# Evaluation of the association between self-reported sleep bruxism and chronotype and sleep quality among dental students

*Avaliação da associação entre cronotipo, qualidade do sono e autorrelato de bruxismo do sono entre estudantes universitários de Odontologia*

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## ABSTRACT

**Background:** Sleep bruxism (BS) is defined as involuntary jaw movements characterized by grinding and clenching teeth. **Objective:** To verify the association between chronotype, sleep quality, and self-reporting of BS in dental students. **Method:** A cross-sectional study was conducted with 214 undergraduate dental students at a public university in northeast Brazil. The participants answered the Munich Chronotype Questionnaire for the identification of chronotype and another questionnaire regarding daily aspects to collect information about sleep quality, self-reported sleep bruxism, the use of sleeping pills, snoring, concentration during daily activities and energy upon waking. **Results:** The prevalence of self-reported sleep bruxism was 11.0%. In the final model, the eveningness chronotype (OR = 23.00; 95% CI: 2.36-223.84, p = 0.007), habitual snoring (OR = 3.12; 95% CI: 1.31-7.39, p = 0.01) and low energy upon waking in the morning (OR = 2.37; 95% CI: 1.96-5.58, p = 0.040) were associated with self-reported sleep bruxism. **Conclusion:** The evening chronotype, presence of snoring, and low energy when waking up in the morning influenced self-reporting of sleep bruxism among undergraduate dental students.

**Keywords:** chronobiology; chronotype; biological rhythm; sleep; bruxism.

## RESUMO

**Introdução:** O bruxismo do sono (BS) é definido como movimentos involuntários da mandíbula caracterizados por ranger e apertar os dentes. **Objetivo:** Verificar se o cronotipo e a qualidade do sono estão associados ao autorrelato de BS em graduandos de Odontologia. **Método:** Um estudo transversal com 214 estudantes de uma universidade pública do Nordeste do Brasil. Os participantes responderam ao *Morningness-Eveningness Questionnaire* para identificar os cronotipos e outro questionário sobre aspectos diários em que foram coletadas informações sobre qualidade do sono, autorrelato de bruxismo do sono, uso de pílulas para dormir, ronco, concentração nas atividades diárias, energia ao acordar.

**Resultados:** A prevalência de autorrelato do bruxismo do sono foi de 11,0%. No modelo final, o cronotipo noturno (OR = 23,00; 95% IC: 2.36-223.84, p = 0,007), o hábito de roncar (OR = 3,12; 95% IC: 1.31-7.39, p = 0,01) e o baixo nível de energia ao acordar pela manhã (OR = 2,37; 95% IC: 1.96-5.58, p = 0,04) estiveram associados com o autorrelato de BS. **Conclusão:** O cronotipo noturno, a presença do ronco e a baixa energia ao se levantar pela manhã influenciaram o autorrelato de bruxismo do sono entre os estudantes de graduação em Odontologia.

**Palavras-chave:** cronobiologia; cronotipo; ritmo biológico; sono; bruxismo.

## INTRODUCTION

Sleep bruxism is a rhythmic (phasic) or non-rhythmic (tonic) masticatory muscle activity during sleep that is characterized by grinding and clenching the teeth, which can lead to other injuries in orofacial structures such as muscles and the temporomandibular joint[1]. Besides tooth wear, bruxism may be associated with headaches, temporomandibular disorder, pain in the muscles of mastication, periodontal problems and even tooth loss[1-3]. The prevalence of sleep bruxism (SB) among Brazilian university students ranges from 11.7 to 31.8% and the etiology of this condition is multifactorial and has been reported by different authors. Sleep bruxism was previously related to central nervous system function and psychological factors, such as anxiety, depression and stress[4,5], as well as genetic and environmental factors[6].

Chronobiology has also recently been associated with bruxism[7]. The chronotype of an individual is characterized as a biological clock that controls daily rhythms of sleep and wakefulness, cyclic behaviors, physiological functions, hormone secretion, body temperature and cognitive functions[8,9]. Each individual has his/her internal biological clock, which is classified into three types: morningness, intermediate, and eveningness. Individuals with the morningness chronotype tend to be more active in the early part of the day[7,9-11]. In the intermediate type, the organism has no preference for the morning or evening hours and adapts to variations in the circadian cycle. Individuals presenting the eveningness chronotype tend to wake up late and have a better physical and mental performance at the end of the day[10]. Studies have suggested that the chronotype has changed in society over the years due to the increased use of devices with light exposure at night[7,11]. This can lead to poor sleep quality, harmful habits and, consequently, a poorer health-related quality of life[12]. Therefore, it is important to study the association between chronobiology and health conditions, such as sleep bruxism.

Other investigations have found that sleep bruxism is associated with microarousals, snoring and respiratory disorders[13]. Longitudinal studies have revealed that 35 to 90% of youths with SB continue to have symptoms as adults and seniors, making correct diagnosis and early intervention essential[14]. Thus, this phase of life may be considered ideal for the prevention and modification of unhealthy behaviors in order to diminish the prevalence of this condition and, consequently, associated costs to the healthcare system[15].

The study hypothesis was that sleep quality and chronobiology are associated with sleep bruxism in university students. Therefore, our aim was to investigate the association between chronotype, sleep quality and self-reported sleep bruxism among undergraduate dental students at a public university in northeast Brazil.

## METHOD

### Study design, setting and population

A cross-sectional study was conducted at a public university in Campina Grande, Brazil. The State University of Paraiba is located in a city that is considered one of the industrial centers of the country and receives students from different regions of Brazil. The city's estimated population is 407.472 inhabitants[16], while the GINI index (0.5859) is similar to the general estimate for Brazil (0.515)[17].

This was a census study involving all undergraduate students of the Dentistry course (n = 214) enrolled in 2018 who answered two questionnaires addressing circadian rhythm, sleep quality and self-reported sleep bruxism. This study included all undergraduate students enrolled in the course who did not have any musculoskeletal disorders that could interfere with the presence of sleep bruxism. Students who used anticonvulsant medication were excluded.

## Data collection instruments and procedures

Data collection was performed in the classroom through the administration of two questionnaires. The Morningness/Eveningness Questionnaire (MEQ) is the most widely used instrument for chronotype evaluation[18-20]. The original instrument was developed and validated in England[21]. It is a self-evaluation questionnaire with response options employing a five-point Likert scale to classify the frequency of events between "never" and "always". A score is attributed to each response and the total ranges from 16 to 86. Scores above 58 classify an individual as having the morningness chronotype, between 42 to 48 as intermediate chronotype, and below 42 indicates an eveningness chronotype.

The participants also answered a questionnaire used in a previous study[15] with open-ended and closed-ended questions addressing sex, age, whether the participant lived with his/her parents, whether the participant had paid employment (extracurricular activities), the number of hours of sleep per night, sleep quality, whether they snored, whether they took sleeping pills, whether they woke during the night, whether they took a long time to fall asleep and whether they woke up tired. The following question related to SB was also posed: "In the last 30 days, has anyone told you that you grind your teeth while sleeping?"[6].

## Data analysis

The data were analyzed using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp, Armonk, NY, USA, 2012). Descriptive statistics were used for the characterization of participants for chronotype and sleep quality. Pearson's chi-squared test was used for comparisons. The variables that had $p < 0.20$ (habitual snoring, individual chronotype, difficulty waking up in the morning (energy) and use of medication) in the unadjusted analysis were inserted in the adjusted analysis, while those with $p < 0.05$ (habitual snoring, individual chronotype, difficulty waking up in the morning (energy)) were associated with the dependent variable. For these analyses, sleep bruxism was dichotomized as "no" (individuals who reported not grinding their teeth while sleeping during the previous 30 days) or "yes" (individuals who reported grinding their teeth while sleeping during the previous 30 days). Age was dichotomized based on the median value. For statistical purposes, we performed the dichotomous categorization of variables (habitual snoring, difficulty waking up in the morning – level of energy, undergraduate student, wakes during the night and takes a long time to fall asleep, hours of sleep) to make the analysis more robust.

## Ethical issues

This study received approval from the Human Research Ethics Committee of the State University of Paraíba (certificate numbers: 2.530.582 and 83391118.9.0000.5187) in accordance with Resolution Nº 466/2016 of the Brazilian National Board of Health and was conducted in accordance with the Declaration of Helsinki. All students who participated in the study signed an informed consent form.

## RESULTS

The study population was composed of 217 dental students and the response rate was 98.6% (n = 214). The losses (1.4%) were due to refusals to participate in the study.

The prevalence of self-reported SB was 11% (n = 24). The female sex accounted for 67.7% of the sample (n = 147); 67.3% of the participants (n = 146) were younger than 22 years of age; 29.5% snored; 60% declared having good sleep quality; 58.1% lived at their parents' home; 64.4% were classified as having the intermediate chronotype; 83.9% had low energy upon waking in the morning; 3.7% had employment in addition to attending university; and 8.7% took sleeping pills (Table 1).

In the final model (Table 2), the following variables were associated with self-reported sleep bruxism: eveningness chronotype (OR = 23.00; 95% CI: 2.36 to 223.84; p = 0.007), habitual snoring (OR = 3.12; 95% CI: 1.31 to 7.39; p = 0.01) and low energy level upon waking in morning (OR = 2.37; 95% CI: 1.96 to 5.58; p = 0.040).

**Table 1.** Sample characterization (n = 214)

| VARIABLE | n (%) |
|---|---|
| Sex | |
| Male | 70 (32.3) |
| Female | 147 (67.7) |
| Age | |
| < 22 years | 146 (67.3) |
| ≥ 22 years | 71 (32.7) |
| Habitual snoring | |
| Never | 153 (70.5) |
| At least once a week | 64 (29.5) |
| Individual Chronotype | |
| Morningness | 4 (1.8) |
| Intermediate | 141 (64.4) |
| Eveningness | 72 (32.9) |
| Difficulty waking up in the morning (energy) | |
| With difficulty (low energy) | 128 (83.9) |
| Without difficulty (high energy) | 89 (16.1) |
| Undergraduate stage | |
| First years (up to 3rd year) | 207 (75.5) |
| Last years (4th and 5th years) | 67 (24.5) |
| Wakes during the night and takes a long time to fall asleep | |
| Never | 132 (60.8) |
| At least once a week | 85 (39.2) |
| Takes sleeping pills | |
| Yes | 19 (8.7) |
| No | 198 (90.4) |
| Sleep quality | |
| Excellent | 13 (6.0) |
| Good | 132 (60.8) |
| Poor | 72 (33.2) |
| Hours of sleep | |
| ≤ 8 horas | 195 (89.0) |
| > 8 horas | 22 (11.0) |
| Sleep bruxism | |
| Yes | 24 (11.0) |
| No | 193 (89.0) |
| Works besides attending university | |
| Yes | 8 (3.7) |
| No | 209 (96.3) |
| Residence | |
| Lives in parents' home | 145 (66.8) |
| Lives away from parents' home | 72 (33.2) |

**Table 2.** Bivariate, unadjusted and adjusted analysis between independent variables and sleep bruxism among dental students (n = 214)

| VARIABLE | SLEEP BRUXISM | | p-value | Unadjusted OR (95% CI) | Adjusted OR (95% CI) | p-value |
|---|---|---|---|---|---|---|
| | Yes n (%) | No n (%) | | | | |
| **Sex** | | | | | | |
| Male | 7 (10.0) | 63 (90.0) | 0.73 | | - | |
| Female | 17 (11.6) | 130 (88.4) | | | - | |
| **Age** | | | | | | |
| < 22 years | 9 (10.3) | 78 (89.7) | 0.78 | | | |
| Older than 22 years | 15 (11.5) | 115 (88.5) | | | | |
| **Habitual snoring** | | | | | | |
| At least once a week | 12 (14.1) | 73 (85.9) | **0.01*** | 1.96 (1.91-3.95) | 3.12 (1.31-7.39) | **0.01*** |
| Never | 14 (7.4) | 175 (92.6) | | 1.00 | 1.00 | |
| **Individual chronotype** | | | | | | |
| Eveningness | 3 (4.2) | 69 (95.8) | **0.01*** | 4.35 (1.28-14.75) | 23.00 (2.36-223.84) | **<0.01*** |
| Intermediate | 19 (13.5) | 122 (86.5) | **0,46** | 1.39 (0.56-3.40) | 6.42 (0.85-48.34) | **0.08** |
| Morningness | 2 (50.0) | 2 (50.0) | | 1.00 | 1.00 | |
| **Difficulty waking up in the morning (energy)** | | | | | | |
| Without difficulty (high energy) | 16 (18.0) | 73 (82.0) | **0.01*** | 5.76 (2.53-13.08) | 2.37 (1.96-5.58) | **0.04*** |
| With difficulty (low energy) | 8 (6.3) | 120 (93.8) | | 1.00 | 1.00 | |
| **Undergraduate phase** | | | | | | |
| First part of course (up to 3rd year) | 21 (10.1) | 186 (89.9) | 0.51 | | - | - |
| End of course (4th and 5th years) | 5 (7.5) | 62 (92.5) | | | | |
| **Wakes at night and takes a long time to fall asleep** | | | | | | |
| Never | 12 (9.1) | 120 (90.9) | 0.24 | | | |
| At least once a week | 12 (14.1) | 73 (85.9) | | | | |
| **Takes sleeping pills** | | | | | | |
| Yes | 4 (21.1) | 15 (78.9) | 0.14 | 2.17 (0.89-5.30) | - | - |
| No | 20 (10.1) | 178 (89.9) | | 1.00 | | |
| **Sleep quality** | | | | | | |
| Good | 10 (10.3) | 130 (89.7) | 0.36 | | - | - |
| Poor | 14 (12.5) | 58 (87.5) | | | | |
| **Hours of sleep per night** | | | | | | |
| ≤ 8 | 23 (11.8) | 172 (88.2) | 0.50 | | - | - |
| > 8 | 1 (6.3) | 15 (93.8) | | | | |
| **Works besides attending university** | | | | | | |
| Yes | 1 (12.5) | 7 (87.5) | 0.89 | | - | - |
| No | 23 (11.0) | 186 (89.0) | | | | |
| **Residence** | | | | | | |
| Lives in parents' home | 19 (13.1) | 126 (86.9) | 0.173 | | - | - |
| Lives away from parents' home | 5 (6.9) | 67 (93.1) | | | | |

*Statistic significant values

## DISCUSSION

Studies that relate self-reported SB to chronotype and sleep quality are incipient. In the present investigation, the prevalence of self-reported SB was 11% and was influenced by habitual snoring, chronotype and energy level upon waking in the morning. The prevalence of self-reported SB was similar to that reported in previous studies with a similar methodology[7,9]. Other studies have found different prevalences[8,14]. Differences in study samples and strategies that reported bruxism between the studies reviewed may explain the differences in the reported prevalence. For example, this study sample comprised only dental undergraduate students. Self-reported bruxism has been used in large epidemiological studies as an alternative to clinical examination and polysomnography[22,23].

Regarding chronobiology, the majority of participants presented the intermediate chronotype type, which agrees with findings from previous studies[19,24-27]. Moreover, those with the eveningness chronotype were more likely to have SB than those with the morningness chronotype. This finding is also in agreement with data reported in previous studies, which found that individuals with the eveningness chronotype have more energy at night and may require greater effort to adapt to circadian desynchronization due to sleeping during this period of greater energy[22,28,29]. Therefore, the chronotype may interfere with academic performance and cognitive functioning, leading to lower grades[22,23]. Authors show that the chronotype represents the set of inter-individual characteristics and preferences manifested by the individual's "biological clock" and manages their energy levels throughout the day[7]. Therefore, social jetlag occurs when the individual needs to perform activities that require greater concentration in periods of lower energy[28]. Thus, social jetlag can cause insomnia and/or excessive daytime sleepiness[29] which can induce BS activity in individuals with more energy at night[30,31].

No association was observed between sleep quality and self-reported SB. In contrast, previous studies show that the chance of presenting SB is greater among individuals with sleep deprivation and microarousals[6,18,19]. This divergence may be explained by the methodology employed. In the present study, no clinical examination was performed for the evaluation of tooth wear. Therefore, the prevalence of SB may have been underestimated. The study of sleep quality in university students is relevant, as this phase is marked by psychosocial changes and the imposition of an increasingly competitive social environment[23]. The pressure to achieve better academic results requires students to choose between maintaining a healthy sleep-wakefulness cycle or fulfilling academic demands[13,14]. Greater sleep quality decreases cortisol levels and lowers the rate of daily tension, which may be a protective factor for sleep bruxism. Sleep disturbances such as difficulty in initiating and maintaining sleep, respiratory sleep disorder, difficulty awakening, excessive daytime sleepiness and sleep hyperhidrosis can compromise good sleep quality and consequently predispose SB due to greater susceptibility to anxiety and stress[6,15,18]. In this context, low energy upon waking was also associated with SB in the final model. Previous studies show that individuals with greater nighttime energy who take sleeping pills and wake up tired are more likely to have SB[7]. This probably occurs due to the intense activity of the masseter and anterior temporal muscles during sleep in individuals with more nighttime energy and, consequently, less energy in the morning hours[25].

Snoring was also associated with self-reported SB. Studies have shown that SB can occur together with other sleep disorders, such as parasomnia, sleep walking and snoring[21,26, 32]. This may be explained by the frequent, brief states of excitation during the sleep cycle, which may cause an alternation between snoring and SB[19]. The mild activation of the masseter muscle has also been associated with the end of the snoring phase, indicating active closing of the mouth[30]. A recent study also suggests that SB increases the occurrence of habitual snoring[5]. In contrast, other researchers found that the prevalence of snoring was low among individuals with SB, since relaxation and opening of the jaw occurs during the interruption of respiration when snoring[27]. The hypothesis regarding the association between SB and snoring is that bruxism could act as a protective factor for sleep breathing disorders[1]. Thus, a more in-depth investigation is needed of the association between these variables in the younger population.

This study used a representative sample of dental students from a public university. Because the city where the study was conducted is an industrial and educational center, the university receives students from different locations throughout Brazil. It was realized as a census study to make its findings more robust, given that the population is not very large and is relatively easy to access. However, this study has the limitations inherent to a cross-sectional design, which does not allow us to establish cause-and-effect relationships. As an epidemiological study, the objective of this study was to verify possible sleep bruxism, considering the presence rather than the severity of BS. Further studies are needed, especially with a longitudinal design that evaluate the level of anxiety and stress among university students and the severity of sleep bruxism.

In the present study, the eveningness chronotype, snoring and having less energy upon waking in the morning were associated with self-reported sleep bruxism among dental students.

## ACKNOWLEDGEMENTS

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