

## **Association Between Stress, Anxiety, Depression and Periodontitis among a Sample of Egyptian Dental Students: A Cross-Sectional Study**

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**Aim:** The current study aims to assess if there is an association between stress, anxiety, depression and periodontitis among a sample of Egyptian dental students.

**Materials and Methods:** A cross-sectional approach and DASS- 21 was used to assess the prevalence of stress, anxiety and depression among dental students. The study was conducted at faculty of Dentistry, Egyptian Russian University during the period between October 2023 to January 2023. The study was conducted on 320 dental students selected by consecutive sampling technique. Periodontal examination was performed to determine healthy, biofilm induced gingivitis or periodontitis with definite stage. Multivariate regression analysis was fitted to study the association. Odds ratios OR with the corresponding 95% confidence interval 95% CI was computed to assess the strength of association.

**Results:** The results showed 56.2% male students have moderate to severe depression compared to 61.1 % female students having moderate to severe depression with no significant difference. There was a significant difference between females and male students as regard to stress and anxiety. There was no statistically significant difference between 4th and 5th academic class in stress, anxiety nor depression. As regard to association to periodontitis, no association was found between stress, anxiety nor depression and periodontitis.

**Conclusion:** No significant association was found between stress, anxiety nor depression and periodontitis among Egyptian dental students.

**Keywords:** Periodontitis, DASS, Stress, Anxiety and Depression.

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## Introduction

Dysbiotic plaque biofilm is the main etiologic factor for the chronic multifactorial inflammatory diseases known as periodontitis. In spite of the chronic nature of the disease; it may lead to teeth loss if left untreated.<sup>1</sup> It's the immense arrays of harmful chemical and cytokines released as host response to the microbial plaque that contribute to the greatest destruction seen in periodontitis.<sup>2,3</sup> This host microbial interaction could be modified by several local and systemic factors.<sup>3</sup> Among these factors; psychological disorders have gained researchers attention in the last decade.<sup>4</sup> The link between stress, anxiety, depression and periodontitis is an area of controversy whereas several studies report significant association and others report no association between them.<sup>5,6</sup> Stress is defined as a psychophysical consequence of a variety of emotional, cognitive, or social demands that the person perceives as being excessive and involves a variety of physiological and emotional responses.<sup>7</sup> It has three phases: alarm, resistance, and exhaustion.<sup>7</sup> It is also can be categorized into acute and chronic according to how long it lasts.<sup>7</sup>

Chronic stress is identified as a major contributor to depression, a mood illness that results in a persistently down mood, lack of interest in activities, and a decrease in energy.<sup>8</sup> Anxiety is a generalized sensation of restlessness, uncontrolled concern, or unease that an individual experience for unidentified or non-specific reason. It frequently comes with bodily symptoms, tension in the muscles, agitation, and disturbed sleep.<sup>9</sup> These psychological and behavioral health issues were recently reported as a serious public health issue, particularly among university students, which necessitate further epidemiological information.<sup>10</sup>

There is currently an insufficient amount of data supporting the link between mental health conditions and periodontal

disease.<sup>11</sup> It has been proposed that the same etio-pathogenic causes underlying both stress and periodontitis. Pro-inflammatory cytokines are among the common pathways that are implicated in both depression and periodontal diseases.<sup>7</sup> Psychological stress may cause disturbance in the periodontal immune homeostasis in several manners. Disruption of hypothalamic–pituitary–adrenal cortex system, the locus ceruleus–sympathetic–adrenal medulla system, and the peptidergic nervous system are all among the suggested mechanisms.<sup>12</sup>

Students studying medicine are frequently exposed to stress and despair. As they transition from being school students to being young physicians, they deal with several stressors. The growing demands of the medical college, challenging subjects that must be studied within a short period of time, financial concerns, and a lack of supervision are all elements that contribute to the rising stress at medical colleges.<sup>9</sup> The frequency of stress, anxiety, and depression among medical students in Egypt, Saudi Arabia, and the United Arab Emirates has lately been found to have grown.<sup>13</sup> The purpose of this study is to assess the association between stress, anxiety, depression, and periodontitis among dental students using depression, anxiety and stress scale (DASS questionnaire) as an indicator of stress, anxiety, and depression.

## Material and Methods

This cross-sectional study aims to assess if there is an association between stress, anxiety, depression and periodontitis among a sample of Egyptian dental students. The study was conducted on 320 dental students aged between 20- 25 years old who were consecutively recruited from the 4th and 5th class, faculty of Dentistry, Egyptian Russian University during the period between October 2023 to January 2024. A written informed consent was obtained from each participant before enrollment into the

study. The proposal had been reviewed and approved by the Ethical Committee, Egyptian Russian University (FD-ERU-REC) with a final registration number (FD-ERU-REC- 3).

### **Sample size calculation**

Based on the prevalence of stress, anxiety, and depression among medical students<sup>13-15</sup> and the association between stress and periodontitis,<sup>16</sup> the total sample size had been calculated to be 320 dental students by adopting a confidence interval of 95%, a margin of error of 5% with finite population correction. Sample size calculation was performed using Epi info for windows version 7. 2.

### **Questionnaire**

This study was conducted on a consecutive random sample of the 4<sup>th</sup> and 5<sup>th</sup> year class after explaining the nature of the study to the student and ensuring their acceptance. A self-administered questionnaire consisting of 21 questions representing a short version of Depression, Anxiety and Stress scale DASS-21<sup>17-19</sup> was fulfilled by the participating students. It's a 21- item questionnaire with a four-point answer scale. It's used to assess psychological distress through determining the symptoms of depression, anxiety, and stress over the last week. These items were divided into 3 subscales; depression, anxiety and stress; 7 items for each subscale.

Each subclass's score equals the sum of seven corresponding questions ranging from 0 to 21. The questionnaire was designed as google form and the link was published to the students during the periodontology class to fulfill it if they were willing to participate in the study. The data were extracted and statistically analyzed to detect students with stress, anxiety and depression. It was mentioned that participating students would be subjected to detailed periodontal examination at the Periodontology Clinic, Faculty of Dentistry, Egyptian Russia

University. Students with higher DASS scores were advised to consult the Psychiatric support office at the university to improve their psychological health.

### **Periodontal recruitment:**

The target sample had been reached through consecutive sampling of the students of 4<sup>th</sup> and 5<sup>th</sup> year class who completed the questionnaire.

### **Inclusion criteria:**

All the students of the faculty of dentistry, Egyptian Russian university was the target population however, our sample was achieved through students of the 4<sup>th</sup> and 5<sup>th</sup> year class. All the participants students were medically healthy according to ASA I.<sup>20</sup>

### **Exclusion criteria:**

Students clinically diagnosed as having depression before joining the faculty or students taking medication for management of depression. Smoking students and pregnant females were also excluded from this study as these are a well-known risk factors for periodontal diseases.<sup>21</sup>

### **Periodontal examination:**

All the students who had filled in the DASS questionnaire were subjected to full mouth periodontal examination. Periodontal charts were recorded by two calibrated examiners. Periodontal diagnosis for all cases was achieved based on the new classification system of periodontal and peri-implant diseases 2017.<sup>22</sup>

Healthy gingiva is defined as those cases with no loss of clinical attachment, probing depth not exceeding 3 mm and bleeding on probing less than 10% of all the sites all over the mouth. Gingivitis is defined as those cases with no loss of clinical attachment, probing depth not exceeding 3 mm and bleeding on probing more than 10% of all the sites all over the mouth.<sup>23</sup> For periodontitis diagnosis a detailed periodontal examination was performed to assess clinical attachment loss, radiographic bone loss and number of teeth missed due to periodontal

disease to determine the exact stage of periodontitis corresponding to severity of the case.<sup>24</sup>

Plaque index (PI) had been measured to assess the oral hygiene status of all the participants.<sup>25</sup> Bleeding on probing (BOP), probing depth (PD) and clinical attachment Loss (CAL)<sup>26</sup> were accurately measured for each participant for accurate periodontal diagnosis. After determination of final periodontal diagnosis; all participants were categorized into two groups according to diagnosis: periodontitis group and non-periodontitis group (healthy or biofilm induced gingivitis).

#### **Statistical Analysis:**

The collected data underwent comprehensive statistical analysis using SPSS software, version 28 for windows. Descriptive statistics, including frequencies and percentages, were employed to summarize the demographic characteristics of the participants. A reliability analysis was conducted using Cronbach's alpha coefficient to assess the internal consistency and reliability of DASS score. A higher value of Cronbach's alpha > 0.7 coefficient indicates enhanced internal consistency among the items.

The potential associations between the DASS scores and demographic variables, were examined using chi-square or Fisher's exact test. Regarding the association between the DASS scores and periodontitis, a binary outcome variable was created to classify participants into two distinct groups: "periodontitis" and "non-periodontitis." The DASS scores were categorized into two levels: "normal to mild" and "moderate to extremely severe," utilizing predefined cut off points determined using DASS score 21. To assess the association between the categorized DASS scores and periodontitis, a logistic regression analysis was performed, while adjusting for potential confounding factors. Odds ratios OR and corresponding

95% confidence intervals CI were calculated to estimate the strength and direction of the association. All statistical tests were conducted with two-tailed significance, and a p-value threshold of less than 0.05 was considered statistically significant. When necessary, adjustments were made for multiple comparisons to maintain the overall significance level.

#### **Results**

**Participants demographics:** This study was performed on 320 dental students. Six students were excluded from the study as they are on anti-depressant therapy to end up with a total sample size of 314 students. 36.0% of our sample were female and 64.0% were male. The majority of participants were in grade four (57.5%), followed by grades five (41.4%).

#### **Psychometric evaluation of the participants and association to demographics:**

The results show varying levels of depression, anxiety, and stress among the students according to DASS score, fig (1). Association between items of DASS score and participants demographics were shown in table 1. For depression, there were no statistically significant differences in the distribution of normal to mild depression and moderate to extremely severe depression between genders ( $p = 0.404$ ) and among different grades ( $p = 0.943$ ).

For anxiety, female gender showed a statistically higher levels than males in the distribution of normal to mild anxiety and moderate to extremely severe anxiety ( $p < 0.001$ ) but there was no significant difference among different grades ( $p = 0.622$ ). For stress, also the female gender showed a statistically significant values higher than males in the distribution of normal to mild stress and moderate to extremely severe stress ( $p = 0.011$ ). However, no significant

Table 1: Association between participants' demographics and DASS

		Depression		P-value	Anxiety		P-value	Stress		P-value
		Normal to mild depression	Moderate to extremely severe depression		Normal to mild anxiety	Moderate to extremely severe anxiety		Normal to mild stress	Moderate to extremely severe stress	
Gender	Female	38.9%	61.1%	0.404	25.7%	74.3%	<0.001	50.4%	49.6%	0.011
	Male	43.8%	56.2%		48.8%	51.2%		65.2%	34.8%	
Grades	Grade four	41.7%	58.3%	0.943	38.9%	61.1%	0.622	58.3%	41.7%	0.702
	Grades five	42.3%	57.7%		43.1%	56.9%		61.5%	38.5%	

Data presented as percentage.

differences were observed in stress levels among different grades ( $p = 0.702$ ).

These findings suggest that there may be some variations in anxiety and stress levels among different demographic groups, but no significant associations were observed between depression and demographic in this sample of Egyptian dental students.

#### Periodontitis diagnosis of the participants and its association with DASS:

The final periodontal diagnosis for all the participants was determined as healthy gingiva, biofilm induced gingivitis or periodontitis. Out of the participants, 79.3% were diagnosed as non-periodontitis (healthy or plaque induced gingivitis), and 20.7% were diagnosed with periodontitis, fig (2). Periodontal parameters as BOP, PI, PD and CAL was recorded for all the participants and each participant were diagnosed as either periodontitis or non-periodontitis table (2).

#### Association between periodontitis and DASS

The association between periodontitis and the three components of DASS; stress, anxiety and depression are presented in Table (3). No significant associations were found between periodontitis and stress, anxiety nor depression.

Table 2: Periodontal parameters of the participants

	Non-Periodontitis		Periodontitis				P-value
	Healthy + Gingivitis		Stage I periodontitis		Stage II Periodontitis		
	Mean	SD	Mean	SD	Mean	SD	
PI	16.45	7.81	30.40	5.45	36.83	5.42	<0.001
BOP	27.09	12.93	43.40	6.11	50.17	8.06	<0.001
PD	1.96	0.26	3.48	0.85	4.83	0.75	<0.001
CAL	0	0	1.79	0.52	2.83	0.75	<0.001

Data presented as mean, standard deviation (SD) and number and percentage

Table 3: Association between stress, anxiety, depression and periodontitis

		Diagnosis		P-value
		Non-periodontitis	Periodontitis	
Depression	Normal to mild depression	80.3%	19.7%	0.709
	Moderate to extremely severe depression	78.6%	21.4%	
Anxiety	Normal to mild anxiety	81.9%	18.1%	0.350
	Moderate to extremely severe anxiety	77.5%	22.5%	
Stress	Normal to mild stress	80.3%	19.7%	0.586
	Moderate to extremely severe stress	77.8%	22.2%	

Data presented as percentage

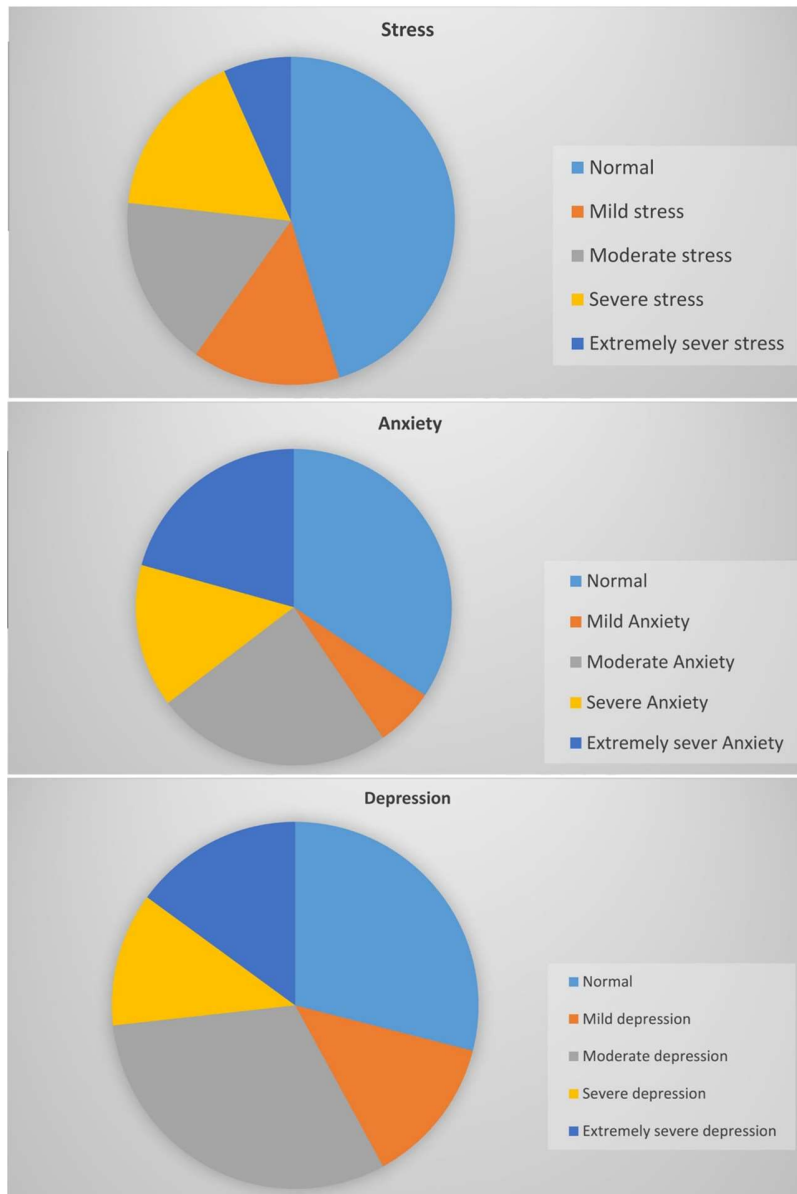


Figure 1: levels of depression, anxiety, and stress among the students according to DASS score

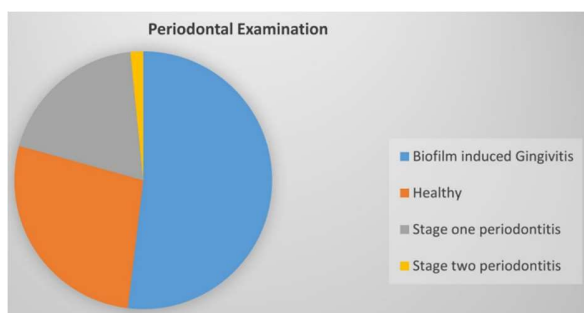


Figure 2: final periodontal diagnosis for all the participants was determined as healthy gingiva, biofilm induced gingivitis or periodontitis

### Periodontitis predictors within the study participants:

To identify potential predictors of periodontitis within our sample; a multivariate logistic regression analysis was conducted, adjusting for potential confounding factors. The results are shown in Table 4. Gender was identified as a significant predictor of periodontitis (OR = 2.658, 95% CI: 1.332, 5.302,  $p = 0.006$ ). However, depression, anxiety, stress, and grades did not significantly predict the presence of periodontitis.

Table 4: Multivariate analysis of factors that predict the periodontitis in the study participants

Predictors	OR 95% CI	P-value
Depression	0.989 (0.942, 1.039)	0.664
Anxiety	1.016 (0.964, 1.071)	0.547
Stress	1.012 (0.958, 1.068)	0.676
History of medical illness	0.920 (0.343, 2.466)	0.869
Gender	2.658 (1.332, 5.302)	<b>0.006</b>
Grades	0.569 (0.054, 6.004)	0.639

Data presented as number and percentage (odds ratio) and 95% Confidence interval of the OR

### Discussion

Dysbiotic plaque is the primary cause of the chronic inflammatory disease chronic periodontitis.<sup>13</sup> Research on the association

between mental health problems and periodontal disease is still pending. The impact of one psychiatric condition as anxiety or depression on periodontitis has been evaluated in several research. To our knowledge, however, this is the first study to examine the relationship between periodontitis on one hand and stress, anxiety, and depression on the other hand. Since most research examine the prevalence of stress, anxiety, and depression among medical students, the fact that we focused on dentistry students makes our study unusual.<sup>9, 13, 2</sup>

DASS-21; a condensed form of the original DASS is a self-report psychometric tools that allows for reliable and standardized recording of feelings and symptoms. It has the advantage of simultaneous assessment of stress, anxiety and depression in one score. A critical shortcoming within this score is its failure to evaluate key crucial signs of depression, such as sleep deprivation, appetite loss, and suicidal ideation.<sup>28</sup> However, the authors believed that the DASS scale was sufficient for a psychometric evaluation within this study because determining the severity of depression was not the study's primary objective.

In this study, the authors gave gender and academic year precedence over other demographics as socioeconomic characteristics and transportation to the faculty; because as the primary focus of this study was the association between psychological disorders and periodontitis not predictors of psychological disorders.

The bivariate regression analysis carried out in the current study revealed that there was no statistically significant difference in the prevalence of depression between students who were male or female.<sup>29</sup> This was consistent with Faud et al.,<sup>27</sup> who found no significant difference between male and females. They used DASS score to assess the prevalence of stress, anxiety and

depression among medical students of Malaysia.

As regard to stress; our study discovered a statistically significant difference in stress ( $P < 0.01$ ) between females and males, 49.6% and 34.8% respectively. This was in accordance with Raja et al,<sup>15</sup> who found that females showed higher statistically significant levels of stress, anxiety and depression than males within a sample of Indian medical students using the same DASS score. In terms of anxiety, there was also a statistically significant difference between females and males 74.3% and 51.2% respectively ( $P 0.001$ ). This was consistent with Alibudbud<sup>30</sup> Kebede<sup>9</sup> and Raja<sup>15</sup> who found that female medical students had higher levels of anxiety. This conclusion was ascribed to heightened exposure to significant life events, gender-specific responsibilities, and more limited social networks.

Regarding the correlation between academic year and the prevalence of stress, anxiety, and depression, there was no statistically significant difference between the 4th and 5th year classes. This could be explained by the fact that; the 4th and 5th grade classes' share the same clinical sciences, although the curricula are distinct so they are exposed to similar amounts of stressors. Our findings differed with those of Kebede<sup>9</sup> who found a statistically significant difference in the levels of depression and anxiety among first-year students compared to those in their final year. They attributed that to the setting altering, the new learning approach of the first year students and the final year students' familiarity with the intense environment of the medical college. In this cross-sectional study, all students underwent a complete periodontal examination, using the new classification system of periodontal and peri-implant diseases, they were all classified as either periodontitis group or non-periodontitis (if

they had healthy or biofilm-induced gingivitis.<sup>22</sup>

Multivariate regression analysis was utilized to investigate the relationship between stress, anxiety, depression, and periodontitis throughout the whole sample. It was discovered that there was no association between periodontitis and stress, anxiety, or depression. This result is consistent with Solis et al.<sup>16</sup> who found no association between depression or psychiatric symptoms and periodontitis. They recommend assessing this association within patients of anxiety and depression disorders.

Our results were different from Hsu, Penmetsa and Wang<sup>8, 31, 32</sup> who could identify a connection between periodontitis and sadness or mental symptoms. They suggest looking into this connection in people with anxiety and depressive illnesses. This can be explained by the different research design used by Hsu et al., who carried out a 10-year longitudinal cohort study. This was very unlike from our cross-sectional study, which was conducted over a three-month period. Additionally, Hsu et al.<sup>8</sup> did not rule out additional comorbidities like diabetes, alcoholism, or cancer that can accelerate periodontal deterioration.

In the same manner, Huang, Wang, and Chang's population-based cohort research from 2001 to 2012 examined the relationship between chronic periodontitis and bipolar disorder.<sup>32</sup> After 7 years of follow-up, they discovered that the chronic periodontitis group had a considerably higher incidence rate of bipolar illness than the non-CP cohort. Additionally, the earlier study did not rule out additional comorbidities that affect periodontitis. According to their claims, bipolar disorder is more common because periodontal pathogens like Aa and porphyromonus gingivalis may directly penetrate the brain through the vascular system, activate microglia and immune cells, and cause neuroinflammation. Another



supposition is that sad emotions are accompanied by increased expression of pro-inflammatory cytokines like IL-6. These inflammatory cytokines play an important role in the development of chronic periodontitis.<sup>32</sup>

Several studies have assessed the association between anxiety and periodontitis. Aragão et al.<sup>6</sup> performed a systematic review evaluating the association between anxiety and periodontitis in 11 studies. They showed an increased level of anxiety in periodontitis subjects compared to non-periodontitis subjects where eight out of eleven studies showed association between periodontitis and anxiety. In spite of this positive association; they state that this association has a very low certainty of evidence.

As the results of this study showed no association between stress, anxiety, depression and periodontitis; no further analysis was performed to assess the association between different stages of periodontitis and degrees of stress, anxiety or depression.

Although this study showed no association between stress, anxiety, depression and periodontitis; the authors attribute this to the nature of our sample. The 4<sup>th</sup> and 5<sup>th</sup> year dental students are final year students that have a detailed knowledge in periodontology science and its importance for maintaining oral health and face beauty. This could explain the increased number of healthy subjects in spite of higher DASS score achieved by them. Also, the difference in study design, scores used for measuring anxiety and also sample size may all contribute to difference between our study results and others.

### Conclusion

The present study showed no association between stress, anxiety,

depression and periodontitis among a sample of Egyptian dental students.

### Limitations and Recommendations

A possible limitation within this study is the cross-sectional design which doesn't ensure the temporality of reversible periodontal diseases. Also, the DASS questionnaire which assess the psychological symptoms over a short period of time; last week may lead to misleading psychological evaluation. The authors recommend multi-center studies of the dental students with several questionnaires to increase the validity of the study finding.

### Funding Information

No funding was obtained for this study.

### Data Availability

Data that support the current study are available from the corresponding author upon reasonable request. All data concerned with DASS score were forwarded to the Psychological and Social Counseling unit of the Egyptian Russian University to introduce help to the students in need.

### Declarations

We declare no conflict of interests.

### Ethical Approval

All the procedure performed in this study had been approved by the Ethical Committee, Egyptian Russian University (FD-ERU-REC) with a final registration number (FD-ERU-REC- 3).

### Consent to participate

A written informed consent was obtained from all the study's participants before being enrolled into the study.

### Competing interest

The authors declare that they have no competing interests.

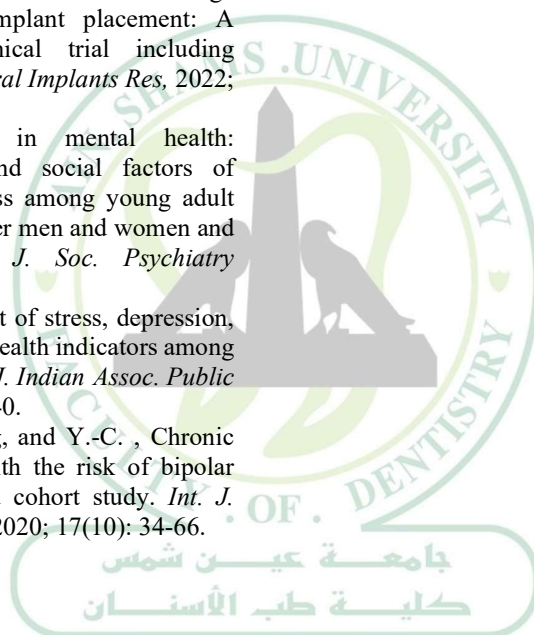
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