



Association between stress and self-reported bruxism among students from University of Sarajevo during the COVID-19 pandemic

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ABSTRACT

Introduction: Stress among students is a growing problem. As emotional stress increases, the limbic structures and hypothalamus are stimulated, activating the gamma efferent system, which ultimately leads to an increase in muscle tone or additional muscle activity that can become repetitive behaviors such as bruxism. The aim of the study was to investigate the stress level that students are exposed to, to determine the difference between students in terms of gender, faculty, and year of study, and to evaluate the possible relationship between stress level and self-reported bruxism in college students during the pandemic COVID-19.

Methods: In April 2022, a cross-sectional study was conducted on a sample of students from the Faculty of Dentistry and the Faculty of Pharmacy at the University of Sarajevo (BiH). The students answered a questionnaire consisting of two parts: The first part contained questions on basic personal data and data on self-reported bruxism and the second part contained questions on the perceived stress scale (PSS).

Results: The study included 756 students from both faculties. Analysis of stress levels among students revealed higher stress levels. Female students were more likely to be under stress than male respondents. Students in the Faculty of Pharmacy were more likely to be stressed than students in the Faculty of Dentistry. At the Faculty of Pharmacy, there was no difference in stress levels between the different years of study, while at the Faculty of Dentistry, the individual score for PSS was highest among 1st-year students. A high prevalence (46.8%) of self-reported bruxism was found among students in both faculties.

Conclusion: A slight positive correlation between self-reported bruxism and stress suggests that it is important to implement stress management strategies during academic education and to prevent bruxism and its consequences.

Keywords: Student's population; self-reported bruxism; stress

INTRODUCTION

The term "stress" was first introduced into the medical lexicon by Hans Selye, who described "a non-specific response of the body to any request" (1). He defined stress as follows: "Stress is an attempt to adapt to a change in the situation, with a response that affects our mind, body, nervous system, circulatory system, immune system, and many other organs" (2). Psychologists today define stress

as psychological and physical response to stressors, that is, events and situations that an individual perceives as stressful (3). Serious health consequences occur when chronic stress occurs, it occurs if there is no period between stressors that is necessary for recovery, but they follow one after the other (4,5). All events of external environment are processed in the central nervous system. External stimuli create signals that are transmitted by nerve fibers to the hypothalamus. In response to stimuli, the hypothalamus stimulates the activation of the sympathetic nervous system and the consequent release of adrenaline. Adrenaline causes tachypnea and tachycardia, increases muscle tension, and raises blood pressure and blood glucose levels (6). The period of late adolescence is the period when young people have already reached sexual maturity, mainly physical

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development; however, they have intellectual upgrading and emotional maturation ahead of them (7). The period of transition from one developmental period to another can be stressful because it requires the individual to perform new academic tasks, make new friendships, and navigate in a new and unfamiliar environment (8,9).

An excessive amount of stress will have a negative outcome in terms of the inability to organize one's obligations and harmonize them with private life and possibly emotional or health consequences (10). It is specific that students of medical groups are exposed to a large amount of stress in their everyday life, because they are required to take on a lot of responsibility. The main stressors are related to oral examinations, teaching overload, lack of time, sleep, taking examinations, and interpersonal aspects (11).

Additional stress for the entire population was the situation caused by the COVID-19 pandemic. It is known that the prevalence of epidemics emphasizes or creates new stressors, including fear and worry for oneself or loved ones, restrictions on physical movement and social activities due to quarantine, sudden and radical changes in lifestyle, online classes, inadequate information, financial problems, and stigma (12,13).

Emotional states that are accompanied by occlusal-muscular disorders are stress, depression, neuroses, phobias, personality disorders, anxiety, and paranoid states (6). With the increase of emotional stress, the limbic structures and the hypothalamus are stimulated, activating the gamma efferent system, which ultimately results in an increase in muscle tone or additional muscle activity that can become a repetitive behavior such as bruxism (14). Bruxism is defined as a behavior characterized by repetitive masticatory muscle activity that occurs during the sleep and/or wakefulness in otherwise healthy subjects (15-17). This muscle activity may result in tooth grinding and clenching and bracing or thrusting the mandible without tooth contact. Sleep bruxism (SB) and awake bruxism (AB) are different entities based on the circadian manifestation (18-20). SB is considered to be centrally mediated, with a complex interaction of all factors that affect the function of the autonomic system during sleep (16). The literature suggests SB prevalence of around 8% in adults and 25% in children, while AB is generally reported by 20-30% of adults based on 1 time questionnaires (20-22). AB is more prevalent in the female population (23). It is difficult to find the primary cause of bruxism because the etiology is multifactorial. The activity of the masticatory muscles is influenced, to a greater or lesser extent, by specific etiological factors. Considering the different characteristics of SB and AB, it can be concluded that the etiological factors are different. Although both types of bruxism are centrally mediated, with AB state psychosocial factors are most important, which are conditioned by lifestyle and its change (24).

Central factors are related to neurotransmission from the brain to the muscles of mastication (pathophysiological and psychological) (25). The balance disorder within the circular processes of the basal ganglia can increase the active muscle tension during sleep and consequently lead to bruxism activities (25,26).

Episodes of bruxism, their duration, and the intensity at which they occur are different, individual for each

patient (14). Various studies have shown that people with bruxism had worse Oral Health-Related Quality of Life than people without bruxism (27-29). A higher rate of anxiety and depression has also been found in people who have bruxism (30,31).

Given that there is little epidemiological data in our country on the mental effects of the COVID-19 pandemic and the level of stress to which students are exposed, and the connection between stress and self-reported bruxism, this research was conducted.

The aim of this study was to investigate the stress level faced by students during the COVID-19 pandemic, to determine the difference between students in terms of gender, type of study, and year of study, and to investigate the relationship between stress level and self-reported bruxism in students during the COVID-19 pandemic.

METHODS

The research was approved by the Ethics Committee of the Faculty of Dentistry in Sarajevo (number: 02-3-4-19-1-7/2022).

A cross-sectional study was conducted on a sample of students from the Faculty of Dentistry in Sarajevo and Faculty of Pharmacy of the University of Sarajevo (BiH) in April 2022. We intended to inquire all students in both faculties. For the school year 2021/2022, there were 770 enrolled students for the Faculty of Pharmacy and 630 of them for the Faculty of Dentistry. Minimal sample size was calculated according to Pourhoseingholi et al. (32), and considering expected prevalences of observed variables (perceived stress and bruxism) among student participants in other studies as well (33,34), using Epi Info™ version 7.2 (35) with 95% CI and 5% margin of error.

Students who decided to integrate the study filled out the questionnaire completely anonymously and voluntarily with informed consent. A questionnaire was divided in two parts. The first part of the questionnaire contained questions about basic data about the subject, data about self-reported bruxism and its symptoms, and the influence of certain situations on the manifestation of bruxism (36). The second part of the questionnaire consisted of questions related to the perceived stress scale (PSS 10). The second part of the questionnaire consisted of questions related to the PSS 10. The PSS 10 has good reliability and validity (37) and it is the most commonly used psychological instrument for measuring the perception of stress.

PSS 10 is a measure of the degree to which situations in life are assessed as stressful. The questions are general in nature and therefore relatively free of content specific to any subpopulation. Individual scores on the PSS can range from 0 to 40 with higher scores indicating greater perceived stress. Participants were asked to rate their experiences on a 5-point Likert scale (0 – never, 1 – almost never, 2 – sometimes, 3 – fairly often, and 4 – very often). The stress perception scale is scored by cancelling the responses (for example 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0) to the four positively worded items (items 4, 5, 7, and 8) and then summing of all items on the scale (38). The stress perception scale (PSS 10) was validated by representatives of the population for measuring stress according to age groups, race, gender

and socioeconomic status, and it shows changes in stress over time (38,39).

The results were statistically analyzed and presented in Tables.

Statistical data analysis was performed using IBM SPSS Statistics v.21 software.

The arithmetical means and standard deviations of quantitative variables, then absolute, and relative frequencies of nominal variables were calculated from the descriptive statistical analysis. Parametric methods were used in the paper, namely, Student t-test for testing two independent samples, Pearson's linear correlation, and one-factor analysis of variance (ANOVA) for testing three independent samples with multiple *post hoc* testing with Tukey HSD test. Among the non-parametric statistical methods, the Chi-square test was used. The research hypotheses were tested at an alpha level of 95% confidence, that is, 5% risk.

RESULTS

The research included 756 students from both faculties (317 from Pharmacy and 439 from Dentistry). We had

ATTACHMENT 1. Norm Table for the PSS 10 item inventory (38,39)

Category	N	Mean	S.D
Gender			
Male	926	12.1	5.9
Female	1406	13.7	6.6
Age			
18-29	645	14.2	6.2
30-44	750	13.0	6.2
45-54	285	12.6	6.1
55-64	282	11.9	6.9
65 & older	296	12.0	6.3
Race			
white	1924	12.8	6.2
Hispanic	98	14.0	6.9
black	176	14.7	7.2
other minority	50	14.1	5.0

TABLE 1. Distribution of respondents according to year of study at the faculty of dentistry and pharmacy

Year of study	Faculty			
	Pharmacy		Dentistry	
	n	%	n	%
1.	99	31.2	87	19.8
2.	86	27.1	90	20.5
3.	37	11.7	81	18.5
4.	62	19.6	43	9.8
5.	33	10.4	64	14.6
6.	0	0.0	74	16.9
Total	317	100	439	100

TABLE 2. Distribution of respondents by gender in relation to the type of study

Faculty	Gender				Total	
	Male		Female		n	%
	n	%	n	%		
Pharmacy	45	26.5	272	46.4	317	41.9
Dentistry	125	73.5	314	53.6	439	58.1
Total	170	100	586	100	756	100

more participants than was requested for both faculties with the inquiry rate for the Faculty of Pharmacy at 41.17% and for the Faculty of Dentistry at 53.81%.

The distribution of respondents according to the year of study at the Faculty of Dentistry and the Faculty of Pharmacy is shown in Table 1, while Table 2 shows the distribution of respondents by gender in relation to the type of study.

Analyzing the level of stress in our study among students mean age 22, the average stress score for students at the Faculty of Dentistry was 20, and at the Faculty of Pharmacy 21.3, which is higher compared to the average value of the score according to the PSS-10 scale, where the normal values for the mentioned population are 14.2 (Attachment 1).

Considering gender, female respondents felt nervous and stressed more often compared to male respondents ($t = -6.32$; $p < 0.001$). All other obtained results comparing the level of stress between the gender of the respondents are shown in Table 3.

Regarding the stress level of the surveyed students in relation to the type of faculty they were studying at, respondents at the Faculty of Pharmacy were statistically significantly more upset about something that had happened unexpectedly than respondents at the Faculty of Dentistry ($t = 2.15$; $p < 0.032$). Students of the Faculty of Pharmacy felt nervous and stressed significantly more often than students of the Faculty of Dentistry. All the other obtained results of the comparison of the level of stress in relation to the different faculty to which the respondents belonged are shown in Table 4.

Pearson's linear correlation was used to examine the relationship between the presence of self-reported bruxism and the level of stress among the students. A statistically significant weak positive correlation was confirmed between the appearance of self-reported bruxism and the answers to the questions: How often have you felt nervous and "stressed," how often have you felt difficulties were piling up so high that you could not overcome them, as well as with the individual total score for PSS (Table 5). The subjects with self-reported bruxism had a slightly higher level of stress, compared to the subjects without self-reported bruxism.

When it comes to the level of stress between different years of study, it was determined that there is no statistically significant difference in the level of stress between different years of study at the Faculty of Pharmacy.

Regarding the level of stress between different years of study at the Faculty of Dentistry, a one-way ANOVA confirmed a statistically significant difference in the following questions: How often did you feel nervous and stressed, how often have you been angered due to things that were outside of your control, as well as overall score for PSS, which is shown in Table 6.

To see between which years the difference in the level of stress is significant, POST HOC multiple comparisons were performed. The result is shown in Table 7.

DISCUSSION

The period of adolescence is a transitional age that implies a profound number of changes in all domains of development

TABLE 3. Comparison of the level of stress between the gender of the respondents

Question	Gender							
	Male			Female			t	p
	n	Mean	SD	n	Mean	SD		
How often have you been upset due to something that happened unexpectedly?	170	2.3	1.1	585	2.7	1.0	-4.83	0.001
How often have you felt that you were unable to control the important things in your life?	170	2.1	1.1	586	3.0	13.7	-0.85	0.396
How often have you felt nervous and "stressed"?	169	2.5	1.1	586	3.1	0.9	-6.32	0.001
How often have you felt confident about your ability to handle your personal problems?	170	3.0	1.1	586	3.0	0.9	0.51	0.612
How often have you felt that things were going your way?	170	2.5	0.9	586	2.6	1.9	-0.35	0.725
How often have you found that you could not cope with all the things that you had to do?	170	1.9	1.0	586	2.3	1.0	-4.56	0.001
How often have you been able to control irritations in your life?	170	2.4	1.0	586	2.4	0.9	-0.47	0.639
How often have you felt that you were on top of things?	170	2.6	0.8	586	2.4	0.9	2.05	0.041
How often have you been angered due to things that were outside of your control?	170	2.4	1.1	586	2.8	1.0	-4.45	0.001
How often have you felt difficulties were piling up so high that you could not overcome them?	170	1.8	1.0	586	2.1	1.0	-3.10	0.002
Individual score for PSS	170	18.6	5.3	586	21.1	5.3	-5.52	0.001

n: Sample size (number of respondents), Mean: Arithmetic mean, SD: Standard deviation, t: Value Student t-test of independent samples, p: Probability of rejecting the null hypothesis with a risk of 5%, PSS: Perceived stress scale

TABLE 4. Comparison of stress levels between different faculties

Question	Faculty							
	Pharmacy			Dentistry			t	p
	n	Mean	SD	n	Mean	SD		
How often have you been upset due to something that happened unexpectedly?	316	2.7	1.0	439	2.6	1.1	2.15	0.032
How often have you felt that you were unable to control the important things in your life?	317	2.5	1.0	439	3.0	15.8	-0.61	0.545
How often have you felt nervous and "stressed"?	317	3.1	0.9	438	2.9	1.0	3.45	0.001
How often have you felt confident about your ability to handle your personal problems?	317	3.0	0.9	439	3.0	1.0	-0.18	0.855
How often have you felt that things were going your way?	317	2.5	0.8	439	2.7	2.1	-1.63	0.104
How often have you found that you could not cope with all the things that you had to do?	317	2.3	1.0	439	2.1	1.0	2.87	0.004
How often have you been able to control irritations in your life?	317	2.4	0.9	439	2.4	0.9	-0.86	0.390
How often have you felt that you were on top of things?	317	2.3	0.9	439	2.5	0.8	-3.03	0.003
How often have you been angered due to things that were outside of your control?	317	2.7	1.0	439	2.7	1.1	0.75	0.451
How often have you felt difficulties were piling up so high that you could not overcome them?	317	2.1	1.0	439	2.0	1.0	1.07	0.283
Individual score for PSS	317	21.3	5.3	439	20.0	5.4	3.28	0.001

n: Sample size (number of respondents), Mean: Arithmetic mean, SD: standard deviation, t: Value student t-test of independent samples, p: Probability of rejecting the null hypothesis with a risk of 5%, PSS: Perceived stress scale

– biological, cognitive, psychosocial, and emotional (40). While studying, most students are still in their adolescence period. The beginning of studies is a very significant, but at the same time stressful event in life because it sets new requirements for young people such as new living conditions, academic obligations, balancing university and other obligations, new friendships, and similar (8,9).

Unlike other students, students of dental medicine have to acquire practical skills in addition to extensive theoretical knowledge. At the beginning of their studies, they undergo preclinical training that depends on certain manual skills, after which they start working with patients. This situation causes a sense of responsibility for the

patient, his treatment, but also for possible complications during and after the operation. These factors lead to a significant level of stress among students of medical sciences, especially dental medicine, as confirmed by numerous studies (41-45).

By analyzing the level of stress in this study among students aged 22, the average stress score for students at the Faculty of Dentistry was 20, and at the Faculty of Pharmacy 21.3, which is higher compared to the average value of the score according to the PSS-10 scale, where for the specified population with a normal value of 14.2. (Attachment 1). This tells us that students of the medical group are exposed to more stress than usual. This research was conducted during

TABLE 5. Correlation between self-reported bruxism and stress

Question	The presence of self-reported bruxism		
	<i>r</i>	<i>p</i>	<i>n</i>
How often have you been upset due to something that happened unexpectedly?	0.067	0.064	755
How often have you felt that you were unable to control the important things in your life?	0.045	0.219	756
How often have you felt nervous and "stressed"?	0.072	0.049	755
How often have you felt confident about your ability to handle your personal problems?	0.033	0.367	756
How often have you felt that things were going your way?	-0.056	0.127	756
How often have you found that you could not cope with all the things that you had to do?	0.045	0.221	756
How often have you been able to control irritations in your life?	-0.027	0.451	756
How often have you felt that you were on top of things?	-0.039	0.279	756
How often have you been angered due to things that were outside of your control?	0.047	0.193	756
How often have you felt difficulties were piling up so high that you could not overcome them?	0.075	0.039	756
Individual score for PSS	0.084	0.020	756

n: sample size (number of respondents), *r*: Pearson's linear correlation coefficient, *p*: Probability of rejecting the null hypothesis with a risk of 5%, PSS: Perceived stress scale

TABLE 6. Comparison of stress levels between different years of study - Faculty of Dentistry

Year of study	<i>n</i>	Mean	SD	F	<i>p</i>
How often have you felt nervous and "stressed"?	1. 87	2.84	1.033	3.017	0.011
	2. 89	3.04	1.033		
	3. 81	2.86	0.848		
	4. 43	2.79	0.861		
	5. 64	2.48	0.926		
	6. 74	3.00	0.951		
How often have you been angered due to things that were outside of your control?	1. 87	2.63	1.001	4.523	0.001
	2. 90	2.93	1.100		
	3. 81	2.46	1.130		
	4. 43	2.95	0.844		
	5. 64	2.25	0.976		
	6. 74	2.72	1.104		
Individual score for PSS	1. 87	20.72	5.029	2.819	0.016
	2. 90	20.56	6.275		
	3. 81	19.37	4.716		
	4. 43	20.67	5.199		
	5. 64	17.98	5.076		
	6. 74	20.53	5.542		

n: Sample size (number of respondents), Mean: Arithmetic mean, SD: Standard deviation, F: Value of Fisher test of independent samples, ANOVA: Analysis of variance, *p*: Probability of rejecting the null hypothesis with a risk of 5%, PSS: Perceived stress scale

the corona virus pandemic, which brought numerous changes in everyday life, due to the emergence of additional challenges and stressors that affected the entire population. The COVID-19 pandemic posed a serious threat to the mental health of young people in particular. The change from live classes to online classes, restrictions on sports and leisure activities, and a partial or complete interruption of social participation have strongly disrupted interpersonal relationships. With longer periods of time spent online and on social networks, many young people experienced feelings of isolation and loneliness, suffered from anxiety, and reported symptoms of depression (46).

Analysis of the stress level between students of the Faculty of Dentistry and Pharmacy showed that the students of the Faculty of Pharmacy were statistically significantly more upset due to something that happened unexpectedly, they felt more nervous and stressed than the students of the Faculty of Dentistry. Such results were expected because

TABLE 7. Multiple Post Hoc (Tukey HSD) comparison of stress levels between each year at the Faculty of Dentistry

Dependent Variable	(I) Year of study	(J) Year of study	Mean Difference (I-J)	<i>p</i>
Individual score for PSS	1	2	0.169	1.000
		3	1.354	0.576
		4	0.050	1.000
		5	2.740*	0.025
		6	0.197	1.000
		2	1	-0.169
	2	3	1.185	0.701
		4	-0.119	1.000
		5	2.571*	0.041
		6	0.029	1.000

(I) (J): Compared groups, Mean difference, *p*: Probability of rejecting the null hypothesis with a risk of 5% with *post hoc* Tukey HSD test, PSS: Perceived stress scale

most students at the Faculty of Pharmacy are female, and this is supported by many previous studies that showed that women experience much more stress than men (25, 47-52). In addition, it should be emphasized that during the entire duration of the pandemic, except for the first 2 months, the students of the Faculty of Dentistry in Sarajevo had practical classes at the faculty, adhering to protective measures. They had the opportunity to learn normally, to exchange experiences, to feel useful, and to socialize with each other, which contributed to less nervousness and stress, although the acquisition of practical skills that students perform on a patient implied a greater possibility of infection with COVID. Daily knowledge exchange, meeting colleagues, and spending time in the community enabled students to more easily overcome all the difficulties brought by the pandemic and to feel much more valuable and positive.

Examining the level of stress among students of the Faculty of Dentistry during different years, we obtained results where it can be seen that the individual score for PSS was the highest among students of the 1st year, followed by the 2nd year. First-year students are in a transition period of education with new life encounters, leaving their families, and living independently. These situations represent very stressful phases in their lives in addition to all the academic challenges. These statements are in agreement with research in Sweden that was conducted in 2008 on students

of natural, technical, social, and humanities faculties. The results of research conducted in Sweden showed that the level of stress and its sources differ depending on the year, with 1st-year students being under the most stress due to the adaptation to a new way of life, that is, the transition to college and the lack of social support (53).

In our research, the 6th year of the Faculty of Dentistry had a significantly higher feeling of nervousness and stress than the 5th year, which can be explained by the fact that final year students also experience a certain amount of stress, but now due to the uncertainty and many challenges that the end of their studies brings. Writing theses, facing reality, and looking for a job are situations that really require a lot of sacrifice and persistence.

In accordance with our results, the study by Silverstein and Kritz-Silverstein the authors found a high level of stress in students of dental medicine in their final year of education, even higher than in students in their 1st year of study (54). In contrast to our results, there was a study by Jowkar et al. who concluded in their study that 6th-year students had significantly lower stress scores than compared to 3rd-, 4th-, and 5th-year students, in which the aforementioned authors explained by greater experience in practice and skills in clinical work (55). Such differences in results could be explained and justified by differences in the curricula and educational systems of the faculties.

At the Faculty of Pharmacy, there was no statistically significant difference in the level of stress between different years of study.

Many studies have revealed that gender has a significant influence on cognitive functions (56). Given that the brain controls cognition and behavior, gender differences in problem solving and decision-making are related to gender-dependent brain structures (57).

When it comes to the gender of the respondents in our research, female students showed more anxiety, they felt more nervous and stressed, then they had the feeling that they could not cope with all the things they had to do. Male respondents showed a significantly higher degree of feeling that they had control over what was happening in their lives.

The results of a study conducted among Polish students of Dentistry, which showed that female students have a higher level of stress than male students, agree with our research (47). A cross-sectional study conducted among dental students in Malaysia showed that female students showed a higher overall mean value for stress related to personal problems compared to their male counterparts (48). Our results in the test of differences between the sexes are in agreement with the research obtained by Peker et al., Polychronopoulou and Divaris, Al-Saleh et al., Hayes et al., and Cavallo et al. (25,49-52).

Excessive or prolonged reactions to stress can exceed the body's natural ability to adapt and permanently affect stress reactions (58,59). The impact of stress on physiological and psychological processes is determined by the characteristics of the stressful stimulus, which can cause changes in several functions in the body, including repercussions on the stomatognathic apparatus (59-61). Various studies consider that stress, anxiety, and genetic predisposition are the

dominant factors that lead to the involuntary activity of the masticatory muscles associated with clenching/grinding the teeth (59,61-63).

At the Faculty of Dentistry and Pharmacy, 46.8% of students reported bruxism, which represents a high prevalence of self-reported bruxism among the student population. Pearson's linear correlation was used to examine the relationship between the presence of self-reported bruxism and the stress level of the subjects. A statistically significant weak positive correlation between the appearances of stress bruxism was confirmed.

Our results correlate with data from a study conducted among students in Pakistan, which showed that bruxism is more prevalent in students with perceived stress (64). In a study conducted on three integrated studies of the Faculty of Medicine of the University of Split, the connection between stress and bruxism was confirmed (36). In the study conducted in Serbia during the pandemic COVID-19, which aimed to determine the incidence of bruxism and its relationship to psychological factors, it was found that symptoms worsened in the majority of students who had previously experienced bruxism, which the above authors explained by the fact that students were exposed to much more stress during the pandemic (65). In 2022, Vlăduțu et al. found a significant connection between bruxism and stress during the COVID-19 pandemic in their research, in which they explained by an increased level of stress during the pandemic (63). In their research, Cavallo et al. came to the conclusion that students as a population show a higher level of stress and bruxism compared to the general population (25). Dias et al. (2022) concluded that the forced changes in dental students' lifestyles in consequence of forced confinement due to COVID-19 resulted in an increase in self-reported AB and a decrease in self-reported SB. Their findings, including data obtained by Ecological Momentary Assessment actually accepted as an important monitoring tool of Bruxism, may suggest that when major forced life changes are introduced, individuals should be encouraged to try normalize their daily life by keeping healthy and steady routines. This might be useful to reduce emotion-related AB and, in turn, reduce the likelihood of clinical consequences. To this purpose, it is also important to make individuals aware of their bruxism behavior to monitor its occurrence (24).

The findings of Dias and the authors are consistent with a cross-sectional study conducted in April 2022 on a sample of students from the Faculty of Dentistry and the Faculty of Pharmacy at the University of Sarajevo (BiH). The aim of this study was to investigate the prevalence of self-reported bruxism among students during the pandemic COVID-19. This study confirmed a higher frequency of awake bruxism compared to nocturnal bruxism (66). A higher frequency of awake bruxism is expected considering that awake bruxism is also centrally mediated but is mainly related to psychosocial factors and behavioral changes associated with lifestyle changes. The COVID-19 pandemic has unsettled the global population because of changes in all aspects of life (24).

This study has several limitations. It was only a cross-sectional study which deals only with the present time, there is a possibility that the situation has changed since the beginning of the pandemic. The study considered self-reported bruxism only, so "possible" bruxism diagnostic. It should be mentioned that

“probable bruxism” is based on a positive self-report, positive clinical examination; and for “definite bruxism,” a positive instrumental assessment should be provided (65). The instrumental measurement of electromyographic activity in the natural environment is the best strategy available to collect information on bruxism (67).

Further work should consider the application of the standardized bruxism assessment tool (STAB) presented by Manfredini et al. (68). The basic premise of the STAB is that as much data as possible should be gathered on bruxism status.

CONCLUSION

Within the limitations of this study, higher level of stress among students during COVID-19 is confirmed. In addition to the stress that students are exposed to during their studies, the pandemic has brought new challenges and an increase in stressors.

A slight positive correlation between bruxism and stress was determined, which points to the importance of the implementation of stress management strategies during academic education, periods of lifestyle changes (forced or not), and as well to prevent bruxism and its consequences.

DECLARATION OF INTERESTS

Authors declare no conflict of interest.

REFERENCES

- Tan SY, Yip A. Hans selye (1907-1982): Founder of the stress theory. *Singapore Med J* 2018;59(4):170-1. <https://doi.org/10.11622/smedj.2018043>
- Baykal D, Tütüncü SK. Perceived stress of paramedic students and paramedics on their stress coping behaviors during COVID. *J Gen Saġlık Bilim Derg* 2021;3(2):90-1. <https://doi.org/10.51123/jgehes.2021.20>
- Larsen RJ, Buss DM. Stres, suočavanje, prilagodba i zdravlje. In: UK. Matešić (Ur.), Psihologija Ličnosti. Jastrebarsko: Naklada Slap; 2008.:566-600.
- Knezevic B, Milosevic M, Golubic R, Belosevic L, Russo A, Mustajbegovic J. Work-related stress and work ability among Croatian university hospital midwives. *Midwifery* 2011;27(2):146-53. <https://doi.org/10.1016/j.midw.2009.04.002>
- Pejčić N, Jovicic MD, Milićević N, Popovic DB, Petrovic V. Posture in dentists: Sitting vs. standing positions during dentistry work--an EMG study. *Srp Arh Celok Lek* 2016;144(3-4):181-7.
- Wieckiewicz M, Paradowska-Stolarz A, Wieckiewicz W. Psychosocial aspects of bruxism: The most paramount factor influencing teeth grinding. *Biomed Res Int* 2014;2014:4249187. <https://doi.org/10.1155/2014/469187>
- Bajraktarević J. Adolescenti I Stres. 2022. Available from: <https://jnasnabajraktarevic.com/adolescenti-i-stres> [Last accessed on 2022 Apr 12].
- Lacković-Grgin K, Sorić I. Korelati prilagodbe studiju tijekom prve godine. *Društvo Istraž* 1997;6(4-5):461-75.
- Burajić A. Psihosocijalne Odrednice Osobno-Emocionalne Prilagodbe Studenata Prve Godine Studija 2022. Magistarski Rad. Sarajevo: Filozofski Fakultet Odsjek Za Psihologiju Univerzitet u Sarajevu; 2022.
- Turčinović Ž. Specifičnosti upravljanja stresom kod nastavnika i studenata u visokom obrazovanju. U I. Gajić (Ur.), Sport, Zdravlje, Životna Sredina, Beograd; 2014:108-13.
- Ihm L, Zhang H, van Vijfeijken A, Waugh MG. Impacts of the Covid-19 pandemic on the health of university students. *Int J Health Plann Manage* 2021;36(3):618-27. <https://doi.org/10.1002/hpm.3145>
- Son C, Hegde S, Smith A, Wang X, Sasangohar F. Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study. *J Med Internet Res* 2020;22(9):e21279. <https://doi.org/10.2196/21279>
- Cascella M, Rajnik M, Aleem A, Dulebohn SC, Di Napoli R. Features, evaluation, and treatment of coronavirus (COVID-19). In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2022.
- Okeson JP. Management of Temporomandibular Disorders and Occlusion. 8th ed. St.

Louis: Mosby; 2019.

- Manfredini D, Ahlberg J, Aarab G, Bracci A, Durham J, Ettlin D, et al. Towards a standardized tool for the assessment of bruxism (STAB)-overview and general remarks of a multidimensional bruxism evaluation system. *J Oral Rehabil* 2020;47(5):549-56. <https://doi.org/10.1111/joor.12938>
- Manfredini D, Colonna A, Bracci A, Lobbezoo F. Bruxism: A summary of current knowledge on aetiology, assessment and management. *Oral Surg* 2020;13:358-70. <https://doi.org/10.1111/ors.12454>
- Lobbezoo F, Ahlberg J, Raphael KG, Wetselaar P, Glaros AG, Kato T, et al. International consensus on the assessment of bruxism: Report of a work in progress. *J Oral Rehabil* 2018;45:837-44. <https://doi.org/10.1111/joor.12663>
- Serra-Negra JM, Dias RB, Rodrigues MJ, Aguiar SO, Auad SM, Pordeus IA, et al. Self-reported awake bruxism and chronotype profile: A multicenter study on Brazilian, Portuguese and Italian dental students. *Cranio* 2021;39(2):113-8. <https://doi.org/10.1080/08869634.2019.1587854>
- Jokubauskas L, Baltrušaitytė A, Pileičikienė G, Žekonis G. Interrelationships between distinct circadian manifestations of possible bruxism, perceived stress, chronotype and social jetlag in a population of undergraduate students. *Chronobiol Int* 2019;36(11):1090-8. <https://doi.org/10.1080/07420528.2019.1660356>
- Machado NA, Costa YM, Quevedo HM, Stuginski-Barbosa J, Valle CM, Bon Jardim LR, et al. The association of self-reported awake bruxism with anxiety, depression, pain threshold at pressure, pain vigilance, and quality of life in patients undergoing orthodontic treatment. *J Appl Oral Sci* 2020;28:e20190407. <https://doi.org/10.1590/1678-2019-0407>
- Manfredini D, Ahlberg J, Lobbezoo F. Bruxism definition: Past, present, and future-what should a prosthodontist know? *J Prosthet Dent* 2021;128:905-12. <https://doi.org/10.1016/j.prosdent.2021.01.026>
- Beddis H, Pemberton M, Davies S. Sleep bruxism: An overview for clinicians. *Br Dent J* 2018;225:497-501. <https://doi.org/10.1038/sj.bdj.2018.757>
- Kanathila H, Pangi A, Poojary B, Doddamani M. Diagnosis and treatment of bruxism: Concepts from past to present. *Int J Appl Dent Sci* 2018;4(1):290-5.
- Dias R, Lima R, Prado IM, Colonna A, Ferrari M, Serra-Negra JM, et al. Impact of confinement by COVID-19 in awake and sleep bruxism reported by Portuguese dental students. *J Clin Med* 2022;11(20):6147. <https://doi.org/10.3390/jcm11206147>
- Cavallo P, Carpinelli L, Savarese G. Perceived stress and bruxism in university students. *BMC Res Notes* 2016;9(1):1-6. <https://doi.org/10.1186/s13104-016-2311-0>
- Paesani DA, Andersen M. Bruxism: Theory and Practice. 1st ed. London: Quintessence Publishing; 2010.
- Phuong NT, Ngoc VT, Linh LM, Duc NM, Tra NT, Anh LQ. Bruxism, related factors and oral health-related quality of life among Vietnamese medical students. *Int J Environ Res Public Health* 2020;17(20):7408. <https://doi.org/10.3390/ijerph17207408>
- Turcio KH, Neto CM, Pirovani BO, Dos Santos DM, Guiotti AM, Bertoz AM, et al. Relationship of bruxism with oral health-related quality of life and facial muscle pain in dentate individuals. *J Clin Exp Dent* 2022;14(5):e385-9. <https://doi.org/10.4317/jced.59255>
- Câmara-Souza MB, de Figueredo OM, Garcia RC. Association of sleep bruxism with oral health-related quality of life and sleep quality. *Clin Oral Investig* 2019;23(1):245-51. <https://doi.org/10.1007/s00784-018-2431-0>
- Alharby A, Alzayer H, Almahlawi A, Alrashidi Y, Azhar S, Sheikho M, et al. Parafunctional behaviors and its effect on dental bridges. *J Clin Med Res* 2018;10(2):73-6. <https://doi.org/10.14740/jocmr3304w>
- Fluerașu MI, Bocșan IC, Țig IA, Iacob SM, Popa D, Buduru S. The epidemiology of bruxism in relation to psychological factors. *Int J Environ Res Public Health* 2022;19(2):691. <https://doi.org/10.3390/ijerph19020691>
- Pourhoseingholi MA, Vahedi M, Rahimzadeh M. Sample size calculation in medical studies. *Gastroenterol Hepatol Bed Bench* 2013 Winter;6(1):14-7.
- Alsalem MA, Alsalem SA, Shehri SA, Awadalla NJ, Miradad TM, Abbag FI, et al. Prevalence and correlates of university students' perceived stress in southwestern Saudi Arabia. *Medicine (Baltimore)* 2021;100(38):e27295. <https://doi.org/10.1097/MD.00000000000027295>
- Soares LG, Costa IR, Brum Júnior JD, Cerqueira WS, Oliveira ES, Douglas de Oliveira DW, et al. Prevalence of bruxism in undergraduate students. *Cranio* 2017;35(5):298-303. <https://doi.org/10.1080/08869634.2016.1218671>
- Epi Info™. Centers for Disease Control and Prevention Website. Available from: <https://www.cdc.gov/epiinfo/index.html> [Last accessed on 2023 Feb 15]
- Zekan J. Učestalost Bruksizma u Studenata Medicinskog Fakulteta Sveučilišta u

- Splitu [Diplomski Rad]. Split: Sveučilište u Splitu, Medicinski Fakultet; 2018. Available from: <https://urn.nsk.hr/urn:nbn:hr:171:438844> [Last accessed on 2023 Feb 15].
37. Lee EH. Review of the psychometric evidence of the perceived stress scale. *Asian Nurs Res (Korean Soc Nurs Sci)* 2012;6(4):121-7. <https://doi.org/10.1016/j.anr.2012.08.004>
 38. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;24(4):385-96. <https://doi.org/10.2307/2136404>
 39. Cohen S, Williamson G. Perceived stress in a probability sample of the United States. In: Spacapan S, Oskamp S, editors. *The Social Psychology of Health: Claremont Symposium on Applied Social Psychology*. Newbury Park, CA: Sage; 1988. p. 31-67.
 40. National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Division of Behavioral and Social Sciences and Education; Board on Children, Youth, and Families; Committee on the Neurobiological and Socio-behavioral Science of Adolescent Development and Its Applications, Backes EP, Bonnie RJ, editors. *The Promise of Adolescence: Realizing Opportunity for All Youth*. Washington, DC: National Academies Press (US); 2019.
 41. Davis EL, Tedesco LA, Meier ST. Dental student stress, burnout, and memory. *J Dent Educ* 1989;53(3):193-5.
 42. Gorter R, Freeman R, Hammen S, Murtoama H, Blinkhorn A, Humphris G. Psychological stress and health in undergraduate dental students: Fifth year outcomes compared with first year baseline results from five European dental schools. *Eur J Dent Educ* 2008;12(2):61-8. <https://doi.org/10.1111/j.1600-0579.2008.00468.x>
 43. Alzahem AM, van der Molen HT, Alaujan AH, Schmidt HG, Zamakhshary MH. Stress amongst dental students: A systematic review. *Eur J Dent Educ* 2011;15(1):8-18. <https://doi.org/10.1111/j.1600-0579.2010.00640>
 44. Schmitter M, Liedl M, Beck J, Rammelsberg P. Chronic stress in medical and dental education. *Med Teach* 2008;30(1):97-9. <https://doi.org/10.1080/01421590701769571>
 45. Stormon N, Ford PJ, Kiseley S, Bartle E, Eley DS. Depression, anxiety and stress in a cohort of Australian dentistry students. *Eur J Dent Educ* 2019;23(4):507-14. <https://doi.org/10.1111/eje.12459>
 46. European Commission, European Education and Culture Executive Agency. *The Impact of the COVID-19 Pandemic on the Mental Health of Young People: Policy Responses in European Countries*. Luxembourg: Publications Office of the European Union; 2022.
 47. Mocny-Pachońska K, Trzcionka A, Doniec RJ, Sieciński S, Tanasiewicz M. The influence of gender and year of study on stress levels and coping strategies among polish dental. *Medicina (Kaunas)* 2020;56(10):531. <https://doi.org/10.3390/medicina56100531>
 48. Babar MG, Hasan SS, Ooi YJ, Ahmed SI, Wong PS, Ahmad SF, et al. Perceived sources of stress among Malaysian dental students. *Int J Med Educ* 2015;6:56-61. <https://doi.org/10.5116/ijme.5521.3b2d>
 49. Peker I, Alkurt MT, Usta MG, Turkbay T. The evaluation of perceived sources of stress and stress levels among Turkish dental students. *Int Dent J* 2009;59(2):103-11.
 50. Polychronopoulou A, Divaris K. A longitudinal study of Greek dental students' perceived sources of stress. *J Dent Educ* 2010;74(5):524-30.
 51. Al-Saleh SA, Al-Madi EM, Al-Angari NS, Al-Shehri HA, Shukri MM. Survey of perceived stress-inducing problems among dental students, Saudi Arabia. *Saudi Dent J* 2010;22(2):83-8. <https://doi.org/10.1016/j.sdentj.2010.02.007>
 52. Hayes A, Hoover JN, Karunanayake CP, Uswak GS. Perceived causes of stress among a group of western Canadian dental students. *BMC Res Notes* 2017;10(1):714. <https://doi.org/10.1186/s13104-017-2979-9>
 53. Owczarek JE, Lion KM, Radwan-Oczko M. Manifestation of stress and anxiety in the stomatognathic system of undergraduate dentistry students. *J Int Med Res* 2020;48(2):300060519889487. <https://doi.org/10.1177/0300060519889487>
 54. Silverstein ST, Kritz-Silverstein D. A longitudinal study of stress in first-year dental students. *J Dent Educ* 2010;74(8):836-48.
 55. Jowkar Z, Masoumi M, Mahmoodian H. Psychological stress and stressors among clinical dental students at Shiraz school of dentistry, Iran. *Adv Med Educ Pract* 2020;11:113-20. <https://doi.org/10.2147/AMEP.S236758>
 56. Cahill L. Why sex matters for neuroscience. *Nat Rev Neurosci* 2006;7(6):477-84. <https://doi.org/10.1038/nrn1909>
 57. Cosgrove KP, Mazure CM, Staley JK. Evolving knowledge of sex differences in brain structure, function, and chemistry. *Biol Psychiatry* 2007;62(8):847-55. <https://doi.org/10.1016/j.biopsych.2007.03.001>
 58. Chrousos GP. Stress and disorders of the stress system. *Nat Rev Endocrinol* 2009;5(7):374-81. <https://doi.org/10.1038/nrendo.2009.106>
 59. Chemel VD, Né YG, Frazão DR, de Souza-Rodrigues RD, Fagundes NC, Magno MB, et al. Is there association between stress and bruxism? A systematic review and meta-analysis. *Front Neurol* 2020;11:590779. <https://doi.org/10.3389/fneur.2020.590779>
 60. Crestani CC. Emotional stress and cardiovascular complications in animal models: A review of the influence of stress type. *Front Physiol* 2016;7:251. <https://doi.org/10.3389/fphys.2016.00251>
 61. Saczuk K, Lapinska B, Wilmont P, Pawlak L, Lukomska-Szymanska M. Relationship between sleep bruxism, perceived stress, and coping strategies. *Int J Environ Res Public Health* 2019;16(17):3193. <https://doi.org/10.3390/ijerph16173193>
 62. Vavrina J, Vavrina J. Bruxism: Classification, diagnostics and treatment. *Praxis (Bern 1994)* 2020;109(12):973-8. <https://doi.org/10.1024/1661-8157/a003517>
 63. Vláduťu D, Popescu SM, Mercuț R, Ionescu M, Scriciu M, Glodeanu AD, et al. Associations between bruxism, stress, and manifestations of temporomandibular disorder in young students. *Int J Environ Res Public Health* 2022;19(9):5415. <https://doi.org/10.3390/ijerph19095415>
 64. Afridi Y. Correlation between perceived stress and bruxism in students. *Dentistry* 2018;8:9. <https://doi.org/10.4172/2161-1122.1000512>
 65. Kolak V, Pavlovic M, Aleksic E, Biocanin V, Gajic M, Nikitovic A, et al. Probable bruxism and psychological issues among dental students in Serbia during the COVID-19 pandemic. *Int J Environ Res Public Health* 2022;19(13):7729. <https://doi.org/10.3390/ijerph19137729>
 66. Šabić Z, Gavranović-Glamoč A, Kazazić L, Berhamović E, Jakupović S, Strujić-Porović S, et al. Frequency of self-reported bruxism among students during the Covid 19 pandemic. *Stomatol Rev* 2022;11(2):2-11.
 67. Colonna A, Noveri L, Ferrari M, Bracci A, Manfredini D. Electromyographic assessment of masseter muscle activity: A proposal for a 24 h recording device with preliminary data. *J Clin Med* 2022;12(1):247. <https://doi.org/10.3390/jcm12010247>
 68. Manfredini D, Ahlberg J, Aarab G, Bender S, Bracci A, Cistulli PA, et al. Standardised Tool for the Assessment of Bruxism. *J Oral Rehabil* 2023;00:1-6. <https://doi.org/10.1111/joor.13411>