

Cases of Obstructive Sleep Apnea in Mouth Breathers: Rapid Review

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Abstract

Bad habits related to the oral cavity are behaviors that are repeatedly and spontaneously carried out by someone and are abnormal in the oral cavity. One of these bad oral habits is mouth breathing. Obstructive Sleep Apnea (OSA) is when an individual experiences sleep-disordered breathing with partial or total obstruction of the airway. The purpose of this study was to determine the prevalence of obstructive sleep apnea in mouth breathers.

The study was conducted using the rapid review method of articles describing the prevalence of obstructive sleep apnea in mouth breather patients. The literature search used the keyword and the Boolean Operator in Pubmed, Cochrane, Scopus, and Google Scholar and followed the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) protocol.

A total of 6 relevant articles that met the inclusion criteria were reviewed. One study examined the prevalence of OSA in patients with isolated CL/P, while five studies provided an explanation of the symptoms or risk factors for obstructive sleep apnea. The prevalence rate of obstructive sleep apnea shows a high variation among the included studies.

This study shows that the prevalence of obstructive sleep apnea in mouth breathers ranges from 1.2% to 55%.

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Introduction

Bad habits related to the oral cavity or bad oral habits are behaviors that a person repeatedly performs, spontaneously and are abnormal in the oral cavity so that they can affect hard tissue, tooth-supporting tissues, and other oral mucosa.^{1,2} Bad oral habits are most often found during infancy because they are part of development. Usually, this habit will disappear over time.^{3,4} There are many bad oral habits that can be identified, one of which is mouth breathing.⁵

Individuals who are mouth breathing should be suspected of having nasal airway obstruction. If nasal breathing is disturbed by hypertrophy of the adenoids and tonsils, rhinitis, or deviation of the nasal septum, there is a possibility that the individual may experience mouth breathing.⁶⁻⁸ Obstructive sleep apnea

(OSA) is a condition in which individuals have sleep breathing disorders or sleep disorders breathing with airway obstruction, either partially or totally.^{9,10,11} Research conducted by Markkanen et al. states that children with OSA breathe more often through their mouths and have larger adenoid tissue than children who breathe normally.¹² The upper airway obstruction will also cause the individual to experience OSA, in which condition the individual will stop breathing repeatedly during sleep.^{1,8,13}

The prevalence of obstructive sleep apnea in the community is estimated to occur in 1 out of 20 adults. The availability of OSA prevalence data in Indonesia is still diverse. A study was conducted by Susanto et al. in 2016 using the Berlin questionnaire on traffic police in East Jakarta. The results of this study showed that 16 out of 93 subjects had a high risk of OSA.¹⁴ Another study in Hong Kong conducted by Fung et al. found that 10.5% of children experienced OSA through mouth breathing.¹⁵

The incidence of obstructive sleep apnea is a clinical problem with increasing prevalence, often going undetected or undiagnosed because individuals who have OSA are not aware of this

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disorder. There are even individuals who do not care about these disturbances, nevertheless, OSA occurs during sleep and is considered harmless. However, in reality, OSA is a critical medical condition due to its significant impact on morbidity and mortality worldwide.¹⁶ Therefore, the authors are interested in conducting research to analyze cases of obstructive sleep apnea in patients' mouth breathing using the literature study method.

Materials and methods

The type of research to be used is a literature review in the form of a rapid review. This method synthesizes knowledge with a simplified systematic review component to obtain results in a shorter time by imposing some limitations on review aspects, such as the breadth of research questions, source search, and depth of analysis.¹⁷ The research instruments used were laptops, Microsoft Software, search engines and databases (PubMed, Cochrane, Scopus, and Google Scholar), Mendeley applications, Rayyan QRCI Software, scientific journal articles, and internet access. Studies were screened and selected using the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) guidelines.¹⁸

Articles searches were conducted using Boolean operators, snowballing method, and hand searching in PubMed, Cochrane, Scopus, and Google Scholar. A comprehensive search strategy was used to maximize the odds of all relevant studies. The authors searched article titles and abstracts using combinations of the keywords “((prevalence) OR (incidence)) AND (“mouth-breathing”) OR (“oral breathing”) AND (“obstructive sleep apnea”) OR (“sleep apnea”)”. This study included articles that discussed obstructive sleep apnea and mouth breathing, articles written in English published within the last 15 years (2008-2023), and accessible. Exclusion criteria in this study included literature or narrative reviews, only available in abstracts, case reports, and case series.

Results

A literature search using the Cochrane, Pubmed, Google Scholar, and Scopus databases

and search engines identified 455 studies. The first screening was done by checking the duplication of all databases and search engines, resulting in 392 articles. The second screening was carried out by reading the title and abstract of the article and then selecting irrelevant ones so that data on 49 articles were obtained. The third screening was carried out by reading the entire content of the article to determine the suitability of the content with the research question, and 6 articles were included in the synthesis. The general characteristics of the selected studies are listed in Table 1. The prevalence of obstructive sleep apnea in mouth breathers is summarized in Table 2. The results of the search and study selection in this review are described in Figure 1.

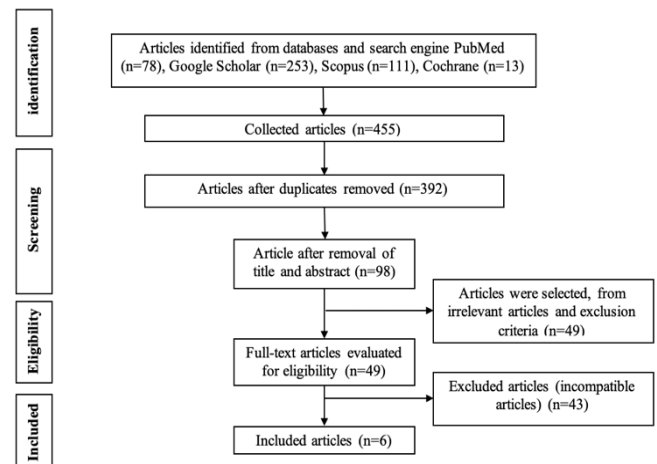


Figure 1. The results of the search and study selection.

Article characteristics were: one study used a cohort retrospective study design¹⁸, one article used a geographically based cohort study design¹⁹, another article used a cohort study design²⁰, one study used a descriptive study design²¹, one article used a pilot study²², and one article used a cross-sectional study²³. The sample ages of the study participants varied from 5 months to 18 years.¹⁸⁻²³ The two studies were conducted in England^{19,20}, one in the United States²¹, one in Brazil¹⁸, one in India²², and one in China²³.

The lowest obstructive sleep apnea prevalence was reported at 1.2%¹⁹ and the highest at 55%²³. There is one study that examined the prevalence of OSA in patients with isolated cleft lip or palate.²⁰ A total of five studies provided an explanation of the characteristics or

risk factors for obstructive sleep apnea in mouth breathers.^{18-20, 22,23}

Author (Year)	Research Location	Total Samples	Sex Distribution		Age (Years)		Prevalence OSA
			Male	Female	Min	Max	
Izu et al. (2010) ¹⁸	Brazil	104	62	42	0	13	42%
Karen et al. (2011) ¹⁹	England	846	Unknown		0,5	6,75	1,2%
Freeman et al. (2012) ²⁰	England	1.152	Unknown		< 3 month	81 month	20%
Silvestre et al. (2014) ²¹	United States	489	291	198	2	18	11%
Kapoor et al. (2021) ²²	India	178	68	110	6	18	8%
Xiao et al. (2022) ²³	China	1.550	922	628	1	18	55%

Table 1. Sample characteristics and prevalence obstructive sleep apnea in mouth breathes

Table 1 shows the characteristics of the study sample, including the author's name, title, type of study design, aims of the study, examination methods, and results. Overall, the studies included in this study demonstrated that patients with mouth breathing had symptoms or risk factors for obstructive sleep apnea. There were variations in the type of study design and study objectives, but all six studies demonstrated the prevalence of obstructive sleep apnea in mouth breathers.

Discussion

Based on the data in Table 2, it is known that the prevalence of obstructive sleep apnea in mouth breathers ranges from 1.2% to 55%, with most studies showing prevalence rates above 20%. These results indicate that the prevalence of obstructive sleep apnea in mouth breathers varies considerably among studies. The significant variation in the prevalence of obstructive sleep apnea can be caused by differences in sampling methods, examination methods, age distribution, sex, and the geographical area where the study was conducted.^{14,18}

The prevalence obtained from the results of this study has varying numbers. The prevalence of OSA in the Asian region has higher rate compared to the Americas and Europe, which is above 50%. Additionally, the prevalence of OSA in Asia shows a fairly high variation, ranging from 8% to 55%, with two studies conducted in India and China.^{21,22} The prevalence of OSA in the United States and Brazil ranges from 11% to 42%.^{18,21} The prevalence of OSA in the European region has

the lowest percentage, around 1.2% to 20%.^{19,20}

The area where the study is conducted can affect the prevalence of OSA due to factors such as air pollution that can affect airway health. The World Air Quality Index in 2021 reports that some cities in China, such as Beijing and Shanghai, have higher levels of air pollution compared to cities in the UK, India, and the United States. This research is consistent with a study conducted by Greenpeace in 2020, which showed that China is the country with the world's largest carbon dioxide emission rate, accounting for around 28% of global emissions. Additionally, other research in the Asian region, specifically in India, conducted by The Guardian in 2019, also showed that several cities in India, such as Delhi and Mumbai, have very high levels of air pollution. This high level of air pollution in China and India can contribute to the highest prevalence of obstructive sleep apnea in people who breathe through their mouths, with a prevalence rate of 55% in China.²³

According to the studies included in this analysis, four articles that reported OSA prevalence showed that men had a higher prevalence of OSA than women. Additionally, several epidemiological studies have also reported that OSA is more common in males than females. The OSA reason is more common in men is not known, nevertheless several hypotheses explain the relationship between sex and the onset of OSA. These hypotheses include hormonal effects that can affect the upper airway muscles, differences in fat distribution, and differences in the structure and function of the pharynx. This hypothesis is supported by Izu et al. showed that OSA prevalence a higher in boys, attributed to the influence of male sex hormones on breathing.¹⁸

The age distribution of OSA sufferers has quite a large variation. This can be seen from the age distribution in the included studies, ranging from 5 months to 18 years. The factors, such as the etiology of obstructive sleep apnea are complex and multifactorial, influencing the relationship between age, OSA, and mouth breathing, making it controversial.²³⁻²⁶ This statement is in line with the research by Karen et al. and Freeman et al. which stated that children who experience sleep-disordered breathing, including snoring, are more likely to experience persistent mouth breathing.^{19,20} Additionally, research conducted by Xiao et al. showed that

obesity, family passive smoking, family history of snoring, allergies, asthma, tonsillar hypertrophy, and adenoid hypertrophy are important risk factors associated with OSA in children.²³ This research is further supported by Karen et al. who stated that children with parents who have smoking habits are at risk of developing OSA.¹⁹

Patients who have certain medical conditions such as heart disease, stroke, mouth breathing, Parkinson's, and even a cleft lip have a higher risk of experiencing OSA and need to be screened at an early stage to prevent more serious health complications.^{21,27-29} Silvestre et al. examined children with isolated cleft lip and/or palate (CL/P) and found of 69.4% of patients who have the habit of mouth breathing, 11% of individuals have OSA disorders and often experience a state of stopping breathing at night and difficulty breathing during sleep.²¹

The cohort study conducted by Izu et al. showed that child participants (248) who had the mouth breathing, 144 (58%) had primary snores, and 104 (42%) had OSA. Primary snoring and OSA are often found in children who mouth breathing.^{4,18,30} Studies conducted by Izu et al. and Xiao et al. conducted polysomnographic examinations, and these two studies found that the majority of children with OSA had adenotonsillar hypertrophy with or without rhinitis.^{18,23} Adenoid-forming structures generally develop after a baby is born until the child is six years old. Children with excessive growth of adenoid tissue will experience upper airway obstruction. Therefore, children who have adenoid tissue hypertrophy often exhibit nasal obstruction, snoring, sleep apnea, and craniofacial abnormalities.^{13,27,31,32}

Mouth breathing is a medical condition associated with a high risk of experiencing obstructive sleep apnea (OSA). This OSA patients experience narrowing of the upper airways and decreased pharyngeal muscle tone, which results in reduced airflow during nocturnal inspiration or during the sleep phase. Most individuals with OSA also have pharyngeal structural abnormalities with narrowing, especially on the lateral side. Nasal obstruction contributes to the pathogenesis of OSA by increasing airway resistance, resulting in pharyngeal collapse, decreased afferent reflexes that maintain muscle tone, reduced moisture, and ultimately causing respiratory arrest.^{33,34}

The incidence of OSA in children who

have mouth breathing can have a negative impact on sleep quality, cognitive function, and behavior. Research conducted by Xiao et al. and Karen et al. identified risk factors associated with this condition and highlighted the importance of developing effective interventions to prevent or treat sleep disorders in children.^{19,23} Another study conducted by Senaratna et al. in 2017 emphasized the importance of early screening in clinical practice.³⁵ This is necessary, sometimes health practitioners often do not consider obstructive sleep apnea as a possible diagnosis in patients with certain clinical symptoms. Therefore, there is a need to increase awareness and knowledge about obstructive sleep apnea and its risks in patients with certain medical conditions.

This rapid review study has several limitations, including some studies having small sample sizes and a quite large age variation in the samples. Despite these limitations, this research has systematically followed PRISMA guidelines maintaining quality at every step. Future studies can conduct further research using systematic review and meta-analysis methods, with this research serving as a preliminary study to see conclusions on the prevalence of obstructive sleep apnea in mouth breathers in several countries.

Conclusions

This study shows that the prevalence of obstructive sleep apnea in mouth breathers ranges from 1.2% to 55%, with an age range of 5 months to 18 years.

Acknowledgements

The article is original, it has never been published before.

Declaration of Interest

The authors report no conflict of interest.

Author (Year)	Title	Study Design	Aim of the Study	Method	Results
Izu et al. (2010) ¹⁸	Obstructive sleep apnea syndrome (OSAS) in mouth breathing children	Cohort retrospective study	To determine the prevalence of obstructive sleep disorder in mouth breathing children and study its correlation with otorhinolaryngological findings.	All patients had nasofibroscopy and Cavum radiographs and polysomnographic exams.	Snoring and OSA are often found in children who mouth breathing. Otorhinolaryngological disorders in children who mouth breathing with OSA disorders are adenotonsillar hypertrophy with or without rhinitis. Besides that, the prevalence of OSA is more common in boys.
Karen et al. (2011) ¹⁹	Prevalence and Persistence of Sleep Disordered Breathing Symptoms in Young Children: A 6-Year Population-Based Cohort Study	Geographically based cohort study	To describe the prevalence, persistence, and characteristics associated with sleep disordered breathing (SDB) symptoms in a population-based cohort followed from 6 months to 6.75 years.	Analysis used The Avon Longitudinal Study of Parents and Children (AL-SPAC) an existing population-based study to assess SDB symptoms in children from infancy through the early school years.	Children whose parents have smoking habits are at risk of developing OSA. Nasal obstruction can lead to upper airway remodeling, which predisposes to OSA.
Freeman et al. (2012) ²⁰	Snoring, mouth-breathing, and apnea trajectories in a population-based cohort followed from infancy to 81 months: A cluster analysis	Cohort study	To characterize phenotypes of sleep disordered breathing (SDB) in early childhood that clinicians may find useful while monitoring symptom progression and associated SDB morbidity.	Parents in the Avon Longitudinal Study of Parents and Children (ALSPAC) reported SDB symptoms by questionnaire for their child at 6, 18, 30, 42, 57, 69, and 81 months of age.	Snoring and mouth breathing are strongly correlated with the occurrence of apnea, besides smoking and maternal health behavior can increase the risk of OSA.
Silvestre et al. (2014) ²¹	Incidence of positive screening for obstructive sleep apnea in patients with isolated cleft lip and/or palate	Descriptive study	To determine the incidence of obstructive sleep apnea (OSA) in children with isolated cleft lip and/or palate (CL/P).	Patients' families prospectively completed the Pediatric Sleep Questionnaire (PSQ), a validated tool used to predict moderate to severe OSA.	Septal deviation is common in children with unilateral CL, and despite normal mandibular anatomy, children with CL/P are at greater risk of developing upper airway obstruction. This chronic obstruction can compromise the nasal airway so that children's mouth breathing and manifest as OSA.
Kapoor et al. (2021) ²²	Development, testing, and feasibility of a customized mobile application for obstructive sleep apnea (OSA) risk assessment: A hospital-based pilot study	Pilot study	To develop a mobile application for OSA-risk assessment and tests its validity, feasibility, and application in a hospital-based pilot sample.	Mobile app development, feasibility, and validation.	Daytime sleepiness, headache, and mouth breathing were also significantly associated with OSA risk. Factors such as gender, socioeconomic status, and blood pressure are not significantly related to OSA risk.
Xiao et al. (2022) ²³	Analysis of the risk factors associated with obstructive sleep apnea syndrome in Chinese children	Cross-sectional study	To explore risk factors related to the incidence and severity of obstructive sleep apnea syndrome (OSAS) in children. Methods.	All children completed a questionnaire and underwent physical examination and polysomnography (PSG).	Obesity, a family history of passive smoking, a family history of snoring, allergic rhinitis, asthma, adenoid hypertrophy, and tonsillar hypertrophy are associated with OSA in children. Adenoid hypertrophy and tonsillar hypertrophy are considered the most critical risk factors associated with the development of OSA in children.

Table 2. General study characteristics.

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