceeded to complete the online survey.

## Survey Development

The first version of the survey was developed after an extensive review of the literature, and was created using the general principles of good survey design.<sup>28</sup> The survey consisted of 30 closed-ended items, with pre-defined answers (16 demographic items and 14 items related to Hospital Anxiety and Depression Scale). To ensure the content and face validity of the survey, the first draft was assessed by five independent academic researchers and experts in the field. Where appropriate, the provided comments on the relevance of each item, the clarity of the word, and reading comprehension were incorporated.

After editing the survey according to the provided feedback, it was pilot tested on a convenience sample of 50 students in order to guarantee the readability and clearness of the questions, as well as its applicability to the students enrolled in Jordanian universities. Moreover, it was confirmed by the students that the survey is free from difficult terminology and medical jargon. The survey was also tested for usability and technical functionality of the electronic questionnaire. The pilot-phase results were not included in the study analysis.

The final version of the survey consisted of two main sections. In the first section, participants' demographic data were collected, while the second section students' anxiety and depression data were collected through the validated published Hospital Anxiety and Depression Scale (HADS).<sup>29,30</sup>

This online survey reported outcomes according to the CHERRIES statement which provides readers a better understanding of the sample, with regard to participants' self-selection and its possible differences from a "representative" sample and multiple entries from the same person.

## The Hospital Anxiety and Depression Scale (HADS)

The HADS is a well-validated, reliable, and published 14-item instrument designed to assess respondents' anxiety (7-item) and depression (7-item). The HADS was devised by Zigmond and Snaith (1983), it is divided into two 7-item subscales.<sup>29</sup> Each item had four possible score options ranging from zero to three; where a higher score indicates higher anxiety or depression scores, ie, higher severity of symptoms. The score of the questionnaire ranges between 0 and 21, with 0–7 indicating a "normal" case, 8–10 indicating "borderline abnormal" case, and 11–21 indicating "abnormal" case.

The overall Cronbach alpha measures of internal consistency were 0.7836 and 0.8760 for anxiety and depression, respectively. Spearman rank correlations of all items of the scale were significantly above zero.<sup>30</sup>

## Survey Implementation

The survey link was distributed through several platforms (eg, Facebook and WhatsApp) or by sending e-mails outlining the purpose of the study. Potential participants were able to open a link in order to view the study's ethical review board-approved information. Despite being created in English originally; the survey was given to the students in Arabic (the formal language in Jordan). The translated previously published questionnaire was used.<sup>30</sup> In addition, two independent researchers who were considered fluent in both languages back-translated the survey from English to Arabic to confirm accuracy for the Jordanian population.<sup>30</sup> The research team designed the survey to be completed in approximately five minutes.

## Ethical Approval

The Applied Science Private University Ethics Committee provided the ethical approval (study approval number: 2022-PHA-15) of the study. In addition, The World Medical Association's Declaration of Helsinki guideline was followed in the study design.

## Sample Size

The sample size was calculated using the Epi Info software, with a 95% confidence level, 50% expected frequency, 5% acceptable margin of error, and a design effect of 1.0, the study required a minimum of 384 participants to be representative of the population.

## Statistical Analysis

Participant responses were coded and entered into a customized database using the Statistical Package for the Social Sciences (SPSS), Version 24.0 (IBM Corp., Armonk, New York, USA). The qualitative variables were presented as frequency and percentages, while continuous variables were presented as mean (standard deviation). In order to determine the factors that influence students' anxiety and depression scores (dependent variable), simple linear regression, followed by multiple regression was performed. Using univariate linear regression analysis, variables that had a p-value of less than 0.25 were added to the multiple linear regression. After checking that the variables are independent, those with a tolerance value  $>0.1$  and variance inflation factor value of 5 or more were chosen to guarantee the absence of multicollinearity between the independent variables. In the multiple linear regression, a variable that has a p-value of 0.052 or less was considered statistically significant. Both complete and partially completed questionnaires were analyzed.

## Results

The mean age of the students was 21.02 (SD = 3.616), with 60.2% being females (n = 747). More than three-quarters of the students were living in Amman (n = 979). The majority were single (n = 1178), non-smokers (n = 938), had no chronic disease/s (n = 1172), and did not use any medication/s (n = 1120). About 23.0% consumed two cups or more of coffee (with caffeine) each day. Only 17.5% (n = 217) reported having a family member diagnosed previously with anxiety or depression. More than 60.0% of the students were studying in a private university, and 70.8% (n = 879) were in their 1st, 2nd, or 3rd academic year (Table 1).

Results found that significantly more females were studying in public universities (40.8%, n = 301) than males (30.2%, n = 149), and a higher proportion were married (4.9%, n = 36) than males (1.8%, n = 9). As for the smoking status, surprisingly, significantly more females (87.0%, n = 641) reported to be smoking than males (58.0%, n = 286) and more females were taking medications (11.7%, n = 86 vs 6.9%, n = 34).

Assessing students' anxiety revealed that 22.7% of the students (n = 282) felt tense or wound up "most of the time" (Table 2). About 19.0% (n = 239) reported getting a sort of frightened feeling as something awful was about to happen "very definitely and quite badly". As for worrying thoughts going through the student's mind, 28.3% of the students (n = 351) responded with yes during "a great deal of the time". Only 34.9% of the students (n = 434) responded with "definitely" with regards to sitting at ease and feeling relaxed. Regarding getting a sort of frightened feeling like "butterflies" in the stomach, 17.3% of the students (n = 214) answered with "not at all", and about 22.0% reported feeling restless (ie, n = 267) answered with "very much indeed". Only 10.9% of the students (n = 135) reported getting sudden feeling of panic (they answered with "very often indeed"). Significant differences were noted in the following three anxiety questionnaire items; item 4 "I can sit at ease and feel relaxed" (p-value= 0.042) where less males answered with "not at all" and "not often" (2.8% and 19.1%) compared to females (3.5% and 18.0%). As for item 6, "I feel restless as I have to be on the move" (p-value  $\geq 0.001$ ), less males answered with "very much indeed" and "quite a lot" (15.4% and 28.2%) compared to females (25.5% and 34.9%). With regard to item 7, "I get sudden feelings of panic" (p-value  $\geq 0.001$ ), less males answered with "very often indeed" and "quite often" (8.1% and 17.6%) compared to females (12.8%

**Table 1** Demographic Characteristics of the Study Participants (n = 1241)

Parameter	n (%)	P-value Comparing Males (n = 494) to Females (n = 747)*
<b>Living place</b>		
• Amman (the capital)	979 (78.9)	
• Other cities	262 (21.1)	0.063
<b>Living condition</b>		
• Rural areas	107 (8.6)	
• Urban areas	1134 (91.4)	0.162
<b>Marital Status</b>		
• Single	1178 (94.9)	
• Other (single, divorced, and widowed)	63 (5.1)	<b>0.005</b>
<b>Smoking status</b>		
• Smoker	303 (24.4)	
• Non-smoker	938 (75.6)	≤ <b>0.001</b>
<b>Do you have a chronic disease?</b>		
• Yes	69 (5.6)	
• No	1172 (94.4)	0.407
<b>Do you take any medication?</b>		
• Yes	121 (9.8)	
• No	1120 (90.2)	<b>0.006</b>
<b>How many cups of coffee (with caffeine) do you drink per day?</b>		
• None	483 (38.9)	
• Less than 2 cups	477 (38.4)	
• 2–4 cups	241 (19.4)	0.347
• More than 4 cups	40 (3.2)	
<b>Do you have a family member diagnosed with anxiety and/or depression?</b>		
• Yes	217 (17.5)	
• No	1024 (82.5)	0.171
<b>Type of university</b>		
• Public university	452 (36.4)	
• Private university	789 (63.5)	≤ <b>0.001</b>
<b>Academic year</b>		
• 3rd year or less	879 (70.8)	
• 4th year or above	362 (29.2)	0.205

Notes: \*Chi square test. P-values in bold are significant at 0.05 significance level.

and 23.9%); answers to the previous three items indicate that females felt significantly more anxious than males (Table 2).

Assessing students' depression score (Table 3) showed that 34.6% of the students still enjoyed the things they used to enjoy previously (ie, n = 429 answered with “definitely as much”). More than half of the students (52.9%, n = 657) answered with “as much as I always could” when asked whether they can laugh and see the funny side of things. Only 3.6% of the students (n = 45) reported “not at all” regarding feeling cheerful. More than one-third of the students (37.5%, n = 465) responded with “nearly all the time” when asked whether they felt as if they were slowed down. In terms of losing interest in appearance, 12.7% of the students (n = 157) responded with “definitely” yes. Concerning looking forward with enjoyment to things, 31.7% of the students (n = 393) answered “as much as I ever did”. Many of the students (40.7%, n = 505) reported that they can enjoy a good book or radio or TV program “often”.

**Table 2** Assessment of Students' Anxiety (n = 1241) Using the Hospital Anxiety and Depression Scale (HADS)

Statement	n (%)	P-value Comparing Males (n = 494) to Females (n = 747)*
<b>I feel tense or "wound up"</b>		
• Most of the time	282 (22.7)	0.162
• A lot of the time	528 (42.5)	
• From time to time, occasionally	339 (27.3)	
• Not at all	92 (7.5)	
<b>I get a sort of frightened feeling as if something awful is about to happen</b>		
• Very definitely and quite badly	239 (19.2)	0.070
• Yes, but not too badly	436 (35.1)	
• A little, but it does not worry me	369 (29.7)	
• Not at all	197 (16.0)	
<b>Worrying thoughts go through my mind</b>		
• A great deal of the time	351 (28.3)	0.126
• A lot of the time	464 (37.4)	
• From time to time, but not too often	293 (23.6)	
• Only occasionally	133 (10.7)	
<b>I can sit at ease and feel relaxed</b>		
• Definitely	434 (34.9)	<b>0.042</b>
• Usually	535 (43.2)	
• Not often	230 (18.5)	
• Not at all	42 (3.4)	
<b>I get a sort of frightened feeling like 'butterflies' in the stomach</b>		
• Not at all	214 (17.3)	0.223
• Occasionally	426 (34.3)	
• Quite often	433 (34.9)	
• Very often	168 (13.5)	
<b>I feel restless as I have to be on the move</b>		
• Very much indeed	267 (21.5)	<b>≤ 0.001</b>
• Quite a lot	391 (31.5)	
• Not very much	318 (25.6)	
• Not at all	265 (21.4)	
<b>I get sudden feelings of panic</b>		
• Very often indeed	135 (10.9)	<b>≤ 0.001</b>
• Quite often	267 (21.5)	
• Not very often	356 (28.7)	
• Not at all	483 (38.9)	

**Notes:** \*Chi square test. P-values in bold are significant at 0.05 significance level. HADS copyright © R.P. Snaith and A.S. Zigmond, 1983, 1992, 1994. Record form items originally published in Acta Psychiatrica Scandinavica 67, 361–70, copyright © Munksgaard International Publishers Ltd, Copenhagen, 1983. Published by GL Assessment Limited, 1st Floor Vantage London, Great West Road, London TW8 9AG, UK. All rights reserved. GL Assessment is part of the GL Education Group.<sup>29,50–52</sup>

In the depression questionnaire items, significant differences were noted between both genders in all of the 7 items, as more males gave responses that indicated higher depressive feelings. This was mostly apparent for item 1 "I still enjoy the things I used to enjoy", as more males answered with "hardly at all" and "only a little" compared to females (males: 8.1% and 22.5% vs females: 6.6% and 20.6%). The case was similar for the rest of the items (Table 3).

With regard to the anxiety scores interpretations obtained from the HADS, as shown in Figure 1, 27.3% of the students (n = 339) had a "normal" anxiety score (score = 0–7), whereas 26.9% (n = 334) had "borderline abnormal" anxiety score (score = 8–10), and 45.8% (n = 568) had "abnormal" anxiety score (score = 11–21). On the other hand, with regard to the depression scores interpretations obtained from the HADS, 52.4% of the students (n = 650) had



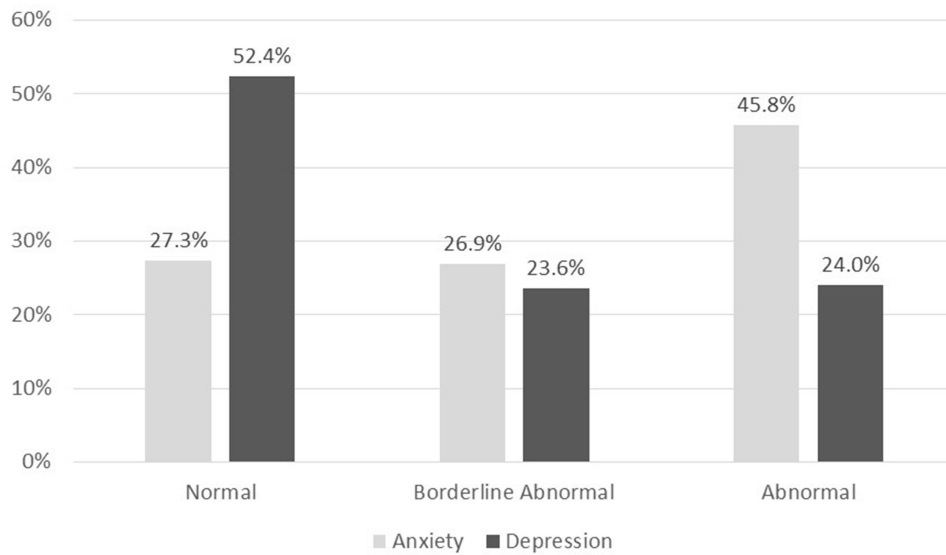
**Table 3** Assessment of Students' Depression (n = 1241) Using the Hospital Anxiety and Depression Scale (HADS)

Statement	n (%)	P-value Comparing Males (n = 494) to Females (n = 747)*
<b>I still enjoy the things I used to enjoy</b>		
• Definitely as much	429 (34.6)	<b>≤ 0.001</b>
• Not quite so much	457 (36.8)	
• Only a little	266 (21.4)	
• Hardly at all	89 (7.2)	
<b>I can laugh and see the funny side of things</b>		
• As much as I always could	657 (52.9)	<b>≤ 0.001</b>
• Not quite so much now	407 (32.8)	
• Definitely not so much now	137 (11.1)	
• Not at all	40 (3.2)	
<b>I feel cheerful</b>		
• Not at all	45 (3.6)	<b>0.003</b>
• Not often	176 (14.2)	
• Sometimes	580 (46.7)	
• Most of the time	440 (35.5)	
<b>I feel as if I am slowed down</b>		
• Nearly all the time	465 (37.5)	<b>≤ 0.001</b>
• Very often	520 (41.9)	
• Sometimes	196 (15.8)	
• Not at all	60 (4.8)	
<b>I have lost interest in my appearance</b>		
• Definitely	157 (12.7)	<b>0.011</b>
• I do not take as much care as I should	309 (24.8)	
• I may not take quite as much care	326 (26.3)	
• I take just as much care as ever	449 (36.2)	
<b>I look forward with enjoyment to things</b>		
• As much as I ever did	393 (31.7)	<b>0.001</b>
• Rather less than I used to	575 (46.3)	
• Definitely less than I used to	207 (16.7)	
• Hardly at all	66 (5.3)	
<b>I can enjoy a good book or radio or Television program</b>		
• Often	505 (40.7)	<b>≤ 0.001</b>
• Sometimes	408 (32.9)	
• Not often	206 (16.6)	
• Very seldom	122 (9.8)	

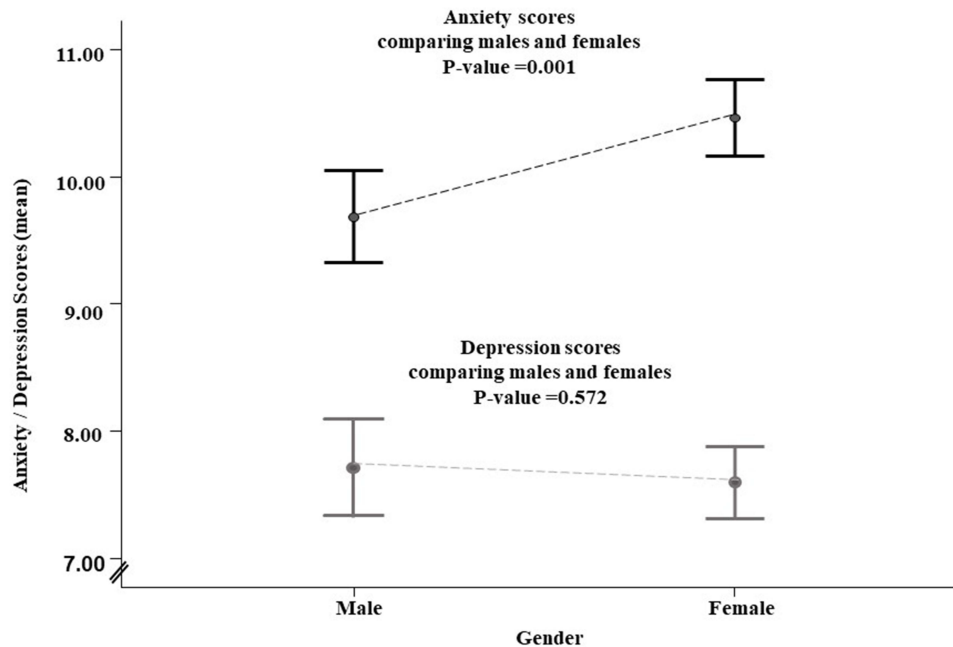
**Notes:** \*Chi square test. P-values in bold are significant at 0.05 significance level. HADS copyright © R.P. Snaith and A.S. Zigmond, 1983, 1992, 1994. Record form items originally published in Acta Psychiatrica Scandinavica 67, 361–70, copyright © Munksgaard International Publishers Ltd, Copenhagen, 1983. Published by GL Assessment Limited, 1st Floor Vantage London, Great West Road, London TW8 9AG, UK. All rights reserved. GL Assessment is part of the GL Education Group.<sup>29,50–52</sup>

a “normal” depression score (score = 0–7), whereas 23.6% (n = 293) had “borderline abnormal” depression score (score = 8–10), and 24.0% (n = 298) had “abnormal” depression score (score = 11–21).

The mean anxiety score among males (n = 494) was 9.68 (SD = 4.10), and 31.3% (n = 155) of the participants had a “normal” anxiety score, whereas 26.6% (n = 131) had “borderline abnormal” anxiety score, and 42.1% (n = 208) had “abnormal” anxiety score. On the other hand, females (n = 747) had a mean anxiety score of 10.46 (SD = 4.14). Yet, 24.5% (n = 183) of the participants had a “normal” anxiety score, and 27.2% (n = 203) had “borderline abnormal” anxiety score, and 48.4% (n = 361) had “abnormal anxiety” score (Figure 2).



**Figure 1** Interpretation of students' (n = 1241) proportions of those with normal vs borderline abnormal vs abnormal symptoms using the Hospital Anxiety and Depression Scale (HADS).



**Figure 2** Comparing the anxiety and depression mean scores of male (n = 494, 39.8%) and female (n= 747, 60.2%) participant students.

The mean depression score among males (n = 494) was 7.77 (SD = 4.31), while 52.8% (n = 261) of the participants had a “normal” depression score, 21.1% (n = 104) had “borderline abnormal” depression score, and 26.0% (n = 129) had “abnormal” depression score. As for females (n = 747), the mean depression score was 7.64 (SD = 4.14), 52.2% (n = 390) of the participants had a “normal” depression score, whereas 25.3% (n = 189) had “borderline abnormal” depression score, and 22.6% (n = 168) had “abnormal” depression score (Figure 2). Multiple linear regression analysis of factors affecting anxiety scores among students (Table 4) revealed that being younger (Beta = -0.014, P-value= 0.036), being a female (Beta = 0.116, P-value= 0.017), taking medication/s (Beta = 0.222, P-value= 0.006), or drinking two cups of coffee with caffeine or more a day (Beta = 0.111, P-value= 0.049) is significantly associated with having a higher anxiety



**Table 4** Assessment of Factors Affecting Anxiety Scores Among the Study Participants (n = 1241)

Parameter	Anxiety Score			
	Beta	P-value <sup>#</sup>	Beta	P-value <sup>§,*</sup>
Age	-0.011	0.098 <sup>^</sup>	-0.014	<b>0.036</b>
Gender				
• Male	Reference		0.116	<b>0.017</b>
• Female	0.132	0.007 <sup>^</sup>		
Living place				
• Amman (the capital)	Reference			
• Other cities	0.013	0.829	-	-
Living condition				
• Urban areas	Reference			
• Rural areas	0.156	0.069 <sup>^</sup>	0.160	0.060
Marital status				
• Married	Reference			
• Other (single, divorced, widowed)	0.099	0.434	-	-
Smoking status				
• Non-smoker	Reference			
• Smoker	-0.044	0.425	-	-
Chronic Disease				
• No	Reference			
• Yes	0.054	0.606	-	-
Taking medication				
• No	Reference			
• Yes	0.239	0.003 <sup>^</sup>	0.222	<b>0.006</b>
Cups of coffee (with caffeine) per day				
• Less than two cups	Reference			
• Two cups or more	0.103	0.069 <sup>^</sup>	0.111	<b>0.049</b>
Having a family member diagnosed with anxiety or depression				
• No	Reference			
• Yes	0.123	0.049 <sup>^</sup>	1.595	0.111
Type of university				
• Private university	Reference			
• Public university	-0.018	0.721	-	-
Academic year				
• 3rd year or less	Reference			
• 4th year or above	0.057	0.279	-	-

**Notes:** <sup>#</sup>Using simple linear regression. <sup>§</sup>Using multiple linear regression. <sup>^</sup>Eligible for entry in multiple linear regression (significant at 0.25 significance level). \*P-values in bold are significant at 0.05 significance level.

**Table 5** Assessment of Factors Affecting Depression Scores Among the Study Participants (n = 1241)

Parameter	Depression Score			
	Beta	P-value <sup>#</sup>	Beta	P-value <sup>§,*</sup>
Age	-0.009	0.178 <sup>^</sup>	-0.013	<b>0.038</b>
Gender				
• Male	Reference			
• Female	-0.025	0.608	-	-
Living place				
• Amman (the capital)	Reference			
• Other cities	0.030	0.603	-	-

(Continued)

Table 5 (Continued).

Parameter	Depression Score			
	Beta	P-value <sup>#</sup>	Beta	P-value <sup>§,*</sup>
Living condition • Urban areas • Rural areas	Reference 0.122	0.151 <sup>^</sup>	0.150	0.069
Marital status • Married • Other (single, divorced, widowed)	Reference 0.028	0.826	–	–
Smoking status • Non-smoker • Smoker	Reference –0.172	0.002 <sup>^</sup>	–0.123	<b>0.025</b>
Chronic Disease • No • Yes	Reference 0.130	0.208 <sup>^</sup>	–0.021	0.851
Taking medication • No • Yes	Reference 0.288	≤ 0.001 <sup>^</sup>	0.267	<b>0.002</b>
Cups of coffee (with caffeine) per day • Less than two cups • Two cups or more	Reference 0.220	≤ 0.001 <sup>^</sup>	0.188	<b>0.001</b>
Having a family member diagnosed with anxiety or depression • No • Yes	Reference 0.346	≤ 0.001 <sup>^</sup>	0.316	≤ <b>0.001</b>
Type of university • Private university • Public university	Reference –0.010	0.833	–	–
Academic year • 3rd year or less • 4th year or above	Reference –0.018	0.730	–	–

Notes: <sup>#</sup>Using simple linear regression. <sup>§</sup>Using multiple linear regression. <sup>^</sup>Eligible for entry in multiple linear regression (significant at 0.25 significance level). \*P-values in bold are significant at 0.05 significance level.

score. Multiple linear regression analysis of factors affecting depression scores among students (Table 5) revealed that being younger (Beta = –0.013, P-value= 0.038), being a non-smoker (Beta = –0.123, P-value= 0.025), taking medication/s (Beta = 0.267, P-value= 0.002), drinking two cups of coffee with caffeine or more (Beta = 0.188, P-value= 0.001), or having a family member diagnosed with anxiety or depression (Beta = 0.316, P-value= ≤ 0.001) is significantly associated with having a depression score indicating depressive symptoms.

## Discussion

The stability of families and individuals was impacted throughout the current global crisis and pandemic,<sup>31</sup> which is a key issue that might significantly affect students' anxiety and depression levels. This is the first study to report the degree of anxiety and depression experienced by university students in Jordan post the COVID-19 pandemic, and its effects on their education. Borderline anxiety and depression levels were found to affect 26.9% and 23.6% of students, and abnormal anxiety and depression affected 45.8% and 24.0% of students. Such high rates were surprising and knowing the associated factors can help target certain vulnerable groups in the future. Higher levels of anxiety and

depression were significantly associated with younger ages, medication use, consuming two or more cups of caffeinated coffee a day and having a family history of anxiety or depression.

This study used the HADS assessment to determine the levels of anxiety and depression amongst students during the pandemic. The HADS questionnaire is the most suitable tool for the bi-dimensional assessment of anxiety and depression symptoms among the study participants due to its validity, reliability, and availability, as it has been published in many countries.<sup>32</sup> Additionally, because it only has 14 questions, 7 of which are related to anxiety symptoms and 7 to depressive symptoms- The questionnaire can be completed online in a short time. Since each item on the questionnaire is graded from 0 to 3, this tool offers an anxiety score and a depression score, as the scores vary from 0 to 21.<sup>32</sup>

The pandemic had an impact on the psychological states of university students all around the world.<sup>33</sup> Similar to the findings of this study, a recent study assessing the psychological impact of COVID-19 on university students in Saudi Arabia reported that 38.6% of participants showed anxiety symptoms, while 33.1% showed depression symptoms.<sup>34</sup> According to reports, in addition to social and financial losses, the lack of resources, forced social and physical distance, and self-quarantining contributed to students' emotional discomfort.<sup>11,12</sup> The pandemic's high rates of financial instability and resource (food and housing) insecurity increased college students' psychological distress, such as anxiety and depression.<sup>35</sup> Also, a study performed by Hamaideh et al on Jordanian students during COVID-19 "home-quarantine" found that the prevalence of anxiety and depression was 67.9% and 78.7%.<sup>36</sup>

The transition from face-to-face learning to online learning becoming a common modality of education meant more social isolation, prolonged screen time, affected studies, worries about future employment, all factors leading to increased stress, burnout, anxiety and depression levels.<sup>37,38</sup> A study conducted on online learning students in Brazil showed that most students reported emotional impact in online learning, followed by learning impact, financial impact, social impact and technological impact.<sup>39</sup> Another study, conducted via an online survey among 5100 medical students engaged in online learning from Wannan Medical College in China showed the prevalence of anxiety and stress to be as high as 32.9% and 14.6%, respectively.<sup>40</sup> Another study included 1210 respondents from 194 cities in China found that 53.8% of respondents rated the psychological impact of the pandemic as moderate or severe; 16.5% reported moderate to severe depressive symptoms while 28.8% reported moderate to severe anxiety symptoms.<sup>41</sup> A recent meta-analysis conducted by Ebrahim et al on a total of 46,284 cases showed an overall pooled prevalence rate of 29.1% for anxiety symptoms and 23.2% for depression symptoms showing significant impact on university students' psychological well-being.<sup>42</sup> A previous study conducted in North India involving nursing students also found significant associations between stress levels and students being in the first-year academic level, as well as students having family members in the medical profession.<sup>26</sup> Hence, it is apparent that the pandemic has increased the rates and level of anxiety and depression amongst students, and that moving forward to online learning may have an association with such increase.

A cross-sectional study was conducted during the COVID-19 pandemic (July 2020) to assess anxiety and depression levels among Jordanian medical students. From the study participants (n = 450), 43.8% had a "normal" anxiety score, and 40.0% had a "normal" depression score. The current study's findings reported a lower level of "normal" anxiety (27.3% vs 43.8%), but a higher level of "normal" depression scores (52.4% vs 40.0%). In addition, comparing the level of "abnormal" anxiety and "abnormal" depression scores, the current study reported a higher level of "abnormal" anxiety score (45.8% vs 33.8%), and a lower level of "abnormal" depression score (24.0% vs 26.2%).<sup>43</sup>

Family history of anxiety or depression and being of a female gender are important when it comes to assessing the liability of individuals to develop the condition.<sup>36,44</sup> In this study, results showed that higher depression scores were associated with a family history. This finding was in concordance with studies that demonstrated that anxiety and depression have genetic ties.<sup>45,46</sup> Females were also found to be at higher risk of anxiety. This finding is in accordance with those of previous studies that demonstrated that females were more likely to develop mood disorders and stress-related mental illnesses including depression and anxiety.<sup>47</sup> This sex difference in developing mental diseases is likely due to genetics and sex steroid hormones.<sup>44</sup>

Although this study provides valuable information about depression and anxiety, and the way changes in the learning process following the pandemic affected such psychological symptoms of students, the study was composed only by self-reported questionnaires that are not deepened with clinical and instrumental examinations. Secondly, there may be a selection bias because the respondents self-selected to respond to the survey; yet, since a large sample size of participants completed the questionnaire, this helped to mitigate the effect of this bias. Also, the results may not

accurately reflect the intensity of anxiety and depression symptoms among students because the research approach followed was unable to reach participants with medically examined anxiety and depression symptoms. Another limitation of this study is not using the tools designed specifically for the COVID-19 pandemic, such as the coronavirus anxiety scale (CAS),<sup>48</sup> yet, the HADS assessment scale is an accurate tool to use and was suitable to answer the objectives of this study. Meanwhile, it could be useful to undertake a prospective study on the same individuals using tools designed specifically for the COVID-19 pandemic to provide a tangible result and support the need for a targeted public health strategy. Finally, the study did not assess for the participation rate (unique number of people who filled in the first page of the survey (or agreed to participate by checking a checkbox) divided by visitors who visited the first page of the survey) nor for the completion rate (number of people submitting the last questionnaire page divided by the number of people who agreed to participate (or submitted the first survey page)). Measures to prevent multiple entries from the same individual were not applied such as the use of cookies which prevents the users from entering the survey twice, or use of IP check where no two entries from the same IP address is allowed.

## Conclusion

In conclusion, this research shows how crucial it is for organizations and decision-makers to assess the mental health status of tertiary education students, and how changes in the educational process following the pandemic have affected such status. This study has shown that 26.9% of university students in Jordan had “borderline abnormal” anxiety score, and 45.8% had “abnormal” anxiety score. Results were also alarming for depression scores, as 23.6% had “borderline abnormal” depression score, and 24.0% had “abnormal” depression score.

Factors affecting anxiety scores among students included younger age, being a female, taking medication/s, or drinking two cups of coffee or more a day. As for depression, such factors included younger age, being a non-smoker, taking medication/s, drinking two cups of coffee, or having a family member diagnosed with anxiety/depression. Unveiling such factors can help policy makers target the groups affected most by anxiety and depression symptoms, devising plans to help the students who have fell victims to such mental problems following the pandemic and the resultant changes that took place in the educational system.

Receiving sufficient training on pandemics can play a vital role in improving self-efficacy and reducing anxiety which would eventually prepare educators and students to face future pandemics in a much better and more efficient manner.<sup>9,47,49</sup> Higher education institutions are well-positioned to offer training and support to educators and students. Students in need of mental health support can also benefit from comprehensive care offered by the University Psychology Clinic during their higher education study years, helping them overcome the new challenges and the post trauma of the pandemic. Referral of students in need of further mental help to more specialized health-care facilities is also vital. Tertiary education institutions can build bridges with other institutions in the country to react to the encounters of recent times as the globe continues to struggle with the far-reaching effects of the deviations faced following COVID-19 pandemic.

## Data Sharing Statement

Data are available upon request from the corresponding author.

## Funding

This research was funded by the Deanship of Research and Higher Studies of the involved universities, grant number [DRG-2021-2022-16], Applied Science Private University (ASU), the University of Jordan (UJ), the Hashemite University (HU), and Princess Sumaya University for Technology (PSUT).

## Disclosure

Authors declare no conflict of interest.

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