Iran J Pediatr. 2023 August; 33(4):e127527. https://doi.org/10.5812/ijp-127527.

Published online 2023 July 26. **Research Article**

Prevalence of Sleep Bruxism and Respiratory Disorders in Schoolchildren Aged 8 - 11 Years in Kerman, Iran: Pre-COVID Pandemic Phase

Elham Farokh Gisoure [1], Athareh Zare Emamzadeh [1] and Amir Nekouei [2, *]

[1] Endodontology Research Center, Kerman University of Medical Sciences, Kerman, Iran
[2] Department of Biostatistics and Epidemiology, School of Public Health, Kerman University of Medical Sciences, Kerman, Iran

[*] *Corresponding author*: Department of Biostatistics and Epidemiology, School of Public Health, Kerman University of Medical Sciences, Kerman, Iran. Email: nekouei.amir@gmail.com

Received 2022 May 11; **Revised** 2023 April 23; **Accepted** 2023 June 14.

Abstract

Background: Bruxism is a parafunctional oral activity defined as excessive teeth grinding or jaw clenching. This disorder causes damage to the teeth and deforms them.
Objectives: This is the first phase of the sleep bruxism and respiratory disorders assessment study in Kerman, Iran, which evaluated respiratory disorders and sleep bruxism in schoolchildren aged 8 - 11 years between 2018 - 2019.
Methods: A total of 573 primary school students aged 8 - 11 years were recruited for this cross-sectional study in Kerman between 2018 - 2019. The subjects were chosen randomly from 20 schools located throughout the city. Following permission from officials, 30 students from each school were admitted to the study randomly. The parents were invited to fill out a checklist that included a history of respiratory and sleep problems and signs of bruxism or abnormal jaw movements. Additionally, an examination was performed, and the symptoms of bruxism, such as tooth wear and restoration fractures, were documented.
Results: The parents of 573 children were recruited to the study. The prevalence of bruxism and respiratory diseases was observed to be 20.6% (n = 118) and 26.5% (n = 152), respectively. The children with sound production had 2.3 times higher odds of bruxism prevalence than those without sound production (P = 0.004). However, children with temporomandibular joint and paranasal sinus sensitivity had 4.5 (P = 0.001) and 3.8 (P = 0.001) times higher odds, respectively. Additionally, the odds of bruxism prevalence were 1.4 times higher in children with respiratory disorders than those without (P = 0.001).
Conclusions: Bruxism was common in children who had a respiratory disorder. Given the potential impact of bruxism on children's dental health, it is important to pay special attention to the health status of children with respiratory disorders.

Keywords: Sleep Bruxism, Respiration Disorder, School Age, Children

1. Background

Respiratory disorders are extremely prevalent, especially in children (1-3). Every year, a large amount of money is spent on diagnosing, treating, and controlling respiratory disorders (1, 4). Asthma and allergies are among the most prevalent childhood respiratory disorders (1, 5).

According to the necessity of respiratory performance, it is important to address the potential impact of factors, such as physical fitness and obesity, on respiratory functions in the introduction of any respiratory-related study. Previous studies have highlighted the prevalence of underweight and overweight in schoolchildren and the potential impact of physical fitness and exercise on lung function and weight loss in obese children (6, 7).

Recent studies have reported a high prevalence of bruxism in children with asthma and allergies (8-10). Bruxism is a condition of jaw motor function defined by teeth grinding or clenching (10). Studies showing a high prevalence of sleep bruxism have also indicated an increase in allergies and chronic respiratory disorders in children and adolescents (11, 12).

According to studies, bruxism is more common in children than adults (13-17). In 2018, Carra stated in a study that bruxism is highly prevalent in children and adolescents (18). A recent systematic study on bruxism in children showed a prevalence as high as 40.6% (19).

In two studies conducted in the United States and Brazil, according to parental reports, the prevalence of sleep bruxism in children was 38% and 35.3%, respectively (20, 21). Adult bruxism can be confirmed by clinical signs and symptoms, such as pain, masticatory muscle hypertrophy, temporomandibular joint (TMJ) disorders, and headache. However, the assessment and identification of bruxism in children is difficult. Therefore, parental reports are among the most critical parameters in diagnosing bruxism in the absence of quantitative data, such as sleep recordings, because bruxism causes certain sounds that are easily heard by family members (13).

The pathophysiology of bruxism is still unknown. Bruxism is a multifactorial condition potentially influenced by the central nervous system (CNS), oral motor performance, sleep-wake cycle, autonomic nervous system, and catecholaminergic, genetic, and psychological factors (22). Studies have associated occlusal interference (23), the rhythmic or tonic activity of the masseter and temporalis muscles (24), and abnormal anatomy of the TMJ (25) with the incidence of bruxism. They have also shown the relationship between bruxism and psychological factors, such as stress and anxiety (24, 26-28). Childhood bruxism might persist into adulthood. Diagnosis and, as a result, timely treatment prevents damage to the masticatory system. In addition to its destructive effects on the mouth, its peripheral structures, and TMJ, sleep bruxism in children can cause sleep disorders, reduced quality of life, and behavioral and cognitive disorders during the day (13).

The evidence has also proposed a chance of bruxism being caused by the CNS as a consequence of an increase in negative pressure in the middle or inner ear induced by allergic edema of the Eustachian tube mucosa, resulting in a reflex in the TMJ and stimulation of the trigeminal nerve nucleus (29). Respiratory disorders associated with bruxism can lead to children's sleepiness, hyperactivity, and inattention during the day (30). Sleep bruxism contributes to TMJ sounds, jaw muscle fatigue, and more frequent headaches in children (31).

Numerous studies have been conducted on the prevalence of asthma and allergic reactions in Iranian children in different cities (32-34). Finding the relevant causes and risk factors and assessing the relationship between respiratory disorders and bruxism can help develop preventive and therapeutic strategies for these two diseases (2).

2. Objectives

Considering the previous reports on the high prevalence of respiratory diseases and the complications of bruxism in Iranian children and the lack of studies on this matter in Iran to date, this study is the first phase of the assessment of sleep bruxism and respiratory disorders and aimed to investigate the prevalence of bruxism and respiratory disorders in children 8 - 11 years in primary schools of Kerman, Iran.

3. Methods

3.1. Statistical Population

This cross-sectional study was conducted on primary school students 8 - 11 years in Kerman between 2018 - 2019. The sampling design was based on the World Health Organization standard pathfinder sampling method (35). To determine the required sample size for estimating the prevalence of bruxism, a first-type error level of 5% was considered. Since the prevalence of bruxism was not known beforehand at the data collection center, an absolute error of 10% of the caries prevalence value was assumed, similar to other studies (36, 37). To determine the sample size in the pathfinder sampling method, it is recommended to select at least 25 - 50 subjects in each sampling location. First, a list of different districts and schools was obtained from the Kerman Department of Education. Afterward, 20 schools (10 female and 10 male schools) from different city areas, including the center, north, south, east, and west, were randomly selected. The children with class II division 2 type of malocclusion or jaw abnormalities were excluded from the study. After explaining the aims and objectives and obtaining written consent from the parents to participate in the study, 30 students from each school were randomly included. This study was approved by the Ethics Committee of Kerman University of Medical Sciences (ethics code: IR.KMU.REC.1397.079).

3.2. Research Tools

The parents filled out a checklist that included personal information, a history of respiratory disorders, and the existence of bruxism or any unusual jaw movement. Respiratory disorders in children were assessed according to the medical history provided by the parents. Then, the pediatric examination was performed under the supervision of a dental specialist using catheters and mirrors and the light of a lamp, according to the method described in Bricker's book (38), and the symptoms of bruxism (including tooth wear and restoration fractures) were recorded. In addition, the children's tooth sensitivity and pain, masticatory muscles, TMJ, and paranasal sinuses were carefully examined.

3.3. Statistical Analysis

For statistical analysis, the collected data were coded and entered anonymously into SPSS software (version 21; SPSS Inc, Chicago, Illinois, USA). Descriptive statistics (i.e., frequency and percentage) were used to describe the data. The Chi-square test was used to investigate the possible relationship between respiratory disorders and bruxism and the prevalence of bruxism between groups. Finally, multivariate analysis (logistic regression) was performed. The effects of the independent variables of gender, tooth wear and pain, pain and sensitivity to touching the TMJ, muscles, and sinuses, and restoration fractures on the dependent variables of bruxism and respiratory diseases were investigated in two separate analyses.

4. Results

In the present study, the parents of 573 children (95.5%) out of 600 completed the questionnaire. These children, 294 (51.3%) of whom were male, were then examined. The prevalence of bruxism and respiratory diseases was observed to be 20.6% (n = 118) and 26.5% (n = 152), respectively. Of the 118 children with bruxism, 64 (54.2%) and 54 (45.8%) cases were male and female, respectively (P = 0.475). Bruxism was observed in 63 (41.4%) and 55 (13.1%) children with and without respiratory disorders, respectively (P < 0.001). Moreover, 38 (32.2%) and 67 (56.8%) children had bruxism with and without pain, respectively. Nearly 30% of children with bruxism had bruxism with sound 2 to 3 times a week (Table 1).

Pediatric examinations showed that 148 children (25.8%) had restoration fractures or sensitivity to touching the masticatory muscles, TMJ, or paranasal sinuses. Moreover, 175 children (31.1%) had tooth wear. In 118 children, tooth wear was observed in all jaw quadrants. Tooth wear was observed in 100 (84.7%) and 78 (17.1%) children with and without bruxism, respectively. Restorative fractures (P = 0.003), sensitivity to palpation in masticatory muscles (P < 0.001) and TMJ (P < 0.001), and sensitivity and pain in the examination of paranasal sinuses (P < 0.001) were significantly higher.

Multivariate analysis showed that the adjusted prevalence of bruxism did not differ significantly (adjusted odds ratio = 1.6, 95% confidence interval [CI]: 0.4 - 6.4) between children with and without the condition. However, the odds of bruxism prevalence were 2.3 (95% CI: 2.2 - 2.4) times higher in children with sound production than those without sound production. Additionally, the odds of bruxism prevalence were 4.5 (95% CI: 4.4 - 4.6) and 3.8 (95% CI: 3.3 - 4.3) times higher in children with TMJ and paranasal sinuses, respectively, than their respective counterparts without these conditions. Finally, the odds of bruxism prevalence were 1.4 (95% CI: 1.3 - 1.6) times higher in children with respiratory disorders than in children without respiratory disorders (Table 2).

Table 1. Characteristics of Bruxism Regarding Age, Pain, Number of Occurrences per Week, and Number of Occurrences of Bruxism with Sound

Categories	No. (%)
Gender	
Male	64 (54.2)
Female	54 (45.8)
Sound production	
Have	67 (56.8)
Do not have	51 (43.2)
Pain	
Have	38 (32.2)
Do not have	80 (67.8)
Number of occurrences of bruxism per week	
2 - 3 times a week	35 (29.7)
Once a week	13 (11)
Every day	12 (10.2)
Once a month	10 (8.5)
3 - 4 times a week with pain	6 (5.1)
5 times a week	3 (2.5)
Total	79 (66.9)
Participants who did not respond	39 (33.1)
Number of occurrences of bruxism with sound	
2 - 3 times a week	29 (43.3)
Once a week	12 (17.9)
Every day or night	8 (11.9)
3 - 4 times a week	4 (6)
Five times a week	3 (4.5)
Total	56 (83.6)
Participants who did not respond	11 (16.4)

5. Discussion

In the present study, the prevalence of bruxism and respiratory disorders was 20.6% and 26.5%, respectively. It was also revealed that children with respiratory disorders had a significantly higher rate of bruxism. Bruxism prevalence was positively associated with sound production, the sensitivity of TMJ, and the sensitivity of paranasal sinuses. The prevalence of bruxism was not observed to be dependent on gender, pain, sensitivity of masticatory muscles, and tooth wear.

Table 2. Adjusted Prevalence Odds Ratios for Bruxism by Variables of Gender, Respiratory Disease, Sound Production, Pain, Sensitivity of Masticatory Muscles, Sensitivity of Temporomandibular Joint, and Sensitivity of Paranasal Sinuses

Variables	Category	Adjusted Odds Ratio	95% Confidence Interval for Adjusted Odds Ratio	P-Value
Gender	Male vs. female	1.64	0.42 - 6.47	0.928
Respiratory disease	Have vs. do not have	1.45	1.34 - 1.63	0.343
Sound production	Have vs. do not have	2.34	2.25 - 2.43	< 0.001
Pain	Have vs. do not have	0.89	0.15 - 5.19	0.987
Sensitivity of masticatory muscles	Have vs. do not have	1.04	0.12 - 8.98	0.996
Sensitivity of temporomandibular joint	Have vs. do not have	4.52	4.43 - 4.61	< 0.001
Sensitivity of paranasal sinuses	Have vs. do not have	3.82	3.35 - 4.36	0.011
Tooth wear	Have vs. do not have	1.12	0.41 - 3.04	0.977

The bruxism prevalence was estimated at 31.6% worldwide (39). The prevalence of bruxism in a study conducted by Seraj et al. (36) on children within 4 - 12 years in Tehran, Iran, was reported to be 26.2%, which is slightly higher than the present study. Cheifetz et al. (20) estimated the prevalence of bruxism in American children under the age of 17 years to be 38%, according to their parents. However, in another study conducted by Redline et al. (26) in the USA, the prevalence of bruxism in children aged 3 - 17 years was estimated to be 15.1%. Moreover, Chen et al. (40) demonstrated that 36.4% of children aged 3 - 6 years in China have bruxism. However, in another study conducted in China, Liu et al. (41) showed that the prevalence of bruxism in children aged 2 - 12 years was 6.5%, which is significantly lower than the present study's result. Farsi reported the prevalence of bruxism in children in Saudi Arabia as 8.4% (42). The prevalence of bruxism was different in previous documents (36). These differences in the prevalence of bruxism are due to the difficult diagnosis of bruxism, different methods of data collection, and samples collected from different races.

The present study showed a significant association between bruxism and respiratory disorders, with 41.4% of children with respiratory disorders exhibiting bruxism, compared to only 13.1% of those without respiratory disorders. Furthermore, the odds of bruxism prevalence were 1.4 times higher in children with respiratory disorders than those without respiratory disorders. These results are consistent with the results of previous studies that have shown a link between bruxism and sleep-disordered breathing, such as obstructive sleep apnea, which is a known cause of respiratory problems. Ohayon et al. have also demonstrated a significant association between bruxism and sleep-disordered breathing (24). Furthermore, Sakaguchi et al. examined the relationship between mandibular position and obstructive sleep apnea, a type of respiratory disorder linked to bruxism, in previous studies. These studies provide further support for the current study's findings and suggest that the association between bruxism and respiratory disorders might be explained by the effects of sleep-disordered breathing on the body (43).

There are some controversies in the literature regarding the association between sleep disorders and bruxism. A systematic review in 2014 showed that there was insufficient evidence to confirm the association between bruxism and sleep-related breathing disorders (44). However, in the same year, in an evidence-based review, Balasubramaniam et al. concluded that bruxism is associated with sleep-related breathing disorders, and both have common risk factors (45). They also suggested that bruxism might act as a reactive or protective mechanism against upper airway obstruction. When patients with bruxism and painful TMJ disorders complain of insomnia, snoring, or sleep apnea, they should be screened for respiratory disorders. This screening is performed in collaboration with sleep medicine specialists using recording systems at home or in the laboratory by electromyographic analysis of the masseter and temporalis muscle activity (45). A study by Motta et al. in Brazil showed that 62.5% of children with respiratory disorders had bruxism. They also showed a link between bruxism, respiratory disorders, and tooth decay (46). However, Seraj et al.'s study reported that asthma and allergies had no association with bruxism (11, 36).

For the mechanism involved in the obtained results, DiFrancesco et al. showed that children with airway obstructions tend to move their mandibles forward and downward to facilitate air passage, which can stimulate the upper airway receptors and increase muscle tone, leading to bruxism (47). In this study, children with respiratory issues had a higher prevalence of bruxism, which could be attributed to the mandibular position

changes reported by the aforementioned study. This knowledge is critical for dentists to refer children for medical evaluation, contributing to the reduction of the adverse effects of respiratory disorders on growth and craniofacial development.

The present study also demonstrated that the odds of bruxism prevalence were higher in children with sound production, TMJ sensitivity, and paranasal sinus sensitivity. These findings suggest that bruxism might be associated with lifestyles and underlying neurological or physiological conditions, such as TMJ disorders, sinusitis, or anxiety, which can cause clenching or grinding of the teeth. According to Suwa et al.'s study, the prevalence of sleep bruxism among Japanese children living in Tokyo is strongly associated with sleep pattern disturbances and psychological stress, which could be due to the lifestyle of both children and their parents (48). On the other hand, the present study's findings contrast with a previous study's finding that showed a link between bruxism and obstructive sleep apnea (43), which suggests that there might be different underlying causes of bruxism in different populations. Similarly, Berger showed no significant association between bruxism and TMJ disorders (49). However, further research is needed to better understand underlying mechanisms and potential causal relationships between these conditions (50).

The current study did not show a significant difference in the prevalence of bruxism between male and female children, in accordance with the literature. Nevertheless, other studies have shown no significant gender differences in the prevalence of bruxism (51, 52). This finding is contrary to the findings of some previous studies that have reported a higher prevalence of bruxism in male children. For instance, Nahas-Scocate et al. reported a significantly higher prevalence of bruxism in male than female children. However, the lack of gender differences in bruxism prevalence in this study might be due to the differences in study populations, such as age range or geographic location (53). Future studies should continue to investigate gender differences in bruxism prevalence to better understand potential underlying factors and how they might affect treatment approaches.

The present study did not demonstrate a significant association between bruxism with pain, sensitivity of masticatory muscles, or tooth wear. These findings suggest that bruxism might not always lead to these common symptoms, which are often reported in clinical practice. It is possible that other factors, such as the severity and frequency of bruxism episodes, the age of the individual, or the presence of other underlying conditions, might influence the development of these symptoms. These results are inconsistent with some previous studies that have reported a significant association between bruxism and pain or tooth wear (54, 55). One possible explanation for this discrepancy is the differences in the study population, methodology, or definition of bruxism used in these studies.

Headache, tooth sensitivity to hot or cold food, tooth fracture or restoration, tooth wear, pain in the masticatory muscles, and joint sounds on touching the TMJ might be present in the examination of patients with bruxism, especially in more advanced cases (22). In the present study, the pediatric examination showed that sensitivity and pain in the masticatory muscles and TMJ were significantly higher in patients with bruxism and respiratory disorders. Recently, some clinicians have suggested the possibility of sleep-related breathing disorders in patients with TMJ disorders, assuming that patients with TMJ disorders caused by bruxism might have an underlying respiratory disorder. In these cases, it was recommended that the respiratory disorder that is the cause of bruxism be treated to eliminate the signs and symptoms related to TMJ (45). In the present study, most patients with TMJ disorders also had pain and sensitivity in the masticatory muscles. Paranasal sinus involvement and restoration fractures were also examined; however, they were observed in only a few cases. The low number of restorative fracture cases was probably why restoration fractures did not show a significant relationship with bruxism and respiratory disorders in multivariate analysis. However, this relationship was significant for the sensitivity of paranasal sinuses. Furthermore, although the number of paranasal sinus involvement cases was low, most cases were observed in children with bruxism, especially those with respiratory disorders. Therefore, according to the present study's results, which were in line with the results of the above-mentioned studies (22, 45), respiratory diseases, bruxism, TMJ involvement, pain, and sensitivity of the muscles and paranasal sinuses can all occur together.

It should be noted that most population-based epidemiological studies on the prevalence of bruxism are based solely on questionnaires (i.e., self-assessment or parents' report of bruxism), whose validity as diagnostic tools is still debated due to many confounding factors. For instance, the normal sound of bruxism caused by teeth grinding is not necessarily heard in all patients with bruxism and all bruxism stages. The sound was estimated to be produced in 50 - 60% of cases. Furthermore, not hearing teeth-grinding sounds during sleep does not ensure the absence of bruxism (18). The present study showed that in almost half of the cases, the sound of bruxism was heard by the parents (29). Pediatric examinations also showed that the prevalence of tooth

sensitivity and pain and tooth wear were significantly higher in children with bruxism compared to the others. Tooth wear, pain, and tooth sensitivity were often observed concomitantly. Due to bruxism and respiratory disorders, these symptoms were significantly higher in children with respiratory problems. This finding is in line with Antunes et al.'s findings showing that bruxism in childhood was associated with respiratory disorders, tooth wear, tooth decay, and malocclusion (8).

The present study's strengths include a large sample size and accurate data collection, which ensure the validity of the estimates. Additionally, the sampling method prevents selection biases, further adding to the robustness of the study. One of the limitations of this study is that the assessment of children's respiratory disorders was based only on their parents' reports and pediatric medical history. Moreover, information about the prevalence of bruxism was based solely on questionnaires of parents' assessment of bruxism, which can affect the accuracy of the results. In this study, the potential effects of these factors have been controlled to ensure the accuracy and reliability of the results. Specifically, some measures, such as standardized physical fitness tests and body mass index assessments, have been employed to control these factors. However, it is important to acknowledge that despite these measures, some limitations might still exist due to the complex nature of these factors and their potential impact on respiratory function. Accordingly, any findings presented in this study should be interpreted with caution.

5.1. Conclusions

The prevalence of bruxism and respiratory diseases was observed to be high. Moreover, it was suggested that bruxism is significantly higher in children with respiratory disorders than those without respiratory disorders. Due to the association of these two disorders, the review of the history of patients with bruxism should include special attention to respiratory disorders and sleep disorders. Overall, the present study highlights the importance of identifying and treating bruxism in children, particularly those with respiratory disorders, sound production, TMJ sensitivity, or paranasal sinus sensitivity. Early diagnosis and intervention can help prevent further damage to teeth and alleviate associated symptoms, such as headaches and jaw pain. This study also underscores the need for further research to investigate the underlying causes of bruxism and its association with other medical conditions.

Acknowledgments

The present study is part of a doctoral dissertation by Athareh Zare Emamzadeh, which was approved by the Research Council of Kerman University of Medical Sciences (IR. KMU. REC. 1397.079). The authors would like to express their gratitude and appreciate all the individuals who contributed to this study.

Footnotes

Authors' Contribution: Study concept and design: Elham Farokh Gisoure; Acquisition of the data: Athareh Zare Emamzadeh; Drafting of the manuscript: Elham Farokh Gisoure and Amir Hossein Nekouei; Statistical analysis: Amir Hossein Nekouei; Study supervision: Elham Farokh Gisoure.

Conflict of Interests: The authors declare no competing interests.

Ethical Approval: This study was approved by the Ethics Committee of Kerman University of Medical Sciences (ethics code: IR.KMU.REC.1397.079).

Funding/Support: The present study is part of a doctoral dissertation by Athareh Zare Emamzadeh, which was approved by the Research Council of Kerman University of Medical Sciences (IR.KMU.REC.1397.079).

Informed Consent: Written consent was obtained from the parents to participate in the study.

References

1. Nair H, Simoes EA, Rudan I, Gessner BD, Azziz-Baumgartner E, Zhang JSF, et al. Global and regional burden of hospital admissions for severe acute lower respiratory infections in young children in 2010: a systematic analysis. *Lancet*. 2013;**381**(9875):1380–90. [PubMed ID: 23369797]. [PubMed Central ID: PMC3986472]. https://doi.org/10.1016/S0140-6736(12)61901-1.
2. Drumond CL, Souza DS, Serra-Negra JM, Marques LS, Ramos-Jorge ML, Ramos-Jorge J. Respiratory disorders and the prevalence of sleep bruxism among schoolchildren aged 8 to 11 years. *Sleep Breath*. 2017;**21**(1):203–8. [PubMed ID: 28155103]. https://doi.org/10.1007/s11325-017-1466-9.
3. Ibatova SM, Uralov SM, Mamatkulova F. Bronchobstructive Syndrome in Children. *Web Scie Int Sci Res J*. 2022;**3**(5):518–22. https://doi.org/10.17605/OSF.IO/5XF6H.
4. Asher I, Pearce N. Global burden of asthma among children. *Int J Tuberc Lung Dis*. 2014;**18**(11):1269–78. [PubMed ID: 25299857]. https://doi.org/10.5588/ijtld.14.0170.
5. Zar HJ, Ferkol TW. The global burden of respiratory disease-impact on child health. *Pediatr Pulmonol*. 2014;**49**(5):430–4. [PubMed ID: 24610581]. https://doi.org/10.1002/ppul.23030.
6. Irandoust K, Taheri M, H'Mida C, Neto GR, Trabelsi K, Ammar A, et al. Exergaming and Aquatic Exercises Affect Lung Function and Weight Loss in Obese Children. *Int J Sports Med*. 2021;**42**(6):566–72. [PubMed ID: 33176381]. https://doi.org/10.1055/a-1289-9307.

7. Abdelkarim O, Ammar A, Trabelsi K, Cthourou H, Jekauc D, Irandoust K, et al. Prevalence of Underweight and Overweight and Its Association with Physical Fitness in Egyptian Schoolchildren. *Int J Environ Res Public Health*. 2019;**17**(1). [PubMed ID: 31861878]. [PubMed Central ID: PMC6981920]. https://doi.org/10.3390/ijerph17010075.
8. Antunes LA, Castilho T, Marinho M, Fraga RS, Antunes LS. Childhood bruxism: Related factors and impact on oral health-related quality of life. *Spec Care Dentist*. 2016;**36**(1):7–12. [PubMed ID: 26388123]. https://doi.org/10.1111/scd.12140.
9. Huynh NT, Desplats E, Bellerive A. Sleep bruxism in children: sleep studies correlate poorly with parental reports. *Sleep Med*. 2016;**19**:63–8. [PubMed ID: 27198949]. https://doi.org/10.1016/j.sleep.2015.09.023.
10. Grechi TH, Trawitzki LV, de Felicio CM, Valera FC, Alnselmo-Lima WT. Bruxism in children with nasal obstruction. *Int J Pediatr Otorhinolaryngol*. 2008;**72**(3):391–6. [PubMed ID: 18234357]. https://doi.org/10.1016/j.ijporl.2007.11.014.
11. Strachan D, Sibbald B, Weiland S, Ait-Khaled N, Anabwani G, Anderson HR, et al. Worldwide variations in prevalence of symptoms of allergic rhinoconjunctivitis in children: the International Study of Asthma and Allergies in Childhood (ISAAC). *Pediatr Allergy Immunol*. 1997;**8**(4):161–76. [PubMed ID: 9553981]. https://doi.org/10.1111/j.1399-3038.1997.tb00156.x.
12. Penard-Morand C, Raherison C, Charpin D, Kopferschmitt C, Lavaud F, Caillaud D, et al. Long-term exposure to close-proximity air pollution and asthma and allergies in urban children. *Eur Respir J*. 2010;**36**(1):33–40. [PubMed ID: 20075054]. https://doi.org/10.1183/09031936.00116109.
13. Caliskan S, Delikan E, Ozcan-Kucuk A. Knowledge of Parents about Bruxism in their Children. *Odovtos Int J Dent Sci*. 2020;**22**(1):123–32. https://doi.org/10.15517/IJDS.2020.38712.
14. Lobbezoo F, Ahlberg J, Raphael KG, Wetselaar P, Glaros AG, Kato T, et al. International consensus on the assessment of bruxism: Report of a work in progress. *J Oral Rehabil*. 2018;**45**(11):837–44. [PubMed ID: 29926505]. [PubMed Central ID: PMC6287494]. https://doi.org/10.1111/joor.12663.
15. Ahlberg J, Rantala M, Savolainen A, Suvinen T, Nissinen M, Sarna S, et al. Reported bruxism and stress experience. *Community Dent Oral Epidemiol*. 2002;**30**(6):405–8. [PubMed ID: 12453110]. https://doi.org/10.1034/j.1600-0528.2002.00007.x.
16. Shetty S, Pitti V, Satish Babu CL, Surendra Kumar GP, Deepthi BC. Bruxism: a literature review. *J Indian Prosthodont Soc*. 2010;**10**(3):141–8. [PubMed ID: 21886404]. [PubMed Central ID: PMC3081266]. https://doi.org/10.1007/s13191-011-0041-5.
17. Hachmann A, Martins EA, Araujo FB, Nunes R. Efficacy of the nocturnal bite plate in the control of bruxism for 3 to 5 year old children. *J Clin Pediatr Dent*. 1999;**24**(1):9–15. [PubMed ID: 10709536].
18. Carra MC. Sleep bruxism and sleep disorders in adolescents. *J Dentofacial Anom Orthod*. 2019;**21**(1):108. https://doi.org/10.1051/odfen/2018046.
19. Katayoun E, Sima F, Naser V, Anahita D. Study of the relationship of psychosocial disorders to bruxism in adolescents. *J Indian Soc Pedod Prev Dent*. 2008;**26 Suppl 3**:S91–7. [PubMed ID: 19127024].
20. Cheifetz AT, Osganian SK, Allred EN, Needleman HL. Prevalence of bruxism and associated correlates in children as reported by parents. *J Dent Child (Chic)*. 2005;**72**(2):67–73. [PubMed ID: 16294935].
21. Serra-Negra JM, Paiva SM, Seabra AP, Dorella C, Lemos BF, Pordeus IA. Prevalence of sleep bruxism in a group of Brazilian schoolchildren. *Eur Arch Paediatr Dent*. 2010;**11**(4):192–5. [PubMed ID: 20840830]. https://doi.org/10.1007/BF03262743.
22. Machado E, Dal-Fabbro C, Cunali PA, Kaizer OB. Prevalence of sleep bruxism in children: a systematic review. *Dental Press J Orthod*. 2014;**19**(6):54–61. [PubMed ID: 25628080]. [PubMed Central ID: PMC4347411]. https://doi.org/10.1590/2176-9451.19.6.054-061.oar.
23. Lavigne GJ, Montplaisir JY. Restless legs syndrome and sleep bruxism: prevalence and association among Canadians. *Sleep*. 1994;**17**(8):739–43. [PubMed ID: 7701186].
24. Ohayon MM, Li KK, Guilleminault C. Risk factors for sleep bruxism in the general population. *Chest*. 2001;**119**(1):53–61. [PubMed ID: 11157584]. https://doi.org/10.1378/chest.119.1.53.
25. Watted N, Zere E, Abu-Hussein M. Bruxism in Childhood-Etiology, Clinical Diagnosis and the Therapeutic Approach. *IOSR-JDMS*. 2015;**14**:54–60. https://doi.org/10.9790/0853-141285460.
26. Redline S, Tishler PV, Schluchter M, Aylor J, Clark K, Graham G. Risk factors for sleep-disordered breathing in children. Associations with obesity, race, and respiratory problems. *Am J Respir Crit Care Med*. 1999;**159**(5 Pt 1):1527–32. [PubMed ID: 10228121]. https://doi.org/10.1164/ajrccm.159.5.9809079.
27. Ferreira-Bacci Ado V, Cardoso CL, Diaz-Serrano KV. Behavioral problems and emotional stress in children with bruxism. *Braz Dent J*. 2012;**23**(3):246–51. [PubMed ID: 22814694]. https://doi.org/10.1590/s0103-64402012000300011.
28. Fonseca CM, dos Santos MB, Consani RL, dos Santos JF, Marchini L. Incidence of sleep bruxism among children in Itanhandu, Brazil. *Sleep Breath*. 2011;**15**(2):215–20. [PubMed ID: 20936432]. https://doi.org/10.1007/s11325-010-0427-3.
29. Marks MB. Bruxism in allergic children. *Am J Orthod*. 1980;**77**(1):48–59. [PubMed ID: 6928084]. https://doi.org/10.1016/0002-9416(80)90223-7.
30. Lin YT, Chen YC, Gau SS, Yeh TH, Fan HY, Hwang YY, et al. Associations between allergic diseases and attention deficit hyperactivity/oppositional defiant disorders in children. *Pediatr Res*. 2016;**80**(4):480–5. [PubMed ID: 27356086]. https://doi.org/10.1038/pr.2016.111.
31. Carra MC, Bruni O, Huynh N. Topical review: sleep bruxism, headaches, and sleep-disordered breathing in children and adolescents. *J Orofac Pain*. 2012;**26**(4):267–76. [PubMed ID: 23110266].
32. Shakurnia AH, Assar S, Afra M, Latifi M. Prevalence of asthma among schoolchildren in Ahvaz, Islamic Republic of Iran. *East Mediterr Health J*. 2010;**16**(6):651–6. [PubMed ID: 20799594].
33. Bidad K, Anari S, Aghamohammadi A, Pourpak Z, Moayeri H. Prevalence of asthma related to BMI in adolescents in Tehran, Iran, 2004-2005. *Eur J Pediatr*. 2007;**166**(5):453–4. [PubMed ID: 17043845]. https://doi.org/10.1007/s00431-006-0259-0.
34. Rahimi Rad MH, Hejazi ME. Agreement between written and video asthma symptoms questionnaires in school children in Urmia, Iran. *Iran J Allergy Asthma Immunol*. 2007;**6**(1):21–5. [PubMed ID: 17303925].
35. World Health Organization. *Oral health surveys: basic methods*. World Health Organization; 2013.
36. Seraj B, Shahrabi M, Ghadimi S, Ahmadi R, Nikfarjam J, Zayeri F, et al. The Prevalence of Bruxism and Correlated Factors in Children Referred to Dental Schools of Tehran, Based on Parent's Report. *Iran J Pediatr*. 2010;**20**(2):174–80. [PubMed ID: 23056700]. [PubMed Central ID: PMC3446016].
37. Soares KA, Melo RM, Gomes MC, Perazzo MF, Granville-Garcia AF, Menezes VA. Prevalence and factors associated to bruxism in preschool children. *J Public Health*. 2016;**24**(3):209–14. https://doi.org/10.1007/s10389-016-0713-z.
38. Bricker SL, Langlais RP, Miller CS. *Oral diagnosis, oral medicine, and treatment planning*. BC Decker; 2001.
39. Soares JP, Moro J, Massignan C, Cardoso M, Serra-Negra JM, Maia LC, et al. Prevalence of clinical signs and symptoms of the masticatory system and their associations in children with sleep bruxism: A systematic review and meta-analysis. *Sleep Med Rev*. 2021;**57**:101468. [PubMed ID: 33836485]. https://doi.org/10.1016/j.smrv.2021.101468.
40. Chen YQ, Cheng HJ, Yu CH, Gao Y, Shen YQ. [Epidemic investigation on 3 to 6 years children's bruxism in Shanghai.]. *Shanghai Kou Qiang Yi Xue*. 2004;**13**(5):382–4. Chinese. [PubMed ID: 15514861].
41. Liu X, Ma Y, Wang Y, Jiang Q, Rao X, Lu X, et al. Brief report: An epidemiologic survey of the prevalence of sleep disorders among children 2 to 12 years old in Beijing, China. *Pediatrics*. 2005;**115**(1 Suppl):266–8. [PubMed ID: 15866861].

https://doi.org/10.1542/peds.2004-0815I.
42. Farsi NM. Symptoms and signs of temporomandibular disorders and oral parafunctions among Saudi children. *J Oral Rehabil*. 2003;**30**(12):1200–8. [PubMed ID: 14641664]. https://doi.org/10.1111/j.1365-2842.2003.01187.x.
43. Sakaguchi K, Mehta NR, Abdallah EF, Forgione AG, Hirayama H, Kawasaki T, et al. Examination of the relationship between mandibular position and body posture. *Cranio*. 2007;**25**(4):237–49. [PubMed ID: 17983123]. https://doi.org/10.1179/crn.2007.037.
44. Canto Gde L, Pachêco-Pereira C, Aydinoz S, Major PW, Flores-Mir C, Gozal D. Biomarkers associated with obstructive sleep apnea: A scoping review. *Sleep Med Rev*. 2015;**23**:28–45. [PubMed ID: 25645128]. [PubMed Central ID: PMC4447611]. https://doi.org/10.1016/j.smrv.2014.11.004.
45. Balasubramaniam R, Klasser GD, Cistulli PA, Lavigne GJ. The Link between Sleep Bruxism, Sleep Disordered Breathing and Temporomandibular Disorders: An Evidence-based Review. *J Dent Sleep Med*. 2014:27–37. https://doi.org/10.15331/jdsm.3736.
46. Motta LJ, Bortoletto CC, Marques AJ, Ferrari RA, Fernandes KP, Bussadori SK. Association between respiratory problems and dental caries in children with bruxism. *Indian J Dent Res*. 2014;**25**(1):9–13. [PubMed ID: 24748291]. https://doi.org/10.4103/0970-9290.131047.
47. DiFrancesco RC, Junqueira PA, Trezza PM, de Faria ME, Frizzarini R, Zerati FE. Improvement of bruxism after T & A surgery. *Int J Pediatr Otorhinolaryngol*. 2004;**68**(4):441–5. [PubMed ID: 15013611]. https://doi.org/10.1016/j.ijporl.2003.11.022.
48. Suwa S, Takahara M, Shirakawa S, Komada Y, Sasaguri K, Onozuka M, et al. Sleep bruxism and its relationship to sleep habits and lifestyle of elementary school children in Japan. *Sleep Biol Rhythms*. 2009;**7**(2):93–102. https://doi.org/10.1111/j.1479-8425.2009.00394.x.
49. Berger M, Szalewski L, Szkutnik J, Ginszt M, Ginszt A. Different association between specific manifestations of bruxism and temporomandibular disorder pain. *Neurol Neurochir Pol*. 2017;**51**(1):7–11. [PubMed ID: 27687043]. https://doi.org/10.1016/j.pjnns.2016.08.008.
50. Wetselaar P, Manfredini D, Ahlberg J, Johansson A, Aarab G, Papagianni CE, et al. Associations between tooth wear and dental sleep disorders: A narrative overview. *J Oral Rehabil*. 2019;**46**(8):765–75. [PubMed ID: 31038764]. [PubMed Central ID: PMC6852513]. https://doi.org/10.1111/joor.12807.
51. Bharti B, Malhi P, Kashyap S. Patterns and problems of sleep in school going children. *Indian Pediatr*. 2006;**43**(1):35–8. [PubMed ID: 16465004].
52. Manfredini D, Winocur E, Guarda-Nardini L, Paesani D, Lobbezoo F. Epidemiology of bruxism in adults: a systematic review of the literature. *J Orofac Pain*. 2013;**27**(2):99–110. [PubMed ID: 23630682]. https://doi.org/10.11607/jop.921.
53. Nahas-Scocate AC, Coelho FV, de Almeida VC. Bruxism in children and transverse plane of occlusion: is there a relationship or not? *Dental Press J Orthod*. 2014;**19**(5):67–73. [PubMed ID: 25715718]. [PubMed Central ID: PMC4296653]. https://doi.org/10.1590/2176-9451.19.5.067-073.oar.
54. Wetselaar P, Vermaire EJH, Lobbezoo F, Schuller AA. The prevalence of awake bruxism and sleep bruxism in the Dutch adult population. *J Oral Rehabil*. 2019;**46**(7):617–23. [PubMed ID: 30830687]. [PubMed Central ID: PMC6849828]. https://doi.org/10.1111/joor.12787.
55. Kapagiannidou D, Koutris M, Wetselaar P, Visscher CM, van der Zaag J, Lobbezoo F. Association between polysomnographic parameters of sleep bruxism and attrition-type tooth wear. *J Oral Rehabil*. 2021;**48**(6):687–91. [PubMed ID: 33474786]. [PubMed Central ID: PMC8248153]. https://doi.org/10.1111/joor.13149.