

# Association Between Exam Related Stress and Frequency of Recurrent Aphthous Stomatitis Among University Students at LUMHS

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## ABSTRACT

**Background:** Recurrent aphthous stomatitis (RAS) is a common inflammatory condition of the oral mucosa characterized by recurrent painful ulcers that may interfere with eating, speaking, and overall quality of life. Psychological stress has been proposed as an important precipitating factor for ulcer development, particularly among university students who frequently experience heightened academic pressure during examination periods. **Objective:** To assess the association between examination-related stress and the occurrence of recurrent aphthous ulcers among university students at Liaquat University of Medical and Health Sciences (LUMHS), and to evaluate the role of selected behavioral and familial risk factors. **Methods:** A cross-sectional observational study was conducted among 105 university students at LUMHS between November 2025 and February 2026. Data were collected through a structured online questionnaire assessing demographic characteristics, history of recurrent aphthous ulcers, examination-related stress scores, sleep duration during exams, smoking status, meal-skipping behavior, family history of ulcers, and medical conditions. Descriptive statistics were used to summarize participant characteristics. Differences in mean stress scores between students with and without ulcers were analyzed using the independent samples t-test, while associations between categorical variables were assessed using the chi-square test. **Results:** Recurrent aphthous ulcers were reported by 58 students (55.2%) during the previous 12 months. The mean examination stress score was significantly higher among students with ulcers ( $17.74 \pm 5.50$ ) compared with those without ulcers ( $14.06 \pm 5.67$ ), with a mean difference of 3.68 (95% CI: 1.34–6.02;  $p = 0.002$ ). Significant associations were observed between ulcer occurrence and smoking (OR = 2.21; 95% CI: 1.02–4.89;  $p = 0.042$ ), sleep duration less than five hours during examinations (OR = 3.86; 95% CI: 1.56–9.57;  $p < 0.001$ ), and positive family history (OR = 3.02; 95% CI: 1.30–7.03;  $p = 0.010$ ), whereas systemic medical conditions showed no significant association ( $p = 0.444$ ). **Conclusion:** Examination-related psychological stress is significantly associated with recurrent aphthous ulcer occurrence among university students. Behavioral factors such as sleep deprivation and smoking, along with familial predisposition, may further increase susceptibility to ulcer episodes. Implementation of stress management strategies and promotion of healthy lifestyle practices within university health programs may help reduce the burden of recurrent aphthous stomatitis in student populations.

**Keywords:** Recurrent aphthous stomatitis; examination stress; university students; oral ulcers; sleep disturbance; smoking; psychological stress; risk factors.

## INTRODUCTION

Recurrent aphthous stomatitis (RAS) is a common oral mucosal disorder characterized by recurrent, painful, non-contagious ulcers that typically arise on non-keratinized mucosa such as the labial and buccal mucosa, floor of mouth, soft palate, and the ventrolateral tongue, and heal spontaneously without scarring (1). Although often self-limiting, RAS can impose meaningful morbidity through pain, burning, soft tissue irritation, and difficulty in eating and speaking, which may compromise nutritional intake and daily functioning, particularly when episodes are frequent or severe (2). Clinically, minor aphthous ulcers constitute the

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most frequent form, while major and herpetiform variants occur less commonly, yet all subtypes can negatively affect quality of life and psychological well-being (3). At a population level, RAS is widely reported across age groups, and global occurrence has been estimated to affect a substantial proportion of individuals, with recurring patterns that are especially prominent among adolescents and young adults (4).

The etiology of RAS is multifactorial and incompletely understood, with proposed contributors including genetic susceptibility, local trauma, hematinic deficiencies (iron, folate, vitamin B12), immune dysregulation, and environmental and behavioral factors (5). Hematinic deficiency-related epithelial atrophy may increase mucosal vulnerability, facilitating antigen penetration and amplifying inflammatory responses that culminate in ulceration (6). Alongside these biological contributors, psychological stress has received consistent attention as a potentially important precipitating or amplifying factor for ulcer episodes, particularly in younger populations exposed to intense academic demands (7). Mechanistically, stress is plausibly linked to RAS through neuroendocrine-immune pathways: activation of the hypothalamic-pituitary-adrenal axis and sympathetic signaling may alter immune regulation, with stress-associated changes in biomarkers such as salivary cortisol reported in relation to anxiety and ulcer activity (8). In addition, stress may indirectly contribute through behavioral pathways—sleep disruption, irregular meals, or parafunctional habits (e.g., cheek or lip biting)—that can compromise mucosal integrity and promote inflammatory flares (1).

Exam-related stress represents a highly relevant and time-bounded form of psychological strain in university settings, often accompanied by reduced sleep and maladaptive coping behaviors (9). Students may experience heightened anticipatory anxiety, impaired concentration, and physiological arousal during examination periods, and such responses may plausibly increase susceptibility to recurrent oral ulceration in those with underlying predisposition (9). Prior questionnaire-based studies in student populations have reported associations between perceived stress and recurrent oral ulcers, supporting a stress-RAS link; however, findings across settings remain heterogeneous, and many studies vary in their stress measurement, outcome definitions, and consideration of lifestyle confounders (7). Importantly, in many academic environments—including local university contexts—students are exposed to clustered examination schedules and concurrent lifestyle perturbations (sleep deprivation, smoking, meal skipping), yet the relative contribution of exam-related stress versus co-occurring behavioral risk factors is not consistently quantified with adequate clarity (1).

Accordingly, the research problem is that recurrent aphthous ulceration appears common among university students and may intensify during examination periods, but locally grounded evidence that simultaneously evaluates exam-related stress alongside key cofactors (sleep disturbance, smoking, dietary disruption, and family history) remains limited and often methodologically inconsistent, restricting the ability of university health programs to target modifiable risks with confidence (1). The knowledge gap is particularly salient in student populations where short-term stressors recur predictably each academic cycle and may interact with behavioral exposures to amplify ulcer occurrence and recurrence (7). The justification for the present study is therefore to generate context-specific, clinically interpretable evidence that clarifies whether higher exam-related stress is associated with a greater burden of RAS among university students, while also characterizing the distribution of ulcer episodes and identifying co-occurring, potentially modifiable risk factors that could be addressed through student wellness and preventive oral health interventions (2).

In PICO terms, among university students at Liaquat University of Medical and Health Sciences (population), higher levels of exam-related psychological stress (exposure) compared with lower stress levels (comparison) may be associated with increased occurrence and/or greater frequency of recurrent aphthous ulcers (outcome). The objective of this study was to assess the association between exam-related stress and recurrent aphthous ulceration among university students at LUMHS and to examine the relationship of selected behavioral and familial factors—particularly sleep disturbance, smoking, meal-skipping, and family history—with ulcer occurrence (1).

## METHODS

This cross-sectional observational study was conducted to evaluate the association between examination-related psychological stress and recurrent aphthous stomatitis (RAS) among university students. The design was selected because it allows assessment of exposure (exam-related stress) and outcome (history of recurrent aphthous ulcers) simultaneously within a defined population and time period, enabling estimation of prevalence and exploration of potential associations between behavioral, familial, and lifestyle factors and the occurrence of oral ulceration (10). The study was carried out at Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, Pakistan, between November 2025 and February 2026, a period that coincided with scheduled academic examinations in several academic programs. Data was collected using an online survey platform accessible through institutional student communication channels, allowing participation across multiple faculties within the university.

The target population consisted of undergraduate and postgraduate students currently enrolled at LUMHS during the study period. Students aged 17–25 years who were actively attending academic sessions and were expected to sit for examinations during the study timeframe were considered eligible for inclusion. Participants were required to be able to read and understand English, as the questionnaire was administered in English. Students who declined consent or submitted incomplete questionnaires lacking key exposure or outcome variables were excluded from analysis. Participants were selected using a convenience sampling approach, whereby the survey link was disseminated through official student groups, academic mailing lists, and institutional messaging platforms. This method was chosen to maximize participation across different academic programs during the limited examination period while ensuring rapid data collection in a geographically dispersed student population.

Recruitment occurred through voluntary participation following dissemination of an invitation message that explained the purpose of the study, eligibility criteria, confidentiality safeguards, and approximate time required to complete the questionnaire. The survey introduction page included an electronic informed consent statement describing the voluntary nature of participation, anonymity of responses, and the right to withdraw at any stage before submission. Only participants who provided electronic consent were able to proceed to the questionnaire. No personally identifiable information was collected to preserve participant anonymity.

Data was collected using a structured, self-administered questionnaire developed following review of previously published literature on stress and recurrent aphthous stomatitis in student populations (11,12). The instrument consisted of multiple sections designed to capture demographic characteristics, history of recurrent oral ulcers, perceived examination-related stress, and potential behavioral or familial risk factors. Demographic variables included age group and basic academic characteristics. The primary outcome variable was

the self-reported occurrence of recurrent aphthous ulcers during the preceding 12 months. For clarity, the questionnaire described aphthous ulcers as small, painful mouth sores occurring on the inner lips, cheeks, tongue, or soft palate that typically heal within one to two weeks and recur periodically without scarring. Participants who report ulcer history were additionally asked about the approximate number of ulcer episodes experienced within the past year, typical pain severity using a numerical self-rating scale from 1 to 10, and average duration of lesions.

The primary exposure variable was perceived examination-related stress, measured through a multi-item stress score derived from participant responses regarding feelings of tension, anxiety, and difficulty concentrating during examination periods. Individual responses were summed to generate a composite stress score, with higher scores reflecting greater perceived examination stress. Secondary explanatory variables included smoking status, average sleep duration during examination periods, and meal-skipping behavior during exams. Family history of recurrent oral ulcers and the presence of systemic medical conditions were also recorded as potential risk modifiers. Sleep duration was categorized into four groups (<5 hours, 5–6 hours, 6–8 hours, and >8 hours per night), and meal skipping was recorded as a binary variable (yes/no). Smoking exposure was recorded based on self-reported current smoking status.

To reduce potential information bias, the questionnaire used closed-ended questions with predefined response options and clear explanatory descriptions of aphthous ulcers. The survey instrument was reviewed for clarity and logical sequence prior to distribution. Data were automatically captured and stored in a password-protected database accessible only to the research team. After completion of data collection, responses were exported into Microsoft Excel for data cleaning, coding, and verification. Duplicate entries were screened using timestamp and response pattern comparisons. Records with incomplete outcome or exposure variables were removed prior to statistical analysis.

The sample size was determined using the standard formula for estimating sample size for prevalence studies with a 95% confidence level and 5% margin of error, based on previously reported variability in recurrent aphthous stomatitis prevalence among student populations. Using these parameters and an estimated standard deviation derived from earlier research, a minimum sample size of 96 participants was calculated to achieve adequate statistical precision (10). To account for potential incomplete responses, a slightly larger number of participants were recruited. Ultimately, 105 complete responses were included in the final analysis.

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic characteristics, prevalence of recurrent aphthous ulcers, and distribution of behavioral variables. Continuous variables were expressed as mean with standard deviation, while categorical variables were presented as frequencies and percentages. The association between examination-related stress and the occurrence of recurrent aphthous ulcers was assessed by comparing mean stress scores between students reporting ulcers and those without ulcer history using the independent samples t-test. Associations between categorical explanatory variables—including smoking status, sleep duration, meal skipping behavior, and family history—and ulcer occurrence were examined using the chi-square test of independence. Statistical significance was defined as a two-sided p-value less than 0.05. To explore potential confounding effects, multivariable logistic regression analysis was additionally performed with ulcer occurrence as the dependent variable and stress score, smoking status, sleep duration, meal skipping, and family history entered as independent

variables, allowing estimation of adjusted odds ratios with corresponding 95% confidence intervals. Missing data were assessed prior to analysis; questionnaires with incomplete primary exposure or outcome variables were excluded, while isolated missing responses within secondary variables were handled using pairwise deletion during analysis to preserve available observations. Internal consistency and data integrity were maintained through standardized coding procedures and independent verification of cleaned datasets by two investigators. All analytic procedures followed predefined statistical plans to ensure transparency and reproducibility.

Ethical approval for the study was obtained from the Research Ethics Committee of Liaquat University of Medical and Health Sciences (Reference No. LUMHS/REC/-1156). Participation was voluntary, informed consent was obtained electronically from all respondents, and all data were collected anonymously to protect participant confidentiality. The study adhered to established ethical principles for research involving human participants, including respect for autonomy, confidentiality, and responsible data management (13).

## RESULTS

A total of 105 university students participated in the study. The age distribution indicated that most participants were between 21 and 23 years of age (82 students, 78.1%), followed by those aged 17–20 years (20 students, 19.0%), while only 3 participants (2.9%) were in the 23–25 year age group. More than half of the participants reported experiencing recurrent aphthous ulcers during the previous 12 months. Specifically, 58 students (55.2%) reported a history of recurrent ulcers, whereas 47 students (44.8%) reported no such history (Table 1). A comparison of examination stress scores between students with and without recurrent aphthous ulcers revealed a statistically significant difference. Students who reported ulcers had a mean stress score of 17.74 with a standard deviation of 5.50, whereas those without ulcers had a lower mean stress score of 14.06 with a standard deviation of 5.67. The mean difference between the two groups was 3.68 points, with a 95% confidence interval ranging from 1.34 to 6.02. Statistical testing using the independent samples t-test showed that this difference was significant ( $p = 0.002$ ), indicating that higher perceived examination stress was associated with a greater likelihood of experiencing recurrent aphthous ulcers (Table 2).

The relationship between recurrent aphthous ulcers and selected behavioral and familial factors is summarized in Table 3. Smoking was reported by 18 students (31.0%) in the ulcer group compared with 8 students (17.0%) in the non-ulcer group. Smokers had approximately twice the odds of reporting recurrent aphthous ulcers compared with non-smokers (OR = 2.21; 95% CI: 1.02–4.89), and this association was statistically significant ( $p = 0.042$ ). Sleep duration during examination periods also showed a significant relationship with ulcer occurrence ( $p < 0.001$ ). Among students reporting ulcers, 26 individuals (44.8%) slept less than 5 hours per night during exams, compared with only 8 students (17.0%) in the non-ulcer group. In contrast, longer sleep durations of 6–8 hours were more commonly observed among students without ulcers (31.9%) compared with those reporting ulcers (15.5%). Short sleep duration of less than five hours was associated with nearly four times higher odds of ulcer occurrence compared with the reference category (OR = 3.86; 95% CI: 1.56–9.57). Family history of recurrent aphthous ulcers also demonstrated a significant association with ulcer occurrence. Among students reporting ulcers, 24 individuals (41.4%) reported a positive family history, whereas only 9 students (19.1%) without ulcers reported a similar history. Students with a positive family history had approximately three times higher odds of developing ulcers (OR = 3.02; 95% CI: 1.30–7.03), and this association was statistically significant ( $p = 0.010$ ). In contrast, the presence of systemic medical conditions did not show a statistically significant relationship with ulcer occurrence. Medical conditions were

reported by 6 students (10.3%) in the ulcer group and by 4 students (8.5%) in the non-ulcer group, yielding an odds ratio of 1.24 (95% CI: 0.33–4.64; p = 0.444).

Clinical characteristics of recurrent aphthous ulcers among affected students are presented in Table 4. Among the 58 participants who reported ulcers, the majority experienced 1–3 episodes per year (41 students, 39.0% of the total sample), while 16 students (15.2%) reported 3–6 episodes annually, and 3 students (2.9%) reported more than six episodes per year. Pain severity was generally mild, with 35 students (61.0%) rating their pain between 1 and 3 on the numerical pain scale. Moderate pain scores (4–6) were reported by 21 students (37.1%), while severe pain scores (7–10) were reported by only 2 students (1.9%). Regarding ulcer duration, most participants (33 students, 56.2%) reported that ulcers typically healed within one week, whereas 25 students (43.8%) reported durations of one week or longer. These findings suggest that the majority of ulcers experienced by students were mild in intensity, relatively short in duration, and occurred a few times per year.

**Table 1. Demographic Characteristics of Study Participants and Prevalence of Recurrent Aphthous Ulcers (n = 105)**

Variable	Category	Frequency (n)	Percent (%)
Age group	17–20 years	20	19.0
	21–23 years	82	78.1
	23–25 years	3	2.9
History of recurrent aphthous ulcers (past 12 months)	Yes	58	55.2
	No	47	44.8

**Table 2. Comparison of Examination Stress Scores Between Students with and Without Recurrent Aphthous Ulcers**

Group	n	Mean Stress Score ± SD	Mean Difference	95% CI	p-value
Ulcers present	58	17.74 ± 5.50			
Ulcers absent	47	14.06 ± 5.67	3.68	1.34 – 6.02	0.002

**Table 3. Association Between Behavioral and Familial Risk Factors and Recurrent Aphthous Ulcers**

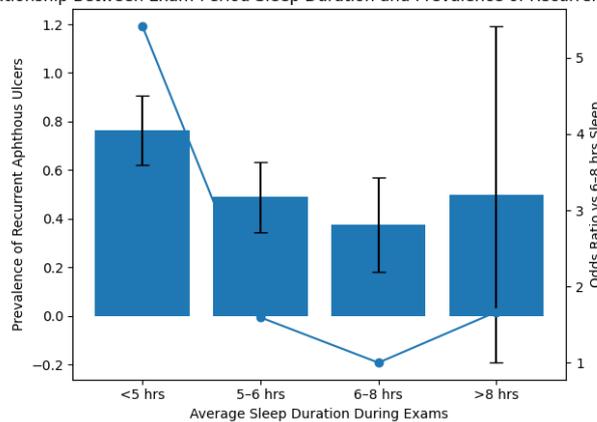
Variable	Category	Ulcers Present n (%)	Ulcers Absent n (%)	Odds Ratio (95% CI)	p-value
Smoking status	Smoker	18 (31.0)	8 (17.0)	2.21 (1.02–4.89)	0.042
	Non-smoker	40 (69.0)	39 (83.0)	Reference	
Sleep duration during exams	<5 hours	26 (44.8)	8 (17.0)	3.86 (1.56–9.57)	<0.001
	5–6 hours	22 (37.9)	23 (48.9)	1.47 (0.64–3.38)	
	6–8 hours	9 (15.5)	15 (31.9)	Reference	
	>8 hours	1 (1.7)	1 (2.1)	—	
Family history of ulcers	Yes	24 (41.4)	9 (19.1)	3.02 (1.30–7.03)	0.010
	No	34 (58.6)	38 (80.9)	Reference	
Medical conditions	Present	6 (10.3)	4 (8.5)	1.24 (0.33–4.64)	0.444
	None	52 (89.7)	43 (91.5)	Reference	

**Table 4. Clinical Characteristics of Recurrent Aphthous Ulcers Among Affected Students (n = 58)**

Characteristic	Category	Frequency (n)	Percent (%)
Number of episodes per year	1–3 episodes	41	39.0
	3–6 episodes	16	15.2
	>6 episodes	3	2.9
Pain severity (self-rated)	Mild (1–3)	35	61.0
	Moderate (4–6)	21	37.1
	Severe (7–10)	2	1.9
Typical ulcer duration	<1 week	33	56.2
	≥1 week	25	43.8

The figure illustrates a clear gradient relationship between sleep duration during examination periods and the prevalence of recurrent aphthous ulcers among university students. The highest ulcer prevalence was observed among students sleeping less than 5 hours per night, where 26 of 34 students (76.5%) reported ulcers. In contrast, prevalence declined to 48.9% (22 of 45 students) among those sleeping 5–6 hours, and further to 37.5% (9 of 24 students) among students sleeping 6–8 hours, which served as the reference category. Students reporting more than 8 hours of sleep had a prevalence of 50.0% (1 of 2 students); however, the wide confidence interval reflects the small sample size in this category. Compared with the reference sleep duration (6–8 hours), the odds of recurrent aphthous ulcers were markedly elevated among students sleeping <5 hours (OR ≈ 5.42), whereas students sleeping 5–6 hours demonstrated a modest increase (OR ≈ 1.59).

Gradient Relationship Between Exam-Period Sleep Duration and Prevalence of Recurrent Aphthous Ulcers



The prevalence bars with 95% confidence intervals combined with the overlaid odds ratio trend reveal a pronounced nonlinear gradient, suggesting that substantial sleep deprivation during examination periods may amplify the risk of ulcer occurrence by more than fivefold relative to students maintaining moderate sleep duration. This pattern supports the clinical interpretation that sleep disruption acts as an important behavioral modifier in the stress–ulcer pathway among students.

## DISCUSSION

The present study evaluated the relationship between examination-related stress and recurrent aphthous stomatitis (RAS) among university students and identified several behavioral and familial factors associated with ulcer occurrence. More than half of the participants (55.2%) reported experiencing recurrent aphthous ulcers within the previous 12 months, indicating a considerable burden of this condition among young adults in an

academic environment. This prevalence appears higher than commonly reported estimates in the general population, which range from approximately 20% to 25%, although such comparisons should be interpreted cautiously because student populations often experience unique psychosocial and behavioral stressors that may increase susceptibility to oral mucosal lesions (14). The findings highlight that RAS represents a frequent and clinically relevant problem within university settings, particularly during periods of heightened academic pressure.

A central finding of this study was the statistically significant association between examination-related stress and ulcer occurrence. Students who reported recurrent ulcers demonstrated significantly higher mean stress scores compared with those who did not report ulcers. This observation supports the hypothesis that psychological stress may act as an important precipitating factor in the development of RAS. Several mechanisms have been proposed to explain this relationship. Psychological stress can influence immune regulation through activation of the hypothalamic–pituitary–adrenal axis, leading to increased cortisol secretion and modulation of inflammatory cytokines, which may alter mucosal immune responses and predispose individuals to ulcer formation (15). Previous studies investigating the association between stress and RAS have similarly reported elevated stress scores and increased salivary cortisol levels among affected individuals, reinforcing the plausibility of a neuroendocrine–immune pathway contributing to ulcer development (16). The present findings therefore add further evidence that perceived psychological stress, particularly in the context of examinations, may represent an important trigger for ulcer episodes in susceptible individuals.

Sleep disturbance during examination periods emerged as one of the strongest associated factors in the present study. Students who reported sleeping less than five hours during examinations exhibited a substantially higher prevalence of ulcers compared with those reporting longer sleep durations. The observed gradient between sleep duration and ulcer occurrence suggests that inadequate sleep may amplify the effects of stress on oral mucosal health. Experimental and epidemiological research has shown that sleep deprivation can impair immune function, increase systemic inflammatory activity, and disrupt normal physiological recovery processes, all of which may increase vulnerability to inflammatory conditions such as RAS (17). Additionally, sleep deprivation is often closely linked with academic stress, potentially acting synergistically with psychological factors to influence mucosal inflammation and ulcer recurrence. These findings emphasize the importance of adequate sleep hygiene as a potential preventive strategy for students experiencing recurrent ulcers.

Smoking was also found to be significantly associated with ulcer occurrence in the current study. Students who reported smoking demonstrated higher odds of experiencing recurrent ulcers compared with non-smokers. The relationship between smoking and RAS has been reported inconsistently in previous research. Some investigations have suggested that smoking may exert a protective effect due to increased mucosal keratinization, which may theoretically reduce susceptibility to ulceration (18). However, other studies have reported either no association or an increased risk associated with tobacco use, potentially reflecting behavioral or immunological changes induced by smoking (19). The results of the present study align with the latter perspective, suggesting that smoking may function as a behavioral risk factor that contributes to ulcer development in this population. Differences in smoking patterns, intensity of exposure, and associated lifestyle factors among students may partially explain variations across studies.

Family history of recurrent aphthous ulcers demonstrated a significant association with ulcer occurrence, suggesting a potential genetic or hereditary component in the pathogenesis of the condition. Students with a positive family history had substantially higher odds of reporting ulcers compared with those without such history. Familial clustering of RAS has been described in several previous investigations, with genetic susceptibility thought to influence immune responses, epithelial integrity, and inflammatory pathways involved in ulcer formation (20). The presence of familial predisposition may therefore interact with environmental triggers such as psychological stress and lifestyle behaviors to determine the likelihood of ulcer recurrence.

In contrast, the presence of systemic medical conditions was not significantly associated with ulcer occurrence in this study. This finding may reflect the relatively young and generally healthy nature of the study population, in which chronic systemic diseases are less common. Although systemic conditions such as gastrointestinal disorders, hematological deficiencies, or autoimmune diseases have been associated with aphthous-like ulceration in clinical settings, these factors may play a smaller role within otherwise healthy student populations (21). Nevertheless, future studies incorporating clinical examinations and laboratory assessments of hematinic deficiencies could provide additional insight into the biological factors that may interact with psychological stress in the development of RAS.

The clinical characteristics of ulcers reported by affected students in this study were generally consistent with the minor subtype of aphthous stomatitis. Most participants reported experiencing one to three episodes annually, with lesions typically described as mild in severity and resolving within one week. These findings correspond with the typical presentation of minor aphthous ulcers described in the literature, which account for the majority of RAS cases and generally heal without scarring (22). Despite their relatively mild clinical course, recurrent ulcers can still significantly affect quality of life by interfering with eating, speaking, and daily activities, particularly when episodes coincide with academically demanding periods.

Several methodological considerations should be acknowledged when interpreting the findings of this study. The cross-sectional design limits the ability to establish causal relationships between examination stress and ulcer occurrence. Although significant associations were identified, temporal relationships between exposure and outcome cannot be definitively confirmed. In addition, the use of self-reported questionnaires may introduce recall bias or misclassification, particularly with respect to the identification of aphthous ulcers without clinical examination. The convenience sampling approach may also limit the generalizability of the findings to other university populations or geographic settings. Despite these limitations, the study provides valuable context-specific evidence regarding the relationship between examination stress, behavioral factors, and recurrent aphthous ulcers in a university population.

Overall, the findings contribute to the growing body of evidence suggesting that psychological stress and lifestyle factors play an important role in the occurrence of recurrent aphthous stomatitis among students. The results emphasize that exam-related stress, sleep deprivation, smoking, and familial predisposition may collectively influence the risk of ulcer development. These observations highlight the potential value of preventive strategies within university health programs, including stress management interventions, sleep hygiene education, and behavioral counseling aimed at reducing modifiable risk factors associated with recurrent oral ulceration (14).

## CONCLUSION

The present study demonstrates a significant association between examination-related psychological stress and the occurrence of recurrent aphthous stomatitis among university students. Students with higher perceived exam stress were more likely to report recurrent oral ulcer episodes, suggesting that psychological stress may act as an important precipitating factor for mucosal inflammation in this population. In addition to stress, behavioral and familial factors such as inadequate sleep during examination periods, smoking, and a positive family history of ulcers were significantly associated with ulcer occurrence, highlighting the multifactorial nature of recurrent aphthous stomatitis. Although most reported ulcers were mild and self-limiting, their frequency and associated discomfort may negatively affect students' well-being, eating habits, and academic performance. These findings underscore the importance of incorporating stress management strategies, promotion of adequate sleep hygiene, and preventive oral health education within university health programs to reduce the burden of recurrent aphthous ulcers among students. Future multicenter and longitudinal studies incorporating clinical examination and biological stress markers are recommended to further clarify causal pathways and strengthen the evidence base regarding the interaction between psychological stress and recurrent aphthous stomatitis.

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## DECLARATIONS

**Ethical Approval:** Ethical approval was taken from Research Ethics Committee (REC) of Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan

**Informed Consent:** Informed Consent was taken from participants.

**Authors' Contributions:**

Concept: MB; Design & Data Collection: KL, SJ, KK, N; Analysis: HM; Drafting: HM, MB; Supervision: AS

**Conflict of Interest:** The authors declare no conflict of interest.

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**Data Availability:** The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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**Study Registration:** Not applicable.