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ORIGINAL ARTICLE

Association between Bullying and Both Awake and Sleep Bruxism in School Adolescents: A Cross-Sectional Study

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ABSTRACT

Objective: To verify the association between bullying and awake and sleep bruxism in school teenagers. **Material and Methods:** A cross-sectional study was conducted from March to June 2018 with adolescents aged 14 to 19 of both sexes enrolled in the state school system of a city in Pernambuco. Students who participated in the stages of data collection and filled out the questions about bullying and bruxism were considered eligible. Those with disabilities or dysfunctions that made it impossible to fill out the questionnaire themselves were excluded. For data collection, an instrument with questions from the National Survey of Adolescent Health (*PeNSE*) and the "Research Diagnostic Criteria for Temporomandibular Dysfunction" (RDC/TMD) questionnaire was used. **Results:** A total of 2,500 adolescents participated in this study. The prevalence of possible awake bruxism among the adolescents was 20.6%, the prevalence of possible sleep bruxism was 21.9%, and 23% of the adolescents reported having experienced bullying. About 2 of 10 male students had possible sleep bruxism (SB), while a fourth of the female students had the condition ($p=0.004$; $OR=1.1$). As seen in the awake bruxism, feelings of sadness, school bullying, and cyberbullying had significant correlations with possible SB ($p<0.001$, $OR=2.4$; $p<0.001$, $OR=1.9$ and $p=0.01$, $OR=1.7$, respectively). **Conclusion:** The association between possible awake and sleep bruxism and bullying in school adolescents was verified, regardless of sex, age, income, and mother's education.

Keywords: Behavior and Behavior Mechanisms; Aggression; Bruxism; Age Groups.

Introduction

During the school phase, adolescence can be marked by bullying, a type of violence generated by an unequal power situation, usually carried out by one or more students without apparent motivation, repeatedly, intentionally, and aggressively [1], which can be classified as physical, verbal or relational [2] — the prevalence of adolescents victims of bruxism range from 30.4% to 67.5% [3]. Young people who face this type of aggression are prone to suffer from high levels of stress, anxiety, low self-esteem, depression, dropping out of school, and even suicide [1], factors that are also related to bruxism [1-6].

Bruxism may be present in 85 to 90% of the population throughout life [7,8]; it is defined as a repetitive muscular activity that involves the masticatory muscles and includes clenching and grinding of the teeth, as well as jaw immobilization and protrusion and lateralization, with or without contact with the dental surfaces [7]. Sleep bruxism (SB) is characterized as rhythmic (phasic) or non-rhythmic (tonic) and occurs during sleep. Awake bruxism (AB) occurs during wakefulness [8]. The assessment of the bruxism can be done through the following characterization: possible sleep/awake bruxism is based on self-report only; probable sleep/awake bruxism on self-report and clinical inspection; definite awake bruxism on self-report, clinical inspection, and electromyography; and definite sleep bruxism on self-report, clinical inspection, and polysomnography [7].

Different risk factors have been associated with bruxism, such as pathophysiological, genetic, and psychosocial [8], but there are still many doubts about its etiology [9]. Among these hypotheses, there have been discussions about the association between behavioral problems and anxiety, and depending on the individual, these muscular activities may be vital in relieving tension and stress [4]. If associated with harmful health outcomes, bruxism can be considered a risk factor [7]. This behavior is more frequent in children and adolescents [10] and may indicate other problems [4-12]. Thus, it is believed that there is a relationship between bullying and bruxism and that it may affect the well-being of adolescents [3]. The present study aimed to investigate the link between bullying and potential awake and sleep bruxism in adolescents attending school.

Material and Methods

Design and Study Population

This is an analytical, cross-sectional, school-based study from the larger project "Oral Health and Modifiable Health Risk Behaviors in Adolescence — Monitoring to Prevent".

The target population was adolescent students from the public school system of Olinda, Brazil, aged 14 to 19, of both genders and regularly enrolled in the teaching units. The study was part of a more extensive research study with 2,500 adolescents as the total sample; however, the estimated sample for the outcome variable bruxism was 1603 individuals.

Of the 39 schools in Olinda, twelve did not participate in the research because they had night classes, did not have a high school, or were located in dangerous areas. All students in the 27 schools were invited to participate in the research. Almost all classrooms (91%) in the schools participated in the data collection.

A pilot study was conducted with 243 students from six Olinda schools to calibrate the researchers and test the reproducibility of the questionnaire application procedures. The study used the sample calculation equation for a ratio study in a finite population to determine the sample size and drew the sample from the pilot study.

Procedures and Measures

Data was collected from March to June 2018 using an instrument with questions from the Youth Risk Behavior Survey (YRBS), validated and adapted in Brazil, and from the National School Health Survey (*PeNSE*) - conducted by the Brazilian Institute of Geography and Statistics (IBGE). Questions related to sociodemographic characterization were used, such as gender (female/male), age (14 to 16 and 17 to 19 years old), mother's education (complete elementary school / complete high school), religion (Catholic / Evangelical / Spiritualist / Afro-Brazilian / other) and monthly family income (≤ 1 minimum wage per month / 1 minimum wage per month). The questions regarding bullying were: In the last 12 months, have you been bullied at your school? In the past 12 months, have you experienced virtual bullying, including e-mail, chat, instant messaging (WhatsApp), websites (Facebook), or text messaging? The answers were dichotomous (yes/no), and being considered a victim of bullying was an affirmative answer to at least one of these two questions. There was also a question from the YRBS about sadness: During the past 12 months, have you felt excessively sad or hopeless almost every day for two or more weeks, causing you to stop your everyday activities? (Yes; No).

The data on the presence of possible awake bruxism (AB) and possible sleep bruxism (SB) were collected through three questions contained in the questionnaire "Research Diagnostic Criteria for Temporomandibular Dysfunction" (RDC/TMD), developed by Dworkin and LeResche in 1992 and validated in Brazil by Lucena et al. [13]. The three questions for sleep bruxism were: "Have you noticed or has anyone ever told you that you grind or clench your teeth when you sleep?" / "Does your jaw feel "tired" or sore when you wake up in the morning?" (Yes; No). Answering at least one question about SB with "yes," the diagnosis was considered positive. For awake bruxism, the question was: "During the day, do you grind or clench your teeth?" (Yes; No). A positive diagnosis of AB was obtained if the student reported "yes" [14].

Students who participated in the stages of data collection and filled out the questions about bullying and bruxism were considered eligible. Those with disabilities or dysfunctions that made it impossible to fill out the questionnaire themselves were excluded.

Statistical Analysis

For the descriptive statistical analysis, absolute and relative frequency values were presented. Pearson's chi-square test was used to compare the sociodemographic characteristics and the prevalence of bullying and bruxism according to gender. Intending to verify which factors or variables influence the occurrence of each of the dependent variables, sleep bruxism, and awake bruxism, a logistic regression model was adjusted for each dependent variable with the variables that showed a significant association of up to 10% (<0.10) in the study bivariate and through the backward step selection process, the variables up to 10% (<0.10). From the model, the "OR" values were estimated with respective confidence intervals, significance values (p-values) of variables and each category in relation to the reference category, acceptance of the model, adjustment of data to the model using the Lemeshow test, and percentage of correct classification of cases, in addition to the probabilities of occurrence of each one type of bruxism for the combinations of independent variables. In all analyses, a value of $p \leq 0.05$ was adopted as statistically significant, and all analyses were conducted using the Statistical Package for Social Science software, version 21.0 (IBM Corp., Armonk, NY, USA).

Ethical Clearance

The research was developed following resolution 466/2012 of the National Health Council and approved by the Research Ethics Committee of the University of Pernambuco, CAAE: 76609817.1.0000.5207. Free and Informed Consent Terms were distributed for signature by parents/guardians, and teenagers under and over 18 received an informed assent form.

Results

Questions regarding sociodemographic data, gender, age, feelings of sadness, bullying, cyberbullying, and bruxism not answered were considered losses. There was a sample loss of 897 (35.88%) related to those who did not answer the questions of interest for the study; thus, the final sample was composed of 1603 adolescents.

Table 1 presents the characteristics of the adolescents included in this study. Income ≥ 1 minimum wage, and mother's education ≥ complete high school. Approximately one-third of the adolescents reported experiencing feelings of sadness. In terms of prevalence, sleep bruxism, and school bullying were more commonly reported by the participants than awake bruxism and cyberbullying.

Table 1. Sociodemographic characteristics, thoughts of sadness, bruxism, and bullying.

Variables	N (%)
Total	1063 (100.0)
Age (Years)	
14 - 16	517 (48.6)
17 - 19	546 (51.4)
Gender	
Male	457 (43.0)
Female	606 (57.0)
Maternal Schooling (Years)	
≤ 8	364 (34.2)
9 to 11	554 (52.1)
≥ 12	145 (13.6)
Paternal Schooling (Years)	
≤ 8	385 (36.2)
9 to 11	557 (52.4)
≥ 12	121 (11.4)
Family Arrangement	
Lives with Mother/Father	370 (34.8)
Lives with Mother/Father and Other relatives	693 (65.2)
Monthly Family Income (Minimum Wage)	
Up to 1	578 (54.4)
> 1 to < 2	332 (31.2)
≥ 2	153 (14.4)
Feeling of Sadness	
Yes	399 (37.5)
No	664 (62.5)
Awake Bruxism	
Yes	219 (20.6)
No	844 (79.4)
Sleep Bruxism	
Yes	233 (21.9)
No	830 (78.1)
School Bullying	
Yes	199 (18.7)
No	864 (81.3)
Cyberbullying	
Yes	115 (10.8)
No	948 (89.2)

Table 2 presents the association of possible awake bruxism according to demographic profile, feelings of sadness, and bullying. It was observed that there was no significant correlation between awake bruxism and parental schooling or with monthly family income, but about one-third of people with awake bruxism had feelings of sadness ($p<0.001$; OR=2.2). Bullying (school bullying and cyberbullying) had a positive correlation with awake bruxism; in both cases, there was statistical significance ($p<0.001$ and $p=0.043$, respectively).

Table 2. Analysis corresponding to the association between awake bruxism and independent variables.

Variables	Awake Bruxism			p-value[1]	OR (95% CI)
	Yes N (%)	No N (%)	Total N (%)		
Total	219 (20.6)	844 (79.4)	1063 (100.0)		
Age (Years)				0.198	
14 - 16	115 (22.2)	402 (77.8)	517 (100.0)		1.2 (0.9-1.6)
17 - 19	104 (19.0)	442 (81.0)	546 (100.0)		1.0
Gender				0.629	
Male	91 (19.9)	366 (80.1)	457 (100.0)		1.0
Female	128 (21.1)	478 (78.9)	606 (100.0)		1.1 (0.8-1.5)
Maternal Schooling (Years)				0.172	
≤ 8	75 (20.6)	289 (79.4)	364 (100.0)		1.0
9 to 11	106 (19.1)	448 (80.9)	554 (100.0)		0.9 (0.7-1.3)
≥ 12	38 (26.2)	107 (73.8)	145 (100.0)		1.4 (0.9-2.1)
Paternal Schooling (Years)				0.572	
≤ 8	86 (22.3)	299 (77.7)	385 (100.0)		1.2 (0.7-1.9)
9 to 11	109 (19.6)	448 (80.4)	557 (100.0)		1.0 (0.6-1.6)
≥ 12	24 (19.8)	97 (80.2)	121 (100.0)		1.0
Family Arrangement				0.971	
Lives with Mother/Father	76 (20.5)	294 (79.5)	370 (100.0)		1.0
Lives with Mother/Father and Other Relatives	143 (20.6)	550 (79.4)	693 (100.0)		1.0 (0.7-1.4)
Monthly Family Income (Minimum Wage)				0.913	
Up to 1	117 (20.2)	461 (79.8)	578 (100.0)		1.0
> 1 to < 2	71 (21.4)	261 (78.6)	332 (100.0)		1.1 (0.8-1.5)
≥ 2	31 (20.3)	122 (79.7)	153 (100.0)		1.0 (0.6-1.6)
Feeling of sadness				<0.001*	
Yes	115 (28.8)	284 (71.2)	399 (100.0)		2.2 (1.6-2.9)
No	104 (15.7)	560 (84.3)	664 (100.0)		1.0
School bullying				<0.001*	
Yes	62 (31.2)	137 (68.8)	199 (100.0)		2.0 (1.4-2.9)
No	157 (18.2)	707 (81.8)	864 (100.0)		1.0
Cyberbullying				0.043*	
Yes	32 (27.8)	83 (72.2)	115 (100.0)		1.6 (1.0-2.4)
No	187 (19.7)	761 (80.3)	948 (100.0)		1.0

[1]Based on Pearson's Chi-square; *Significance set at p<0.05.

The factors associated with possible sleep bruxism in adolescents are presented in Table 3. About 2 of 10 male students had possible sleep bruxism (SB), while a fourth of the female students had the condition (p=0.004; OR=1.1). As seen in the awake bruxism, feelings of sadness, school bullying, and cyberbullying had significant correlations with possible SB (p<0.001, OR=2.4; p<0.001, OR=1.9 and p=0.01, OR=1.7, respectively).

Table 3. Analysis corresponding to the association between possible sleep bruxism and independent variables.

Variables	Sleep Bruxism			p-value[1]	OR (95% CI)
	Yes N (%)	No N (%)	Total N (%)		
Total	233 (21.9)	830 (78.1)	1063 (100.0)		
Age (Years)				0.400	
14 - 16	119 (23.0)	398 (77.0)	517 (100.0)		1.1 (0.8-1.5)
17 - 19	114 (20.9)	432 (79.1)	546 (100.0)		1.0
Gender				0.004*	
Male	81 (17.7)	376 (82.3)	457 (100.0)		1.0
Female	152 (25.1)	454 (74.9)	606 (100.0)		1.6 (1.1-2.1)
Maternal Schooling (Years)				0.230	
≤ 8	89 (24.5)	275 (75.5)	364 (100.0)		1.1 (0.7-1.7)
9 to 11	110 (19.9)	444 (80.1)	554 (100.0)		0.8 (0.5-1.3)

≥ 12	34 (23.4)	111 (76.6)	145 (100.0)		1.0
Paternal Schooling (Years)				0.330	
≤ 8	82 (21.3)	303 (78.7)	385 (100.0)		1.3 (0.8-2.2)
9 to 11	130 (23.3)	427 (76.7)	557 (100.0)		1.5 (0.9-2.4)
≥ 12	21 (17.4)	100 (82.6)	121 (100.0)		1.0
Family Arrangement				0.427	
Lives with Mother/Father	76 (20.5)	294 (79.5)	370 (100.0)		1.0
Lives with Mother/Father and Other Relatives	157 (22.7)	536 (77.3)	693 (100.0)		1.1 (0.8-1.5)
Monthly Family Income (Minimum Wage)				0.926	
Up to 1	129 (22.3)	449 (77.7)	578 (100.0)		1.1 (0.7-1.7)
> 1 to < 2	72 (21.7)	260 (78.3)	332 (100.0)		1.0 (0.7-1.7)
≥ 2	32 (20.9)	121 (79.1)	153 (100.0)		1.0
Feeling of Sadness				<0.001*	
Yes	126 (31.6)	273 (68.4)	399 (100.0)		2.4 (1.8-3.2)
No	107 (16.1)	557 (83.9)	664 (100.0)		1.0
School Bullying				<0.001*	
Yes	64 (32.2)	135 (67.8)	199 (100.0)		1.9 (1.4-2.7)
No	169 (19.6)	695 (80.4)	864 (100.0)		1.0
Cyberbullying				0.010*	
Yes	36 (31.3)	79 (68.7)	115 (100.0)		1.7 (1.1-2.7)
No	197 (20.8)	751 (79.2)	948 (100.0)		1.0

[1]Based on Pearson's Chi-square; *Significance set at p<0.05.

Tables 4 and 5 present the logistic regression results for awake and sleep bruxism, respectively. The feeling of sadness and school bullying had a statistically significant correlation with awake bruxism both in the bivariate and in the adjusted logistic regression, regarding possible sleep bruxism, gender, feelings of sadness, and school bullying statistical significance in the logistic regression (bivariate and adjusted).

Table 4. Analysis corresponding to the logistic regression results for the prevalence of awake bruxism.

Variables	Bivariate		Adjusted	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Feeling of Sadness		<0.001*		<0.001*
Yes	2.2 (1.6-2.9)		2.0 (1.5-2.7)	
No	1.0		1.0	
School Bullying		<0.001*		0.002*
Yes	2.0 (1.4-2.9)		1.7 (1.2-2.5)	
No	1.0		1.0	

*Significance set at p<0.05.

Table 5. Analysis corresponding to the logistic regression results for the prevalence of sleep bruxism.

Variables	Bivariate		Adjusted	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Gender		0.004*		0.035*
Male	1.0		1.0	
Female	1.6 (1.1-2.1)		1.4 (1.0-1.9)	
Feeling of Sadness		<0.001*		<0.001*
Yes	2.2 (1.6-2.9)		2.1 (1.5-2.8)	
No	1.0		1.0	
School Bullying		<0.001*		0.003*
Yes	2.0 (1.4-2.9)		1.7 (1.2-2.4)	
No	1.0		1.0	

*Significance set at p<0.05.

Discussion

According to the 2015 National Survey of School Health (*PeNSE*), 7.4% of participating students reported experiencing bullying [14]; perhaps the fact that *PeNSE* evaluates a broader and diverse conglomerate

may have decreased this prevalence because other surveys conducted in smaller groups in Brazil have brought different results, with higher prevalence of this phenomenon [15]; as a cross-sectional survey of 2,293 school adolescents in Vitória/ES, which identified that 41% of the participants had experienced bullying [16]; in 2017, another research study, conducted in São Paulo, with 2,680 adolescents, showed that 18.3% of this total were victims of bullying [17]. This indicates that, despite the importance of national studies, it is interesting that the data evaluation be carried out at the local or regional level, especially if the intention is to use prevalence to develop and monitor public policies or programs.

Regarding bruxism, this study found a prevalence of 20,6% of possible awake bruxism and 21,9% of possible sleep bruxism, which are within the margin of the prevalence of sleep bruxism among children and adolescents (3%-49%) [18] and above compared to a study of Israeli adolescent students, which found a frequency of 14.8% wakefulness bruxism and 7.3% sleep bruxism [19]. This wide margin of prevalence may be because the vast majority of epidemiological studies on bruxism are based on self-report instruments, mainly because of the low cost.

No significant difference was found between genders for the report of possible awake bruxism, although for possible sleep bruxism, there was an association with the female gender. In a study with 189 individuals about probable sleep bruxism in children and adolescents, Craciun et al. [20] found that the prevalence was 34.9% for males and 28.5% for females. As that study had a slight sample, the divergence in prevalence may be due to this [20]. Another study seeking to evaluate the relationship between bullying and probable awake bruxism found a higher prevalence of bruxism in girls (53.7%) [21]. The difference between these examples and this study may be due to the different assessments (possible x probable bruxism) and the size of the samples.

Currently, there are three types of diagnoses for bruxism: the family report or when there is a self-report of noise or grinding of teeth during sleep if it is sleep bruxism, or clenching sensation during the day if it is wakefulness, being called possible bruxism; the self-report of grinding and clinical characteristics compatible with bruxism, such as increased and coincident tooth wear between antagonist's teeth at the moment of the exam, pain or fatigue of the masticatory muscles and hypertrophy of the masseter, called probable bruxism; or portable diagnostic instruments; and polysomnography, exam considered the gold standard, called definitive bruxism [22], depending on the type of classification used and the type of bruxism, this prevalence can vary greatly.

Bruxism is associated with several disorders, and psychosocial factors such as depression, anxiety, and stress are relevant contributors to this condition [6]. Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest [23]. Therefore, the correlation of feeling of sadness with awake and possible sleep bruxism can be because depression has been associated with bruxism in previous studies [24,25].

Bruxism showed no significant association with age, income, mother's education, and religion. A systematic review pointed out that the age of 15 to 18 may be a risk factor for sleep bruxism compared to the elderly population [8]. However, when the research involved only adolescents, a study conducted in Israel showed no association with age for sleep bruxism, only for wakefulness bruxism, which was higher for participants aged 14 to 16 years [18].

As this research was conducted in public schools in the same municipality, neither the variables of income nor the mother's education were similar. Income may be an essential factor; a case-control study conducted with school adolescents in Brazil showed that bruxism was more frequent in participants from lower economic classes (C, D, and E) [4]. As this research was conducted in public schools in the same municipality, neither the variables of income nor the mother's education were similar. Income may be an essential factor; a

case-control study conducted with school adolescents in Brazil showed that bruxism was more frequent in participants from lower economic classes (C, D, and E).

Bullying is violence between peers involving a power relationship, which explains why younger students are victims while older ones can be bullies [26]. Another point to be highlighted is sexual maturation and growth, considering that some physical characteristics can be generators of bullying situations, such as being tall or short, pretty or ugly, fat or thin [26,27].

It was observed that adolescents who reported episodes of bullying had a higher chance of reporting bruxism. This result is ratified by other studies with children and adolescents in Brazil [4,28-30]. However, the relationship between bruxism and bullying is still unclear, but both conditions are associated with psychological factors such as stress, anxiety, and depression [31-37]. In the case of bullying, the victim may find themself unable to defend themself and tend not to externalize their feelings [38], which can release tension and stress in the muscles of the stomatognathic system, causing bruxism.

Considering the association of bullying with bruxism, another hypothesis would be that bruxism may serve to assist in the detection of cases of school bullying [28] because it is a physical sign and easy to track (possible and probable bruxism). It could be used as a warning sign for school health or primary care staff, considering that the adolescent who suffers bullying may not report the bullying episodes to parents, guardians, educators, or health professionals [38-40].

The study investigated bullying through self-reporting, which may have generated a memory bias. Bruxism was also evaluated through self-reporting, which may have generated an information bias. However, this type of research, through self-reporting and anonymity, contributes to the capture of data for epidemiological surveys with larger samples.

Conclusion

The association between possible bruxism and bullying in school adolescents was verified, regardless of age, sex, income, and mother's education.

Authors' Contributions

TF	https://orcid.org/0000-0001-8329-6027	Conceptualization, Formal Analysis, Data Curation, Writing - Original Draft and Visualization.
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All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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None.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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