Psychology Research and Behavior Management

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Depression Among University Students in Jordan After the COVID-19 Pandemic: A Cross-Sectional Study

Ahlam J Alhemedi[1], Motaz Ghazi Qasaimeh[2], Nour Abdo[1], Lina Elsalem[3], Dina Qaadan[4], Esraa Alomari[5], Qudama Issa[1], Mohammed Alhadeethi[1], Hamza Mazin Abdul Kareem[1], Ayham Almasri[1], Osama Elkhateeb[1], Abdallah Y Naser[5]

[1]Department of Public Health and Family Medicine, Faculty of Medicine, Jordan University of Science and Technology, Irbid, 22110, Jordan; [2]Department of General Surgery and Anesthesia, Faculty of Medicine, The Hashemite University, Zarqa, Jordan; [3]Department of Pharmacology, Faculty of Medicine, Jordan University of Science and Technology, Irbid, 22110, Jordan; [4]Department of Clinical Medical Sciences, Faculty of Medicine, Yarmouk University, Irbid, Jordan; [5]Department of Applied Pharmaceutical Sciences and Clinical Pharmacy, Faculty of Pharmacy, Isra University, Amman, Jordan

Correspondence: Ahlam J Alhemedi, Assistant Professor in Family Medicine, Department of Public Health and Family Medicine, Faculty of Medicine, Jordan University of Science and Technology, P.O. Box 3030, Irbid, 22110, Jordan, Tel +00962796555971, Email ajalhmedy@just.edu.jo

Background: University students encounter stressors that make them more susceptible to depression than the general population. Depression negatively impacts mental and physical health. Our study assessed the prevalence of depression among university students in Jordan and its associated predictors after the COVID-19 pandemic.

Methods: We conducted this cross-sectional online survey study in the first quarter of 2022 by sending an online questionnaire to university students aged 18 years and older. This study assessed the symptoms of depression using the Patient Health Questionnaire-9 (PHQ-9). Binary logistic regression analysis was used to identify associated predictors of depression.

Results: A total of 535 university students participated in this study. The mean depression score for the study participants was 13.9 (SD: 7.1) out of 27, representing a moderate level of depression. Among the participants, 26.2% had moderate, 19.3% had moderately severe, and 25.8% had severe depression. Students who drink three or more cups of coffee per day, have had an evaluation of their psychological state by specialists before, and have been diagnosed with any mental illness were more likely to have a higher depression score compared to others ($p<0.05$). On the other hand, students who were aged 24 years and older and those who practiced regular exercise were less likely to have a higher depression score compared to others ($p<0.05$).

Conclusion: We found a high prevalence of depression among university students in Jordan. This result is vital for decision-makers to implement a plan to prevent and manage this mental health issue.

Keywords: depression, Jordan, prevalence, students, university

Introduction

Depression is a significant mental health disease that needs more worldwide attention from the public health sector, as it affected more than 300 million people on a global scale in 2017.[1] In addition, depression is one of the most significant contributors to worldwide disability (about 7.5% in 2015) and a significant contributor to about 800,000 suicides every year.[2] Depression is a common and treatable disorder usually recognized by frequent changes in mood and cognitive and physical symptoms for two weeks or more.[3]

The primary symptoms of depression are the loss of positive interactions, sleep disturbances, low self-care, low concentration, anxiety, and a lack of interest in daily life and new experiences.[4] Depression can be diagnosed clinically through traditional diagnostic interviews, but in studies measuring the prevalence of depression, researchers usually use a validated self-report screening instrument.[5] The prevalence of depression is affected by socio-demographic factors such as sex, age, environment, and personal character.[6] It also changes with personal income and health-related behaviors.[7]

Received: 13 September 2023
Accepted: 11 October 2023
Published: 18 October 2023

University students experience high academic and non-academic stressors, making them vulnerable to developing mental health issues, including depression. Studies indicate that university students have higher levels of depression than other populations.[5,8,9] The COVID-19 epidemic has had a multifaceted impact on the overall well-being of society, including several dimensions such as social, emotional, economic, and educational aspects.[10–19]

Previous research conducted among nursing students revealed the presence of notable levels of distress within this population.[20] Stress level found a significant association with first-year academic level and family members in the medical profession. The utilization of acceptance and religious/spiritual coping methods enabled students to effectively manage stress.[20] Another study found that the majority of nursing students experienced stress ranging from moderate to high levels. It has been proven that there is a significant but weak negative correlation between self-esteem and depression.[21] A previous study compared the distress levels in the general population to those of university students and found them to be significantly higher in students in the 18 to 34 year age group.[22] In Jordan, scant studies about this issue existed before the onset of the COVID-19 pandemic. One study in 2008 found the prevalence of depression among university students to be 75%.[23]

In contrast, research conducted during the COVID-19 pandemic revealed a substantial frequency of depression among university students as a result of the challenges experienced during that period. The aforementioned research employed diverse methodologies in order to assess the prevalence, employing varying criteria for defining the phenomenon. In 2020, a research study conducted in Jordan aimed to examine the psychological ramifications of quarantine on university students. The findings revealed a notable prevalence of depression symptoms, with 71% of participants exhibiting such symptoms. Further analysis indicated that 34% of participants experienced severe depressive symptoms, while 37% reported high levels of depressive symptoms. Notably, female participants displayed a larger percentage of depressive symptoms compared to their male counterparts.[24,25] Another study by Hamaideh, S.H.et al reported a prevalence rate of 78.7%.[26] Nowadays, after the end of pandemic restrictions and the return to in-person teaching and hands-on training, it is crucial to have an updated estimate of depression prevalence among university students in Jordan and to study its association with other factors in students' lives to take steps to prevent and manage this critical health issue.

Materials and Methods

Study Design

This is an online cross-sectional survey study that examined the prevalence of depression among university students in Jordan. The data were collected from 02/01/2022 to 31/03/2022 and targeted students aged 18 and above.

Participants Recruitment

The convenience sampling technique was used in this study to recruit the participants. The social media websites (Facebook, WhatsApp, Snapchat, and Instagram) were used to invite the study participants. The inclusion criteria for the study population are university students from any specialty currently studying at a Jordanian university. There was no restriction on the year of the study or the field of the study. The inclusion criteria were highlighted in the cover letter of the study. Participants who met the inclusion criteria were asked to participate in the study. The study's aims and objectives were highlighted in the cover letter. Participants were asked to participate after giving their consent.

Data Collection and Measures

We used the Patient Health Questionnaire-9 (PHQ-9) questionnaire in this research. The PHQ-9 is a tool recommended by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) to make a provisional diagnosis and assess the severity of depression. It comprises nine items answered on a four-point scale. PHQ-9 scores range from 0 to 27, with higher scores indicating a higher severity of depression. We made a provisional diagnosis of depressive disorder if the PHQ-9 score was four or more.[27] The study questionnaire included three parts: The first concerns demographic information, including age, sex, university specialty, grade, residency status, and place. The second is about behaviors and previous illnesses that include smoking, coffee drinking, energy drink consumption, exercise performance, previous

diagnosis of a mental disorder, previous psychological evaluation by a specialist, and COVID-19 infection diagnosed by a polymerase chain reaction (PCR) test.

The third part consists of the questions from the PHQ-9; we used the validated Arabic version. For each question, the answers range from 0 to 3, where 0 means "not at all" and 3 means "almost every day". The total scores were categorized as follows: minimal or no depression (0–4), mild depression (5–9), moderate depression (10–14), moderately severe depression (15–19) and severe depression (20–27).

Pilot Study

We conducted a pilot study by approaching 10 participants who met our inclusion criteria; those participants were not included in the final study sample. The pilot study examined participants' understanding of the questionnaire and asked them whether they faced any difficulties in filling it out.

Questionnaire Validity

Cronbach's alpha was used to ensure the reliability of the questions. The acceptable factor loading was 0.70 or above.[28] We calculated Cronbach's alpha internal consistency coefficients for mental health on a factor basis. The Cronbach's alpha values were determined to be 0.88 for depression, which reflects good internal consistency.

Ethical Statement

We obtained approval for our study from the Institutional Review Board (IRB) of the Jordan University of Science and Technology (number 2021/678). Study participants voluntarily accepted and participated by filling out the online questionnaire. We ensured the confidentiality and anonymity of the participants and restricted the data collected to the research team. Our methods followed the relevant guidelines and regulations.

Data Analysis

Collected data were analyzed using the statistical analysis program SPSS version 26. Descriptive analysis was implemented to present the data for this study. Categorical variables were presented as percentages and frequencies. Continuous variables were presented as mean and standard deviation (SD) as the data were normally distributed. The normality of the depression score was checked using skewness and kurtosis measures and the histogram. Therefore, we used analysis of variance (ANOVA) and t-tests to examine the difference in the mean depression score. Predictors of depression were identified using binary logistic regression analysis, where the dummy variable was defined as the mean depression score for the study sample. A 95% confidence interval ($p \leq 0.05$) was applied to indicate the statistical significance of the results, and a significance level of 5% was assigned.

Results

Participants Demographic Characteristics

This study included 535 students. The mean age of the students was 22.2 (SD: 3.3) years. We sorted the participants into three groups according to their ages: 18–20 years (32%), 21–23 years (46%), and ≥24 years (22.1%). Females represented 72.5% of our study sample. Most participants were Jordanians (93.3%). The highest percentage of the students were from the faculty of engineering (22.4%), followed by medicine (14.8%), and computer and information technology (13.1%), with only (0.7%) in veterinary medicine. Regarding residency status, 84.7% of participants lived with their families, while the remainder lived alone or in student parties. About half of the students (48.4%) reported excellent academic performance, while only (0.9%) reported a fair degree of academic achievement. Most participants were non-smokers (82.4%) and did not consume energy drinks (79.4%). 44.9% of participants did not drink coffee, while 18.7% drank three or more cups daily. Only 39.8% of students performed exercise.

Regarding past illnesses, 46% of participants had a previous COVID-19 infection, 15.3% were diagnosed with a mental illness, and 10.8% had a psychological state evaluation by a specialist. Table 1 presents the demographic characteristics of the study participants.

Table 1 Participants' Demographics Characteristics

	Frequency	Percent
Age range		
18–20	171	32
21–23	246	46
≥=24	118	22.1
Gender		
Female	388	72.5
Male	147	27.5
Nationality		
Jordanian	499	93.3
Non-Jordanian	36	6.7
Faculty		
Faculty of Engineering	120	22.4
Faculty of Medicine	79	14.8
Faculty of Computer and Information Technology	70	13.1
Faculty of Pharmacy	51	9.5
Faculty of Graduate Studies	50	9.3
Faculty of Dentistry	43	8.0
Faculty of Applied Medical Sciences	41	7.7
Faculty of Science and Art	28	5.2
Faculty of Agriculture	19	3.6
Faculty of Architecture and Design	17	3.2
Faculty of Nursing	13	2.4
Faculty of Veterinary Medicine	4	0.7
Residence Nature		
With family	453	84.7
Not with family	82	15.3
Academic performance		
Fair	5	0.9
Good	64	12
Very good	207	38.7
Excellent	259	48.4
Smoking		
Smoker	78	14.6
Ex-smoker	16	3
Not smoker	441	82.4
Coffee Consumption		
Non Coffee drinker	240	44.9
Drink 1 to 2 cups per day	195	36.4
Drink 3 or more cups per day	100	18.7

(*Continued*)

Table 1 (Continued).

	Frequency	Percent
Energy Drinks Consumption		
Consuming energy drinks	110	20.6
Not consuming energy drinks	425	79.4
Do you exercise?		
No	322	60.2
Yes	213	39.8
Have you ever been infected with Coronavirus (COVID-19) before?		
Yes	246	46
NO	289	54
Have you ever had any evaluation of your psychological state by specialists?		
Yes	58	10.8
NO	477	89.2
Have you ever been diagnosed with any mental illness (such as depression, frustration, sadness, etc.)		
Yes	82	15.3
NO	453	84.7
How difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?		
Not difficult at all	84	15.7
Somewhat difficult	295	55.1
Very and extremely difficult	156	29.2

Depression Screening and Severity

Figure 1 shows the percentages of depression according to severity: 10% of the study participants had minimal or no depression, 18.7% had mild depression, 26.2% had moderate depression, 19.3% had moderately severe depression, and 25.8% had severe depression.

Depression Score Stratified by Participants' Demographic Characteristics

Table 2 shows participant demographics characteristics and their associated mean depression scores. The mean depression score significantly differed across participants based on different demographical characteristics ($p<0.05$) Younger university students (aged 18–20 years), females, consumers of energy drinks, students who had a previous psychological evaluation by a specialist, those diagnosed with any mental illness, and those who encountered very or extreme difficulties in their lives tend to have higher depression mean scores compared with others ($p<0.05$). On the other hand, students from the faculty of medicine and those practicing exercise tend to have lower depression mean scores than others ($p<0.05$), Figure 2.

Nationality, residence nature, academic performance, smoking, coffee consumption, and previous COVID-19 infection did not show any statistical differences in mean depression scores ($p>0.05$) (Table 2).

Predictors of Participants' Higher Depression Score

The mean depression score for the study participants was 13.9 (SD: 7.1) out of 27, representing a moderate level of depression. Binary logistic regression analysis identified that those who drink 3 or more cups of coffee per day, those

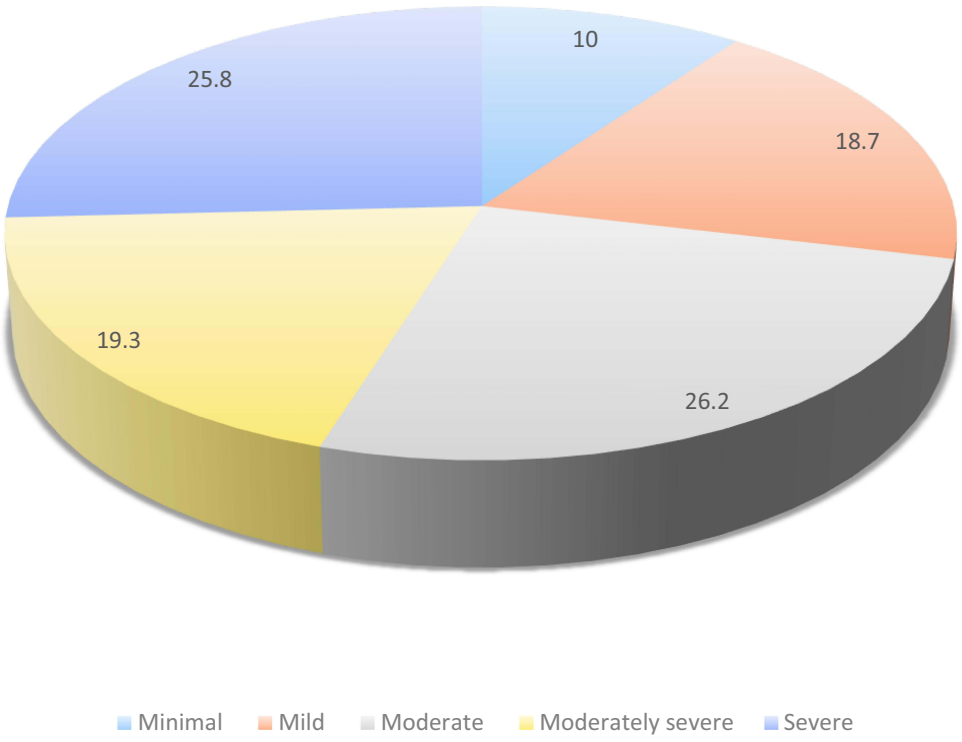

Figure 1 Percentages of depression according to severity.

who have had an evaluation of their psychological state by specialists before, and those who have been diagnosed with any mental illness were more likely to have a higher depression score compared to others ($p<0.05$). On the other hand, students who were aged 24 years and older, and those who practiced regular exercise were less likely to have a higher depression score compared to others ($p<0.05$) (Table 3).

Table 2 Depression Score Stratified by Participants' Demographic Characteristics

Factor	Mean (SD)	P-value
Age range (years)		
1- (18–20)	15.35 (6.84)	
2- 21–23	13.87 (7.26)	0.00
3- ≥24	12 (6.81)	
Gender		
Female	14.41 (6.90)	0.01
Male	12.65 (7.54)	
Nationality		
Jordanian	14.08 (7.07)	0.06
Non-Jordanian	11.81 (7.51)	
Faculty		
1-Faculty of Medicine	10.15 (6.75)	0.00
2-Faculty of Dentistry	15.02 (6.48)	
3-Faculty of Pharmacy	14.71 (7.17)	
4-Faculty of Nursing	14.60 (6.69)	
5-Faculty of Applied Medical Sciences	13.71 (6.48)	
6-Faculty of Computer and Information Technology	14.46 (6.73)	
7-Faculty of Architecture and Design	16.18 (5.62)	

(*Continued*)

Table 2 (Continued).

Factor	Mean (SD)	P-value
8-Faculty of Agriculture	14.21 (5.84)	
9-Faculty of Engineering	15.24 (7.46)	
10-Faculty of Science and Art	16.86 (6.32)	
11-Faculty of Veterinary Medicine	16.00 (11.69)	
12-Faculty of Graduate Studies	11.62 (7.22)	
Residence nature		
With family	13.99 (7.11)	0.5
Not with family	13.60 (7.19)	
Academic performance		
Fair	19.20 (7.05)	0.19
Good	14.98 (7.33)	
Very good	13.92 (7.28)	
Excellent	13.58 (6.91)	
Smoking		
Non smoker	13.85 (7.01)	0.26
Ex-smoker	11.81 (9.88)	
Current smoker	14.82 (7.08)	
Coffee consumption		
Non drinker	13.44 (7.30)	0.07
Light drinker (1–2 cups per day)	13.80 (7.18)	
Heavy drinker (3 or more cups per day)	15.37 (6.41)	
Energy drink consumption		
Not consuming energy drinks	13.57 (7.10)	0.02
Consuming energy drinks	15.33 (7.04)	
Practicing exercise.		
No	14.49 (7.11)	0.02
Yes	13.08 (7.07)	
Previous Coronavirus (COVID-19) infection.		
No	14.14 (7.07)	0.47
Yes	13.69 (7.19)	
Previous psychological evaluation by a specialists.		
No	13.71 (7.12)	0.04
Yes	15.71 (6.95)	
Diagnosis with any mental illness.		
No	13.37 (7.06)	0.00
Yes	17.04 (6.66)	
Difficulty encountered at home, work, on dealing with people.		
Not difficult at all	6.7 (5.60)	0.00
Somehow difficult	12.95 (5.91)	
Very or extremely difficult	19.68 (5.32)	

Discussion

In our study, we addressed the gap in the literature on depression among Jordanian university students post-COVID-19 pandemic, and we examined multiple factors that may be associated with this mental issue. Of the 535 participants in our study, the prevalence of depression (ranging from minimal to severe) was 89.9%. Previous studies in Asia indicate a range of between 4% and 79.2% among university students.[29–31] A previous study conducted in Jordan in 2008 showed a 75% prevalence of depression among university students.[23] During the COVID-19 pandemic home quarantine in 2021, the prevalence of depression was 78.7% among students of Jordanian universities.[26] Previous research examined the

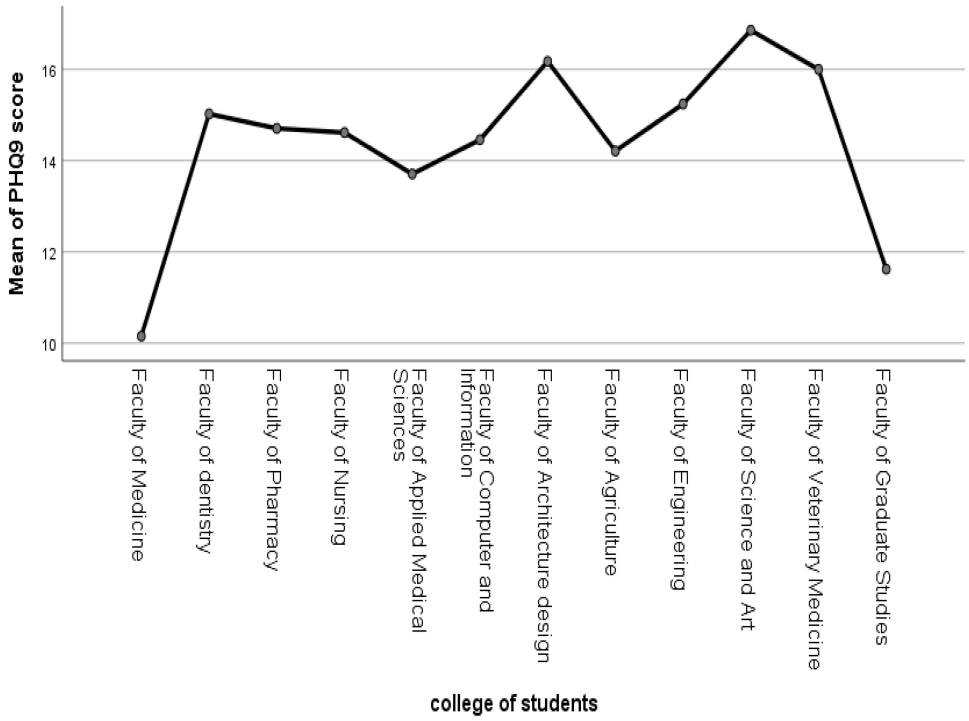

Figure 2 Depression score according to the college of students.

psychological burden of the pandemic and reported that nursing students demonstrated notable levels of distress.[20] Stress level found a significant association with first-year academic level and family members in the medical profession. The utilization of acceptance and religious/spiritual coping methods enabled students to effectively manage stress.[20] Another study found that the majority of nursing students experienced stress ranging from moderate to high levels. It has been proven that there is a significant but weak negative correlation between self-esteem and depression.[21]

Table 3 Binary Logistic Regression Analysis

Variable	Odds Ratio of Having Higher Depression Score	p-value
Age range		
18–20 (Reference group)	1.00	
21–23	1.08 (0.77–1.52)	0.661
≥24	0.54 (0.36–0.83)	0.004**
Gender		
Males (Reference group)	1.00	0.122
Females	1.35 (0.92–1.98)	
Nationality		
Jordanian (Reference group)	1.00	0.213
Non-Jordanian	0.64 (0.32–1.29)	

(*Continued*)

Table 3 (Continued).

Variable	Odds Ratio of Having Higher Depression Score	p-value
Residence Nature		
With family (Reference group)	1.00	0.459
Not with family	1.14 (0.81–1.61)	
Academic performance		
Fair (Reference group)	1.00	
Good	1.39 (0.82–2.36)	0.216
Very good	0.99 (0.70–1.40)	0.947
Excellent	0.84 (0.60–1.18)	0.313
Smoking		
Smoker (Reference group)	1.00	
Ex-smoker	0.62 (0.22–1.72)	0.356
Not smoker	1.26 (0.78–2.03)	0.352
Coffee Consumption		
Non Coffee drinker (Reference group)	1.00	
Drink 1 to 2 cups per day	0.95 (0.67–1.36)	0.788
Drink 3 or more cups per day	1.56 (1.01–2.43)	0.046*
Energy Drinks Consumption		
Not consuming energy drinks (Reference group)	1.00	
Light consumption	1.64 (0.99–2.69)	0.053
Heavy consumption	1.18 (0.60–2.32)	0.637
Do you exercise?		
No (Reference group)	1.00	0.019*
Yes	0.66 (0.47–0.93)	
Have you ever been infected with Coronavirus (COVID-19) before?		
No (Reference group)	1.00	0.438
Yes	0.87 (0.62–1.23)	
Have you ever had any evaluation of your psychological state by specialists?		
No (Reference group)	1.00	0.004**
Yes	2.34 (1.31–4.16)	
Have you ever been diagnosed with any mental illness (such as depression, frustration, sadness, etc.)		
No (Reference group)	1.00	<0.001
Yes	3.16 (1.89–5.29)	

Notes: *p<0.05; **p<0.01.

Due to the different methods used in previous studies to diagnose depression, we cannot accurately predict the actual increase in its prevalence. The high percentages of depression in our study may result from the shift in learning methods to online and hybrid learning, which puts high pressure on the students in front of this new challenge. Also, many families lost their occupations after the pandemic, which caused financial difficulties. These results need more attention from the decision-makers in the universities and the healthcare system to take steps to minimize this problem.

We found that the severity of depression symptoms also increased compared to previous studies; moderately severe and severe depression were 45.1% in our study compared to 22.3% in a study conducted during the pandemic that used the same PHQ-9 scale.[32] In our study, the PHQ-9 score was higher in female than male students. This result is consistent with Centers for Disease Control and Prevention (CDC) reports showing that women were almost twice as likely as men to have had depression during 2013–2016. Similar results were found in recent studies,[25,33,34] which indicated higher depression values among females compared to males. Gender differences in depression have been described previously, and several studies have demonstrated that female gender is a risk factor for developing depression. This difference could be due to the increased frequency of hormonal changes in women compared with men.[35] Social differences between males and females may also explain these differences.[36]

We found an inverse relationship between the student's age and the depression score. The same was noted in a previous study on medical students in Saudi Arabia, where depression was higher in the first two years and then dropped in the third year.[37] Another study in China showed that depression is higher in the first three academic years and then decreases in the fourth year[38] This result was also shown in other studies.[39,40] This result may be due to the new challenges the junior students encounter at their university, separation from family, change of friends, academic pressure, and engagement in more social activities.[40–42]

Many studies discuss depression in medical students,[36,43] but very few deal with other faculties. In our study, medical students had the lowest depression scores compared with other faculties mentioned in the result section. Our result was like that of a study that revealed that medical students had a lower severity of depression compared with non-medical students.[44] This may be attributed to the hypothesis that medical students are afraid of the stigma of being diagnosed and treated for depression or a similar psychiatric condition. They are afraid that a diagnosis of psychiatric illness could interfere with academic standing and the acquisition of competitive residency positions.[45] Art and science faculty students had a higher mean depression score. A previous study in the art and science faculty showed high depression in these specialties.[46] In literature, most universities have an art faculty alone or with music; the same is true for the science faculty, which is usually a separate faculty. The art faculty may have more depressive symptoms attributed to factors associated with the stress of college life, financial problems, and the uncertainties of future careers associated with this chosen faculty.[47]

Students who consumed energy drinks had a higher mean depression score than those who did not; one study found a relationship between the frequency of energy drink consumption and depression, but the study does not ensure the cause-result relationship.[48] Another study held over two years to investigate the effects of energy drink consumption on depression found an increase in depression among male participants.[49] Depression decreases after the ingestion of energy drinks transiently, but it is the most common psychological side effect of energy drink use; probably, it is an initial effect that will then change.[50]

In our study, practicing exercise was associated with a decrease in the mean depression score. In the literature, exercise is considered one of the non-pharmacological treatments for several mental illnesses, including depression.[51–53] Exercise training causes an increase in anti-inflammatory and anti-oxidant enzymes[54] and a decrease in IL-6 levels.[55] These markers are altered in depressed people. Individuals previously diagnosed with mental illness displayed a higher average score on the PHQ-9 than those without such diagnoses. A prospective national study revealed that not only was the relative risk of depression particularly high within the first year following a non-affective disorder diagnosis, but it also remained significantly elevated for more than five years compared to young individuals without such disorders.[56]

Our results revealed that students who had previously undergone psychological assessments by a specialist exhibited greater depressive symptoms. Numerous studies have explored the various psychological facets that are linked to depression, such as adverse self-perception, susceptibility to rejection, neuroticism, excessive contemplation, negative emotional tendencies, and other related factors.[57] This is logical since those who complain of depressive symptoms will

seek medical attention to assess their psychological state. Depression makes it difficult for the affected person to deal with daily life and work.[4] In our study, the difficulty encountered by the person in his life increased with his depression score, so the greater the depression severity, the greater the effect on his life. Consumption of three or more cups of coffee was associated with an increased depression score. Previous studies showed that heavy consumption of coffee was associated with a higher risk of depression,[58,59] as most people will have sleep problems that will affect their minds. Also, depressed people might choose to consume more caffeine as a form of self-medication.

Our study has limitations in that it is an observational study conducted using an online questionnaire. This might have affected the generalizability of our study findings due to the restriction of our study population to social media users. The cross-sectional study design restricted our ability to explore causality among our study variables.

Conclusion

Depression is a prevalent mental health issue observed among university students globally, which has been exacerbated by the onset of the COVID-19 pandemic. This psychological condition has a significant impact on the overall psychological well-being of people within the community. The likelihood of experiencing higher depression scores is greater among students who use three or more cups of coffee daily, have undergone a pre-evaluation of their psychological condition by professionals, and have received a diagnosis of a mental disorder, in comparison to their counterparts. In contrast, individuals who were 24 years of age or older and engaged in regular exercise exhibited a decreased likelihood of having elevated depression scores in comparison to their counterparts. It is imperative for policymakers at Jordanian institutions to develop comprehensive strategies aimed at offering necessary mental support to these populations following the end of the pandemic.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval and Informed Consent

We obtained approval for our study from the Institutional Review Board (IRB) of the Jordan University of Science and Technology (number 2021/678). Informed consent was obtained from all subjects involved in the study. The study was designed and conducted in accordance with the ethical principles that have their origin and comply with the Declaration of Helsinki.

Acknowledgment

We thank the Jordan University of Science and Technology for its support.

Author Contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work. All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Funding

The research received no external funding.

Disclosure

The authors declare no conflicts of interest in this work.

References

1. Freidrich M. Depression is the leading cause of disability worldwide. *JAMA*. 2017;317(1517):10.1001.
2. Depression W. *Other common mental disorders: global health estimates*. Geneva: World Health Organization; 2017. 24.
3. American Psychiatric Association D, Association AP. *Diagnostic and Statistical Manual of Mental Disorders: DSM-5: American Psychiatric association*. Washington, DC; 2013.
4. Depression N. the Treatment and Management of Depression in Adults (Update). *NICE Clinical Guideline*. 2009;90.
5. Ibrahim AK, Kelly SJ, Adams CE, Glazebrook C. A systematic review of studies of depression prevalence in university students. *J Psychiatr Res*. 2013;47(3):391–400. doi:10.1016/j.jpsychires.2012.11.015
6. Kaplan GA, Shema SJ, Leite CMA. Socioeconomic determinants of psychological well-being: the role of income, income change, and income sources during the course of 29 years. *Ann Epidemiol*. 2008;18(7):531–537. doi:10.1016/j.annepidem.2008.03.006
7. Blanco C, Okuda M, Markowitz JC, Liu S-M, Grant BF, Hasin DS. The epidemiology of chronic major depressive disorder and dysthymic disorder: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry*. 2010;71(12):6501. doi:10.4088/JCP.09m05663gry
8. Akhtar P, Ma L, Waqas A, et al. Prevalence of depression among university students in low and middle income countries (LMICs): a systematic review and meta-analysis. *J Affect Disord*. 2020;274:911–919. doi:10.1016/j.jad.2020.03.183
9. Zou Y, Lu Y, Zhou F, et al. Three Mental Health Symptoms of Frontline Medical Staff Associated With Occupational Stressors During the COVID-19 Peak Outbreak in China: the Mediation of Perceived Stress and the Moderation of Social Support. *Front Psychol*. 2022;13.
10. Abu Alhommos AK, Naser AY, Abu Alhommous LK. Psychoeconomic Impact of the Coronavirus Pandemic on the General Population in Saudi Arabia: a Cross-Sectional Study. *Disaster Med Public Health Prep*. 2023;17:e346. doi:10.1017/dmp.2022.303
11. Abuhamdah SMA, Naser AY, Abdelwahab GM, AlQatawneh A. The Prevalence of Mental Distress and Social Support among University Students in Jordan: a Cross-Sectional Study. *Int J Environ Res Public Health*. 2021;18(21):11622. doi:10.3390/ijerph182111622
12. Alqahtani JS, AlRabeeah SM, Aldhahir AM, et al. Sleep Quality, Insomnia, Anxiety, Fatigue, Stress, Memory and Active Coping during the COVID-19 Pandemic. *Int J Environ Res Public Health*. 2022;19(9):4940. doi:10.3390/ijerph19094940
13. Alsairafi Z, Naser AY, Alsaleh FM, Awad A, Jalal Z. Mental Health Status of Healthcare Professionals and Students of Health Sciences Faculties in Kuwait during the COVID-19 Pandemic. *Int J Environ Res Public Health*. 2021;18(4):2203. doi:10.3390/ijerph18042203
14. Alyami HS, Naser AY, Dahmash EZ, Alyami MH, Alyami MS. Depression and anxiety during the COVID-19 pandemic in Saudi Arabia: a cross-sectional study. *Int J Clin Pract*. 2021;75(7):e14244. doi:10.1111/ijcp.14244
15. Naser AY, Al-Hadithi HT, Dahmash EZ, Alwafi H, Alwan SS, Abdullah ZA. The effect of the 2019 coronavirus disease outbreak on social relationships: a cross-sectional study in Jordan. *Int J Soc Psychiatry*. 2021;67(6):664–671. doi:10.1177/0020764020966631
16. Samannodi M, Bulkhi A, Alwafi H, et al. Impact of COVID-19 Pandemic on Medical Education: a Cross-Sectional Study in the Western Region of Saudi Arabia. *Adv Med Educ Pract*. 2022;13:741–754. doi:10.2147/AMEP.S369213
17. Abukhalaf AHI, Naser AY, Cohen SL, von Meding J, Abusal DM. Evaluating the mental health of international students in the U.S. during the COVID-19 outbreak: the case of University of Florida. *J Am College Health*. 2023;1–10. doi:10.1080/07448481.2023.2168547
18. Abukhalaf AHI, Naser AY, von Meding J, Cohen SL, Mehdipour H, Abusal DM. COVID-19 outbreak impact on the wellbeing of migrants in U.S. college towns: the Case of Gainesville, Florida. Qeios. *International Journal of Disaster Risk Reduction*. 2023;96:103973. doi:10.1016/j.ijdrr.2023.103973
19. Cohen S, Abukhalaf AHI. COVID-19's Negative Mental Health Impact Goes Well Beyond Standard At-Risk Populations: action Needs To Be Taken to Combat Long-term Nationwide Emotional Disruption. *Academia Lett*. 2021.
20. Sharma A, Kumar R. Psychological distress and coping styles among baccalaureate nursing students: promoting mental health of future nurses in COVID-19 pandemic. *J Educ Health Promot*. 2022;11(1):331. doi:10.4103/jehp.jehp_1140_21
21. Self Esteem RK. Stress and Depression in Nursing Students. *Indian J Continuing Nursing Educ*. 2016;17(1):30–36.
22. Stallman HM. Psychological distress in university students: a comparison with general population data. *Aust Psychol*. 2010;45(4):249–257. doi:10.1080/00050067.2010.482109
23. Hamdan-Mansour AM, Halabi JO, Dawani HA. Depression, hostility, and substance use among university students in Jordan. *Mental Health Substance Use: Dual Diagnosis*. 2009;2(1):52–63. doi:10.1080/17523280802593301
24. Saadeh H, Saadeh M, Almobaideen W, et al. Effect of COVID-19 quarantine on the sleep quality and the depressive symptom levels of university students in Jordan during the spring of 2020. *Front Psychiatry*. 2021;12:605676. doi:10.3389/fpsyt.2021.605676
25. Naser AY, Dahmash EZ, Al-Rousan R, et al. Mental health status of the general population, healthcare professionals, and university students during 2019 coronavirus disease outbreak in Jordan: a cross-sectional study. *Brain Behav*. 2020;10(8):e01730. doi:10.1002/brb3.1730
26. Hamaideh SH, Al-Modallal H, Tanash M. Hamdan-Mansour3 A. Depression, anxiety and stress among undergraduate students during COVID-19 outbreak and "home-quarantine". *Nursing Open*. 2022;9(2):1423–1431. doi:10.1002/nop2.918
27. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606–613. doi:10.1046/j.1525-1497.2001.016009606.x
28. Shelby LB. Beyond Cronbach's alpha: considering confirmatory factor analysis and segmentation. *Human Dimensions Wildlife*. 2011;16(2):142–148. doi:10.1080/10871209.2011.537302
29. Eskanadrieh S, Liu Y, Yamashina H, et al. Depressive symptoms among international university students in northern Japan: prevalence and associated factors. *J Int Health*. 2012;27(2):165–170.
30. Iqbal S, Gupta S, Venkatarao E. Stress, anxiety & depression among medical undergraduate students & their socio-demographic correlates. *Indian J Med Res*. 2015;141(3):354. doi:10.4103/0971-5916.156571
31. Tuyen NTH, Dat TQ, Nhung HTH. Prevalence of depressive symptoms and its related factors among students at Tra Vinh University, Vietnam in 2018. *AIMS Public Health*. 2019;6(3):307. doi:10.3934/publichealth.2019.3.307
32. Naser AY, Alwafi H, Amara NA, et al. Epidemiology of depression and anxiety among undergraduate students. *Int J Clin Pract*. 2021;75(9):e14414. doi:10.1111/ijcp.14414
33. Abuhammad S, Khabour OF, Alomari MA, Alzoubi KH. Depression, stress, anxiety among Jordanian people during COVID-19 pandemic: a survey-based study. *Informatics Med Unlocked*. 2022;30:100936. doi:10.1016/j.imu.2022.100936

34. Bahhawi TA, Albasheer OB, Makeen AM, et al. Depression, anxiety, and stress and their association with khat use: a cross-sectional study among Jazan University students, Saudi Arabia. *Neuropsychiatr Dis Treat*. 2018;Volume 14:2755–2761. doi:10.2147/NDT.S182744
35. Albert PR. Why is depression more prevalent in women? *J Psychiatry Neuroscience*. 2015;40(4):219. doi:10.1503/jpn.150205
36. González G, Vives A. Work status, financial stress, family problems, and gender differences in the prevalence of depression in Chile. *Ann Work Ex Health*. 2019;63(3):359–370. doi:10.1093/annweh/wxy107
37. Hamasha AA-H, Kareem YM, Alghamdi MS, Algarni MS, Alahedib KS, Alharbi FA. Risk indicators of depression among medical, dental, nursing, pharmacology, and other medical science students in Saudi Arabia. *Int Rev Psychiatry*. 2019;31(7–8):646–652. doi:10.1080/09540261.2019.1584095
38. Liu X, Gao X, Ping S. Post-1990s college students academic sustainability: the role of negative emotions, achievement goals, and self-efficacy on academic performance. *Sustainability*. 2019;11(3):775. doi:10.3390/su11030775
39. Peng P, Hao Y, Liu Y, et al. The prevalence and risk factors of mental problems in medical students during COVID-19 pandemic: a systematic review and meta-analysis. *J Affect Disord*. 2022;321:167–181. doi:10.1016/j.jad.2022.10.040
40. Liu X-Q, Guo Y-X, Zhang W-J, Gao W-J. Influencing factors, prediction and prevention of depression in college students: a literature review. *World J Psychiatry*. 2022;12(7):860. doi:10.5498/wjp.v12.i7.860
41. Abukhalaf AHI, Okhai R, Naser AY, et al. COVID-19 outbreak impact on the wellbeing of migrants in U.S. college towns: the case of Gainesville, Florida. *Int J Dis Risk Reduction*. 2023;96.
42. Alqahtani JS, Mendes RG, Triches MI, et al. Perspectives, practices, and challenges of online teaching during COVID-19 pandemic: a multinational survey. *Heliyon*. 2023;9(8):e19102. doi:10.1016/j.heliyon.2023.e19102
43. Islam MA, Low WY, Tong WT, Yuen CW, Abdullah A. Factors associated with depression among university students in Malaysia: a cross-sectional study. *KnE Life Sci*. 2018;415.
44. Honney K, Buszewicz M, Coppola W, Griffin M. Comparison of levels of depression in medical and non-medical students. *Clin Teach*. 2010;7 (3):180–184. doi:10.1111/j.1743-498X.2010.00384.x
45. Levine RE, Breitkopf CR, Sierles FS, Camp G. Complications associated with surveying medical student depression: the importance of anonymity. *Academic Psychiatry*. 2003;27:12–18. doi:10.1176/appi.ap.27.1.12
46. Wani MA, Sankar R, Rakshantha P, Nivatha A, Sowparnika C, Marak L. Stress anxiety and depression among science and arts students. *Int J Educ Psychol Res*. 2016;5(3):48–51.
47. Ajinkya S, Schaus JF, Deichen M. The relationship of undergraduate major and housing with depression in undergraduate students. *Cureus*. 2016;8 (9). doi:10.7759/cureus.786
48. Kim H, Park J, Lee S, Lee SA, Park E-C. Association between energy drink consumption, depression and suicide ideation in Korean adolescents. *Int j Social Psychiatry*. 2020;66(4):335–343. doi:10.1177/0020764020907946
49. Kaur S, Christian H, Cooper MN, Francis J, Allen K, Trapp G. Consumption of energy drinks is associated with depression, anxiety, and stress in young adult males: evidence from a longitudinal cohort study. *Depress Anxiety*. 2020;37(11):1089–1098. doi:10.1002/da.23090
50. Petrelli F, Grappasonni I, Evangelista D, et al. Mental and physical effects of energy drinks consumption in an Italian young people group: a pilot study. *J Prev Med Hyg*. 2018;59(1):E80. doi:10.15167/2421-4248/jpmh2018.59.1.900
51. Carek PJ, Laibstain SE, Carek SM. Exercise for the treatment of depression and anxiety. *Int j Psychiatry Med*. 2011;41(1):15–28. doi:10.2190/PM.41.1.c
52. Craft LL, Perna FM. The benefits of exercise for the clinically depressed. *Prim Care Companion J Clin Psychiatry*. 2004;6(3):104. doi:10.4088/pcc.v06n0301
53. Schuch FB, Stubbs B. The role of exercise in preventing and treating depression. *Curr Sports Med Rep*. 2019;18(8):299–304. doi:10.1249/JSR.0000000000000620
54. Schuch FB, Deslandes AC, Stubbs B, Gosmann NP, da Silva CTB, de Almeida Fleck MP. Neurobiological effects of exercise on major depressive disorder: a systematic review. *Neurosci Biobehav Rev*. 2016;61:1–11. doi:10.1016/j.neubiorev.2015.11.012
55. Lavebratt C, Herring MP, Liu JJ, et al. Interleukin-6 and depressive symptom severity in response to physical exercise. *Psychiatry Res*. 2017;252:270–276. doi:10.1016/j.psychres.2017.03.012
56. Gundel LK, Pedersen CB, Munk-Olsen T, Dalsgaard S. Longitudinal association between mental disorders in childhood and subsequent depression–A nationwide prospective cohort study. *J Affect Disord*. 2018;227:56–64. doi:10.1016/j.jad.2017.10.023
57. Remes O, Mendes JF, Templeton P. Biological, psychological, and social determinants of depression: a review of recent literature. *Brain Sci*. 2021;11(12):1633. doi:10.3390/brainsci11121633
58. Yu ZM, Parker L, Dummer TJ. Associations of coffee, diet drinks, and non-nutritive sweetener use with depression among populations in Eastern Canada. *Sci Rep*. 2017;7(1):6255. doi:10.1038/s41598-017-06529-w
59. Carlo Tenore G, Daglia M, Orlando V, et al. Coffee and depression: a short review of literature. *Curr Pharm Des*. 2015;21(34):5034–5040. doi:10.2174/1381612821666150825145112