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Engku Ahmad Muzhaffar
Periodontics Unit, School of Dental Sciences, Universiti Sains Malaysia Health Campus, Kelantan, Malaysia; Periodontics Unit, Pusat Pakar Pergigian Seremban, Negeri Sembilan, Malaysia, engkuahmadmuzhaffar@gmail.com

Zurairah Berahim
Periodontics Unit, School of Dental Sciences, Universiti Sains Malaysia Health Campus, Kelantan, Malaysia, zurairah@usm.my

Norsila Abdul Wahab
Basic and Medical Sciences Unit, School of Dental Sciences, Universiti Sains Malaysia Health Campus, Kelantan, Malaysia, norsila@usm.my

Norkhafizah Saddki
Dental Public Health Unit, School of Dental Sciences, Universiti Sains Malaysia Health Campus, Kelantan, Malaysia, fizah@usm.my

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Cover Page Footnote

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ORIGINAL ARTICLE

Perceived Stress, Severity of Xerostomia, and Periodontal Status in Undergraduate Dental Students

Engku Ahmad Muzhaffar[1,2], Zurairah Berahim[1], Norsila Abdul Wahab[3*], Norkhafizah Saddki[4]

[1]Periodontics Unit, School of Dental Sciences, Universiti Sains Malaysia Health Campus, Kelantan, Malaysia
[2]Periodontics Unit, Pusat Pakar Pergigian Seremban, Negeri Sembilan, Malaysia
[3]Basic and Medical Sciences Unit, School of Dental Sciences, Universiti Sains Malaysia Health Campus, Kelantan, Malaysia
[4]Dental Public Health Unit, School of Dental Sciences, Universiti Sains Malaysia Health Campus, Kelantan, Malaysia
**Correspondence e-mail to: norsila@usm.my*

ABSTRACT

Dentistry is a highly stressful program; stress is associated with xerostomia and periodontal disease. **Objective:** This study aims to investigate the association of perceived stress, severity of xerostomia, and periodontal status in dental students. **Methods:** This was a two-phase cross-sectional study of 245 Universiti Sains Malaysia (USM) undergraduate dental students. Phase 1 involved administration of the Perceived Stress Scale (PSS-10) and Summated Xerostomia Inventory (SXI). In phase 2, the Community Periodontal Index (CPI) was performed on 150 students to determine their periodontal status. **Results:** Mean PSS-10 and SXI scores were 19.6 (SD 5.47) and 7.9 (SD 2.04), respectively. Only 7.3% students had healthy periodontium while 17.3% had gingival bleeding, 65.3% had calculus, 6.7% had shallow pockets, and 3.3% had deep pockets. The association of perceived stress, severity of xerostomia, and periodontal status was not significant. Nevertheless, a significant positive correlation was found between PSS-10 and SXI scores ($r = 0.318$, $p < 0.01$). **Conclusion:** Most USM dental students were affected by some degree of periodontal disease, but it was not associated with perceived stress or severity of xerostomia. Students with higher perceived stress had more severe xerostomia. Information from this study could be utilised by the dental school in planning towards providing a stress-free training environment.

Key words: dental students, periodontal disease, psychological stress, xerostomia

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INTRODUCTION

Undergraduate dental education stands out as a unique educational system. It involves the acquisition of required academic, clinical, and interpersonal skills within four- to six-year programs. Different regions of the world offer different undergraduate dental curriculum systems. Each system may have its own way of leading to stress among students.[1] Stress can be broadly classified into (i) environmental perspective, which focuses on stressors or life events; (ii) psychological perspective, which assesses subjective stress appraisal and affective reactions; and (iii) biological perspective, which assesses the activation of the physiological systems involved in the stress response.[2] However, this study was only focusing on psychosocial stress.

Psychosocial stress is the physiological and psychological changes that occur in the body when an individual's adaptive ability is unable to cope with an external demand or stressor.[3] Several studies have assessed the stress level perceived by dental students during their undergraduate life and the associated factors.[4-6] Other studies have also indicated that dental students have greater stress than medical, pharmacy, and nursing students.[7,8] Academic achievement, students' physical and mental health, and an individual's quality of life (QoL) may be impacted by stress.[9,10] Additionally, stress is a well-established risk factor for periodontal disease[11] and it can also lead to xerostomia.[12,13] Xerostomia is a subjective feeling of dry mouth and occurs most commonly in the elderly and patients population.[14] It

can cause deleterious effects on oral health including caries and gingivitis; thus, affecting the QoL.[10,15] Periodontal disease is the eleventh most prevalent disease in 2016.[16] The Malaysia National Oral Health Survey of Adults in 2010 (NOHSA 2010)[17] revealed that 94% of the Malaysian adult population suffered from some form of periodontal disease, with nearly half of them presented with periodontal pocket depth of at least 4 mm. Patients with periodontal disease are at risk of multiple tooth loss, edentulism, and masticatory dysfunction, all of which have a negative impact on their nutrition, QoL, and self-esteem, as well as impose significant socioeconomic and healthcare expenditures.[18]

To the best of our knowledge, no published study has investigated the association of perceived stress, severity of xerostomia, and periodontal status in undergraduate dental students. Moreover, data that assessed perceived stress among dental students in Malaysia are scarce.[5] Limited number of studies have reported xerostomia in young adults and dental students.[15,19] Only few studies have evaluated periodontal status in dental students,[20-22] but none was for Malaysian population, and one study has reported the association between perceived stress and xerostomia in dental students.[19]

Thus, this study was conducted to determine perceived stress, severity of xerostomia, and periodontal status, as well as investigating the association between these variables in undergraduate dental students at the School of Dental Sciences (SDS), Universiti Sains Malaysia (USM).

METHODS

Study design and sampling

This was a cross-sectional study consisted of two phases. Phase 1 involved questionnaire administration while Phase 2 involved periodontal examination. The study protocol has received ethical clearance from Human Research Ethics Committee USM, reference number USM/JEPeM/17070319. All participants have given written informed consent.

The sample for Phase 1 included all 245 undergraduate dental students at SDS, USM. For Phase 2, the exclusion criteria applied were being a current or previous smoker, alcohol drinker, having chronic medical illnesses, under prolonged use of medication, and pregnancy. Based on a calculated sample size, a nonproportionate stratified random sampling method was chosen to select 150 samples from the eligible 207 students. The strata were applied equally according to year of study (total five years, N = 30 for each year of study). The sampling frame in each stratum was determined (Year 1, N = 44; Year 2, N = 42; Year 3, N = 50; Year 4, N = 35; Year 5, N = 36). Following that, a simple random sampling procedure was executed using the SPSS software to select the samples within each stratum of the population.

Research tools

A sociodemographic form was filled by all participants at the beginning of Phase 1. Each form was assigned a specific study code number for anonymity.

The Perceived Stress Scale (PSS) is the most often used validated self-report measure for perceived stress assessment and possesses excellent psychometric properties.[23] In this study, the original English version of 10-item PSS (PSS-10) was used to self-appraised stress. It consists of items with two domains: six negatively worded items (items 1, 2, 3, 6, 9, and 10) and four positively worded items (items 4, 5, 7, and 8).[23] The PSS-10 assesses perceived stressful experiences or stress responses over the previous month with a five-point Likert scale (0=never, 1=almost never, 2=sometimes, 3=fairly often, and 4=very often). Responses to the four positively stated items were reversed (0=very often, 1=fairly often, 2=sometimes, 3=almost never, and 4=never). The PSS-10 scores were then obtained by summing across all scale items. The scores range from 0 to 40, with higher scores indicating greater stress.[23] Collin and co-workers considered scores 20 or greater as having a high level of perceived stress.[6]

The Summated Xerostomia Inventory (SXI) is the most commonly used validated tool and has high reliability to assess severity of xerostomia.[24] The original English version was used that consists of five items ("My mouth feels dry", "I have difficulty in eating dry foods", "My mouth feels dry when eating a meal", "I have difficulties swallowing certain foods", and "My lips feel dry"). For each SXI item, the respondents were asked to rate their experience of dry mouth during the last one month, on a five-point Likert scale (never, hardly ever, occasionally, frequently, and always). A three-response format was adapted (1=never, 2=hardly ever and occasionally, and 3=frequently and always). The total SXI score was a summation of five individual item scores. Therefore, the SXI score for each participant ranged from 5 (no xerostomia) to 15 (extreme xerostomia).[24] Wang and co-workers classified the degree of dry mouth based on SXI scores as follows: 5, no dry mouth; 6 to 8, mild dry mouth; 9 to 12, moderate dry mouth; and 13 to 15, severe dry mouth.[25]

The Community Periodontal Index (CPI) examination form was used to record periodontal health status of the participants.[26] The WHO CPI probe with a 0.5 mm ball tip was used. Three indicators of periodontal status used for this assessment were gingival bleeding, calculus, and periodontal pockets. The mouth was divided into six sextants. The index teeth, or all remaining teeth in a sextant where there was no index

Table 1. Characteristics of participants (N = 245).

Variable	Frequency (%)
Year of study	
Year 1	50 (20.4)
Year 2	47 (19.2)
Year 3	55 (22.4)
Year 4	43 (17.6)
Year 5	50 (20.4)
Preclinical (Year 1 and 2)	97 (39.6)
Clinical (Year 3, 4, and 5)	148 (60.4)
Ethnicity	
Malay	127 (51.8)
Chinese	83 (33.9)
Indian	18 (7.3)
Others	17 (6.9)
Malay	127 (51.8)
Others	118 (48.2)
Sex	
Male	76 (31.0)
Female	169 (69.0)
Marital status	
Single	241 (98.4)
Married	4 (1.6)
Repeating year of study	
No	234 (95.5)
Yes	11 (4.5)
Satisfaction with decision taking dentistry	
No	18 (7.3)
Yes	227 (92.7)
Presence of medical illness	
No	222 (90.6)
Yes	23 (9.4)
Current medication	
No	227 (92.7)
Yes	18 (7.3)
Smoking status	
Non-smoker	243 (99.2)
Current smoker	2 (0.8)
Previous smoker	0 (0.0)
Alcohol consumer	
No	238 (97.1)
Yes	7 (2.9)
Residential status	
Campus hostel	242 (98.8)
With family	3 (1.2)

tooth, were probed and the highest CPI score for each sextant was recorded. The highest score of the sextants was considered as the CPI score of the participant.

Data collection

A calibration exercise for CPI measurement was conducted prior to data collection by examining 5% (N = 8) of the sample size (N = 150) to assess the intra- and inter-examiner reliability using Kappa statistic. The Kappa values of intra- and inter-examiner agreement were 0.81 and 0.75, respectively.

Phase 1 involved questionnaire administration. Following written informed consent, all 245 students filled in the sociodemographic form, PSS-10, and SXI, which were collected immediately afterwards. In Phase 2, CPI assessment was performed on 150 students using a flat mouth mirror and a WHO CPI probe.

Table 2. Perceived stress, severity of xerostomia, and the relationship with students' characteristics (N = 245).

Variable	PSS-10 score Mean (SD)	p‡	SXI score Mean (SD)	p‡
Year of study				
Year 1	20.2 (5.24)		8.3 (1.79)	
Year 2	18.4 (5.61)		7.6 (1.99)	
Year 3	19.0 (4.84)		7.8 (2.04)	
Year 4	19.5 (5.21)		8.2 (1.93)	
Year 5	20.9 (6.24)		7.7 (2.38)	
Preclinical	19.3 (5.47)	0.539	8.0 (1.91)	0.763
Clinical	19.8 (5.48)		7.9 (2.13)	
Ethnicity				
Malay	20.5 (5.43)		8.0 (2.13)	
Chinese	18.4 (5.35)		8.0 (2.05)	
Indian	19.4 (5.17)		7.2 (1.51)	
Others	18.9 (5.96)		7.4 (1.66)	
Malay	20.5 (5.43)	0.009	8.0 (2.13)	0.305
Others	18.7 (5.38)		7.8 (1.94)	
Sex				
Male	18.1 (5.45)	0.005	8.0 (2.08)	0.507
Female	20.3 (5.36)		7.9 (2.02)	
Satisfaction with decision taking dentistry				
No	24.3 (6.90)	0.006	8.4 (2.01)	0.249
Yes	19.2 (5.17)		7.9 (2.04)	
Current medication				
No	19.4 (5.42)	0.125	7.8 (1.98)	0.046
Yes	21.5 (5.90)		8.8 (2.55)	
Residential status				
Campus hostel	19.5 (5.39)	0.041	7.9 (2.04)	0.939
With family	26.0 (8.89)		8.0 (2.65)	
All	19.6 (5.47)		7.9 (2.04)	

‡; the significant difference was tested by t-test, significance at $p < 0.05$
SD; standard deviation.

Statistical analysis

Data were analyzed using SPSS version 24.0. Descriptive statistics were used to analyze the sociodemographic profile, perceived stress level, severity of xerostomia, and periodontal status of the students. Mean (SD) was computed for perceived stress level and severity of xerostomia. Frequency (%) was computed for sociodemographic data and periodontal status. A simple logistic regression analysis was used to find the association of students' characteristics, perceived stress, and severity of xerostomia, with the presence of periodontal pockets (CPI 3 and 4). A generated scatter plot and Pearson's correlation analysis were used to find the relationship between PSS-10 and SXI scores. P-value of <0.05 with 95% confidence interval was considered statistically significant.

RESULTS

All 245 students responded in answering the questionnaires. More than two-thirds of them were

Table 3. Distribution of the students' CPI scores based on their characteristics (N = 150).

Variable	Frequency (%)				
	CPI 0 Healthy	CPI 1 Bleeding	CPI 2 Calculus	CPI 3 Shallow pocket	CPI 4 Deep pocket
Year of study					
Year 1 (N = 30)	0 (0.0)	7 (23.3)	21 (70.0)	1 (3.3)	1 (3.3)
Year 2 (N = 30)	1 (3.3)	2 (6.7)	23 (76.7)	3 (10.0)	1 (3.3)
Year 3 (N = 30)	1 (3.3)	2 (6.7)	23 (76.7)	3 (10.0)	1 (3.3)
Year 4 (N = 30)	4 (13.3)	5 (16.7)	16 (53.3)	3 (10.0)	2 (6.7)
Year 5 (N = 30)	5 (16.7)	10 (33.3)	15 (50.0)	0 (0.0)	0 (0.0)
Preclinical (N = 60)	1 (1.7)	9 (15.0)	44 (73.3)	4 (6.7)	2 (3.3)
Clinical (N = 90)	10 (11.1)	17 (18.9)	54 (60.0)	6 (6.7)	3 (3.3)
Ethnicity					
Malay (N = 77)	6 (7.8)	16 (20.8)	46 (59.7)	5 (6.5)	4 (5.2)
Chinese (N = 52)	5 (9.6)	7 (13.5)	35 (67.3)	4 (7.7)	1 (1.9)
Indian (N = 10)	0 (0.0)	0 (0.0)	9 (90.0)	1 (10.0)	0 (0.0)
Others (N = 11)	0 (0.0)	3 (27.3)	8 (72.7)	0 (0.0)	0 (0.0)
Malay (N = 77)	6 (7.8)	16 (20.8)	46 (59.7)	5 (6.5)	4 (5.2)
Others (N = 73)	5 (6.8)	10 (13.7)	52 (71.2)	5 (6.8)	1 (1.4)
Sex					
Male (N = 64)	5 (7.8)	8 (12.5)	45 (70.3)	4 (6.3)	2 (3.1)
Female (N = 86)	6 (7.0)	18 (20.9)	53 (61.6)	6 (7.0)	3 (3.5)
All	11 (7.3)	26 (17.3)	98 (65.3)	10 (6.7)	5 (3.3)

Table 4. Simple logistic regression analysis of factors associated with periodontal pockets (CPI≥3) (N = 150).

Variable	Crude OR	95% CI	X^2 (df)[a]	p[a]
Year of study				
Preclinical	1.00			
Clinical	1.00	0.34, 2.97	0.00 (1)	1.000
Ethnicity				
Malay	1.00			
Others	1.48	0.50, 4.38	0.51 (1)	0.477
Sex				
Male	1.13	0.38, 3.35	0.05 (1)	0.825
Female	1.00			
Perceived stress	1.08	0.98, 1.19	2.08 (1)	0.149
Severity of xerostomia	1.05	0.80, 1.37	0.13 (1)	0.721

[a] Likelihood ratio (LR) test

female; the mean age was 21.2 years (SD 1.54). Based on ethnic group, more than half of the students were Malay (51.8%). Most of the students were single (98.4%), satisfied with their decision to study dentistry (92.7%), and medically healthy who did not take any medication (90.6%). Out of the 9.4% students with medical problems, only 7.3% were on medication. About 4.5% students had a history of repeating years of study. Only 0.8% and 2.9% students admitted that they were current smokers and alcohol drinkers, respectively. Almost all students stayed in the campus hostel except for 1.2% who were living out of campus with their families. The characteristics of all participants from Phase 1 are tabulated in Table 1.

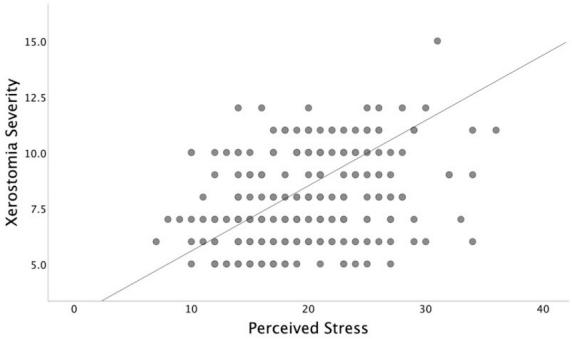

Figure 1. Correlation between PSS-10 and SXI scores.

Table 2 shows the PSS-10 and SXI scores in relation to the students' characteristics. The mean PSS-10 score was 19.6 (SD 5.47). Final-year students had the highest mean PSS-10 score, followed by first-year students, while second-year students had the lowest score. The score was significantly higher for Malay, female, students who were unsatisfied with their decision to pursue dentistry, and those who lived out campus with their families. The mean SXI score was 7.9 (SD 2.04). First-year students had the highest mean SXI score, followed by fourth-year students, while the lowest score was in the second-year students. The score was significantly higher for the group of students who were currently taking medication.

Only 7.3% of the 150 students had healthy periodontium while others were affected by some degree of periodontal disease. More than half (65.3%) of them had calculus detected during probing and 17.3% had bleeding after probing. Students presented with shallow (4-5 mm) and deep (≥6 mm) periodontal pockets were 6.7% and 3.3%, respectively. Overall, only 10.0% of them had periodontal pockets while 90.0% had no pocket. Distribution of the students' CPI scores based on their characteristics is shown in Table 3.

Table 4 shows the results of a simple logistic regression analysis of factors associated with periodontal pockets. No significant association was found between the presence of periodontal pockets and the students' characteristics: Year of study ($p = 1.000$), ethnicity ($p = 0.477$), sex ($p = 0.825$), PSS-10 score ($p = 0.149$), and SXI score ($p = 0.721$).

A scatter plot shows the linear relationship between PSS-10 and SXI scores, with a bivariate normal distribution (Figure 1). Pearson's correlation analysis revealed that there was a significant linear correlation between PSS-10 and SXI scores ($p < 0.01$), although the correlation was low ($r = 0.318$). The positive

correlation coefficient value suggested a direct relationship between the variables; students with a higher PSS-10 score were more likely to report a higher SXI score.

DISCUSSION

Findings from this study have fulfilled all the study objectives. The students' perceived stress, severity of xerostomia, and periodontal status were determined; and no association has been found among these variables. However, there was a positive correlation between perceived stress and severe xerostomia.

Perceived stress

The mean stress level of 19.6 (SD 5.47) of undergraduate dental students in this study can be considered as low stress level.[6] This finding is comparable to the undergraduate dental students in Australia (19.8, SD 7.63)[7] and the United Kingdom (19.83, SD 6.69).[6] However, dental students in other countries were reported to have higher stress levels, such as in Saudi Arabia (22.8, SD 3.99),[4] or lower stress levels, such as in China (18.06, SD 4.55),[27] Japan (17.9, SD 6.03),[28] and Vietnam (17.2, SD 5.39).[28] Multiple factors might contribute to the variation in the stress level pattern globally such as the type of dental educational system adopted by the schools, stress coping strategies adopted by the students, and the way the data were collected. Interestingly, this cohort of students (academic year 2017/2018) had a lower stress level compared to an earlier cohort (academic year 2009/2010) from the same dental school in Malaysia, where the recorded PSS score was 21.2, SD 5.08.[5] The reduced stress level may be attributed to USM's commitment to improve its dental education; one of the main changes was reduction of some medical subjects and hospital-based clinical postings that were not directly related to dentistry. Thus, the students have more time to focus on dental subjects and their clinical requirements.

Final-year students had the highest perceived stress level, followed by first-year students, possibly because the final-year students were struggling to catch up on fulfilling the clinical case requirements and preparing for their final professional examinations. Meanwhile, for the first-year students, their struggles might be related to adapting to a new study environment and stress from basic medical science subjects. When the students were grouped by preclinical and clinical groups, both groups showed similar stress levels, in contrast to previous studies which reported higher stress level in clinical students than preclinical students.[4-6] Meanwhile, several studies had the same agreement with the findings that being female and students who were unsatisfied with their decision to pursue dentistry had higher stress levels than males or those who were satisfied to study dentistry, respectively.[4,5] Studies have shown that male students are more likely to use better stress coping strategies than female students,[29] which could explain the finding. The reasons students living off-campus have higher stress level than students living in campus could possibly be due to distractions associated with family matters and other affairs at home, and added stress of commuting to campus.

Severity of xerostomia

The mean SXI score of 7.9 (SD 2.04) of the study sample can be considered as mild xerostomia. Comparison with previous studies from other dental schools could not be done, as to date there is very limited number of studies investigating xerostomia in dental students,[19] and they did not report the mean SXI score. However, Atif and co-workers supported the finding that female students had similar xerostomia severity to male students.[19] The finding that xerostomia was more severe in students who were currently taking medication is expected as medication-induced xerostomia has been demonstrated by other researchers.[14]

Periodontal status

Only 7.3% of students in this study had healthy periodontium while others were affected by some degree of periodontal disease. Ten percent of them had periodontal pocket, which indicated that in general, the students in this study had better periodontal health than the Malaysian adult population, where 48.5% had periodontal pocket.[17] Since the study subjects were undergraduate dental students, probably they had more awareness and knowledge about maintaining their periodontal health than the general adult population. Nevertheless, the presence of calculus could be due to neglect because they may be too busy with their study and have limited time to take better care of their oral health. Majority of students in Yemen, Saudi Arabia, Turkey, and Tunisia dental schools also had calculus, which were in line with our findings.[20-22] However, some of the students from our study presented with deep periodontal pockets, while there was no report of deep pockets in undergraduate dental students in Yemen, Saudi Arabia, Turkey, and Tunisia.[20-22] The difference in the pattern of findings might be related to the population-specific risk gene variants that might lead to the variation in susceptibility to the disease in a different population.[30]

Association of perceived stress, severity of xerostomia, and periodontal status

In the present study, no association was found among all the studied variables. Specifically, there was no association between the presence of periodontal pocket and the students' characteristics, as well as their perceived stress and severity of xerostomia. However, there was a positive correlation between perceived stress and severity of xerostomia. Undergraduate dental students with higher perceived stress levels were more likely to have higher severity of xerostomia. This

finding was similar to undergraduate dental students in Pakistan[19] and in agreement with findings by previous studies[12,13] in non-dental students, where a positive correlation between perceived stress and severity of xerostomia was reported. As a follow-up from this study, students with a high level of stress were given some advice on stress management and they were given the option of being referred to a psychologist for further counselling. Those who had xerostomia and unhealthy periodontal status were arranged for treatment accordingly.

Limitations and recommendations

This study has limitations that need to be considered when interpreting its findings. Apart from budget and time limitations, it was a cross-sectional study in a single institution setting; thus, the results cannot be generalized to all dental students in other dental schools. To overcome the limitations, it is recommended that future research expands the study by incorporating undergraduate and postgraduate students from different dental schools in Malaysia, as well as conducting a well-designed longitudinal study from the first year until final year of academic study. Further, it is recommended to incorporate the objective dry mouth assessment (by measuring salivary flow rate), in addition to the subjective dry mouth assessment (using SXI).

CONCLUSION

Within the limitations of the study, it can be concluded that, while periodontal status was not associated with perceived stress or severity of xerostomia, students with higher perceived stress were more likely to experience more severe xerostomia. This finding could be beneficial for academia to improve their teaching and learning activities for a better learning experience in dental schools, which could potentially prevent the adverse consequences of stress and xerostomia among dental students and future dentists.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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