




Association Involving Possible Sleep Bruxism, Stress, and Depressive Symptoms in Brazilian University Students: A Cross-sectional Study

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Abstract

The aim of the present study was to examine the association regarding sleep bruxism (SB), depression, and stress in Brazilian university students. We conducted a cross-sectional study with a large-sample of university students ($n = 2,089$) in the city of Pelotas, Rio Grande do Sul, Southern Brazil. A self-administered questionnaire was sent to classrooms to evaluate socioeconomic and demographic characteristics. Possible SB was detected by self-report according to the International Consensus on The Assessment of Bruxism Criteria (2018). The Patient Health Questionnaire-9 and the Perceived Stress Scale were used to assess depression and stress symptoms respectively. Crude and adjusted Poisson regression analyses were performed. The prevalence of possible SB, high level of stress, and depressive symptoms in the sample were of 20.4%, 16.6%, and 16.6% respectively. Stress in female students was significantly associated with an increased prevalence of possible SB, but not in male students. Regarding depression, the prevalence of SB was 28% higher in students with depressive symptoms. Students with stress or depression had a 35% higher prevalence of SB than those without any symptoms.

Keywords

- ▶ sleep bruxism
- ▶ depression
- ▶ stress
- ▶ University students
- ▶ young adult

Conclusion The findings have shown that university students with stress and depressive symptoms were more likely to be detected with possible SB.

Introduction

Sleep bruxism (SB) is defined as masticatory muscle activity during sleep, which is characterized as rhythmic (phasic) or nonrhythmic (tonic) and is not a movement disorder or sleep

disorder in otherwise healthy individuals. It can be categorized as “possible” based on self-report, “probable” based on clinical examination, or “definite” based on a polysomnographic record.¹ Its negative consequences may include tooth wear, masticatory muscle pain, headache, and exacerbation

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of temporomandibular disorders.² Sleep bruxism is considered a motor behavior with a multifactorial etiology, and research has focused on the associated factors that play a role in its pathophysiology.^{1,3} Lifestyle habits, such as smoking, alcohol and coffee consumption, and psychological traits, such as anxiety, stress, depression, and sleep disorders, have been associated with increased SB.^{4,5}

University students may be subjected to considerable levels of stress, anxiety, and depression, which may be associated with several psychosocial stressors emerging from the academic environment.^{6,7} Furthermore, sleep quality can be related to academic lifestyle.⁸ Poor sleep quality, including inadequate sleep duration and nightmares, is significantly associated with SB among students.⁹ In Brazil, a study¹⁰ with dental students found a prevalence of SB of 21.5%, which was significantly associated with sleep quality. Poor sleep quality is an important factor that is directly related to stress and depression.^{11,12} A study¹³ conducted in Italy showed that university students presented higher bruxism and stress levels than the general population. Few studies have investigated the mental outcomes associated with bruxer behavior in university students. Controversial cross-sectional findings regarding the correlation regarding stress levels^{13,14} and depression^{5,15} with bruxism have also been identified, which may be related to the small samples and specific characteristics of the populations included in these investigations.

Thus, it is important that studies including large representative samples of students from different courses and fields of knowledge be performed to clarify the relationship involving bruxism, mood disorders such as stress, and the presence of depressive symptoms. Future evidence may be useful for the development and performance of activities aimed at promoting mental health and the consequent and potential reduction of bruxism in students. Therefore, the present study aimed to investigate the influence of depressive symptoms and stress on possible SB among university students in Southern Brazil. The hypothesis is that stress and depressive symptoms are associated with SB in the present sample.

Material and Methods

Study Design and Ethical Aspects

The present cross-sectional study evaluated the psychosocial and oral health characteristics of university students in the city of Pelotas, Southern Brazil. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement¹⁶ was used to guide the reporting of information. The study was approved by the institutional Ethics in Research Committee (approval protocol #49449415.2.0000.5317).

Subjects

All university students enrolled in 2016 were eligible for the study, except those who were unable to answer the questionnaire by themselves. According to institutional data, 3,237 students were enrolled in 2016. All academic units were

contacted to obtain a letter of authorization and the recommendation of a college professor to perform data collection in his/her class. To reduce bias due to losses, the courses were visited until 60% of the enrolled students were reached. This procedure was performed more than twice when 60% of the students were not reached on the first return. Before data collection, all students were invited to participate through an information letter about the study, and those who agreed signed an informed consent form.

Data Collection

The data collection team consisted of one supervisor (a graduate student) and three undergraduate students who were previously trained. A self-administered questionnaire was sent to the classrooms, which included questions about socioeconomic, demographic, psychological, and oral health characteristics. After filling out the questionnaire, the students were instructed to place it attached to the consent form in a specific folder. Details on the methods and logistics can be found in a study by Chisini et al.¹⁷ **►Supplementary file 1** shows a structured questionnaire that contains the variables included in the present study.

Variables

The detection of possible SB in university students (outcome) was performed according to the criteria established in the International Consensus on the Assessment of Bruxism proposed by Lobbezoo et al.¹ Students were asked the following question: "Have you been told, or do you notice that you clench or grind your/their teeth or clench your/their jaw(s) while sleeping at night?" The answer options were yes and no.¹

The main exposure variables were depressive symptoms and stress. Depressive symptoms were assessed using the Brazilian version of the Patient Health Questionnaire (PHQ-9),¹⁸ which is composed of two questions that assess anhedonia ("little interest or pleasure in doing things") and the frequency of depressed mood ("feeling more sad, depressed, or hopeless") during the past two weeks. Each question contains four response options (never; for several days; for more than 1 week; almost every day), scored on a 4-point Likert scale (from 0 to 3). The total score ranged from 0 to 6. For statistical purposes, we considered a positive diagnosis of the presence of depressive symptoms when the students scored ≥ 3 on the PHQ-9.¹⁹

The stress level was measured using a modified version of the Perceived Stress Scale (PSS).²⁰ In this instrument, respondents rate the frequency of their feelings and thoughts related to events and situations that occurred in the last month. In total, 6 items are negative (1, 2, 3, 6, 9, and 10), and 4 are positive (4, 5, 7, 8). Each question is rated on a 5-point Likert-type scale (1 = never; 5 = very often) and produces a total score ranging from 0 to 40. In the present study, the total score was used in two ways: it was dichotomized into levels of perceived stress (low – score: ≤ 14 ; high – score: >14)²⁰ and categorized into quintiles. In addition, the university students were classified according to the presence or absence of at least one of the conditions described above.

Other covariates included to control for confounding factors, such as sex (male or female), age (categorized based on the distribution of quintiles of the reported age: 16–17, 18–24, 25–34, and ≥ 35 years old), paid employment (yes or no), and family income (in Brazilian reais converted to US dollars in June, 2022).

Statistical Analysis

Data were double entered in EpiData software (The EpiData Association, Odense, Denmark), version 3.1. The statistical analyses were performed using the Stata Statistical Software (Stata Corp, College Station, TX, United States), version 14.0. All data that support the findings of the present study are available from the corresponding author upon reasonable request, according to the findability, accessibility, interoperability, and reusability (FAIR) data principles (www.force11.org/group/fairgroup/fairprinciples).

Absolute and relative frequencies, as well as 95% confidence intervals (95% CIs), were described, and the association regarding possible SB and the independent variables was tested using the Chi-squared test. To assess the association of depression and stress with SB, crude and adjusted Poisson regression analyses were used to estimate the prevalence ratios (PRs) and the respective 95% CIs. Variables with $p < 0.25$ on crude analysis were included in the adjusted analysis and retained regardless of the p -value. Variables with $p < 0.05$ were considered factors associated with the outcome. The results of stress level and possible SB were stratified by sex due to differences in the prevalence of stress between females and males.

Results

Of the 3,237 students enrolled in our institution in 2016, 2,089 (64.5%) signed the consent form to participate in the study. Of these, 2,059 answered all questions on SB (response rate = 98.6%). The reasons for nonparticipation included failure to attend during the day of data collection (34.6%), and 29 students (0.89%) refused to participate in the study.

The mean age was of 22.4 ± 8.2 years, with a minimum age of 16 and a maximum age of 73 years. Nearly 52% (95% CI: 49.9–54.2) of the subjects were female, $\sim 62\%$ (95% CI: 59.2–63.8%) had a family income between 310 and 1,548 US dollars, and 22.8% (95% CI: 21.0–24.7%) had paid employment. The prevalence of possible SB was of 24.6% (95% CI: 22.8–26.5%). The prevalence of high stress was of 46.6% (95% CI: 44.4–48.7%), and that of depressive symptoms was of 16.6% (95% CI: 14.9–18.2%). The frequency distributions of the covariates according to the outcome are described in **Table 1**.

The crude and adjusted analyses of the levels of stress and depressive symptoms with self-reported SB are described in **Tables 2** and **3**. After adjustment, a high level of stress remained associated with the outcome in female students, but not male students. Female university students with high stress levels had a 61% higher prevalence of SB than those with low stress levels (PR: 1.61; 95% CI: 1.28–2.03). When the stress scores in quintiles were evaluated, we observed that

the prevalence of self-reported SB increased with the stress level. Female university students in the highest quintile of stress had a 42% higher prevalence of SB than those in the lowest quintile of stress (PR: 1.42; 95% CI: 1.02–1.99). When the presence of depressive symptoms was evaluated, the prevalence of SB was 28% higher in students with depressive symptoms (PR: 1.28; 95% CI: 1.05–1.57).

The combined effects of stress and depression on SB were analyzed, as shown in **Table 3**. An association with SB was found between students who presented only one of the psychological disorders and students who presented both (stress and depression). After adjustment, university students with depressive symptoms and stress had a 57% higher prevalence of self-reported SB than students without symptoms (PR: 1.57; 95% CI: 1.24–1.98).

Discussion

The findings of the present study corroborated the relationship between possible SB and psychological disorders, including high levels of stress and the presence of depressive symptoms, thus confirming the hypothesis of the study. Additionally, a synergistic effect of stress and depression on possible SB was identified.

In the present study, SB was reported in 24.6% of university students, a rate similar to the one reported in another study conducted in Brazil.¹⁰ However, the prevalence was higher than that reported in other studies. In Japan,²¹ a study with 1,506 first-year college students found a prevalence of SB of 6.7%. In a study⁵ on the risk factors for SB in the general population of the United Kingdom, Germany, and Italy, the prevalence of SB was of 4.4%. Differences in the worldwide prevalence of SB may be explained by the specific characteristics of the population evaluated and the different criteria used to diagnose SB.¹

Stressed individuals have a higher chance of developing bruxism than healthy individuals. Two recent systematic reviews and meta-analyses^{22,23} found that stressed adults are approximately two to five times more likely to self-report the diagnosis of SB. However, the present study confirmed these associations. Although the mechanism that explains the association between stress and SB is not well elucidated, SB is mainly centrally mediated and part of an arousal response.²⁴ Movements related to the disorder can be a physiological response to imbalances related to stress. Therefore, stress could improve neuromuscular activity, leading to a higher risk of developing muscular bruxism.²⁵

When the analysis was stratified by sex, a significant association involving SB and depressive symptoms and stress was observed among female students, which is consistent with the literature.¹⁴ The explanation for these findings can be related to possible differences in stress responses and reactivity to stressful life events between male and female individuals. Higher levels of stress in female subjects have been suggested to be explained by hormonal characteristics.²⁶ Other factors, such as psychological pressure and expectations, can influence the levels of stress and the occurrence of SB in female students as an adaptive behavior

Table 1 Characteristics of the study sample according to the frequency of possible sleep bruxism

Variables	Total sample (n = 2,059)			Sleep bruxism (n = 507; 20,4%)
	N	%	95% confidence interval	% (95% confidence interval)
<i>Sex^a (n = 2,050)</i>				
Male	983	47.9	45.8–50.1	22.4 (19.8–24.9)
Female	1,067	52.1	49.9–54.2	26.7 (24.1–29.4)
<i>Age in years^a (n = 2,050)</i>				
16–17	310	15.1	13.6–16.7	26.4 (21.5–31.4)
18–24	1,352	65.9	63.9–68.0	22.6 (20.4–24.9)
25–34	214	10.4	9.1–11.8	23.8 (18.1–29.6)
≥ 35	174	8.5	7.3–9.7	37.4 (30.1–44.6)
<i>Paid employment^a (n = 2,053)</i>				
No	1,584	77.2	75.3–79.0	23.5 (21.5–25.6)
Yes	469	22.8	21.0–24.7	28.4 (24.3–32.5)
<i>Family income (US\$, February 2022; n = 1,695)</i>				
0–309	272	16.1	14.3–17.8	24.6 (19.5–29.8)
310–1,548	1,043	61.5	59.2–63.8	24.7 (22.1–27.4)
≥ 1,549	380	22.4	20.4–24.4	26.3 (21.9–30.8)
<i>Stress level^a (n = 2,034)</i>				
Low (score ≤ 14)	1,087	53.4	51.3–55.6	21.3 (18.9–23.8)
High (score > 14)	947	46.6	44.4–48.7	28.6 (25.7–31.5)
<i>Stress level (score in quintiles)^a (n = 2,034)</i>				
1 st	417	20.5	18.7–22.3	21.8 (17.8–25.8)
2 nd	436	21.5	19.6–23.2	19.5 (15.8–23.2)
3 rd	456	22.4	20.6–24.2	24.1 (20.2–28.1)
4 th	334	16.4	14.8–18.0	27.8 (23.0–36.7)
5 th	391	19.2	17.5–20.9	31.7 (27.1–36.3)
<i>Depressive symptoms^a (n = 2,034)</i>				
No	1,703	83.4	81.8–85.0	23.7 (21.7–25.7)
Yes	338	16.6	14.9–18.2	29.3 (24.4–34.2)

Note: ^aChi-squared and Fisher exact tests; *p*-value < 0.05.

Table 2 Crude and adjusted analyses of the psychological factors associated with possible sleep bruxism by sex

Variables	Sleep bruxism			
	Male (n = 983)		Female (n = 1,067)	
	PR _{CRUDE} (95%CI)	PR _{ADJUSTED} ^E (95%CI)	PR _{CRUDE} (95%CI)	PR _{ADJUSTED} ^a (95%CI)
<i>Stress level</i>				
Low (score ≤ 14)	1.00	1.00	1.00	1.00
High (score > 14)	1.11 (0.87–1.40)	1.15 (0.88–1.50)	1.49 (1.21–1.85) ^b	1.61 (1.28–2.03) ^b
<i>Stress level (score in quintiles)</i>				
1 st	1.00	1.00	1.00	1.00
2 nd	0.93 (0.65–1.35)	0.98 (0.66–1.45)	0.81 (0.54–1.19)	0.72 (0.48–1.09)
3 rd	1.36 (0.98–1.89)	1.35 (0.94–1.94)	0.84 (0.59–1.22)	0.80 (0.54–1.18)
4 th	1.10 (0.74–1.63)	1.16 (0.75–1.82)	1.26 (0.89–1.78)	1.27 (0.89–1.80)
5 th	1.36 (0.94–1.97)	1.49 (0.98–2.26)	1.35 (0.98–1.87)	1.42 (1.02–1.99) ^b

Abbreviations: 95%CI, 95% confidence interval; PR, prevalence ratio.

Notes: ^aAdjusted by age and family income; ^b*p*-value = 0.001 in the regression analysis.

Table 3 Effect of the association of depressive symptoms and stress on possible sleep bruxism

Variables	Sleep bruxism	
	PR _{CRUDE} (95%CI)	PR _{ADJUSTED} [£] (95%CI)
Depression symptoms		
No	1.00	1.00
Yes	1.23 (1.02–1.48)	1.28 (1.05–1.57)
Stress and depression symptoms		
No	1.00	1.00
Depression or stress	1.32 (1.11–1.56)*	1.35 (1.12–1.64)*
Depression and stress	1.42 (1.15–1.75)	1.57 (1.24–1.98)*

Abbreviations: 95%CI, 95% confidence interval; PR, prevalence ratio.

Notes: [£]Adjusted by age and family income; **p*-value < 0.001 in the regression analysis.

to stress.²⁷ Many factors can be involved in the occurrence of self-reported SB, and it is difficult to isolate the effect of stress.

In the present study, the prevalence of SB was 28% higher among students with depressive symptoms. It has been suggested that the association between depression and SB is due to low levels of dopaminergic neurons in subjects with depression. Dopamine is the main neurotransmitter associated with motor activity, and a deficiency can cause increased muscle movement, which may contribute to the occurrence of SB.^{28,29} Additionally, depressive symptoms can be induced by stressful events, which explains the association of these psychological conditions with SB and the cumulative effect of both conditions.^{1,30}

The identification of a significant association regarding possible SB and symptoms of depression and stress in university students is important mainly for two reasons: SB may suggest associated psychological disorders that affect academic performance and general quality of life, and SB as a result of high levels of stress and depressive mood, in the same way, can impact daily performance due to headaches and discomfort.

The present study has some limitations that need to be considered while interpreting the results, and that should be considered by other researchers while planning future investigations. The cross-sectional design limits the cause-effect relationship. Additionally, the generalizability of the results to the general population is not indicated, since university students differ from the general population due to their high level of schooling. Although the researchers in the present study returned to the classroom three times, significant losses were identified in the sample, which are partly explained by the high number of events observed in this population (almost 10%). The remaining students were not included because they were not present in class during the data collection period. However, similar questionnaire-based studies²⁶ have shown comparable results. Still, it is important to highlight that, even though the PHQ-9 is useful to screen for disorders, it does not replace the diagnosis based on a clinical interview conducted by psychologists and psychiatrists. Furthermore, the method used to measure the outcomes can be considered a limitation. Self-reporting of SB alone may underestimate the prevalence of the disorder,

whereas it depends on the report of the other person, such as roommate, partner, or parents.³¹ However, the question used to identify individuals with SB in the present study showed a high correlation (0.93) when the presence of clinical signs of bruxism was also considered, and the PHQ-9 is considered a valid tool for use in wide epidemiological studies.²⁷ Additionally, validated instruments were used for data collection to measure the main exposure. An important strength is the wide sample size, which highlights the relationship between stress and depressive mood in this specific population.

Given the possible damages caused by all mental disorders, it is important that universities discuss and implement actions to improve or prevent psychological disorders in students. Successful examples of activities to promote the mental health of university students have been reported in the literature, such as conversation circles and psychological support.^{32,33} In addition, it has been suggested that universities carry out actions aimed at managing risk factors associated with the onset of stress and depressive symptoms, such as poor sleep quality and sedentary lifestyle, through targeted campaigns to encourage the daily adoption of sleep hygiene measures and the practice of regular physical activity.^{34,35} Finally, it is essential that the teaching staff of the institutions be able to guide and refer students to specialized medical assistance. Cost-effective therapeutic approaches, such as cognitive-behavioral therapy and mindfulness-based stress reduction, are viable treatment modalities to reduce mental disorder symptoms in students.^{36,37} These strategies should be applied to prevent mental problems and promote better quality of life for students, which may reduce bruxer behavior in this group.

In conclusion, the present study reported a relationship involving possible SB and stress in women and symptoms of depression. Additionally, an association was observed between possible SB and the presence of both psychological disorders.

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Conflict of Interests

The authors have no conflict of interests to declare.

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