

# Depression, anxiety, and stress and their association with khat use: a cross-sectional study among Jazan University students, Saudi Arabia

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**Background:** Depression, anxiety, and stress levels are considered important indicators for mental health. Khat chewing habit is prevalent among all segments of Jazan population in Saudi Arabia. Few studies have been conducted to evaluate depression, anxiety, and stress among Jazan University students, and information about the correlation between khat use and these disorders is scarce. Thus, this study aims to evaluate the prevalence of depression, anxiety, and stress and their correlation with khat chewing and other risk factors among Jazan University students.

**Methods:** A cross-sectional study was conducted on 642 students from Jazan University. Multistage sampling was used, with probability proportional to size-sampling technique. The Depression, Anxiety, and Stress Scale 21 questionnaire was used to collect the data, which were analyzed using SPSS Version 20.0 software.

**Results:** Moderate depression was prevalent among 53.6% of the sample, anxiety was found among 65.7%, while 34.3% of the students suffered from stress. Female gender was strongly associated with higher mean scores for symptoms of depression, anxiety, and stress, with *P*-values <0.05 for all. Moreover, anxiety symptoms scores were statistically associated with grade point average and caffeine consumption. Khat use was statistically associated with higher mean scores of anxiety among males and a higher mean score of depression and anxiety among females.

**Conclusion:** The results indicate a high rate of symptoms of depression, anxiety, and stress among Jazan University students. Khat use was associated with anxiety, and a higher rate of symptoms of depression, anxiety, and stress was indicated among female students. Therefore, strategy for the prevention and management of depression, anxiety, and stress is highly recommended to minimize the impact of these serious disorders.

**Keywords:** depression, anxiety, stress, DASS-21, khat use, and Jazan

## Introduction

The WHO considers mental health as a fundamental aspect of human health and published an action plan for 2013–2020 to promote the prevention, treatment, and overcoming of mental health disorders.<sup>1</sup> Depression, anxiety, and stress levels are considered important indicators for mental health, and the inability to detect and address these psychological disorders negatively affects individuals.<sup>2,3</sup> University students are increasingly prone to stress, anxiety, and depression, which increase the psychological morbidity and influence their academic performance.<sup>4</sup> Furthermore, stress, anxiety, and depression are linked to several risk factors, such as age;<sup>5</sup> gender, specifically being female, which can be attributed to biological factors;<sup>6,7</sup> academic pressure stemming from factors, including exams and study load and accommodation

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problems,<sup>8</sup> and financial burdens.<sup>9</sup> Conversely, students who are urban residents have lower levels of depression, anxiety, and stress.<sup>6</sup>

Several studies on khat-induced psychological problems have been published, though results seem to be inconsistent. Yeshaw and Mossie (2017) indicated that being a khat user is one of the predictors of depression, anxiety, and stress.<sup>10</sup> Odenwald, 2007 related the psychological effect of khat to its chronic use.<sup>11</sup> Some khat research suggested khat chewing habits to be associated with depression, anxiety and stress.<sup>12,13</sup>

A study conducted on undergraduate students attending Franciscan University, Ohio, in the US indicated the prevalence of depression, anxiety, and stress as 33%, 40%, and 38%, respectively.<sup>14</sup> Moreover, a study conducted in Malaysia showed the prevalence of moderate symptoms of depression, anxiety, and stress as 37%, 63%, and 23.7%, respectively.<sup>5</sup> Additionally, in Hong Kong the prevalence of moderate symptoms of depression, anxiety, and stress as 21%, 41%, and 27%, respectively.<sup>15</sup> In Ethiopia similar findings were reported with the prevalence of moderate symptoms of depression, anxiety, and stress as 35%, 48%, and 18%, respectively.<sup>16</sup> Globally, studies from around the world documented a high prevalence of depression, anxiety, and stress among university students.<sup>17,18</sup> In Saudi Arabia, a study conducted at King Faisal University, Al-Ahsa, recorded the prevalence of depression and anxiety as 24.4% and 18%, respectively,<sup>19</sup> while a study from Jazan University showed that 30% of students suffered from problems related to psychological distress.<sup>20</sup> Because awareness of stress and depression among young adults lead to better management and outcomes,<sup>21</sup> early detection and prevention of psychological problems are crucial to improve students' health.

Few studies have been conducted to evaluate depression, anxiety, and stress among Jazan University students.<sup>20,22</sup> Although some literature documented a high prevalence of khat use among Jazan university students,<sup>23-25</sup> no prior effort has been conducted to assess the association between depression, anxiety, and stress and khat use. This study aimed to evaluate the prevalence of depression, anxiety, and stress and their correlation with khat chewing and other risk factors among Jazan University students.

## Materials and methods

### Design and setting

A cross-sectional study was conducted in April 2018 among Jazan University students. Jazan University, a leading higher education institution with 26 faculties and more than 50,000 students, is located in Jazan, one of the smallest regions in

Saudi Arabia. The region is situated in the southwest of the country and aligns with the southern seaboard of Yemen. According to the 2015 census conducted by the Saudi General Authority of Statistics, the total population of the region is about 1.5 million.

### Sampling procedure

The sample size for this study was calculated to be 712 students, based on a sample size formula for cross-sectional study design. Parameters used for sample size estimation were  $P=50%$ , 95% CI, error below 4%, and a nonresponse rate of 20%. A multistage sampling technique was used. First university colleges were stratified into three strata (health sciences colleges, other science colleges, and nonscience colleges), and then two colleges from each stratum were selected randomly. Finally, the probability proportional to size sampling was used to determine the number of students at each selected college with the random selection of students.

### Data collection

The data were collected using an Arabic self-administered questionnaire consisting of questions about demographic information, such as age, sex, college being attended, academic level, marital status, living standard, place of residence, and grade point average (GPA) and about risk factors, such as khat chewing, smoking, and caffeine consumption. In addition, the questionnaire contained a section on Depression, Anxiety, and Stress Scale 21 (DASS-21). Khat use was measured with two questions on whether the respondent had ever used khat and on the frequency of khat use in the preceding 30 days. Respondents were defined as khat users by ever khat use or use of khat in the preceding 30 days. DASS-21 had previously been translated into Arabic and validated.<sup>26</sup>

The DASS-21 is a shorter version of the DASS designed to measure the constructs of depression and anxiety and to address the failure of earlier emotional measures in discriminating between anxiety and depression. DASS-21, developed by Lovibond and Lovibond to reduce administration time, has been used widely in clinical and nonclinical samples to screen for symptoms at different levels of depression, anxiety, and stress.<sup>27</sup> Participants were asked to rate their perceptions using a 4-point Likert scale (with 0 being *does not apply* and 3 being *very applicable/applies most of the time*). Scores were calculated for depression, anxiety, and stress subscales by summing the scores for each subscale and multiplying by 2. Based on the categorization of Lovibond (1995),<sup>27</sup> the cutoff points are as shown in Table 1.

**Table 1** Prevalence and score severity ratings of depression, anxiety, and stress among Jazan University students

Variable (n=642)	Score severity ratings	Frequency (%)
Depression		
Normal	0–9	203 (31.6)
Mild	10–13	95 (14.8)
Moderate	14–20	214 (33.3)
Severe	21–27	67 (10.4)
Extremely severe	28+	63 (9.8)
M ± SD		14.07±8.83
Anxiety		
Normal	0–7	170 (26.5)
Mild	8–9	50 (7.8)
Moderate	10–14	156 (24.3)
Severe	15–19	86 (13.4)
Extremely severe	20+	180 (28)
M ± SD		13.77±9.08
Stress		
Normal	0–14	316 (49.2)
Mild	15–18	106 (16.5)
Moderate	19–25	128 (19.9)
Severe	26–33	67 (10.4)
Extremely severe	34+	25 (3.9)
M ± SD		15.61±8.56

## Data analysis

Data were entered, cleaned, and analyzed using SPSS version 20 (SPSS Inc, Chicago, IL, USA). Data analysis involved descriptive statistics and several inferential statistics techniques. Normality test for the study variables has been assessed and all variables were normally distributed. The sociodemographic data were presented by frequency and percentage, except age, which was shown by mean (M) and SD. The outcome variables were presented by M's and SD. Bivariate correlation of age with the differences in means of depression, anxiety, and stress symptom scores were used. Student's *t*-tests were used to test the differences in means of depression, anxiety, and stress symptom scores by gender, academic level, khat use, and place of residence, while one-way ANOVA tests were used to test the differences in depression, anxiety, and stress symptom scores by college specialty, marital status, perceived family economic status, GPA, and caffeine consumption. One-way ANOVA tests with a stratified analysis by gender were used to examine the relationship between khat use and the differences in score symptoms of depression, anxiety, and stress.

## Ethics

Ethical approval was obtained from Jazan University Institutional Review Board with reference number (REC39/8S018). Students were told that they have the right to not participate in the study or withdraw from the study at any time. Participants' privacy was respected, and data were kept confidential and used for study purposes only. All participants read, understood, and signed a written consent form.

## Results

The questionnaires were completed by 642 students, which yielded a response rate of 90.16%. Their demographic characteristics are summarized in Table 2. The sample mean age was 22.14 years, with SD of 1.7 years. Of the sample, 51.1% were males. Most of the students in the sample were single and living in rural areas, at 84.4% and 62.8%, respectively. Khat chewing habit was prevalent among 15.3% of the study participants.

The mean scores of symptoms of depression and anxiety were at a moderate level, while stress levels were at mild level (Table 1). The prevalence of moderate symptoms of depression, anxiety, and stress were 53.6%, 65.7%, and 34.3%, respectively.

Student's *t*-tests showed a significant difference between means score of symptoms of depression, anxiety, and stress according to gender (value <0.05 for all). Moreover, one-way ANOVA tests showed that higher mean anxiety symptom scores were associated with GPA and caffeine consumption (Table 3).

Table 4 presents the mean scores of depression, anxiety, and stress according to khat chewing status. Student's *t*-tests revealed that the mean scores of anxiety are significantly different according to khat chewing status for males and hence, khat use was found to be statistically associated with higher mean scores of anxiety. For females, khat use was associated with higher mean scores of depression and anxiety.

## Discussion

The aim of this study was to enrich the epidemiological data about the prevalence and determinants of depression, anxiety, and stress among Jazan University students and evaluate the relationship between khat use and these psychological disorders. The analysis has indicated a high rate of moderate symptoms of depression (53.6%), anxiety (65.7%), and stress (34.3%). Despite the differences in the measuring scales and the sample characteristic in several previous studies, our results were similar to a number of studies,

**Table 2** Sociodemographic characteristics of Jazan University students sample

Characteristics (n=642)	Frequency (%)
Age (M ± SD)	22.14±1.7
Gender (n=642)	
Male	328 (51.1)
Female	314 (48.9)
College specialty (n=642)	
Health sciences colleges	78 (12.2)
Other science colleges	246 (38.3)
Nonscience colleges	318 (49.5)
Academic level (n=639)	
Level 1–6	345 (54)
Level 7–12	294 (46)
Marital status (n=641)	
Single	541 (84.4)
Married	87 (13.5)
Divorced	10 (1.6)
Widowed	3 (0.5)
Perceived family economic (n=640)	
Low	50 (7.8)
Moderate	529 (82.7)
High	61 (9.5)
Place of residence (n=640)	
Urban	238 (37.2)
Rural	402 (62.8)
GPA (n=608)	
4.5–5	136 (22.4)
3.75–4.4	162 (26.6)
2.75–3.74	225 (37)
Lower than 2.75	85 (14)
Khat use (n=642)	
Non khat user	544 (84.7)
Khat user	98 (15.3)
Caffeine consumption (n=624)	
None	168 (26.9)
1–2 cups of coffee per day	372 (59.6)
3 or more cups of coffee per day	84 (13.5)
Smoking (n=622)	
Non-smoker	493 (79.3)
Less than half pack per day	84 (13.5)
Half pack to one pack per day	33 (5.3)
More than one pack per day	12 (1.9)

**Abbreviation:** GPA, grade point average.

which documented a high rate of symptoms of depression, anxiety, and stress.<sup>18,22,28–30</sup>

Conversely, some studies showed lower rates of symptoms of depression, anxiety, and stress.<sup>3,6,14,15,31</sup> In previous

studies, high rates of symptoms of depression, anxiety, and stress seemed to occur in studies conducted in the Middle East and in samples drawn from a health-related college, especially medical schools.

In studying sociodemographic factors, the female gender was highly correlated with high levels of depression, anxiety, and stress compared with those found in males. These findings are similar to findings of a study performed in Egypt,<sup>18</sup> whereas studies done in Turkey and Hong Kong showed high levels of anxiety and stress among female respondents, while depression was not significant.<sup>6,15</sup> On the other hand, some studies showed no significant difference according to gender.<sup>5,17</sup> GPA was inversely correlated with anxiety only. These findings were similar to those of studies done in Egypt and Malaysia.<sup>18,32</sup> Moreover, a similar finding was seen among medical students.<sup>33</sup> In contrast, another study examined the relationship between academic achievement and anxiety using a different scale and found no significant association.<sup>3</sup> In addition, similar to findings reported previously,<sup>30,34</sup> excess caffeine consumption was associated with higher rates of anxiety symptoms. Excess caffeine consumption overactivates the nervous system and produces symptoms similar to those of anxiety.<sup>35</sup> Previous studies of the relationship between caffeine consumption and depression often showed that caffeine can reduce the incidence of depression.<sup>35,36</sup> The study also showed that the risk of depression as a result of caffeine consumption actually fell when individuals increased their daily consumption of caffeine.<sup>35</sup> This study found that risk of depression and caffeine consumption was not significantly correlated. More large population and experimental studies are needed to test this relationship. Other demographic characteristics, such as age, academic level, place of residence, and perceived economic status, were not significantly associated with the psychological disorders under study.

Regarding khat chewing habits, the prevalence of khat use was 98 (15.2 %), with the majority from male students 81 (82.7%), which is consistent with studies from Jazan region<sup>23,24</sup> and elsewhere.<sup>10,13</sup> In the univariate analysis, khat use was not associated with depression, anxiety, and stress. After stratification of the sample by gender, a significant association was found between khat use and anxiety among male students. These results are supported by a study done in Ethiopia, which found a significant association between khat use and depression, anxiety, and stress.<sup>10</sup> Moreover, a study conducted in Ethiopia showed a significant association between khat use and depression and anxiety.<sup>37</sup> Previous study from Jazan region among university students supported

**Table 3** Association of depression, anxiety, and stress and demographic characteristics among Jazan University students

Characteristics n=642	Depression, M (SD)	Anxiety, M (SD)	Stress, M (SD)
All (n=642)	14.07±8.83	13.77±9.08	15.61±8.56
Age	r=0.032 P=0.425	r=0.047 P=0.236	r=0.049 P=0.214
Gender (n=642)			
Male	12.40 (8.16)	11.68 (7.90)	14.65 (8.53)
Female	15.82 (9.17) t = -4.993, P=0.000*	15.94 (9.70) t = -6.082, P=0.000*	16.62 (9.09) t = -2.844, P=0.005*
College specialty (n=642)			
Health sciences colleges	14.53 (10.20)	12.9 (11.63)	16.74 (11.10)
Other science colleges	14.11 (8.54)	13.51 (8.84)	15.74 (8.73)
Nonscience colleges	13.92 (8.72) F = (2, 0.159), P=0.85	14.18 (8.72) F = (2, 0.777), P=0.46	15.24 (8.19) F = (5, 0.944), P=0.39
Academic level (n=639)			
Level 1–6	13.95 (8.45)	13.77 (8.78)	15.57 (8.61)
Level 7–12	14.11 (9.11) t = -2.31, P=0.81	13.65 (9.27) t=0.178, P=0.85	15.63 (9.11) t = -0.78, P=0.93
Marital status (n=640)			
Single	13.59 (8.6)	13.29 (8.94)	15.18 (8.81)
Married	16.46 (9.58)	16.32 (9.31)	17.98 (8.55)
Divorced	16 (8.69)	17.60 (10.14)	18.60 (9.75)
Widow	23.33 (11.79) F = (3, 4.33), P=0.005*	15.33 (11.37) F = (3, 4.45), P=0.016*	20 (13.11) F = (3, 3.16), P=0.024*
Perceived family economic status (n=640)			
Low	16.48 (9.32)	16.44 (8.90)	18.20 (10.02)
Moderate	13.89 (8.74)	13.49 (9.01)	15.45 (8.63)
High	13.80 (9.01) F = (2, 2), P=0.135	14.26 (9.49) F = (2, 2.5), P=0.08	15.18 (9.51) F = (2, 2.3), P=0.10
Place of residence (n=640)			
Urban	14.37 (8.67)	14.24 (8.99)	15.71 (8.63)
Rural	13.59 (9.08) t=1.08, P=0.27	13.05 (9.18) t=1.6, P=0.10	15.52 (9.22) t=0.26, P=0.79
GPA (n=608)			
4.5–5	14.63 (9.13)	14.07 (9.62)	15.34 (8.23)
3.75–4.4	13.09 (8.50)	12.33 (8.20)	14.63 (8.83)
2.75–3.74	14.22 (8.73)	14.12 (9.37)	16.19 (9.15)
Lower than 2.75	15.79 (9.31) F = (3, 1.87), P=0.13	15.88 (8.97) F = (3, 3.01), P=0.03*	17.41 (9.18) F = (3, 2.13), P=0.09
Khat use (n=642)			
Non khat user	13.88 (8.81)	13.50 (9.12)	15.42 (8.83)
Khat user	15.14 (8.89) t = -1.3, P=0.19	15.27 (8.71) t = -1.8, P=0.69	16.69 (8.92) t = -1.3, P=0.19
Caffeine consumption (n=624)			
None	14.23 (9.21)	12.96 (9.28)	15.54 (8.89)
1–2 cups per day	13.60 (8.49)	13.53 (8.66)	15.12 (8.49)
3 or more cups per day	15.74 (9.34) F = (2, 2.06), P=0.12	16.14 (9.85) F = (2, 3.72), P=0.02*	17.45 (9.85) F = (2, 12.4), P=0.09

**Note:** \*Statistically significant.

**Abbreviation:** GPA, grade point average.

an association between Khat chewing and anxiety.<sup>38</sup> Among female respondents, there was a significant association between khat use and depression and anxiety, but this finding is inconclusive due to the small sample of female

khat users. Khat use was further associated with more mood disturbances than experienced by those who did not use khat and significantly associated with depression, anxiety, and cortisol stress response.<sup>39</sup>

**Table 4** Correlation of depression, anxiety, and stress with khat use status stratified by gender among Jazan University students

Characteristics	Frequency (%)		Depression		Anxiety		Stress	
	No	%	M	SD	M	SD	M	SD
Male	328	100	12.40	8.16	11.68	7.90	14.65	8.53
Non khat user	247	75.3	11.94	8.07	10.91	7.58	14.15	8.31
Khat user	81	24.7	13.78	8.33	14.02	8.42	16.15	9.04
			$t = -1.7, P=0.08$		$t = -3.1, P=0.002^*$		$t = -1.8, P=0.07$	
Female	314	100	15.82	9.17	15.94	9.70	16.62	9.08
Non khat user	297	94.6	15.48	9.09	15.64	9.72	16.47	9.13
Khat user	17	5.4	21.65	8.83	21.18	7.78	19.29	8.02
			$t = -2.72, P=0.007^*$		$t = -2.3, P=0.02^*$		$t = -1.24, P=0.21$	

Note: \*Statistically significant.

Chronic stress was linked with chronic diseases, such as cardiovascular diseases and metabolic syndrome.<sup>40,41</sup> Our study showed a high rate of depression, anxiety, and stress in young population. Thus, the implications of these results are very important for public interventions to manage and prevent those psychological disorders to limit their impact.

Moreover, our results showed that individuals who use khat are at higher rates of mental distress. Thus, preventive measure to minimize khat use could improve mental health. However, causal association could not be established due to cross-sectional nature of the study, which omits the temporal relationship between depression, anxiety, and stress and sociodemographic factors, such as khat use, gender, and caffeine consumption. Moreover, this study was based on a self-administered questionnaire, which increases the probability of reporting bias. Moreover, DASS-21 is not a diagnostic tool and is only useful for screening purposes.

## Conclusion

The study has clearly shown that depression, anxiety, and stress are highly prevalent among Jazan University students. Khat use was associated with anxiety. Female students showed a higher rate of symptoms of depression, anxiety, and stress. Findings from this study necessitate that implementing strategy for the prevention and management of depression, anxiety, and stress is highly recommended to minimize the impact of these disorders.

## Acknowledgments

We acknowledge the general assistance provided by Jazan University in the completion of this study. No specific fund was accessed for the research.

## Author contributions

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; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

## Disclosure

The authors report no conflicts of interest in this work.

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