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Prevalence of Stress-induced Xerostomia among Libyan Students: A Cross-sectional Study on Exam-related Stress and Its Impact on Oral Health

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ABSTRACT

Objectives: This cross-sectional study aimed to investigate the prevalence of stress-induced xerostomia among Libyan students during exam periods and explore its association with academic-related stress.

Materials and Methods: A total of 700 students from various universities in Libya were selected through convenience sampling. A self-administered questionnaire, including the Perceived Stress Scale (PSS-10) and the Xerostomia Inventory (XI), was used to assess stress and xerostomia symptoms. Statistical analysis was performed using SPSS, employing Pearson's correlation coefficient and logistic-regression models to explore the relationship between stress and xerostomia.

Results: Xerostomia was reported by 48% of students, with a significant positive correlation ($r = 0.58$, $p < 0.001$) between stress levels and xerostomia severity. Health sciences' students exhibited the highest stress and xerostomia prevalence. Logistic regression identified additional variables associated with xerostomia, including gender, study year, and smoking status. High stress remained the strongest predictor of xerostomia ($OR = 3.1$, $p < 0.001$).

Conclusions: The study highlights a significant association between exam-related stress and xerostomia among Libyan students. These findings emphasize the need for stress-management interventions in educational settings, particularly for students in high-stress disciplines.

Keywords: Stress, Xerostomia, Libyan students, Oral health, Exam-related stress, Perceived-stress scale, Xerostomia inventory, Academic pressure.

1. Introduction

Stress significantly influences both physical health and mental health, with important implications for oral health. University students, in particular, experience high levels of stress due to academic pressure, financial concerns, and social expectations. Studies have shown that stress can lead to various health issues, including xerostomia (dry mouth), which may contribute to dental complications, such as tooth decay, gum disease, and oral infections (1). However, the relationship between

stress and xerostomia in students, especially during exam periods, remains underexplored.

Xerostomia occurs when salivary glands fail to produce adequate saliva, which plays a critical role in neutralizing acids, providing antimicrobial activity, and aiding digestion (2). Reduced salivary flow can increase the risk of dental caries and other oral pathologies. Stress affects the autonomic nervous system, including the parasympathetic pathways responsible for stimulating salivary secretion. Chronic stress can reduce salivary

flow, exacerbating xerostomia symptoms (3).

While previous studies have investigated the prevalence of xerostomia among students, most research has been limited to non-Libyan populations. For example, Turner et al. (2021) reported that 37% of medical students in a South Asian university experienced xerostomia during exams (4), and Mahmoud et al. (2021) found a 41% prevalence in Egyptian students preparing for high-stake exams (5). Despite academic stress being a global issue, the relationship between stress and xerostomia among Libyan university students remains understudied.

In Libya, few studies have explored the link between academic stress and oral-health outcomes. Most research has focused on mental health, leaving a gap in understanding how stress impacts oral health in this population (6). Given the high academic pressure faced by Libyan students due to economic and socio-political factors, this study aims to investigate the prevalence of stress-induced xerostomia during exam periods and its association with stress.

Additionally, gender differences in stress-induced xerostomia are debated. Some studies suggest that women may be more prone to stress-related oral health issues due to hormonal fluctuations and higher levels of perceived stress (7), while others argue that gender does not significantly affect xerostomia once stress levels are controlled (8). This study will also explore gender differences in the prevalence of stress-induced xerostomia among Libyan students.

Interventions like mindfulness-based stress reduction and relaxation exercises have shown promise in reducing stress and improving both psychological and oral health outcomes (9). The findings of this study may help inform targeted interventions to manage stress and improve oral health among students in Libyan universities.

2. Materials and Methods

2.1 Study Design and Population

This cross-sectional study was conducted to investigate the prevalence of stress-induced xerostomia among university students in Libya during exam periods.

A total of 700 undergraduate and postgraduate students, aged 18-35 years, were recruited from multiple universities across Libya. Participants were selected using convenience sampling, a non-probability method where participants are chosen based on their availability and willingness to participate. While convenience

sampling is efficient in terms of accessibility and time, it may introduce bias, potentially limiting the generalizability of the findings. This can affect the external validity, as the sample may not accurately represent the entire Libyan student population.

Participation was voluntary, and informed consent was obtained electronically before the completion of a self-administered online questionnaire, which was distributed through e-mail, WhatsApp, and social media platforms. Out of the 850 questionnaires distributed, 700 students responded, yielding a response rate of 82.35%. While this is an acceptable rate for studies of this kind, non-response bias may still affect the findings as non-respondents' characteristics might differ from those of respondents.

2.2 Inclusion and Exclusion Criteria

Students enrolled in a university in Libya who had experienced at least one exam session in the past 12 months were eligible to participate. Participants had to provide consent and be willing to complete the survey. Students with known medical conditions that could cause xerostomia, such as Sjögren's syndrome or diabetes, or those taking medications known to induce dry mouth, were excluded to reduce potential confounding factors.

2.3 Sample Size Calculation

The sample size of 700 students was calculated to provide a representative snapshot of the student population, ensuring a 95% confidence level and a 5% margin of error. The calculation was based on the formula for estimating prevalence in large populations:

$$n = \frac{Z^2 \cdot p \cdot (1 - p)}{E^2}$$

where:

- n is the required sample size.
- Z is the Z-score for a 95% confidence interval (1.96).
- p is the estimated prevalence of xerostomia (assumed to be around 50% due to a lack of specific prevalence data for Libyan students), and
- E is the margin of error (5%).

2.4 Data Collection Tool

Data was collected using a structured, self-administered questionnaire consisting of three main sections. The first section gathered demographic

information, such as age, gender, academic level, and field of study. The second section assessed stress levels using the Perceived Stress Scale (PSS-10), a validated tool for measuring perceived stress (10). The PSS-10 includes 10 items rated on a 5-point Likert scale (0 = never to 4 = very often), with total scores ranging from 0 to 40. Higher scores indicate greater levels of perceived stress, with scores above 20 generally considered indicative of high stress levels. The final section assessed xerostomia using the Xerostomia Inventory (XI) (11), which comprises 11 items rated on a 5-point Likert scale (1 = never to 5 = always), with higher scores reflecting more severe xerostomia symptoms. A score of 25 or higher on the XI was used to define the presence of clinically significant xerostomia.

The PSS-10 and XI were originally developed in English; however, to ensure accessibility for Libyan students, the questionnaires were translated into Arabic following a forward-backward translation process. This involved translating the scales from English into Arabic by a bilingual expert, followed by back-translation into English by an independent translator to ensure the accuracy of the translation. The translated version was then pre-tested on a small sample of students to assess clarity and cultural relevance.

2.5 Statistical Analysis

Data analysis was performed using SPSS, version 22. Descriptive statistics, including means, standard deviations, and frequencies, were used to summarize

demographic characteristics, stress levels, and xerostomia prevalence. Pearson's correlation coefficient was calculated to assess the relationship between stress and xerostomia severity. Chi-square tests were used to examine associations between categorical variables, such as gender, academic level, and xerostomia prevalence. Logistic regression analysis was employed to identify predictors of xerostomia, controlling for confounding variables, such as age, gender, and academic discipline. The odds ratio (OR) was reported to indicate the strength of the association between stress and xerostomia. A p-value of less than 0.05 was considered statistically significant.

3. Results

A total of 700 valid responses were collected from Libyan students across various universities. The data was analyzed to assess the prevalence of stress-induced xerostomia and the relationship between exam-related stress and xerostomia severity.

3.1 Demographic Characteristics

Table 1 presents the demographic distribution of the participants. The sample was composed of 60% (n = 420) females and 40% (n = 280) males. The majority of participants were undergraduates (n = 525, 75%), with a mean age of 22.7 years. Participants were from a variety of academic disciplines: 40% (n = 280) from Dental, 35% (n = 245) from Medical, and 25% (n = 175) from Social Sciences background.

Table 1: Demographic characteristics of participants

Characteristic	Number (%)
<i>Gender</i>	
Male	280 (40%)
Female	420 (60%)
<i>Age</i>	
18-25 years	525 (75%)
26-35 years	175 (25%)
<i>Academic Level</i>	
Undergraduate	525 (75%)
Postgraduate	175 (25%)
<i>Field of Study</i>	
Dental	280 (40%)
Medical	245 (35%)
Social Sciences	175 (25%)

3.2 Stress Assessment

Based on the Perceived Stress Scale (PSS-10), the mean stress score was 24.5 ± 5.8 , indicating moderate to high levels of perceived stress among participants during exam periods. Table 2 summarizes the distribution of stress levels: The highest stress levels were observed among dental students, with a mean score of 26.1 ± 4.9 , followed by medical students (mean score 24.2 ± 5.7), and social sciences students (mean score 22.3 ± 6.1).

Table 2: Distribution of stress levels among participants

Stress Level	Number (%)
Low (0-13)	35 (5%)
Moderate (14-26)	385 (55%)
High (27-40)	280 (40%)

3.3 Prevalence of Xerostomia

Xerostomia was reported by 48% (n = 336) of participants, with varying levels of severity. Figure 1 provides details on the prevalence of xerostomia symptoms across the sample. Of the participants, 20% (n = 140) experienced moderate and mild xerostomia and 8% (n = 56) severe symptoms. Prevalence was highest among Dental students (n = 154, 55%), followed by Medical students (n = 123, 50%) and Social Sciences students (n = 66, 38%).

3.4 Relationship between Stress and Xerostomia

A significant positive correlation was found between stress levels and xerostomia severity ($r = 0.58$, $p < 0.001$), suggesting that students with higher stress levels were more likely to experience xerostomia. Specifically, students in the high-stress group (PSS score ≥ 27) had a significantly higher prevalence of moderate-to-severe xerostomia (n = 180, 60%) compared to those in the low-to-moderate stress group (n = 156, 30%).

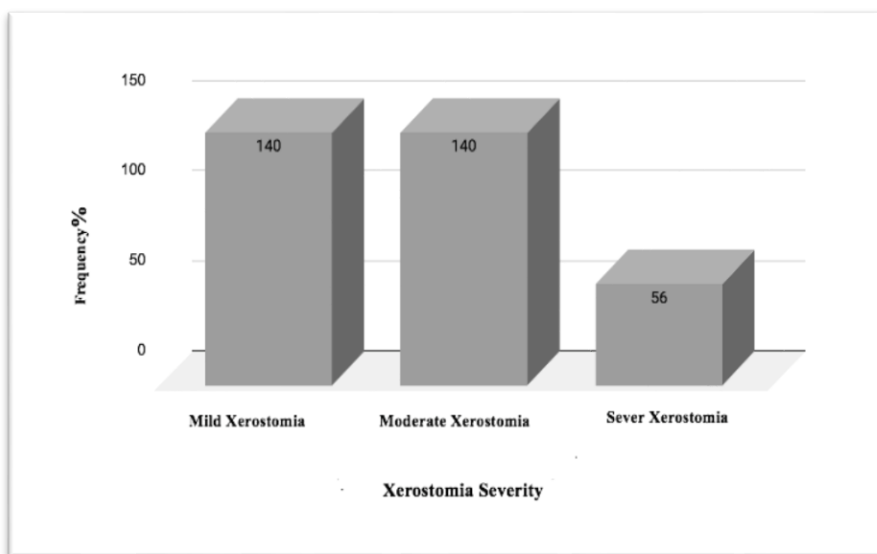


Figure 1: Prevalence and severity of xerostomia

Chi-square tests revealed a statistically significant association between academic discipline and xerostomia prevalence ($p = 0.01$), with dental students more likely to report dry mouth symptoms. Logistic regression analysis identified high stress as a significant predictor of xerostomia (OR = 3.1, 95% CI = 1.9–4.8, $p < 0.001$), even after adjusting for gender, age, and field of study (Table 3). This indicates that students with high stress levels were approximately three times more likely to

develop xerostomia than those with lower stress levels. Academic discipline was also found to be a significant predictor of xerostomia, with a p-value of 0.01, as dental students reported a higher prevalence of xerostomia symptoms compared to students in other fields. This suggests that both high stress and being in the dental field may contribute to an increased risk of xerostomia, highlighting the need for targeted interventions in these high-risk groups.

Table 3: Odds ratios for predictors of xerostomia

Predictor	Odds Ratio (OR)	95% CI	p-value
High Stress (PSS \geq 27)	3.1	1.9–4.8	< 0.001
Gender (Female vs. Male)	1.2	0.8–1.6	> 0.05
Age (26-35 vs. 18-25 years)	0.9	0.7–1.3	> 0.05
Academic Discipline (Dental vs. Others)	1.5	1.1–2.2	0.01

4. Discussion

The findings of this study demonstrate a strong association between exam-related stress and xerostomia among Libyan university students, with nearly a half (48%) of participants reporting symptoms of dry mouth. These results align with previous research highlighting stress as a critical factor affecting oral health (12, 13). The positive correlation between higher perceived stress levels and increased xerostomia severity ($r = 0.58$, $p < 0.001$) reinforces existing evidence that psychological stress can influence salivary-gland function, leading to xerostomia (14).

4.1 Xerostomia Prevalence and Academic Discipline

This study found that students from dental (55%) and medical disciplines (50%) experienced higher levels of xerostomia compared to those in social sciences (38%). This finding is consistent with earlier studies, which have shown that students in academically demanding fields often report higher stress levels, leading to adverse health effects, including xerostomia (15, 16). Dental and medical students, in particular, face substantial academic pressure, including extensive coursework and clinical training, contributing to their higher stress and xerostomia rates (17-21).

Conversely, students in social sciences reported relatively lower stress and xerostomia levels, potentially due to differences in curriculum structure, where students in technical and health-related fields face more intensive academic workloads, examinations, and practical assessments, as suggested by Alshahrani and Alharbi (2022) (17). The significant association between academic discipline and xerostomia prevalence ($p = 0.01$) highlights the need for targeted stress-management interventions, particularly for students in higher-stress fields.

4.2 Gender Differences

While xerostomia was more commonly reported by female students (52%) than male students (42%), gender

was not identified as a significant predictor of xerostomia when adjusting for stress levels ($p = 0.07$). This finding contrasts with some previous studies, which suggest that women may be more susceptible to stress-induced xerostomia due to hormonal differences and higher levels of perceived stress (12). However, the results of this study suggest that stress, regardless of gender, plays the most critical role in the onset of xerostomia, indicating that interventions should focus on stress-management rather than on gender-specific factors.

4.3 Comparison with Global Studies

The overall prevalence of xerostomia (48%) in this study is higher than reported in studies conducted among university students in other regions. For example, research conducted in South Asia and North America has shown lower xerostomia rates, potentially due to differences in academic pressure, coping mechanisms, and healthcare access (13, 14). Cultural factors, such as the emphasis placed on academic performance in different regions, may also contribute to the observed disparities. Libyan students may experience unique cultural pressures related to academic success, societal expectations, and limited access to mental-health services, which can exacerbate stress-related conditions like xerostomia. These cultural and regional factors suggest that stress-related xerostomia is not only a physiological response, but also influenced by socio-cultural context, warranting further cross-cultural research to fully understand its prevalence and impact.

4.4 Recommendations for Stress Management

The findings highlight the importance of addressing mental-health issues, particularly stress, as part of a comprehensive approach to improving oral health in university students. Educational institutions should consider implementing stress-management programs and promoting oral-health awareness, especially in high-stress academic fields. Given the high prevalence of

xerostomia observed in this study, it is crucial to implement targeted interventions aimed at managing stress during exam periods in particular. Universities should consider developing comprehensive mental-health programs, which include stress-management workshops, counseling services, and strategies to help students cope with academic pressures. These interventions should be particularly emphasized in high-stress academic disciplines, such as dental and medical fields. Additionally, promoting oral-health awareness through educational campaigns can help students better understand the relationship between stress and oral health, encouraging them to adopt preventive measures, such as maintaining proper hydration, reducing caffeine consumption, and practicing stress-reduction techniques, like mindfulness and relaxation exercises.

4.5 Limitations and Future Research

Despite the important findings, this study has several limitations. First, the use of self-administered questionnaires to assess stress and xerostomia introduces the potential for response bias, as participants may overestimate or underestimate their symptoms. Objective measures of salivary flow or clinical assessments could provide more accurate data on xerostomia prevalence. Second, the cross-sectional design limits the ability to establish causality between stress and xerostomia. While a significant correlation was observed, longitudinal studies are needed to determine the causal direction of this relationship. Third, the reliance on convenience sampling may limit the generalizability of the results to other populations.

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Although this study included a diverse group of students from different academic disciplines, the findings may not be representative of all Libyan university students or students from other countries. Lastly, this study did not account for other potential factors affecting xerostomia, such as diet, hydration, and caffeine consumption, which are known to influence salivary flow. Future research should control for these factors to isolate the impact of stress on xerostomia and should explore the long-term impacts of stress on oral health using longitudinal designs and include clinical assessments to provide a more objective understanding of xerostomia.

5. Conclusions

This study provides valuable insights into the relationship between exam-related stress and xerostomia among Libyan university students, revealing a high prevalence of xerostomia (48%) and a significant positive correlation between stress and xerostomia severity. Dental and medical students, who experience greater academic pressure, were more likely to report both higher stress levels and xerostomia symptoms.

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Conflict of Interests

The authors declare no conflict of interests.

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