

# Relationship between stress and sleep bruxism in children and their mothers: A case control study

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## ABSTRACT

**Introduction:** Sleep bruxism (SB) is a frequent condition in children. Its pathophysiology involves certain neurotransmitters (serotonin, dopamine, noradrenalin, histamine), but the environment seems to influence its occurrence. **Objective:** The objective of this study was to investigate the prevalence of SB in children and their biological mothers, relating it to stress through a case control study. **Methods and Material:** The group of cases (SG) was composed of 48 subjects, including 24 children with SB and their mothers, and the control group (CG), formed by 36 children without SB and their mothers. The chi-Square test was used and the probability was computed with 95% confidence intervals ( $p < 0.05$ ). Results: The prevalence of probable awareness of SB in children was 22.6%, while it was 30.8% among caregivers. There were no significant associations between the socio-demographic variables and SB. There was an increase in the occurrence of SB in children ( $p = 0.02$ ) when their caregiver also had this condition. **Conclusions:** Psychological stress did not establish a significant relationship with SB in either the child or their mothers.

**Keywords:** bruxism; sleep bruxism; child; Stress; Physiological.

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## INTRODUCTION

Bruxism is a common condition in the pediatric dentistry clinic; it is reported more frequently in children than in adults and can reach a frequency of up to 40.6% of a sample of children<sup>1</sup>. The “International Consensus on Defining and Grading of Bruxism” defined it as a rhythmic and repetitive muscle activity of the mandible characterized by grinding, squeezing and/or touching the teeth or even keeping the mandible in the same position without necessarily touching the teeth, which may occur during sleep and/or wakefulness<sup>2</sup>.

It is well established that sleep bruxism (SB) has a central and non-peripheral origin and that its pathophysiology involves the dopaminergic system, altering its physiological parameters<sup>3-6</sup>. However, the environment, including systemic conditions, seems to influence or modulate its occurrence, justifying the importance of studying this condition considering the possible combination of genetic and environmental factors<sup>7-9</sup>. Thus, the etiology of SB is accepted as multifactorial and even as related to psychosocial factors<sup>10,11</sup>.

Among the psychosocial factors, stress is one of the most studied. The effects of stress are considered to be detrimental to the homeostasis of the organism and may be associated with several diseases<sup>12</sup>. Childhood stress resembles that of the adult, with several clinical manifestations. It is possible that different forms of stress have different effects on the child<sup>13-16</sup>.

The direct association between SB and stress in children has been reported by several authors over time<sup>10,16</sup>; however, more recent studies begin to counteract this causal relationship<sup>17</sup>.

This study aimed to investigate the prevalence of probable SB in children and their biological mother to characterize its occurrence in the family, relating it to perceived stress in the child and the mother in question. To date, article is the first to assess the correlation of these outcomes.

## METHODS

This research was conducted in full accordance with the World Medical Association Declaration of Helsinki and approved by the Ethics Committee of Cruzeiro do Sul University - Brazil (Protocol: 042/2014). Prior to their inclusion in the study, all participants provided informed consent.

It was an observational, case-control study type and is nested in a previous cross-sectional study that evaluated a random probabilistic sample with 246 subjects, where 123 were children and 123 were caregivers who self-reported as being the primary caregiver of the children - always one of their biological parents. For the SB diagnostics, the cross-sectional study adhered to the recommendations by Lobbezoo et al.<sup>2</sup> which met the minimum diagnostic criteria established by the American Sleep Disorders Association<sup>18</sup>. All necessary questions about the children were answered by their parents.

To make it possible to investigate the relationship between SB and stress in the child and their mothers, a case-control study was outlined. All of the cases with reports of diurnal

bruxism were excluded, and only those with reports of SB were considered. In order to form the two groups (Case and Control), all the children between 6-10 years old who participated of the previous cross-sectional study and whose mothers were the main caregiver were included. The variables used for pairing were sex and age.

In this way, two groups were formed, with children between 6 and 10 years of age: the group of cases (SG) formed by 48 subjects, including 24 children with SB and their mothers, and the control group (CG), formed by 36 children without SB and their mothers.

The facets of wear on dental structures were evaluated by direct observation, determining the presence and magnitude of wear, according to the scale of Hugoson et al.<sup>19</sup>. These clinical signs were classified as grade 0 when there was no tooth wear, grade 1 when there was enamel wear, grade 2 when wear of the dentin was up to one-third of the crown height, and grade 3 if there was wear of more than one-third of the height of the crown and/or excessive wear of the restorative material. The presence of wear in any degree was only considered for SB diagnosis if there was also a current SB report since this clinical sign may have a cumulative nature<sup>20</sup>. All the study conducted by two trained examiners ( $\kappa=0.79$ ).

For the identification of socio-demographic data (Race and color skin), the family structure was classified according to the Brazilian Institute of Geography and Statistics<sup>21</sup>.

Stress in children was measured using the Child Stress Scale (CSS)<sup>13</sup>, and stress among adults was measured using the Lipp Stress Symptom Inventory (LSSI)<sup>22</sup>. All responsibility for the acquisition, application and interpretation of the data concerning these tests was assumed by a psychologist, who was a specialist and professor of the psychology course at the State University of Feira de Santana at the time of the study (MOM).

CSS was applied individually only in children 6 years old or older. This instrument is composed of 35 questions, grouped into four factors: physical reactions, psychological reactions, psychological reactions with depressive components and psychophysiological reactions. The children who presented stress were classified into one of the four sequential phases described: alert phase, resistance phase, near-exhaustion phase and exhaustion phase, which is considered the most severe form of stress, in which the child may become physically or psychologically ill<sup>13</sup>.

In the LSSI, the individual identified with stress was included in one of the four phases predicted in this instrument: the alert phase, which evaluates the symptoms presented in the last 24 hours and characterizes recent contact with the source of stress; the resistance phase, which evaluates the symptoms presented in the last month and is considered intermediate in that the organism seeks the return to a place of balance; and the phases almost exhaustion and exhaustion, when physical involvement can occur<sup>22</sup>.

All statistical calculations were performed with Project-R software (R program). The statistical significance level established for all analyses was  $p<0.05$  (two-tailed test) for Chi-square

analysis ( $\chi^2$ ). The dependent variable was SB in the child, and all other variables were considered independent. The odds ratio (OR) and its respective 95% confidence interval (CI) were calculated.

## RESULTS

The socio-demographic characterization related to the child and her family is presented in Table 1. The family structures of the children were classified according to the Brazilian Institute of Geography and Statistics<sup>21</sup>, where a nuclear family was considered one formed by a couple and children, a woman and children, or a man and children.

No statistical significance was observed in the variation of sociodemographic data related to the families of children with and without SB.

Facets of wear were present in 23 children of the SG (38.33%), and wear was present in 19 (31.67%) of the children of the CG. A statistically significant association was identified between the presence of facets of wear in the children of the SG and the CG ( $p=0.0004$ ). The mothers of the children of the SG and the CG were classified regarding the presence of SB to investigate the association with the presence of facets of wear;

no significant association was identified regarding their presence with the occurrence of SB among these women ( $p=0.4090$ ) (Table 2).

To investigate the association of stress with SB in groups, children and their mothers were classified for the presence of stress (Table 3).

When analyzing the association of the presence of stress and the occurrence of SB in the children of the SG and the CG, no statistically significant values were found for overall stress ( $p=0.743$ ), stress in the near exhaustion phase ( $p=0.8952$ ), mothers' stress ( $p=0.0730$ ), and mothers' stress in the more advanced stages ( $p=0.5351$ ). However, when investigating the association of the presence of SB in the child and their mothers ( $p=0.254$ ), a statistical significance was observed; furthermore, the OR reflected a greater chance of SB occurrence in children when their mother also presented the condition (OR = 3.5000: 95% CI 1.1403-10.7426) (Table 4).

The stress observed in mothers was not associated with the occurrence of this condition among them ( $p=0.201$ ), even when stress was considered in the more advanced phases ( $p=0.788$ ) (Table 5).

**Table 1.** Investigation of association of socio-demographic factors of the families of the children in the SG and the CG. Odds ratio (OR) with 95% confidence interval (95% CI),  $p$ -value of the chi-square test ( $\chi^2$ ) for independence or association.

| Group of cases and controls      | SG (24) |       | CG (36) |       | $p$ -value $\chi^2$ | OR      | PR (95% CI) |             |
|----------------------------------|---------|-------|---------|-------|---------------------|---------|-------------|-------------|
|                                  | N       | %     | N       | %     |                     |         | Lower limit | Upper limit |
| Child gender                     |         |       |         |       |                     |         |             |             |
| Female                           | 10      | 41.67 | 20      | 55.56 | 0.292               | 0.5714  | 0.2011      | 1.6238      |
| Male                             | 14      | 58.33 | 16      | 44.44 |                     |         |             |             |
| Family arrangement               |         |       |         |       |                     |         |             |             |
| Nuclear                          | 19      | 79.17 | 31      | 86.11 | 0.479               | 0.6129  | 0.1500      | 2.4000      |
| Others                           | 05      | 20.83 | 05      | 18.89 |                     |         |             |             |
| Responsibility for family        |         |       |         |       |                     |         |             |             |
| Shared                           | 15      | 62.50 | 17      | 47.22 | 0.245               | 1.8627  | 0.6492      | 5.3449      |
| Either father or mother          | 09      | 37.50 | 19      | 52.78 |                     |         |             |             |
| Caregiver race/color             |         |       |         |       |                     |         |             |             |
| Brown                            | 14      | 58.33 | 15      | 41.67 | 0.206               | 1.9600  | 0.6874      | 5.6879      |
| Others                           | 10      | 41.67 | 21      | 58.33 |                     |         |             |             |
| Child race/color                 |         |       |         |       |                     |         |             |             |
| Brown                            | 19      | 79.17 | 18      | 50.00 | 0.023*              | 3.8000* | 1.1652      | 12.3926     |
| Others                           | 05      | 20.83 | 18      | 50.00 |                     |         |             |             |
| Family income                    |         |       |         |       |                     |         |             |             |
| Up to 03 minimum wages           | 21      | 87.50 | 25      | 69.44 | 0.105               | 3.0800  | 0.7578      | 12.5184     |
| More than 03 minimum wages       | 03      | 12.50 | 11      | 30.56 |                     |         |             |             |
| Marital status                   |         |       |         |       |                     |         |             |             |
| Married                          | 17      | 70.83 | 20      | 55.56 | 0.233               | 1.9429  | 0.6476      | 5.8286      |
| Others                           | 07      | 29.17 | 16      | 44.44 |                     |         |             |             |
| Caregiver education              |         |       |         |       |                     |         |             |             |
| Up to high school                | 10      | 41.67 | 19      | 52.78 | 0.399               | 0.6391  | 0.2253      | 1.8126      |
| Undergraduate/graduate education | 14      | 58.33 | 17      | 47.22 |                     |         |             |             |

\* Evidence of statistical significance.

**Table 2.** Investigation of association of sleep bruxism and presence of facets of wear in mothers in the sample. Prevalence (%), prevalence ratio (PR) with 95% confidence interval (95% CI), and *p*-value of the chi-square test ( $\chi^2$ ).

| Facets of wear                         |     | Women (60) |       |            |       | <i>p</i> -value | OR     | Odds (95% CI) |             |
|--|-----|------------|-------|------------|-------|-----------------|--------|---------------|-------------|
|  |     | SB         |       | Without SB |       |                 |        | Lower limit   | Upper limit |
|  |     | N          | %     | N          | %     |                 |        |               |             |
| * Evidence of statistical significance | Yes | 16         | 23.66 | 28         | 46.66 | 0.4090          | 1.7143 | 0.4730        | 6.2125      |
|  | No  | 04         | 06.66 | 12         | 20.00 |                 |        |               |             |

\* Evidence of statistical significance

**Table 3.** Frequencies of SB related to the presence of stress and its phases.

|                                     | Children (60) |        |            |        |
|-------------------------------------|---------------|--------|------------|--------|
|                                     | SB            |        | Without SB |        |
|                                     | N             | %      | N          | %      |
| Without Stress (21)                 | 09            | 42.86  | 12         | 57.14  |
| Overall Stress (39)                 | 15            | 38.46  | 24         | 61.54  |
| Phases of Stress in Children (39)   |               |        |            |        |
|                                     | SB            |        | Without SB |        |
|                                     | N             | %      | N          | %      |
| Alert (21)                          | 07            | 33.33  | 14         | 66.67  |
| Resistance (06)                     | 03            | 50.00  | 03         | 50.00  |
| Near exhaustion (12)                | 05            | 41.67  | 07         | 58.33  |
| Exhaustion (00)                     | -             | -      | --         | -      |
| Mothers (60)                        |               |        |            |        |
|                                     | SB            |        | Without SB |        |
|                                     | N             | %      | N          | %      |
| Without Stress (31)                 | 08            | 25.81  | 23         | 74.19  |
| Overall Stress (29)                 | 12            | 41.38  | 17         | 58.62  |
| Stages of Stress in the mother (29) |               |        |            |        |
|                                     | SB            |        | Without SB |        |
|                                     | N             | %      | N          | %      |
| Alert (01)                          | 01            | 100.00 | -          | -      |
| Resistance (20)                     | 08            | 40.00  | 12         | 60.00  |
| Almost exhaustion (07)              | 03            | 42.86  | 04         | 57.14  |
| Exhaustion (01)                     | -             | -      | 01         | 100.00 |

**Table 4.** Investigation of the association of stress observed in the child and her/his mother with the occurrence of the child's SB and the association of the occurrence of SB in the child and the SB of her/his mother in the SG and the CG. Frequency (%), odds ratio (OR) with 95% confidence interval (95% CI), and *p*-value of the Chi-square test ( $\chi^2$ ) for independence and association.

|   |     | Children with and without SB |       |         |       | <i>p</i> -value $\chi^2$ | OR      | Odds (95% CI) |             |
|---|-----|------------------------------|-------|---------|-------|--------------------------|---------|---------------|-------------|
|   |     | SG (24)                      |       | CG (36) |       |                          |         | Lower limit   | Upper limit |
|   |     | N                            | %     | N       | %     |                          |         |               |             |
| Child with stress                                   | Yes | 15                           | 62.50 | 24      | 66.67 | 0.7403                   | 0.8333  | 0.2834        | 2.4502      |
|   | No  | 09                           | 37.50 | 12      | 33.33 |                          |         |               |             |
| Child with almost exhaustion stress                 | Yes | 05                           | 20.83 | 07      | 19.44 | 0.8952                   | 1.0902  | 0.3015        | 3.9417      |
|   | No  | 19                           | 79.17 | 29      | 80.56 |                          |         |               |             |
| Mother with stress                                  | Yes | 15                           | 62.50 | 14      | 38.89 | 0.0730                   | 2.6190  | 0.9038        | 7.5894      |
|   | No  | 09                           | 37.50 | 22      | 61.11 |                          |         |               |             |
| Mother with almost exhaustion and exhaustion stress | Yes | 04                           | 16.67 | 04      | 11.11 | 0.5351                   | 1.6000  | 0.3590        | 7.1299      |
|   | No  | 20                           | 83.33 | 32      | 88.89 |                          |         |               |             |
| Bruxism in mothers                                  | Yes | 12                           | 50.00 | 08      | 22.22 | 0.0254*                  | 3.5000* | 1.1403        | 10.7426     |
|   | No  | 12                           | 50.00 | 28      | 77.78 |                          |         |               |             |

\* Evidence of statistical significance

**Table 5.** Investigation of the association of SB of the mothers of the children of the SG and the CG with stress. Frequency (%), odds ratio (OR) with 95% confidence interval (95% CI), and *p*-value of the Chi-square test ( $\chi^2$ ) for independence and association.

|  |     | Mothers with SB |       |                 |       | p-value $\chi^2$ | OR     | OR (95% CI) |             |
|--|-----|-----------------|-------|-----------------|-------|------------------|--------|-------------|-------------|
|  |     | SB (20)         |       | Without SB (40) |       |                  |        | Lower limit | Upper limit |
|  |     | N               | %     | N               | %     |                  |        |             |             |
| Mothers with stress                                  | Yes | 12              | 60.00 | 17              | 42.50 | 0.201            | 2.0294 | 0.6807      | 6.0505      |
|  | No  | 08              | 40.00 | 23              | 57.50 |                  |        |             |             |
| Mothers with almost exhaustion and exhaustion stress | Yes | 03              | 15.00 | 05              | 12.50 | 0.788            | 1.2353 | 0.2637      | 5.7865      |
|  | No  | 17              | 85.55 | 35              | 87.50 |                  |        |             |             |

## DISCUSSION

The present study is the first to evaluate stress and SB in children and adults, the latter being the children's biological mothers. The frequency of children initially identified with SB was within the percentage range described by Manfredini et al.<sup>1</sup> and Tachibana et al.<sup>23</sup>. The choice of the mother as a representative member of the family took into consideration the fact the mother is the caregiver and the promoter of health in the family<sup>10</sup>. The differences between the numbers of positive cases for SB among the surveys can be attributed mainly to the diagnostic criteria and biases that exist in the identification of this condition, which are usually based on the reports of patients and caregivers<sup>24</sup>. The perception of sound caused by teeth grinding can be masked even by family habits during sleep<sup>25</sup>.

Wear facets are clinical signs that increase the reliability of the diagnosis, but only when associated with sound reporting. In the SG and the CG, the facets of wear observed in children were statistically associated with SB in children ( $p=0.0004$ ); however, in mothers, this finding was not confirmed statistically ( $p=0.4090$ ). These results corroborate the understanding that wear facets may represent other clinical situations, such as physiological wear or even past SB signs<sup>20</sup>.

Socio-demographic variables investigated sought to characterize the child's family, and no significant associations were found between these SB variables in the child, reflecting the findings of a study that evaluated similar parameters in Chinese children<sup>26</sup> and contrary to what was reported by Manfredini et al.<sup>17</sup>. However, these authors evaluated six social strata, which may have contributed to the identification of a possible influence of these factors. When considering SB as a biological condition with genetic and environmental influences, one can conjecture that the socio-demographic status of the child exerts some influence on the condition. However, there is notable difficulty in clearly assigning how and under what exact circumstances these outcomes could be considered in the occurrence of SB. Further research with more elaborate designs would be necessary to ascertain such patterns of influence<sup>17</sup>.

A significant increase was observed in the odds of SB occurrence in children when their mothers also presented this condition, this finding reinforces the genetic question ascertained by several authors, who noticed similarity in the occurrence model of SB in the family<sup>11,27</sup>. In addition to being subjected to similar environmental factors, it may be assumed that parents who present bruxism pay more attention to the

occurrence of this behavior in their child since the diagnosis of child bruxism depends directly on the parents' perception, and bruxism is directly influenced by several factors<sup>25</sup>.

The idea that stress is a factor in the onset and worsening of SB has been losing strength in the face of advances in research that point to a greater involvement of systemic rather than psychological factors in this issue. For example, the causal associations of SB with airway resistance and gastroesophageal reflux are being well explained<sup>28,29</sup>, and a recent study notes the lack of a clear causal association between psychological aspects and SB<sup>17</sup>. This fact had already been highlighted in a 2009 review, where the authors concluded that diurnal bruxism seems to be associated with psychosocial factors and with a psychopathological symptom, whereas there was no evidence to relate SB with psychosocial disorders<sup>30</sup>.

There is no biological plausibility to justify a change in the frequency of childhood SB in relation to the mothers' stress. Although not confirmed, researchers consider that the physiology of maternal stress is associated with the stress responses of young children. Thus, it was thought that the stress of the mother could be a possible environmental factor for the stress of her child, taking into account the fact that the context of daily life and the relationships of parents with their children are essential for the development and maintenance of the mental and overall health of children<sup>15</sup>. However, in this study, the stress of the mother did not influence the occurrence of SB in her children ( $p=0.073$ ), even when the stress was evaluated in the more advanced stages ( $p=0.5251$ ).

Like any study of bruxism that does not employ polysomnography in the methodology, this study has limitations inherent to the category of diagnosis of probable bruxism that is based on an interview and on parameters subject to bias. Although the case-control study does not provide us with insights into the causal relationship, it provides us with important developmental information more precisely than prospective studies.

One difficulty found for this study was the parents adherence to clinical evaluation and the performance of the psychological test. This difficulty was predicted since the pilot study and previous awareness campaigns were conducted in institutions to minimize the expected difficulty by means of posters, which disseminated the study announcement and highlighted the importance of participation. In addition, an excess of 20% children was invited to compose the sample to minimize the losses.

## CONCLUSION

An increase was observed in the chances of occurrence of SB in children when their mothers presented this condition. Psychological stress did not establish a significant relationship with SB in either the child or their mothers, even when identified in more advanced stages according to the instruments used. In addition, the stress of the mother as a possible environmental factor did not influence the occurrence of the child's SB. Thus, the findings of this study reinforce the idea that stress is not an initiating and maintenance factor for the clinical condition of SB.

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