Nigerian Journal of Pharmaceutical and Biomedical Research
Vol. 10 Issue.2 August, 2026. p-ISSN: 2579-1419 e-ISSN: 2814-1423

ASSOCIATION BETWEEN EXAM STRESS AND SLEEP DEPRIVATION AND EAR, NOSE AND THROAT SYMPTOMS AMONG UNIVERSITY STUDENTS

Ruaa Luay Al-Janabi[1*], Saif Husam Aljamal[2]

[1] Department of Surgery, College of Medicine, Wasit University, Kut, Wasit, Iraq
[2] Al-Zahraa Teaching Hospital, Wasit Health Directorate, Kut, Wasit, Iraq

DOI 10.5281/zenodo.24213959

ABSTRACT

Background: University students often experience intense stress and shortened sleep during examination periods, but the combined relationship of these factors with ear, nose, and throat (ENT) symptoms has rarely been studied. **Objectives:** This study assessed the association of exam stress and sleep deprivation with ENT symptoms among university students and examined whether it differs by symptom domain. **Methods:** A cross-sectional online survey was conducted among 246 students at Wasit University, Iraq, in May 2024. The questionnaire covered demographics, exam stress, sleep duration and disturbance, ENT symptoms, and their perceived effects on concentration, sleep, and academic performance. Data were analysed with Spearman correlation, non-parametric tests, and multivariable linear and logistic regression. **Results:** Overall, 81.7% of students reported at least one ENT symptom; throat or voice symptoms were the most frequent (66.3%), followed by ear (41.1%) and nasal symptoms (32.9%). Dry mouth (52.8%), dizziness (45.1%), and headache (32.1%) were the commonest individual symptoms. Symptom burden increased with stress level, and stress was correlated with ear ($p = 0.003$) and throat symptoms ($p = 0.003$) but not with nasal symptoms ($p = 0.718$). After adjustment, stress remained independently associated with the symptom score ($B = 0.59$, $p < 0.001$), whereas sleep restriction did not. Stress and sleep disturbance were moderately correlated ($\rho = 0.43$, $p < 0.001$). **Conclusions:** Higher exam stress was associated with a greater burden of ear and throat symptoms, independent of sleep duration, while nasal symptoms were not clearly related to stress; symptom burden was also associated with poorer perceived academic functioning.

Keywords: Ear, nose, and throat symptoms; Exam stress; Sleep deprivation; University students

1. INTRODUCTION

University students, and medical students in particular, often face intense pressure during examination periods, which commonly goes together with shortened and disturbed sleep. Studies of medical students have shown that students without stress are less likely to have poor sleep quality (Almojali et al., 2017), and that the link between perceived stress and sleep quality may be mediated by anxiety and depressive symptoms (Huang et al., 2024).

Stress is also reflected in symptoms of the ear, nose, and throat (ENT). Among university students, perceived stress has been correlated with vocal symptoms such as throat dryness and vocal fatigue (Alonso et al., 2024), and vocal fatigue has been associated with stress and intensive voice use (Ferreira et al., 2012). In the case of nasal symptoms, stress and anxiety can precipitate and prolong the

symptoms of allergic rhinitis (Kiecolt-Glaser et al., 2009), and academic exam stress has been shown to affect airway immune markers in both healthy and allergic students (Trueba et al., 2013). Ear symptoms have been less studied, although tinnitus was reported in 13% of medical college students in one Iranian study (Kiakojouri et al., 2009).

However, each of these studies examines a single symptom or domain. To our knowledge, few studies have assessed ear, nose, and throat symptoms together in students during exams, and we could not find any study that considered exam stress and sleep deprivation side by side. We also did not identify comparable studies from Iraq. This matters because ENT symptoms may add to the burden of exam stress, affecting concentration, sleep, and academic performance, and these effects need proper evaluation if the quality of life of university students is to be improved.

The aim of this study was to assess the association between exam stress and sleep deprivation and the presence of ear, nose, and throat symptoms among university students, and to examine whether this association differs by symptom domain.

2. MATERIALS AND METHODS

2.1 Study design and participants

A cross-sectional, questionnaire-based survey was conducted among university students at Wasit University using an online self-administered form created with Google Forms. Responses were collected between 10 and 19 May 2024. A total of 246 complete responses were received and all were included in the analysis; there were no missing values in the main questions and no duplicate submissions. Ethical approval was obtained from the Wasit University Ethical Committee.

2.2 Questionnaire

The questionnaire (in Arabic) collected: (i) demographic and lifestyle data (age, sex, academic stage, field of study, smoking status, regular headphone use, caffeine intake, and reading aloud while studying); (ii) exam stress level (none, mild, moderate, severe); (iii) sleep duration during exams (<4, 4-6, 6-8, >8 hours per day), sleep disturbance (no, sometimes, yes), and physical fatigue; (iv) ear symptoms (multi-select list of dizziness, ear blockage, tinnitus, hearing loss, and ear pain); (v) nasal symptoms (single-choice list of congestion, sneezing, rhinorrhea, itching, postnasal drip, and headache), where a single choice was adopted to reduce the interchangeable use of terms and survey fatigue in an online form; (vi) throat and voice symptoms (multi-select list of dry mouth, hoarseness, throat pain, and dysphagia); and (vii) perceived effects of the symptoms on concentration, sleep quality, and academic performance.

2.3 Variable coding

Stress was coded 0-3 (none to severe). Sleep restriction was coded 0-3 (>8 hours to <4 hours), so that higher values indicate less sleep. Sleep disturbance was coded 0-2. Inconsistent entries were harmonised before analysis (sex labels "Female"/"male" merged into the Arabic categories, and a spelling variant of "sometimes" corrected).

An ENT symptom score was calculated for each participant as the number of ear symptoms selected (0-5) plus the presence of any nasal symptom (0-1) plus the number of throat symptoms selected (0-4), giving a possible range of 0-10. Because dizziness and headache are not specific to the ear and nose and may be related to stress itself, a stricter score excluding these two items was also calculated (range 0-8) and used as a sensitivity analysis. Domain-specific outcomes (any ear, any nasal, and any throat symptom) were also analysed.

2.4 Statistical analysis

Statistical analysis was performed using SPSS v26 and Microsoft Excel 2019. Categorical variables are presented as frequencies and percentages and continuous scores as mean (SD). Associations between ordinal exposures (stress, sleep restriction, sleep disturbance) and symptom scores were assessed with Spearman's rank correlation and the Kruskal-Wallis test; two-group comparisons used the Mann-Whitney U test or the chi-square test. Multivariable linear regression (outcome: ENT symptom score) and logistic regression (outcome: presence of symptoms in each domain) were used to estimate the association of stress and sleep restriction after adjusting for sex, smoking, headphone use, caffeine intake, field of study (medical vs other), and academic stage. Age was not included because it was perfectly determined by academic stage in this dataset. A two-sided p-value <0.05 was considered statistically significant.

3. RESULTS

3.1 Participant characteristics

The study included 246 students, of whom 179 (72.8%) were female and 218 (88.6%) studied a medical specialty. Ages ranged from 19 to 26 years. Exam stress was common: 111 students (45.1%) reported severe and 85 (34.6%) moderate stress. Most students slept less than 6 hours per day during exams (76.0%), and 153 (62.2%) reported sleep disturbance (Table 1).

Table 1. Characteristics of the study participants (N = 246)

Characteristic	n (%)
Sex	
Female	179 (72.8)
Male	67 (27.2)
Academic stage (age in years)	
Stage 1 (19)	57 (23.2)
Stage 2 (20)	20 (8.1)
Stage 3 (21)	37 (15.0)
Stage 4 (22)	24 (9.8)
Stage 5 (23)	92 (37.4)
Stage 6 (24)	6 (2.4)
Postgraduate (26)	10 (4.1)
Field of study	
Medical	218 (88.6)
Engineering	16 (6.5)
Humanities	5 (2.0)
Other	7 (2.8)
Smoking status	
Current smoker	27 (11.0)
Former smoker	5 (2.0)
Non-smoker	214 (87.0)
Lifestyle during exams	
Regular headphone use	98 (39.8)
Increased caffeine intake	132 (53.7)
Exam stress level	
None	11 (4.5)
Mild	39 (15.9)
Moderate	85 (34.6)
Severe	111 (45.1)
Sleep duration during exams	
< 4 hours	73 (29.7)
4-6 hours	114 (46.3)
6-8 hours	46 (18.7)
> 8 hours	13 (5.3)
Sleep disturbance during exams	
Yes	153 (62.2)
Sometimes	67 (27.2)

Characteristic	n (%)
No	26 (10.6)

3.2 Prevalence of ENT symptoms during exams

Using the strict definition, 201 of 246 students (81.7%) reported at least one ENT symptom: throat or voice symptoms were the most frequent (163; 66.3%), followed by ear symptoms (101; 41.1%) and nasal symptoms (81; 32.9%). The mean total symptom score was 2.76 (SD 1.96) and the mean strict score was 1.99 (SD 1.67). The most common individual symptoms were dry mouth (52.8%), dizziness (45.1%), and headache (32.1%) (Table 2).

Table 2. Frequency of individual symptoms reported during exams

Symptom	n (%)
Ear symptoms	
Dizziness/vertigo	111 (45.1)
Sensation of ear blockage	43 (17.5)
Tinnitus	42 (17.1)
Hearing loss	37 (15.0)
Ear pain	31 (12.6)
Nasal symptoms (single-choice item)	
Headache	79 (32.1)
Nasal congestion	30 (12.2)
Sneezing	25 (10.2)
Rhinorrhea	15 (6.1)
Nasal itching	10 (4.1)
Postnasal drip	1 (0.4)
Throat and voice symptoms	
Dry mouth	130 (52.8)
Dysphagia	66 (26.8)
Hoarseness	48 (19.5)
Throat/pharyngeal pain	46 (18.7)

Ear and throat items were multi-choice questions, so percentages do not sum to 100%. The nasal item allowed a single choice; 86 students (35.0%) selected "none".

3.3 Association of exam stress with ENT symptoms

Symptom burden increased progressively with stress level (Table 3, Figure 1). The mean total score increased from 1.09 among students with no stress to 3.25 among those with severe stress (Kruskal-Wallis $p < 0.001$), and the strict score showed a similar gradient ($p = 0.002$). Stress was positively correlated with the total score ($\rho = 0.29$, $p < 0.001$) and the strict score ($\rho = 0.23$, $p < 0.001$). By domain, stress was associated with ear symptoms ($\rho = 0.19$, $p = 0.003$) and throat symptoms ($\rho = 0.19$, $p = 0.003$), but not with nasal symptoms ($\rho = 0.02$, $p = 0.718$) (Table 4, Figure 2).

Table 3. ENT symptom scores and domain prevalence by exam stress level

Stress level	n	Total score, mean (SD)	Strict score, mean (SD)	Ear	Nose	Throat
None	11	1.09 (1.22)	0.82 (1.25)	18%	27%	27%
Mild	39	2.13 (1.38)	1.46 (1.17)	31%	26%	62%
Moderate	85	2.64 (2.17)	2.01 (1.87)	39%	38%	62%
Severe	111	3.25 (1.87)	2.28 (1.62)	49%	32%	75%

The strict score excludes dizziness and headache. The Ear, Nose, and Throat columns show the percentage of students with at least one symptom in that domain (strict definition for ear and nose).

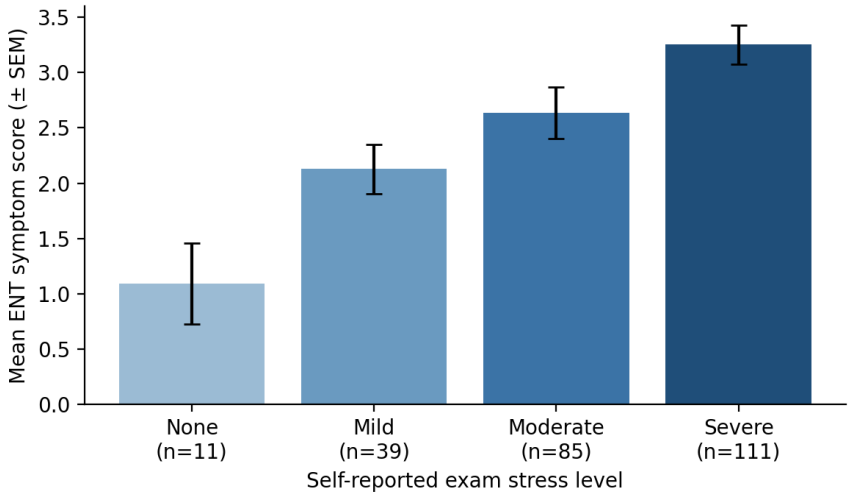

Figure 1. Mean ENT symptom score by self-reported exam stress level (error bars, ± SEM).

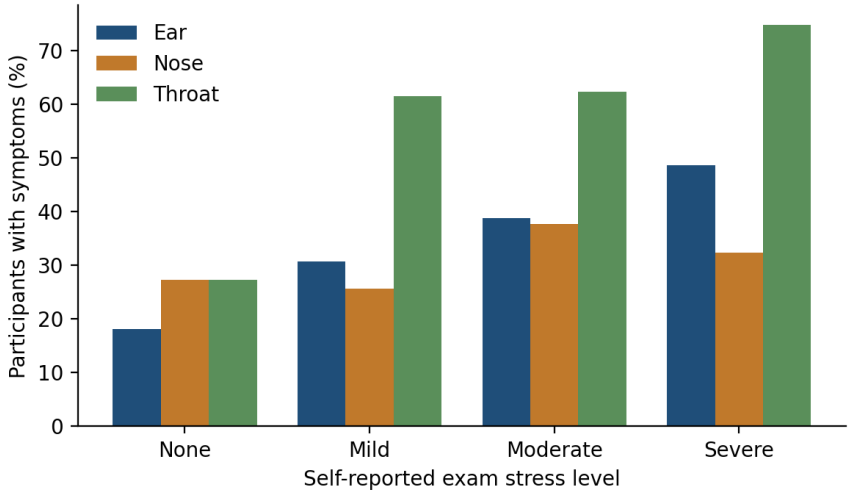

Figure 2. Proportion of students with ear, nasal, and throat symptoms by exam stress level.

Table 4. Spearman correlations between exposures and ENT symptom outcomes

Outcome	ρ stress	p	ρ sleep restriction	p	ρ sleep disturbance	p
Total ENT symptom score	0.29	<0.001	0.20	0.002	0.29	<0.001
Total score (strict)	0.23	<0.001	0.14	0.027	0.23	<0.001
Ear symptoms (strict)	0.19	0.003	0.06	0.375	0.13	0.035
Nasal symptoms (strict)	0.02	0.718	0.03	0.688	0.09	0.164
Throat symptoms	0.19	0.003	0.15	0.023	0.24	<0.001

ρ, Spearman's rank correlation coefficient. Sleep restriction: higher values indicate fewer hours of sleep.

When stress was dichotomised, students with moderate or severe stress (n = 196) had a higher mean total score than those with no or mild stress (n = 50): 2.98 vs 1.90 ($p < 0.001$). They also had a higher prevalence of ear symptoms (44% vs 28%, $p = 0.036$), throat symptoms (69% vs 54%, $p = 0.040$), and dizziness (50% vs 26%, $p = 0.002$) (Table 5).

Table 5. Symptom prevalence by dichotomised stress level

Outcome	None/mild (n = 50)	Moderate/severe (n = 196)	p
Any ear symptom (strict)	28%	44%	0.036
Any nasal symptom (strict)	26%	35%	0.243
Any throat symptom	54%	69%	0.040
Dizziness	26%	50%	0.002
Dry mouth	44%	55%	0.160
Dysphagia	16%	30%	0.053
Hoarseness	12%	21%	0.133

p-values from chi-square tests.

3.4 Sleep and ENT symptoms

Shorter sleep duration was weakly correlated with a higher total score ($\rho = 0.20$, $p = 0.002$), although the pattern was not strictly linear: students sleeping 6-8 hours had the lowest mean score (2.04), and those sleeping 4-6 and <4 hours had similar scores (2.93 and 2.99). Sleep disturbance showed a stronger relationship ($\rho = 0.29$, $p < 0.001$); mean scores were 1.69, 2.31, and 3.14 among students reporting no, occasional, and frequent sleep disturbance, respectively. Stress and sleep disturbance were themselves moderately correlated ($\rho = 0.43$, $p < 0.001$), and stress and sleep restriction weakly so ($\rho = 0.17$, $p = 0.007$).

3.5 Adjusted analysis

In multivariable linear regression, stress remained independently associated with the total symptom score: each one-category increase in stress was associated with 0.59 additional symptoms (95% CI 0.29 to 0.88, $p < 0.001$), and with 0.39 additional symptoms on the strict score (95% CI 0.13 to 0.64, $p = 0.004$). Sleep restriction was no longer significant after adjustment (Table 6), suggesting that its crude association is largely shared with stress. Female students had a higher mean score than males (2.97 vs 2.22, crude $p = 0.002$; adjusted $B = 0.79$, $p = 0.016$). Smoking, headphone use, and caffeine intake were not significantly associated with symptoms. The models explained a modest share of the variance ($R^2 = 0.136$ and 0.083).

Table 6. Multivariable linear regression for ENT symptom score

Predictor	B (total)	95% CI	p	B (strict)	95% CI	p
Exam stress level (per category)	0.59	0.29 to 0.88	<0.001	0.39	0.13 to 0.64	0.004

Predictor	B (total)	95% CI	p	B (strict)	95% CI	p
Sleep restriction (per category)	0.20	−0.10 to 0.49	0.193	0.10	−0.16 to 0.35	0.472
Female sex	0.79	0.15 to 1.42	0.016	0.49	−0.07 to 1.05	0.091
Current smoker	0.72	−0.16 to 1.61	0.110	0.42	−0.36 to 1.19	0.297
Regular headphone use	−0.33	−0.81 to 0.16	0.187	−0.11	−0.54 to 0.31	0.599
Increased caffeine intake	0.25	−0.24 to 0.74	0.310	0.23	−0.21 to 0.66	0.306
Medical specialty	−0.93	−1.70 to −0.17	0.017	−0.72	−1.39 to −0.05	0.037
Academic stage (per stage)	−0.05	−0.18 to 0.09	0.492	0.01	−0.11 to 0.13	0.902

B, unstandardised regression coefficient; CI, confidence interval. The strict score excludes dizziness and headache.

In logistic regression for each domain, higher stress was associated with greater odds of ear symptoms (OR 1.43 per stress category, 95% CI 1.02-2.02, p = 0.038) and showed a borderline association with throat symptoms (OR 1.40, 95% CI 0.99-1.98, p = 0.055). There was no association with nasal symptoms (OR 1.07, p = 0.717). Sleep restriction was not independently associated with any domain (Table 7).

Table 7. Multivariable logistic regression for symptoms by domain

Outcome	OR per stress level (95% CI)	OR per sleep category (95% CI)	p (stress)	p (sleep)
Ear symptoms (strict)	1.43 (1.02-2.02)	1.00 (0.72-1.39)	0.038	0.997
Nasal symptoms (strict)	1.07 (0.76-1.50)	1.03 (0.73-1.44)	0.717	0.875
Throat symptoms	1.40 (0.99-1.98)	1.39 (0.98-1.97)	0.055	0.064

OR, odds ratio; CI, confidence interval. Adjusted for sex, smoking, headphone use, caffeine intake, field of study, academic stage, and the other exposure shown.

3.6 Perceived impact

Higher ENT symptom scores were associated with greater self-reported effects on academic performance (ρ = 0.39, p < 0.001), sleep quality (ρ = 0.25, p < 0.001), and concentration (ρ = 0.22, p < 0.001). Overall, 114 students (46.3%) believed that stress worsens their throat or voice symptoms, and a further 86 (35.0%) answered "maybe". Reading aloud while studying was associated with hoarseness (ρ = 0.18, p = 0.005) and with the throat symptom count (ρ = 0.29, p < 0.001).

4. DISCUSSION

4.1 Principal findings

In this survey of 246 university students, exam stress and short sleep were very common (79.7% reported moderate or severe stress and 76.0% slept less than six hours a day during exams), and most students reported at least one ENT symptom. The main finding is a positive, graded relationship between stress and symptom burden: the mean symptom score roughly tripled from the "no stress" to the "severe stress" group, and the association persisted after adjustment for sleep, sex, lifestyle factors, and academic background. The relationship between sleep duration and symptoms was largely explained by stress, and the pattern differed by domain, being clearly present for ear and throat symptoms and absent for nasal symptoms.

4.2 Throat and voice symptoms

The association between stress and throat symptoms is consistent with earlier work in university students. In a survey of 517 college students, vocal fatigue was associated with stress and intensive voice use, and hoarseness with heavy voice use (Ferreira et al., 2012). A later study of university students likewise found significant correlations between perceived stress and vocal symptoms such as throat dryness and vocal fatigue (Alonso et al., 2024). Our observation that reading aloud while studying was related to hoarseness also fits the role of voice use reported by Ferreira et al. (2012).

Dry mouth was reported far more often in our sample (52.8%) than in the earlier survey (21%) (Ferreira et al., 2012). This probably reflects differences in the recall period (our students were asked about the exam period specifically), in how the symptom was asked, and in the population. Dry mouth is also a common autonomic response to anxiety, and more than half of our students reported higher caffeine intake during exams, so it is a less specific marker of an ENT disorder than hoarseness or throat pain. The adjusted association between stress and throat symptoms was borderline (OR 1.40, $p = 0.055$) and should be interpreted cautiously.

4.3 Ear symptoms

Stress was independently associated with ear symptoms in the adjusted analysis. Tinnitus was reported by 17.1% of our students, which is of a similar order to the 13% found among medical students in Babol, Iran, who had higher rates than technology students (Kiakojouri et al., 2009). Studies in Brazilian medical students have also examined the co-occurrence of tinnitus and headache in an academic setting (Bessa et al., 2021), and headache was the most frequent nasal-domain symptom in our sample (32.1%). Dizziness was the commonest ear-related complaint (45.1%), well above the 26% reported in a much older survey of schoolchildren (Araújo et al., 2004); differences in age, period, and definition limit this comparison, and dizziness during exams may have non-otologic causes such as anxiety, sleep loss, and irregular meals. For this reason we also report a strict score that excludes dizziness and headache, and the stress gradient remained significant in that analysis.

4.4 Nasal symptoms

We found no association between stress and nasal symptoms, although some clinical studies suggest that stress can worsen allergic rhinitis. Anxiety and stress enhanced and prolonged allergic responses in patients with allergic rhinitis (Kiecolt-Glaser et al., 2009), and academic exam stress altered airway immune markers in both healthy and allergic students (Trueba et al., 2013). A likely reason for our null result is that the nasal item did not distinguish allergic from non-allergic symptoms and allowed only one answer, so that students with several symptoms could not report them

all; stress effects would be expected mainly in students with underlying allergy. The prevalence of allergic rhinitis among students has been reported to range from about 19% in Indian college students (Chauhan et al., 2022) to 39% in South African medical students (Seedat et al., 2018), and the proportion of our students with nasal symptoms (32.9% by the strict definition) falls within this range. Seasonal and environmental exposures were not assessed.

4.5 Sleep

Stress and sleep disturbance were moderately correlated in our data (ρ = 0.43), in line with studies of medical students showing that students without stress are less likely to have poor sleep quality (Almojali et al., 2017) and that the stress-sleep relationship may itself be mediated by anxiety and depressive symptoms (Huang et al., 2024). In our analysis, sleep duration lost its association with symptoms once stress was taken into account, whereas self-reported sleep disturbance was more strongly related to symptoms than hours of sleep. This suggests that the perceived quality of sleep, rather than its length alone, may matter, and that stress and poor sleep may act together or along the same pathway. Sleep disturbance was not included in the adjusted models because of its overlap with stress, and a formal analysis would be a logical next step.

4.6 Sex differences and practical implications

Female students had higher symptom scores than males, including after adjustment. Because 72.8% of the sample was female and the data are self-reported, this could reflect differences in symptom reporting between the sexes as well as real differences, and it should be explored in a more balanced sample.

Higher symptom scores were associated with worse self-rated academic performance, sleep quality, and concentration. These findings suggest that universities, especially medical schools, could consider including stress management, sleep hygiene, and basic voice care (such as limiting prolonged reading aloud and maintaining hydration) in student support programmes during exam periods, and that persistent ear, throat, or nasal symptoms in stressed students should not be dismissed without appropriate assessment. We offer this as a suggestion rather than a conclusion of the study.

4.7 Limitations

This study has several limitations. First, its cross-sectional design cannot establish whether stress or sleep loss causes ENT symptoms, and reverse or shared causation (for example, symptoms disturbing sleep) is possible. Second, the questionnaire was self-reported and not validated: stress was measured with a single item rather than a validated scale such as the Perceived Stress Scale, and symptoms were self-attributed to the exam period without clinical examination. Third, dizziness, headache, and dry mouth are common stress-related complaints; the strict analysis addresses this, but the nasal domain remains limited by its single-choice format. Fourth, 88.6% of participants were medical students and 72.8% were female, recruited through an online sample over about one week, which limits generalisability, and the "no stress" (n = 11) and ">8 hours of sleep" (n = 13) groups were small. Finally, pre-existing conditions such as seasonal rhinitis, otitis media, or previous nasal surgery, mentioned in some free-text comments, were not systematically recorded and may have confounded the symptom reports.

5. CONCLUSIONS

Among the university students studied, higher exam stress was associated with a greater number of ear and throat symptoms, independent of sleep duration

and other measured factors, while nasal symptoms were not clearly related to stress. Stress and sleep disturbance were closely linked, and a higher symptom burden was associated with poorer perceived academic performance. Because the design is cross-sectional and based on self-report, these findings indicate an association rather than causation, and they should be confirmed in studies using validated stress and sleep scales and clinical assessment.

Declarations

Acknowledgements: The authors thank Wasit University, where the survey was conducted, and the students who took part in the study.

Ethical approval: Ethical approval was obtained from the Wasit University Ethical Committee. [Authors to supply the approval/reference number before resubmission.]

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflicts of interest: The authors declare no conflict of interest.

Data availability: The data supporting this study are available from the corresponding author on reasonable request.

References

Almojali, A. I., Almalki, S. A., Alothman, A. S., Masuadi, E. M., & Alaqeel, M. K. (2017). The prevalence and association of stress with sleep quality among medical students. *Journal of Epidemiology and Global Health, 7*(3), 169-174. https://doi.org/10.1016/j.jegh.2017.04.005

Alonso, J., Moreno, A., Ocampos, L., Talavera, T., & Torales, J. (2024). Mental health and its implications on the voice: Relationship between perceived stress and vocal symptoms in university students of the Health Sciences School at Universidad Autonoma de Asuncion. *Revista Cientifica de la UCSA, 11*(3), 161-165. https://doi.org/10.18004/ucsa/2409-8752/2024.011.03.161

Araújo, S. A., Moura, J. R., & Camargo, L. A. (2004). Main otolaryngological symptoms among school children. *International Archives of Otorhinolaryngology, 8*(1).

Bessa, D. R., Dunkel, M. A. A., Bessa, L. R., Cruz, L. A. B., Avena, K. M., & Lessa, B. F. (2021). Association between headache and tinnitus among medical students. *Arquivos de Neuro-Psiquiatria, 79*(11), 982-988. https://doi.org/10.1590/0004-282X-ANP-2021-0023

Chauhan, R., Rajesh, S. K., & Chauhan, S. (2022). Prevalence of allergic rhinitis and its perceived effect on academic activity among college students: A cross-sectional study. *National Journal of Community Medicine, 13*(4). https://doi.org/10.55489/njcm.13420226

Ferreira, L. P., Guerra, J. R., Loiola, C. M., & Ghirardi, A. C. A. M. (2012). Relationship between vocal symptoms in college students and their possible causes. *International Archives of Otorhinolaryngology, 16*(3), 306-312. https://doi.org/10.7162/S1809-97772012000300002

Huang, W. M., Wen, X. K., Li, Y. J., & Luo, C. L. (2024). Association of perceived stress and sleep quality among medical students: The mediating role of anxiety and depression symptoms during COVID-19. *Frontiers in Psychiatry, 15*, Article 1272486. https://doi.org/10.3389/fpsyt.2024.1272486

Kiakojouri, K., Alhavaz, A., Foroughi, R., Kheyrkhah, F., Motalebnejad, M.,

Akhavan Tafti, A., Hajian, K., & Raieszadeh, S. (2009). Evaluation of temporomandibular disorders and tinnitus in the students of medical sciences and technology universities in Babol. *Journal of Babol University of Medical Sciences, 11*(5), 59-63.

Kiecolt-Glaser, J. K., Heffner, K. L., Glaser, R., Malarkey, W. B., Porter, K., Atkinson, C., Laskowski, B., Lemeshow, S., & Marshall, G. D. (2009). How stress and anxiety can alter immediate and late phase skin test responses in allergic rhinitis. *Psychoneuroendocrinology, 34*(5), 670-680. https://doi.org/10.1016/j.psyneuen.2008.11.010

Seedat, R. Y., Sujee, M., Ismail, W., Vallybhai, N. Y., Cassim, M. I., Khan, S., Solwa, A., & Joubert, G. (2018). Allergic rhinitis in medical students at the University of the Free State. *South African Family Practice, 60*(4). https://doi.org/10.4102/safp.v60i4.4907

Trueba, A. F., Rosenfield, D., Oberdorster, E., Vogel, P. D., & Ritz, T. (2013). The effect of academic exam stress on mucosal and cellular airway immune markers among healthy and allergic individuals. *Psychophysiology, 50*(1), 5-14.