

Association of perceived stress, sleep quality, temporomandibular disorders, and oral health-related quality of life among dental students: A cross-sectional study

Esam Halboub

Jazan University

Amal Bajonaid

Jazan University

Mohammed Sultan Al-Ak'hali

Jazan University

Mohammed Nasser Alhajj

m.n.alhajj@hotmail.com

Thamar University

Research Article

Keywords: Temporomandibular disorder, Perceived stress, Sleep quality, Oral health-related quality of life

Posted Date: October 6th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10923670/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Dental education is a stressful, demanding environment that may adversely affect various aspects of students' health, including temporomandibular disorders (TMD), perceived stress, poor sleep, and oral health-related quality of life (OHRQoL). This study assessed the interrelationships among TMD, perceived stress, sleep quality, and OHRQoL among dental students.

Methods

We conducted a cross-sectional study among 168 dental students at the College of Dentistry, Jazan University, Saudi Arabia. Participants completed the following validated Arabic short-form tools: the Short Fonseca Anamnestic Index for TMD (SFAI-TMD), 5-item Oral Health Impact Profile (OHIP-5), 4-item Perceived Stress Scale (PSS-4), and 6-item Pittsburgh Sleep Quality Index (PSQI-6). We assessed associations between outcomes and participant characteristics using Mann–Whitney U and Kruskal–Wallis tests and examined correlations using Spearman's correlation coefficient. The p-value was set at < 0.05 .

Results

The mean scores were 16.97 ± 21.93 for SFAI-TMD, 7.44 ± 2.98 for OHIP-5, 12.02 ± 2.65 for PSS-4, and 6.58 ± 3.22 for PSQI-6. TMD symptoms were present in 44.8% of students, predominantly mild TMD. Significant positive correlations were observed between SFAI-TMD and OHIP-5 ($r_s=0.397$), SFAI-TMD and PSQI-6 ($r_s=0.248$), OHIP-5 and PSS-4 ($r_s=0.225$), and PSS-4 and PSQI-6 ($r_s=0.293$). Perceived stress was significantly higher among females and preclinical students. Poorer sleep quality was observed among smokers, while a history of oral and maxillofacial surgery was associated with higher TMD scores.

Conclusion

TMD, perceived stress, sleep quality, and OHRQoL appear to be interconnected among dental students. Screening and supportive interventions may need to be tailored to address these interconnected domains rather than targeting them individually.

Introduction

Dental education is not stress-free. Instead, it is a demanding academic and clinical environment with many rigorous, challenging requirements. Students carry serious curriculum-related responsibilities, including developing complex psychomotor skills, performing clinical procedures, and managing patient

care. These responsibilities and demands come at a cost, contributing to psychological distress and may negatively affect students' well-being and sleep. This stress increases during examinations, academic performance, clinical requirements, and performance pressure [1, 2]. A recent study of medical students at Jazan University, a somewhat similar environment, demonstrated a high burden of psychological distress and sleep difficulties [3]. Therefore, dental students represent an important population in which the interlinks between psychological stress, sleep quality, temporomandibular disorders (TMD), and oral health-related quality of life (OHRQoL) can be investigated.

OHRQoL captures individuals'/patients' subjective perceptions of oral health and its consequences for daily activities and functioning. The Oral Health Impact Profile (OHIP) is one of the most widely used instruments for assessing OHRQoL. The Arabic version of the shortened OHIP tool (OHIP-5) has been developed and validated [4]. OHRQoL is particularly relevant when evaluated along with TMD, sleep quality, and stress, as they represent major components of quality of life.

TMD is an umbrella term representing a heterogeneous group of musculoskeletal conditions affecting the temporomandibular joints, masticatory muscles, and associated structures, with jaw or facial pain, joint sounds, headache, altered mandibular movement, and functional limitations being the main manifestations. TMD are common, and their development and persistence are multifactorial, involving interactions among biological, psychological, and behavioral factors [5]. TMD may be an important oral/maxillofacial health condition affecting dental students' perceived well-being. A recent systematic review found that dental students frequently report TMD, highlighting the potential contribution of academic demands, psychosocial stress, and occupational strain [6]. The effect of TMD on the quality of life is a foregone conclusion. A systematic review and meta-analysis demonstrated a significant adverse effect of TMD on OHRQoL across the available literature [7]. One valid and reliable tool to assess TMD is the Fonseca Anamnestic Index for assessing temporomandibular joint disorders (SFAI TMD). The short-form Fonseca Anamnestic Index (SFAI TMD) is a five-item instrument comprising pain- and function-related questions. Validation against the Diagnostic Criteria for TMDs showed high diagnostic accuracy in identifying overall TMDs, as well as pain-related and intra-articular disorders, supporting its use as a screening instrument in epidemiological studies [8]. The Arabic version of this form is valid and reliable [9]. Stress refers to an individual's perception of situations as uncontrollable and/or overwhelming. The Perceived Stress Scale (PSS) is widely used to assess this experience. The shortened Arabic version (PSS-4) has been shown to be both valid and reliable [10] and is suitable for studies that require measuring multiple constructs while reducing respondent burden. Stress can negatively affect the above-mentioned health dimensions, namely, OHRQoL, sleep quality, and TMD symptoms. In the context of TMD, stress increases muscle tension, entices parafunctional behaviors, alters pain perception, and shapes psychological responses to pain. A recent systematic review identified stress as a significant factor in TMD among dental students, though heterogeneity of the included studies limits the strength of this conclusion [6]. Perceived stress has been shown to induce poor sleep quality among medical students [11]. Similarly, perceived stress has been shown to worsen OHRQoL among 4100 aphthous stomatitis outpatients in Egypt [12].

Continuing from what was mentioned previously, sleep quality, in terms of sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction over one month, is another potentially important factor interlinked with psychological stress, TMD, and OHRQoL. The original PSQI assesses subjective sleep quality, and its Arabic version is both valid and reliable [13]. Recent evidence from Saudi Arabia involving dental students and interns found that poor sleep quality was highly prevalent and was significantly correlated with both TMD and OHRQoL [14]. Another recent study reported poor sleep quality among TMD-positive Turkish dental students [15]. These findings provide further support for examining sleep quality alongside TMDs and perceived stress when evaluating OHRQoL.

Previous research has examined TMD, stress, sleep quality, and OHRQoL but either individually or in pairs. Relatively few studies have evaluated more than two of these factors concurrently among dental students [14]. Assessing these health outcomes together may provide a more comprehensive understanding of the psychosocial and functional factors associated with perceived oral health and TMD in this population. It may help identify modifiable factors that student support and preventive programs could address. Therefore, this study aimed to assess perceived stress, sleep quality, and TMD and OHRQoL among dental students at Jazan University.

Materials and Methods

This was a cross-sectional study. The target population was all dental students at the College of Dentistry, Jazan University, Jazan, Saudi Arabia, in the 203–204 academic year (N = 310). The Intern Research Unit, College of Dentistry, Jazan University, approved the study proposal (CODJU-23321), and the study was conducted in accordance with the Declaration of Helsinki guidelines and regulations. All study procedures were conducted at the College of Dentistry, Jazan University, KSA. The study utilized the translated-to-Arabic, validated, and reliability-assessed short versions of the following questionnaires: Fonseca Anamnestic Index for assessing temporomandibular joint disorders (SFAI TMD) [9], 5-item Oral Health Impact Profile (OHIP-5) [4], Cohen Perceived Stress Scale (PSS-4) [10], and Pittsburgh Sleep Quality Index (PSQI), modified by choosing the six items from the full Arabic translated version [13]. The items from these questionnaires were combined into a single paper-based questionnaire that included demographic and academic questions. The questionnaire began with an introductory paragraph inviting the target students to participate voluntarily, explaining the study and its objectives, and assuring them that participation or refusal would not cause harm. The paragraph concluded with the participant's signature to consent to participate. Thus, all participants provided informed consent before participating. To make the questionnaire easier for students to understand, the researchers prepared it bilingually, including the original English items alongside Arabic translations. To ensure the questionnaire reached all targeted students, the researchers contacted the leaders of each academic year, who were interested and helpful, distributed the papers to their peers, and returned the completed questionnaires to the researchers.

The SFAI TMD consisted of 5 items, with responses of "Yes" (score 10), "Sometimes" (score 5), and "No" (score 0). The sum of the five items would therefore range from 0 to 50. This overall score was calculated by summing the individual item scores and multiplying by 2, yielding a minimum of 0 and a maximum of 100. Higher scores indicate greater TMD potential and severity. The overall SFAI TMD score was further converted into TMD severity classes as follows: no TMD (0–15 points), mild TMD (20–40 points), moderate TMD (45–65 points), and severe TMD (70–100 points). Of note, SFAI-TMD is a screening instrument that identifies TMD symptoms/screen-positive categories rather than establishing a clinical TMD diagnosis.

The OHIP-5 consisted of 5 items with responses: "Never" (1), "Rarely" (2), "Sometimes" (3), "Usually" (4), and "Always" (5). The overall score was calculated by summing the individual item scores, ranging from 5 to 25. Higher scores indicate worse oral health.

The PSS-4 consisted of 4 items with responses: "Never" (1), "Rarely" (2), "Sometimes" (3), "Usually" (4), and "Always" (5). Because the second and third items were positively worded, their scores were reversed; hence, the responses for these two items were coded as follows: "Never" (5), "Rarely" (4), "Sometimes" (3), "Usually" (2), and "Always" (1). The overall score was calculated by summing the individual item scores. Hence, it ranged from 4 to 20, with higher scores indicating greater perceived stress.

The PSQI contains 19 self-rated items assessing different aspects of sleep over the past month, completed by the participant, and represents 7 components. We have adopted the PSQI-6 by choosing six items from the Arabic version of the PSQI [13]. These six items were items 1 and 3 (habitual sleep efficiency); 2 (sleep latency); 4 (sleep duration); 5b (sleep disturbances); and 6 (sleep quality). Item number 1 asks about the bedtime, coded as follows: < 23:00 was given a score of 0, 23:00 to 23:59 was given a score of 1, 00:00 to 01:59 was given a score of 2, and ≥ 02:00 was given a score of 3. Item number 2 was about how many minutes it takes to fall asleep, coded as follows: ≤ 15 minutes was given a score of 0, 16–30 minutes was given a score of 1, 31–60 minutes was given a score of 2, and > 60 minutes was given a score of 3. Item number 3 concerned wake-up time, coded as follows: < 06:00 was given a score of 0, 6:00 to 06:59 was given a score of 1, 07:00 to 07:59 was given a score of 2, and ≥ 08:00 was given a score of 3. Item 4 asked how many hours of sleep respondents got, coded as follows: ≥ 7 hours was scored as 0, 6–7 hours as 1, 5–6 hours as 2, and < 5 hours as 3. Item number 5 was about how many times the respondents had problems leading to trouble sleeping and waking up at night or early morning, coded as follows: 0 for "Not during the past month", 1 for "Less than once a week", 2 for "Once or twice a week", and 3 for "Three or more times a week". Item 6 concerned how the respondent generally assesses their sleep, coded as follows: 0 for "Very good", 1 for "Fairly good", 2 for "Fairly bad", and 3 for "Very bad". The overall score was calculated by summing the individual item scores. Hence, it ranged from 0 to 18, with higher scores indicating worse sleep quality.

The questionnaire included three global questions about participants' health: "How do you assess your general health?" "How do you assess your oral health?" and "How do you assess your psychological health?" Responses were coded as follows: "very good" = 1, "Fairly good" = 2, "Fairly bad" = 3, and "very

bad" = 4. For each of these three questions, the overall score ranged from 1 to 4. Higher scores indicate worse general/oral/psychological health.

Data were input into an Excel file, double-checked, processed, and analysed in IBM SPSS (Version 26). Variables were presented as frequencies with proportions or means with standard deviations, as appropriate. We assessed numerical variables for normality using the Kolmogorov-Smirnov test. Because the distributions were not normal, we analysed the data using non-parametric tests (Mann-Whitney and Kruskal-Wallis tests) to assess differences in the main outcomes (SFAI TMD, OHIP-5, PSS-4, and PSQI-6) across grouping factors. For significant Kruskal-Wallis results, we adjusted pairwise comparison p-values using Bonferroni correction. We also assessed correlations among these outcomes and with the global health questions using the nonparametric Spearman correlation test. A p-value of less than 0.05 was considered significant. No overall adjustment for multiple testing was applied because the analyses were exploratory and hypothesis-generating. We planned to exclude questionnaires with more than 25% unanswered items. Otherwise, we excluded cases listwise for the unanswered items.

Results

Details about the study sample are presented in Table 1. A total of 168 students took part in this study, representing a 54.2% response rate; 53% were female (one student did not report their gender), 25.6% were in the sixth year, and 60.1% were clinical students. The mean age was 22.06 ± 1.84 years (range: 18 to 27 years). The mean GPA was 4.43 ± 0.52 (range: 2 to 5). Only 4.2% and 19% reported having systemic diseases and taking medications, respectively. Surprisingly, 4.2% of the participants reported not brushing their teeth, and 7.1% reported smoking. Up to 11.3%, 33.9%, and 17.3% reported having a dental prosthesis, having/having had orthodontic treatment, and having undergone surgical treatment, respectively. Up to 51% and 49% reported their general and oral health, respectively, as "very good," while 25% and 11% reported their psychological health as "very good" and "very poor," respectively. The mean SFAI TMD score was 16.97 ± 21.93 , ranging from 0 to 100. The mean OHI was 7.44 ± 2.98 , ranging from 5 to 19. The mean PSS-4 score was 12.02 ± 2.65 , ranging from 4 to 16. The mean PSQI-6 score was 6.58 ± 3.22 , ranging from 1 to 15 (Table 2).

Table 1
Characteristics of the sample (N = 168 unless otherwise indicated)

Factor	Categories	N	%
Gender (N = 167)	Males	78	46.7
	Females	89	53.3
Study level	Second	33	16.9
	Third	34	20.2
	Fourth	38	22.6
	Fifth	20	11.9
	Sixth	43	25.6
Clinical stage	Pre-clinical	67	39.9
	Clinical	101	60.1
Systemic diseases	Yes	7	4.2
	No	161	95.8
Current drug use	Yes	32	19
	No	136	81
Tooth brushing (N = 167)	Yes	160	95.8
	No	7	4.2
Smoking (N = 167)	Yes	12	7.2
	No	155	92.8
Dental prosthesis	Yes	19	11.3
	No	149	88.7
Orthodontic treatment	Yes	57	33.9
	No	111	66.1
Maxillofacial surgery	Yes	29	17.3
	No	139	82.7
Self-assessment of general health (N = 167)	Very good	85	50.9
	Good to some extent	73	43.7
	Poor to some extent	9	5.4
	Very poor	0	0

Factor	Categories	N	%
Self-assessment of oral health (N = 167)	Very good	81	48.5
	Good to some extent	81	48.5
	Poor to some extent	5	3
	Very poor	0	0
Self-assessment of psychological health (N = 167)	Very good	42	25.1
	Good to some extent	68	40.7
	Poor to some extent	39	23.4
	Very poor	18	10.8
Age: Mean $\pm$ SD (N = 149)	22.06 $\pm$ 1.84		
GPA; Mean $\pm$ SD (N = 88)	4.43 $\pm$ 0.52		

Table 2
Means and SDs of the scales used by different variables

Variables	Categories	SFAI TMD	OHIP-5	PSS-4	PSQI-6
Overall		16.97 ± 21.93	7.44 ± 2.98	12.02 ± 2.66	6.58 ± 3.22
Gender (N = 164/166/166/150)	Males (n = 76/78/76/71)	14.11 ± 19.27	7.12 ± 2.97	11.21 ± 2.97 ^A	6.3 ± 3.23
	Females (n = 88/88/89/79)	19.43 ± 23.94	7.75 ± 2.98	12.69 ± 2.12^B	6.81 ± 3.22
Study level (N = 165/167/167/151)	Second (n = 33/33/33/30)	12.12 ± 18.83	7.82 ± 3.26	13.27 ± 1.35^A	6.37 ± 2.92 ^{AB}
	Third (n = 33/33/34/30)	12.12 ± 12.44	7.24 ± 2.74	12 ± 2.62 ^{AB}	6.5 ± 3.75 ^{AB}
	Fourth (n = 37/38/38/37)	17.03 ± 19.13	8.03 ± 3.09	12.92 ± 1.99 ^{AB}	7.14 ± 2.79 ^A
	Fifth (n = 19/20/20/19)	36.32 ± 36.85	6.02 ± 2.09	9.15 ± 3.34^C	4.05 ± 2.46^B
	Sixth (n = 43/42/42/35)	15.81 ± 19.67	7.36 ± 3.12	11.62 ± 2.58 ^{BC}	7.63 ± 3.22 ^A
Clinical stage (N = 165/167/167/151)	Pre-clinical (n = 66/67/67/60)	12.12 ± 15.84	7.52 ± 3	12.63 ± 2.17^A	6.43 ± 3.33
	Clinical (n = 99/100/100/91)	20.2 ± 24.74	7.38 ± 2.98	11.62 ± 2.88 ^B	6.68 ± 3.15
Systemic diseases (N = 165/167/167/151)	Yes (n = 7 each))	35.71 ± 39.94	7 ± 4.04	11.71 ± 4.27	6.86 ± 3.53
	No (n = 158/160/160/144)	16.14 ± 20.62	7.46 ± 2.91	12.04 ± 2.58	6.57 ± 3.21
Current drug use (N = 165/167/167/151)	Yes (n = 31/32/32/29)	21.94 ± 23.15	7.56 ± 3.23	12.56 ± 2.56	7.24 ± 3.24
	No (n = 134/135/135/124)	15.82 ± 21.57	7.41 ± 3.93	11.9 ± 2.67	6.43 ± 3.21
Tooth brushing (N = 164/166/166/151)	Yes (n = 157/159/159/145)	17.13 ± 22.28	7.47 ± 2.87	12.01 ± 2.69	6.55 ± 3.25
	No (n = 7/7/7/6)	10 ± 10	7.14 ± 5.24	12.29 ± 2.14	7.33 ± 2.5
Mean values with a different single capital-letter superscript differ significantly.					

Variables	Categories	SFAI TMD	OHIP-5	PSS-4	PSQI-6
Smoking (N = 164/166/166/150)	Yes (n = 11/12/12/9)	19.09 ± 16.4	7.92 ± 3.9	12.25 ± 2.34	9.78 ± 3.63^A
	No (n = 153/154/154/141)	16.8 ± 22.38	7.36 ± 2.87	12.01 ± 2.69	6.4 ± 3.1 ^B
Dental prosthesis (N = 164/166/166/151)	Yes (n = 19/19/19/16)	21.05 ± 22.08	8 ± 3.18	11.37 ± 2.43	5.88 ± 2.31
	No (n = 146/148/148/135)	16.44 ± 21.93	7.36 ± 2.96	12.11 ± 2.68	6.67 ± 3.31
Orthodontic treatment (N = 165/167/167/151)	Yes (n = 55/57/57/52)	18.55 ± 22.4	7.54 ± 2.97	12.23 ± 2.65	6.9 ± 3.34
	No (n = 110/110/110/99)	16.18 ± 21.76	7.38 ± 2	11.92 ± 2.67	6.41 ± 3.15
Maxillofacial surgery (N = 165/167/167/151)	Yes (n = 28/29/29/25)	28.93 ± 29.73^A	7.62 ± 3.18	11.86 ± 2.84	6.12 ± 3.06
	No (n = 137/138/138/126)	15.53 ± 19.21 ^B	7.4 ± 2.95	12.06 ± 2.63	6.67 ± 3.25
Self-assessment of general health (N = 165/166/166/150)	Very good (n = 85/85/84/80)	12.94 ± 20.29 ^A	6.81 ± 2.72 ^A	11.46 ± 2.74^A	5.93 ± 2.98^A
	Good to some extent (n = 71/72/73/61)	22.11 ± 23.29^B	8.14 ± 2^B	12.47 ± 2.54 ^{AB}	7.2 ± 3.22 ^B
	Poor to some extent (n = 9 each)	14.44 ± 23.29 ^{AB}	8 ± 4.15 ^{AB}	13.56 ± 1.67 ^B	8.89 ± 3.41 ^B
	Very poor (n = 0 each)	-	-	-	-
Self-assessment of oral health (N = 165/166/166/150)	Very good (n = 81/81/80/75)	15.31 ± 23.83	6.49 ± 2.68^A	11.58 ± 2.9	6.03 ± 3.31^A
	Good to some extent (n = 79/80/81/70)	18.23 ± 19.46	8.3 ± 3.05 ^B	12.41 ± 2.4	7.21 ± 3.01 ^B
	Poor to some extent (n = 5 each)	24 ± 28.81	9.4 ± 1.67 ^B	12.8 ± 2.66	7.2 ± 2.86 ^{AB}
	Very poor (n = 0 each)	-	-	-	-
Self-assessment of psychological health (N = 165/166/166/150)	Very good (n = 42/42/41/39)	11.9 ± 19.66	6.26 ± 2.9^A	9.88 ± 2.98^A	5.21 ± 2.78^A
Mean values with a different single capital-letter superscript differ significantly.					

Variables	Categories	SFAI TMD	OHIP-5	PSS-4	PSQI-6
	Good to some extent (n = 67/67/68/60)	17.16 ± 21.51	8.06 ± 2.87 ^B	12.59 ± 1.94 ^B	6.57 ± 2.81 ^{AB}
	Poor to some extent (n = 38/39/39/34)	22.11 ± 23.15	7.62 ± 3.11 ^B	12.67 ± 2.61 ^B	8.01 ± 3.37 ^B
	Very poor (n = 18/18/18/17)	17.22 ± 24.92	7.61 ± 2.77 ^{AB}	13.33 ± 1.64 ^B	7.18 ± 3.83 ^{AB}
Mean values with a different single capital-letter superscript differ significantly.					

Regarding the TMD classes, 91 students (54.2%) had no TMD, with a mean SFAI TMD score of 2.2 ± 4.16 , ranging from 0 to 10; 58 (34.5%) students had mild TMD, with a mean SFAI TMD score of 25.17 ± 6.82 , ranging from 20 to 40; 6 students (3.6%) had moderate TMD, with a mean SFAI TMD score of 55 ± 5.48 , ranging from 50 to 60; and 10 (6.1%) students had severe TMD, with a mean SFAI TMD score of 81 ± 11.01 , ranging from 70 to 100 (Classes not shown in the tables). No gender- or clinical-wise differences were found except for the PSS-4 and PSQI-6. PSS-4 was significantly higher among females than males (12.69 ± 2.12 versus 11.21 ± 2.67 ; $p = 0.001$) and among preclinical students than clinical students (12.63 ± 2.17 versus 11.62 ± 2.88 ; $P = 0.030$). Similarly, PSS-4 scores were significantly higher among second-year students (13.27 ± 1.35) than among students at other levels; fifth-year students scored the lowest on the PSS-4 (9.15 ± 3.34 , $P < 0.001$). Similarly, fifth-year students scored the lowest on the PSQI-6 (4.05 ± 2.46), significantly lower than sixth- and fourth-year students (7.14 ± 2.79 and 7.63 ± 3.22 , respectively; $P = 0.003$; Table 2).

Smoking was not associated with differences in the obtained score, except for PSQI-6: those who reported smoking scored significantly higher than non-smokers (9.78 ± 3.63 versus 6.4 ± 3.1 ; $P = 0.006$; Table 2).

Interestingly, those who reported their general health as "very good" had significantly lower scores in SFAI TMD (12.94 ± 20.29), OHIP-5 (6.81 ± 2.72), PSS-4 (11.46 ± 2.74) and PQSI6 (5.93 ± 2.98) compared to other general health categories ($P = 0.008$, 0.004 , 0.009 , 0.005 , respectively; Table 2).

Those who reported their oral health as "very good" had significantly lower OHIP-5 (6.49 ± 2.68) and PQSI-6 (6.03 ± 3.31) scores than those in other oral health categories ($P < 0.001$ and 0.035 , respectively; Table 2).

Similarly, those who reported their psychological health as "very good" had significantly lower scores on the OHIP-5 (6.26 ± 2.9), PSS-4 (9.88 ± 2.98), and PQSI-6 (5.21 ± 2.78) than those in other psychological health categories ($P < 0.001$, < 0.001 , and 0.035 , respectively; Table 2).

Those who reported having maxillofacial surgery scored significantly higher in SFAI TMD (28.93 ± 29.73) than those who did not (15.53 ± 19.21 ; $P = 0.022$).

Table 3 presents the correlation matrix among the different factors. The scales were positively correlated with each other and with self-assessments of general, oral, and psychological health. Significant correlations ranged from weak ($r_s = 0.162$; $P = 0.037$) between SFAI TMD and self-assessment of oral health to moderate ($r_s = 0.409$; $P < 0.001$) between OHIP-5 and self-assessment of oral health.

Table 3
Correlations between different assessed scales and the self-assessed own health.

Variables	SFAI TMD total score	OHIP-5 total score	PSS-4 total score	PSQI-6 total score	Self-assessment of general health	Self-assessment of oral health	Self-assessment of psychological health
SFAI TMD total score	1.000						
OHIP-5 total score	.397**	1.000					
PSS-4 total score	.027	.225**	1.000				
PSQI-6 total score	.248**	.250**	.293**	1.000			
Self-assessment of general health	.203**	.233**	.235**	.264**	1.000		
Self-assessment of oral health	.162*	.409**	.136	.209*	.311**	1.000	
Self-assessment of psychological health	.139	.205**	.385**	.281**	.365**	.152	1.000
**: Correlation is significant at the 0.01 level (2-tailed); *: Correlation is significant at the 0.05 level (2-tailed)							

Discussion

To the best of our knowledge, this is the first study to use four tools assessing four different health dimensions relevant to different environments and apply them in a dental education setting. The findings indicate that TMD symptoms, OHRQoL, perceived stress, and sleep quality are intercorrelated. These outcomes are also intercorrelated with self-rated general, oral, and psychological health. A previous study assessed three of these four dimensions, namely, TMD, sleep quality, and stress among dental

students, and reported associations among them, particularly stress with sleep quality and TMD, but not between sleep quality and TMD [16]. In sum, the dental education environment seems stressful enough to affect many aspects of students' lives, including sleep, psychological, oral, and general health, which all seem to feed into one another. Taken together, it may be recommended to understand TMD and/or OHRQoL among dental students as multidimensional, in which signs and symptoms of TMD and oral health interact with each other, as well as with sleep, psychological factors, and perceived health. However, the cross-sectional design limits conclusions regarding temporal or causal relationships. While students reported their general and oral health as very good or good to some extent, they perceived their psychological health as less favorable: one-third of students reported their psychological health as poor or very poor. This is likely because dental education combines academic requirements with clinical responsibilities and patient-related demands. The less favorable perception of psychological health compared with general and oral health suggests that psychological well-being may be an important aspect of dental students' health profile. The most important finding was the moderate correlation between OHIP-5 and the general question on perceived oral health ($r_s = 0.409$). This finding supports the validity and reliability of the study findings, as both assess oral health, although OHIP is more specific and more comprehensive. A similar correlation ($r_s = 0.44$) was found between the two outcomes in a large Yemeni sample in a study that developed and validated the Arabic version of the OHIP-5 [4]. Another prominent finding was the significant positive correlation between the SFAI-TMD and OHIP-5 ($r_s = 0.397$). This finding aligns with growing evidence that TMD extends beyond localized temporomandibular signs and symptoms and may affect broader physical, functional, and psychosocial well-being [7, 17]. A recent study of Chinese young adults reported that global TMD severity was moderately correlated with OHRQoL and was an important determinant of poorer OHRQoL [18]. Another community-based study involving 1,327 participants found that more TMD signs and symptoms were associated with higher scores of OHRQoL; the association was particularly pronounced when more than three typical TMD symptoms were present [19], strongly supporting the present observation that TMD symptoms are associated with students' perceptions of their oral health and daily quality of life. The magnitude of the correlation observed ($r_s = 0.397$) seems clinically meaningful, while still consistent with the multifactorial nature of OHRQoL, which is influenced by multiple oral and psychosocial conditions. That said, TMD would not necessarily account for most of the variance in OHIP-5 scores; nevertheless, the association indicates that TMD symptoms are an important component of dental students' overall oral health experience. This argument is also supported by recent work, which demonstrated that TMD symptom dimensions, particularly TMD severity, incorporating symptom duration, frequency, intensity, and interference, were the main determinant of low OHRQoL in Chinese young adults [20]. This may help explain why even relatively young individuals, such as the students in the present study, can experience measurable effects of TMD on quality of life.

A second important finding was the significant positive correlation between SFAI TMD and PSQI-6, although weak ($r_s = 0.248$). This finding is consistent with recent evidence indicating a close relationship between TMD and sleep disturbances. A recent umbrella review concluded that pain associated with TMD affects sleep quality, highlighting the potentially bidirectional relationship between TMD and sleep

disorders [21]. Another recent study found that poorer daily sleep quality increased the likelihood of within-day exacerbations of TMD pain, rather than merely being a consequence of pain, underscoring the importance of addressing patients' sleep quality and psychological states in the management of painful TMD [22]. It may be a bidirectional link in which TMD-related pain, muscle discomfort, and/or functional limitation interfere with sleep initiation and/or maintenance, while inadequate sleep increases pain sensitivity, reduces coping ability, and heightens awareness of musculoskeletal symptoms. Mounting evidence from longitudinal research reported an association between poor sleep quality and TMD onset, in addition to other factors such as female sex, psychological symptoms, perceived stress, and other comorbidities [23]. However, because the study is cross-sectional, this correlation should be interpreted as an association, not causation. Follow-up studies among dental students would help determine whether changes in sleep quality precede changes in TMD symptoms, particularly during periods of increased academic or clinical demand. Contrastingly, the correlation between TMD and perceived stress was not statistically significant ($r_s = 0.027$). This is an important and even unanticipated finding. Typically, psychological stress is frequently reported as a potential contributor to TMD. Rather, it suggests that the association between these outcomes may be more complex than a simple direct association. A recent systematic review of cohort studies concluded that perceived stress, among other factors, is a potential risk factor for TMD, underscoring that TMD is multifactorial and highlighting the need for standardized methodologies [23]. Another recent study showed that TMD severity was significantly associated with psychological distress, even though the strength of this association varied according to the TMD symptom dimensions examined [18]. The following argument can explain the discrepancy between our finding and studies reporting an association between psychological factors and TMD. First, the PSS-4 specifically assesses perceived stress; hence, it may not capture the broader psychological processes involved in TMD. In fact, perceived stress is not equivalent to anxiety, depression, catastrophizing, or other psychological distress dimensions. Second, sleep disturbance or oral health behaviors may mediate the association between stress and TMD rather than it occurring directly. Our findings support this: perceived stress was significantly correlated with OHIP-5 ($r_s = 0.225$), PSQI-6 ($r_s = 0.293$), self-assessment of oral health ($r_s = 0.233$), and self-assessment of psychological health ($r_s = 0.385$), underscoring that perceived stress is related to both OHRQoL, sleep quality, and general and psychological health, even in the absence of a significant direct correlation with TMD. Third, the study sample, dental students, is a relatively homogeneous young population unlike clinical TMD populations in symptom severity, chronicity, and psychological characteristics. Overall, this finding suggests that stress may contribute to dental students' broader health experience without necessarily being reflected in their TMD scores. The significant positive association between PSS-4 and self-assessment of psychological health ($r_s = 0.385$) further strengthens the validity of the tools used. The significant correlations among OHIP-5, PSS-4, PSQI-6, self-assessment of oral health, and self-assessment of psychological health provide additional evidence for an interconnected pattern, reflecting the cumulative effect of several interconnected experiences. That said, students who experience stress and sleep difficulties may perceive oral symptoms as more burdensome or may experience greater functional and psychosocial consequences from otherwise similar oral conditions. The inverse is true.

Because of the cross-sectional design, the direction of these correlations cannot be determined, highlighting considering oral health, sleep, and psychological well-being together.

Although female students scored higher than males on all tools, the significant difference was limited to PSS-4 (12.69 ± 2.12 versus 11.21 ± 2.97 ; $P < 0.05$). Evidence suggests males have higher coping capacity than females, leading them to perceive stress as much lower than females do [24]. Acartürk (2023) reported gender-related differences in the dental context not only in perceived stress but also in other psychological responses, such as dental anxiety, which may help frame the relationship between gender and psychological experiences in the dental setting within a broader framework [25]. Interestingly, second-year students had the highest PSS-4 score, while fifth-year students had the lowest. This finding was further supported by significantly higher PSS-4 scores among students in the preclinical stage than among students in the clinical stage. This suggests that enrolment in a new environment is stressful, while stress eases as students become accustomed to it [26]. Another study by Acartürk (2023) reported similar results, indicating that preclinical practical courses and the process of acquiring new professional skills may constitute additional sources of stress for students [27]. However, we reported the opposite in our previous 5-year follow-up study of dental students across their program journey, in which perceived stress among dental students is notably high and increases progressively throughout the academic years, peaking during the clinical stage [28]. Furthermore, our findings contradict a recent study that reported higher stress and TMD among clinical students [29].

The strongest pattern across several outcomes involved self-rated health. Students who rated their general health as very good generally showed significantly lower (favourable) scores on the SFAI TMD, OHIP-5, PSS-4, and PSQI-6. Similarly, students who rated their oral health as very good showed significantly lower (favourable) scores on the OHIP-5 and PSQI-6, and students who rated their psychological health as very good showed significantly lower (favourable) scores on the OHIP-5, PSS-4, and PSQI-6. The correlation analyses support these subgroup findings. These general single-question items are used for convergent validity in questionnaire development [4], further supporting the validity of the findings. In sum, these findings may indicate that students' subjective perceptions of their health correspond reasonably well with standardized assessments of oral health impact, TMD-related symptoms, perceived stress, and sleep quality.

Students who reported having had oral and maxillofacial surgery scored higher on the SFAI TMD (28.93 ± 29.73) than those who did not (15.53 ± 19.21). Notably, most, if not all, respondents had third molar surgery. Evidence exists regarding the development of TMD after third molar surgery [30].

Smokers scored higher on the PSQI-6 (9.78 ± 3.63) than non-smokers (6.40 ± 3.10 ; $P < 0.05$), reflecting poorer sleep quality. Evidence supporting this notion does exist, ascribing it to nicotine's stimulant effects on the central nervous system. This increases physiological arousal, which in turn interferes with the normal sleep process and likely causes prolonged sleep latency, more frequent nocturnal awakenings, and reduced overall sleep quality [31, 32].

According to the study findings, dental education is stressful and burdens enrolled students, highlighting the importance of assessing dental student health, including brief screening for TMD symptoms, OHRQoL, perceived stress, and sleep problems, particularly among students reporting poorer oral or general health. This doesn't necessarily imply that all students with stress or poor sleep have TMD or poor oral health. Instead, it would help identify students who may benefit from further assessment. Because oral health, TMD, sleep quality, and perceived stress can coexist, management strategies that consider pain, function, sleep, psychological well-being, and quality of life may be more appropriate than approaches that focus exclusively on one condition.

A major strength of the current study is that it is the first of its kind to simultaneously evaluate TMD, perceived stress, sleep quality, and OHRQoL using standardized tools, allowing examination of relationships among distinct but interconnected health domains. However, we must acknowledge several limitations. The study used a cross-sectional design; hence, determining causality or temporal direction is not practical. The small sample size, although representing a 54.2% response rate, may limit the results' generalizability. The 45.8% non-response was due to students not being available on the days of data collection, incomplete questionnaires (more than 25% of the items), or refusal to participate. Recall bias is another limitation, as it cannot be ruled out because several outcomes were self-reported. Another limitation is that some subgroups are small, including students with systemic disease and smokers, limiting the strength of subgroup comparisons. A further limitation is that because the study was conducted at a single dental school, generalizability to dental students at other universities or to young adults in the wider population is limited. In addition, because the analyses were primarily bivariate, residual confounding cannot be excluded. Furthermore, no overall adjustment for multiple testing was applied because the analyses were exploratory and hypothesis-generating. Therefore, future large-scale, more robust studies using multivariable models and P-value adjustment would help determine whether the observed relationships between TMD, sleep, stress, and OHRQoL remain significant after adjustment for demographic, behavioural, and clinical factors.

Conclusion

Given the limitations of the present study, temporomandibular disorders, OHRQoL, perceived stress, and sleep quality are interconnected with each other and with self-assessed general, oral, and psychological health. Among these outcomes, PSS-4 varies by gender, study level, and clinical stage; PSQI-6 varies by smoking; and SFAI TMD varies by history of oral and maxillofacial surgery.

Declarations

Supplementary Information: The supplementary file contains the bilingual questionnaire used in the study.

Acknowledgments: Not applicable.

Author contributions: EH: Conceived the study idea, designed the research protocol, collected the data, conducted the analysis and literature review, and drafted the manuscript.

AB: Contributed to data analysis and the literature review and assisted with drafting the manuscript. MS: Participated in developing the study concept, conducted literature searches, and contributed to manuscript preparation. MN: Participated in the data analysis, conducted literature searches, and contributed to manuscript preparation. All authors read and approved the final version of the manuscript.

Funding: This study received no external funding.

Data availability: The datasets used and analysed in this current study are available from the corresponding author upon reasonable request.

Declarations: The study strictly adhered to the principles of the Declaration of Helsinki.

Human Ethics and Consent to Participate: The Intern Research Unit, College of Dentistry, Jazan University, approved the study proposal (CODJU-23321), and the study was conducted in accordance with the Declaration of Helsinki guidelines and regulations.

Declarations: The introductory part of the questionnaire included a note that participation is voluntary and concluded with the participant's signature to participate. All participants provided informed consent ahead of participation.

Clinical trial number: Not applicable.

Consent for publication: Not applicable

References

1. Khanagar SB, Al-Ehaideb A, Jamleh A, Ababneh K, Maganur PC, Vishwanathaiah S, Awawdeh MA, Naik S, Al-Kheraif AA, Bhandi S et al: **Psychological Distress among Undergraduate Dental Students in Saudi Arabia and Its Coping Strategies-A Systematic Review**. *Healthcare (Basel)* 2021, **9**(4).
2. Smolana A, Loster Z, Loster J: **Assessment of stress burden among dental students: A systematic literature review and meta-analysis of data**. *Dent Med Probl* 2022, **59**(2):301-307.
3. Sayed AI, Mobarki SJ, Oberi IA, Omar YZ, Moafa SH, Ayoub RA, Ajeebi Y, Hakami F, Hakami A, Somaili M: **Effect of Stress on Sleep Quality among Medical Students: A Cross-sectional Study at Jazan University, Saudi Arabia**. *Ann Afr Med* 2024, **23**(4):586-593.
4. Alhajj MN, Halboub E, Khalifa N, Amran AG, Reissmann DR, Abdullah AG, Assad M, Al-Basmi AA, Al-Ghabri FA: **Translation and validation of the Arabic version of the 5-item Oral health impact profile: OHIP5-Ar**. *Health Qual Life Outcomes* 2018, **16**(1):218.

5. Alqutaibi AY, Alhammad MS, Hamadallah HH, Altarjami AA, Malosh OT, Aloufi AM, Alkahtani LM, Alharbi FS, Halboub E, Almashraqi AA: **Global prevalence of temporomandibular disorders: a systematic review and meta-analysis.** *J Oral Facial Pain Headache* 2025, **39**(2):48-65.
6. Walczuk N, Borawski A, Skomro P, Wojcik M, Gronwald H, Sroczyk-Jaszczynska M, Maslyk D, Barczyk I, Grzegocka M, Kijak K et al: **Temporomandibular joint disorders in dental students - a systematic review of the literature.** *BMC Oral Health* 2026, **26**(1).
7. Qamar Z, Alghamdi AMS, Haydarah NKB, Balateef AA, Alamoudi AA, Abumismar MA, Shivakumar S, Cicciu M, Minervini G: **Impact of temporomandibular disorders on oral health-related quality of life: A systematic review and meta-analysis.** *J Oral Rehabil* 2023, **50**(8):706-714.
8. Yap AU, Zhang MJ, Lei J, Fu KY: **Diagnostic accuracy of the short-form Fonseca Anamnestic Index in relation to the Diagnostic Criteria for Temporomandibular Disorders.** *J Prosthet Dent* 2022, **128**(5):977-983.
9. Alyessary AS, Yap AU, Almousawi A: **The Arabic Fonseca Anamnestic Index: Psychometric properties and use for screening temporomandibular disorders in prospective orthodontic patients.** *Cranio* 2023, **41**(2):131-138.
10. Ali AM, Hendawy AO, Ahmad O, Al Sabbah H, Smail L, Kunugi H: **The Arabic Version of the Cohen Perceived Stress Scale: Factorial Validity and Measurement Invariance.** *Brain Sci* 2021, **11**(4).
11. Rebello CR, Kallingappa PB, Hegde PG: **Assessment of perceived stress and association with sleep quality and attributed stressors among 1(st)-year medical students: A cross-sectional study from Karwar, Karnataka, India.** *Tzu Chi Med J* 2018, **30**(4):221-226.
12. Ghalwash D: **Prevalence profile perceived stress and impact on quality of life for recurrent aphthous ulcers: a cross-sectional epidemiological study in Egypt.** *BMC Oral Health* 2026, **26**(1).
13. Suleiman KH, Yates BC, Berger AM, Pozehl B, Meza J: **Translating the Pittsburgh Sleep Quality Index into Arabic.** *West J Nurs Res* 2010, **32**(2):250-268.
14. Alsubaie N, Alshahrani W, Alabdulkarim SS, Alghannam RJ, Shahin S, Alamri A, Nazir MA: **Sleep Quality and Its Relationship with Temporomandibular Disorders and Oral Health-Related Quality of Life Among Dental Students and Interns: A Cross-Sectional Study.** *Patient Prefer Adherence* 2026, **20**:575424.
15. Kaya I: **Association between temporomandibular disorders and sleep quality among undergraduate dental students: a cross-sectional study.** *BMC Oral Health* 2026, **26**(1).
16. Gaikwad S, Waingade M, Medikeri RS, Jangam DK: **Correlation between Temporomandibular Joint Disorders, Sleep Quality and Stress among Dental Students: A Cross-sectional Study.** *Journal of Clinical and Diagnostic Research* 2023, **17**(7):ZC25-ZC28.
17. AlSahman L, AlBagieh H, AlSahman R: **Oral Health-Related Quality of Life in Temporomandibular Disorder Patients and Healthy Subjects-A Systematic Review and Meta-Analysis.** *Diagnostics (Basel)* 2024, **14**(19).
18. Yap AU, Lei J, Liu C, Huang Z, Fu KY: **Correlates Between Temporomandibular Disorder Symptom Severity, Psychological Distress, Well-Being, and Oral Health-Related Quality of Life: Insights From**

Chinese Young Adults. *J Oral Rehabil* 2025, **52**(6):795-806.

19. Wang Y, Xu J, Li X, Liu X, Wan Y, Xing T: **Associations between temporomandibular disorder subtypes and oral health-related quality of life: A systematic review and meta-analysis.** *Cranio* 2026, **44**(5):830-843.
20. Yap AU, Liu C, Fu KY, Lei J: **Symptom Dimensions of Temporomandibular Disorders: Correlates With Emotional Distress, Jaw Function and Oral Health-Related Quality of Life.** *J Oral Rehabil* 2025, **52**(9):1407-1419.
21. Rigon M, Obara K, Paixao L, Cardoso JR, Machado Junior AJ: **Relationship between temporomandibular and sleep disorders in adults: An overview of systematic reviews.** *Sleep Med* 2024, **124**:404-415.
22. Herrero Babiloni A, Provost C, Charlebois-Plante C, De Koninck BP, Apinis-Deshaies A, De Beaumont L, Lavigne GJ, Martel MO: **The Contribution of Sleep Quality and Psychological Factors to the Experience of Within-Day Pain Fluctuations Among Individuals With Temporomandibular Disorders.** *J Pain* 2024, **25**(9):104576.
23. Da-Cas CD, Valesan LF, Nascimento LPD, Denardin ACS, Januzzi E, Fernandes G, Stuginski-Barbosa J, Mendes de Souza BDM: **Risk factors for temporomandibular disorders: a systematic review of cohort studies.** *Oral Surg Oral Med Oral Pathol Oral Radiol* 2024, **138**(4):502-515.
24. Graves BS, Hall ME, Dias-Karch C, Haischer MH, Apter C: **Gender differences in perceived stress and coping among college students.** *PLoS One* 2021, **16**(8):e0255634.
25. Acartürk M: **Sosyodemografik faktörler ile dental kaygı düzeyleri arasındaki ilişkinin değerlendirilmesi.** *Avrasya Sağlık Bilimleri Dergisi* 2023, **6**(3).
26. Adams KL, Saunders KE, Keown-Stoneman CDG, Duffy AC: **Mental health trajectories in undergraduate students over the first year of university: a longitudinal cohort study.** *BMJ Open* 2021, **11**(12):e047393.
27. Acartürk M: **Diş Hekimliği Öğrencilerinin Restoratif Diş Tedavisi Preklinik Uygulama Dersine Bakış Açıları Ve Stres Seviyelerinin Değerlendirilmesi.** *Yükseköğretim Ve Bilim Dergisi* 2023, **13**(2):219-224.
28. Amran AG, Halboub E, Al-Sosowa AA, Al-Maweri AA, Al-Maweri SA, Alhajj MN: **Stress Dynamics in Future Dentists: Insights From a 5-Year Cohort Study.** *Eur J Dent Educ* 2026, **30**(2):418-426.
29. Ozcan B, Mustafaoglu E: **Investigation of the relationship between stress and temporomandibular joint dysfunction during preclinical and postclinical education among dentistry faculty students at Kutahya Health Sciences University.** *BMC Oral Health* 2026, **26**(1).
30. Damasceno YSS, Espinosa DG, Normando D: **Is the extraction of third molars a risk factor for the temporomandibular disorders? A systematic review.** *Clin Oral Investig* 2020, **24**(10):3325-3334.
31. Al-Mshari A, AlSheikh MH, Latif R, Mumtaz S, Albaker W, Al-Hariri M: **Impact of smoking intensities on sleep quality in young Saudi males: a comparative study.** *J Med Life* 2022, **15**(11):1392-1396.
32. Amiri S, Behnezhad S: **Smoking and risk of sleep-related issues: a systematic review and meta-analysis of prospective studies.** *Can J Public Health* 2020, **111**(5):775-786.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryFileQuestionnairebilanguage.pdf](#)