Original Article:

Awareness of Pediatric Obstructive Sleep Apnea among parents in Majmaah, Saudi Arabia

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Received on Feb11, 2025, accepted for publication on May 10, 2025, dx.doi.org/10.5455/mjhs.2026.01.014

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Abstract

Background and Aims:
Obstructive Sleep Apnea (OSA) is one of the most common 'sleep disorders involving episodes of complete or partial collapse of the airway, leading to a decrease in oxygen saturation or arousal from sleep. The main consequences in children involve the nervous, cardiovascular, endocrine, and metabolic systems. The objective of this study is to assess the level of awareness of pediatric Obstructive Sleep Apnea (OSA) among parents in Majmaah, Saudi Arabia.

Methods:
This cross-sectional study was conducted in Majmaah, Saudi Arabia. The study participants were the male and female population of Majmaah. The data was collected by a pre-tested questionnaire. The questionnaire assessed awareness regarding the OSA definition, risk factors, associated symptoms, and treatment. The data was analyzed by using a statistical package for social sciences (SPSS).

Results:
The results of the study show that most of the participants, 169 (61.7%) had moderate knowledge of OSA, 66 (24.2%) had high knowledge, and 38 (13.9%) had low knowledge of OSA.

Conclusion: This study shows that most parents surveyed were not well-informed about the signs and risk factors of OSA in children. Our study emphasizes the need to educate parents more about pediatric OSA to increase the level of awareness.

Keywords:
Obstructive Sleep Apnea, Awareness, Children, Snoring

Introduction:

Pediatric Obstructive Sleep Apnea is a relatively common disorder defined as a condition when the upper airway is partially or completely blocked during sleep. Besides a range of disorders associated, it is distressing in children due to the potential difficulty in their physical development, cognitive function, and behavior. The prevalence of the disease varies, and, according to different authors, affects 1-5% of the world's child population.[2]. Nevertheless, beyond the influence, it is less studied and diagnosed, particularly in the third world and developing countries.

The causes of the disorder are diverse due to environmental and individual factors, and lymphadenoid hypertrophy, obesity, facial features, and malformed neuronic control can be highlighted as the most frequent ones [4.5.] The main symptoms of the disorder are loud snoring, missing breathing, restless sleep, hyperactivity, and aloofness[6,7]. Unaddressed, pediatric OSA may lead to severe problems—infection of cardiovascular conditions is one of the long-term consequences—other critical areas of concern include growth floors and cognitive dysfunction. Early recognition and intervention are crucial to mitigate these adverse outcomes.

Previous studies on pediatric OSA have predominantly been conducted in Western countries, where the condition is more widely recognized and diagnosed. Saran et al. carried out a study in Italy whose results indicated that most respondents (68%) knew about otorhinolaryngologists and oral areas when going for checkups. However, they acknowledged that the study was limited by the complexity of the research.

Among the handful of studies on awareness of OSA in Saudi Arabia is Alosaimi et al.'s study, which revealed low awareness levels and knowledge about pediatric OSA among residents of Jeddah[10]. The study recommended the implementation of health campaigns and training programs on the same. Bashir et al. carried out an assessment of pediatric OSA among parents in Saudi Arabia and found that many parents did not know about it[11]. Flemban et al. carried out a similar study among parents in KSA and found that the level of awareness and knowledge was high—41% of respondents had high knowledge and 38% had moderate knowledge—only 1% of respondents reported poor knowledge of pediatric OSA[12].

To the best of our knowledge, there was no previous research on pediatric OSA awareness in Majmaah, Saudi Arabia. Therefore, the purpose of this study was to investigate the level of parents' awareness of pediatric OSA in Majmaah, Saudi Arabia.

Methodology:

This research utilized a cross-sectional design and was carried out from October 2023 up to April 2024 among the parents in Majmaah, Saudi Arabia. The study aimed to determine the parents' awareness of pediatric obstructive sleep apnea in Majmaah, Saudi Arabia. The inclusion criteria for the study encompassed all parents residing in Majmaah who were currently married and had children. This includes both male and female parents who are in a marital relationship and actively involved in the upbringing of their children. The exclusion criteria eliminated any individuals who are not married, regardless of their gender, as well as married individuals who do not have children.

The questionnaire was developed from recent literature with alignment to the study objective. The questionnaire's feasibility, understandability, and readability were evaluated by ten respondents during the piloting phase, and the reliability of the questionnaire was calculated. In addition, the author took the questionnaire from a previous study conducted by Alosaimi A et al[13] and made minor modifications. The main study did not include the respondents who participated in the pilot study. The Cronbach's alpha was equal 0.817

The questionnaire was distributed to parents in Majmaah, Saudi Arabia via WhatsApp, Facebook, and Telegram groups after being adjusted in response to pilot feedback. The study involved 16 knowledge questions. The respondents who correctly answered 11 out of 16 questions were deemed to have high knowledge. The respondents who correctly answered 5-10 questions had moderate knowledge, while those who answered less than 5 questions correctly had poor knowledge.

The data collected was initially entered into an Excel database for cleaning. The data cleaning exercise involved checking for outliers and removing duplicates and incomplete entries. Afterward, the data was coded and transferred into SPSS software version 27 for analysis. Categorical variables were reported as counts and frequencies, whereas continuous variables were presented as means and standard deviations. To identify associations between categorical variables, inferential statistics, the Chi-square test were employed, with the significance level set at $p<0.05$.

The ethical approval was obtained from the ethics committee of Majmaah University. Data collection was conducted

anonymously, with no personal identifiers, ensuring that individual identities could not be linked to the study results. Confidentiality measures were rigorously implemented, and informed consent was secured. Participants were fully briefed on the study's objectives, procedures, potential risks, and benefits before their participation. Consent was obtained voluntarily, without any coercion. Researchers were dedicated to safeguarding participants' privacy by maintaining their anonymity and protecting sensitive data.

Results:

Table 1 shows that a total of 273 participants were surveyed. The majority of the participants, 265 (97.1%), surveyed were Saudi nationals, while only 8 (2.9%) were non-Saudi. In addition, 163 (59.7%) were men, while 110 (40.3%) were women. Marital status: Most of the participants, 176 (64.5%), were married, while 97 (35.5%) were single. Education level: 229 (83.9%) had a university-level education, 30 (11.0%) had a secondary school education, 8 (2.9%) had intermediate and 6 (2.2%) had a primary school education. Finally, 185 (67.8%) had 1-2 children, 62 (22.7%) had 3-5 children, 20 (7.3%) had 6-8 children, and 6 (2.2%) had 9-12 children.

Table 1: Social Demographic Characteristics of the Participants (n=273)

Variable	Category	n (%)
Nationality	Saudi	265 (97.1%)
	Non-Saudi	8 (2.9%)
Gender	Male	163 (59.7%)
	Female	110 (40.3%)
Marital Status	Single	97 (35.5%)
	Married	176 (64.5%)
Education	Primary	6 (2.2%)
	Secondary	30 (11.0%)
	Intermediate	8 (2.9%)
	University	229 (83.9%)
Number of Children	1-2 Children	185 (67.8%)
	3-5 Children	62 (22.7%)
	6-8 Children	20 (7.3%)
	9-12 Children	6 (2.2%)

Data has been presented as n and %.

Table 2 shows that 112 (41.0%) of the participants knew that a child's academic performance could be impacted by childhood obstructive sleep apnoea. Seventy-two (26.4%) of the respondents knew that depression is more common in children with obstructive sleep apnea, and 109 (39.9%) knew that attention and behavior are impacted by childhood obstructive sleep apnea. In addition, 157 (57.5%) thought that the genetic factor could have a role in the cause of childhood obstructive sleep apnea, 217 (79.5%) thought that childhood obstructive sleep apnea could be managed, and 235 (86.1%) believed that early intervention and treatment of children with obstructive

sleep apnea can lower the potential risk of complications. Moreover, 239 (87.5%) of the participants believe that raising parents' knowledge of obstructive sleep apnea in children may reduce the load on both the population and the parents. 227 (83.2%) thought that obstructive sleep apnea can cause restless sleep, and 211 (77.3%) thought that obstructive sleep apnea can cause mouth breathing. Further, 211 (77.3%) of the participants thought that obstructive sleep apnea can cause snoring, 197 (72.2%) thought that obstructive sleep apnea can cause noticed episodes of breathing pauses during sleep, 212 (77.7%) thought that obstructive sleep apnea can cause sleep arousal, and 166 (60.8%) thought that obstructive sleep apnea can cause daytime sleepiness. Finally, 181 (66.3%) thought that obstructive sleep apnea can cause sleep terrors, 102 (37.4%) thought that obstructive sleep apnea can cause hyperactivity, and 107 (39.2%) thought that obstructive sleep apnea can cause bed-wetting.

Table 2: General Knowledge of Obstructive Sleep Apnea among the Participants (n=273).

Variable	Category	n (%)
Do you know how a child's academic performance can be impacted by childhood obstructive sleep apnea?	Yes	112 (41.0%)
	No	161 (59.0%)
Did you know that depression is more common in children with obstructive sleep apnea?	Yes	72 (26.4%)
	No	201 (73.6%)
Do you know the attention and behavior are impacted by childhood obstructive sleep apnea?	Yes	109 (39.9%)
	No	164 (60.1%)
Do you believe that the cause of childhood obstructive sleep apnea may include a hereditary component?	Yes	157 (57.5%)
	No	116 (42.5%)
Is it possible to treat childhood obstructive sleep apnea?	Yes	217 (79.5%)
	No	56 (20.5%)
Do you believe that early intervention and treatment of children with obstructive sleep apnea can lower the potential risk of complications?	Yes	235 (86.1%)
	No	38 (13.9%)
Do you believe that raising parents' knowledge of obstructive sleep apnea in children may reduce the load on both the population and the parents?	Yes	239 (87.5%)
	No	34 (12.5%)
Do you believe restlessness during sleep can be a result of obstructive sleep apnea?	Yes	227 (83.2%)
	No	46 (16.8%)
Does mouth breathing occur with obstructive sleep apnea?	Yes	211 (77.3%)
	No	62 (22.7%)
Do you believe that snoring can be caused by obstructive sleep apnea?	Yes	211 (77.3%)
	No	62 (22.7%)

Do you think obstructive sleep apnea can cause noticed episodes of breathing pauses during sleep?	Yes	197 (72.2%)
	No	76 (27.8%)
Do you think obstructive sleep apnea can cause sleep arousal?	Yes	212 (77.7%)
	No	61 (22.3%)
Do you think obstructive sleep apnea can cause daytime sleepiness?	Yes	166 (60.8%)
	No	107 (39.2%)
Do you think obstructive sleep apnea can cause sleep terrors?	Yes	181 (66.3%)
	No	92 (33.7%)
Do you think obstructive sleep apnea can cause hyperactivity?	Yes	102 (37.4%)
	No	171 (62.6%)
Do you think obstructive sleep apnea can cause bed-wetting?	Yes	107 (39.2%)
	No	166 (60.8%)

Data has been presented as n and %.

Figure 1 shows that most of the participants, 169 (61.9%), had moderate knowledge of OSA, 66 (24.2%) had high knowledge, and 38 (13.9%) had low knowledge

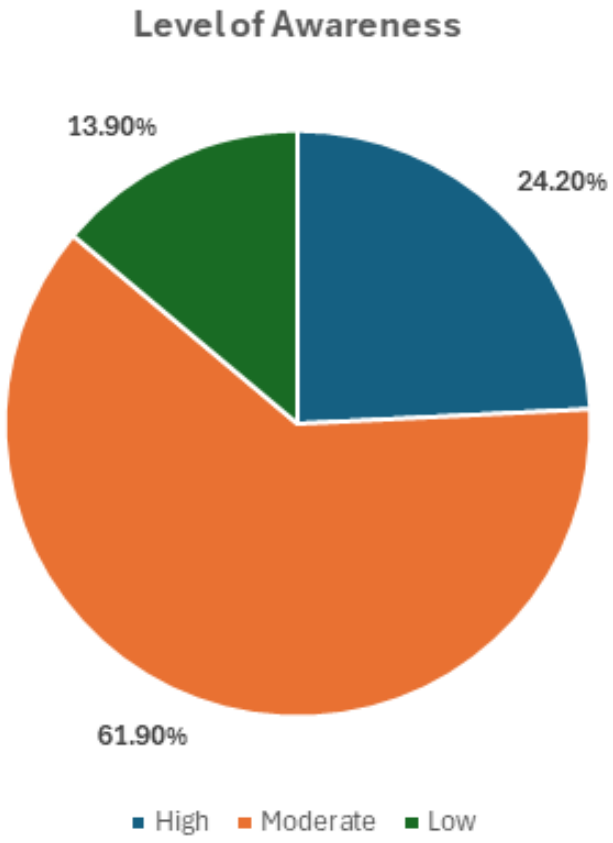


Figure 1: Level of Obstructive Sleep Apnea Awareness among the Participants (n=273).

The included studies were published between 2015 and 2024, with sample sizes ranging from 42 patients to 276 patients. All studies evaluated dupilumab as the biologic agent, while endoscopic sinus surgery procedures were standardized across studies according to established protocols. The primary outcomes assessed included changes in the nasal polyp score (NPS), SNOT-22 scores, and Lund-Mackay CT scores, with follow-up periods ranging from 24 to 52 weeks. Most studies were conducted in tertiary care centers across North America and Europe, with one multicenter study including sites in Asia.

Narrative synthesis:

Chen et al. (2023) focused primarily on dupilumab efficacy, incorporating five pivotal trials including the landmark SINUS-24 and SINUS-52 studies, along with more recent trials OSTRO, SYNAPSE, and POLYP-OLE (Table 1-3). Kim et al. (2024) concentrated on surgical outcomes through four contemporary studies (2022-2024), providing recent evidence on ESS effectiveness. The historical perspective was captured by Rix et al. (2015), who included seven studies examining various interventions, including montelukast, omalizumab, and erythromycin, in CRSwNP patients with asthma[45]. Kim et al. (2023) provided the most comprehensive coverage, including nine studies spanning from 2016 to 2023, with notable overlap in key trials like SINUS-24 and SINUS-52, while also incorporating newer surgical studies by Dharmarajan and Miglani.

Systematic analysis of CRSwNP treatment has revealed distinct patterns across therapeutic modalities. Initial data from Chen et al. (2023) and Kim et al. (2024) demonstrated notable temporal variations in the SNOT-22 scores between surgical and medical interventions. ESS achieved rapid improvement with maximal effect at 12 weeks (approximately -41 points from baseline), maintaining stability through 24 weeks (-39 points) before showing slight attenuation by 48-52 weeks (-36 points). In contrast, dupilumab exhibited progressive improvement, starting from -28 to -30 points at 12 weeks, increasing to -32 to -34 points at 24 weeks, and reaching a maximal improvement of -41 to -42 points by 48-52 weeks.

Nasal polyp scores, with comparable baseline values (approximately 6.2 ± 1.2), showed superior reduction with ESS at both 24 weeks (-4.64 to -4.71) and 48-52 weeks (-4.92 to -5.00) compared to Dupilumab (-2.84 to -2.96 at 24 weeks; -3.79 to -3.82 at 48-52 weeks). Safety profiles remained comparable between treatments, with serious adverse event rates rang-

ing from 4.8-5.5% across interventions. Dupilumab-associated adverse events primarily included injection site reactions (14.8-16.1%), conjunctivitis (8.7%), nasopharyngitis (12.3%), and upper respiratory infections (11.2%), while ESS-related events mainly comprised epistaxis (7.2%) and headache (5.8%).

The historical perspective from Rix et al.'s (2015) systematic review of 317 adults with CRSwNP and asthma provided additional insights into therapeutic approaches. Their analysis of montelukast demonstrated significant improvements in nasal symptoms and endoscopy findings with limited pulmonary function impact. Omalizumab showed efficacy in both allergic and non-allergic patients, improving nasal polyp scores and CT findings, but with mixed pulmonary outcomes. Erythromycin was superior to Functional Endoscopic Sinus Surgery (FESS) in improving pulmonary function while establishing significant correlations between nasal symptom improvement and asthma control.

Evidence synthesis across studies revealed high-quality evidence for SNOT-22 outcomes, nasal congestion improvements, and safety profiles, whereas moderate-quality evidence supported nasal polyp score changes and olfactory function improvements. The temporal pattern suggested that ESS provided rapid improvement with a potential plateau or slight decline, while dupilumab demonstrated progressive improvement over time, particularly in SNOT-22 scores and olfactory function. This pattern aligns with the "united airways" concept, supporting the strong association between CRSwNP and asthma (45-65% prevalence) and emphasizing the increased disease burden when conditions coexist.

The comparative effectiveness of biological therapies and ESS demonstrates distinct temporal patterns in treatment response. Early effectiveness data from Kim et al. (2024) revealed that ESS achieved superior initial results, with SNOT-22 scores showing significant improvements during the first three months (mean difference: -12.4 points, 95% CI: -15.8 to -9.0, $p<0.001$). Chen et al. (2023) provided supporting evidence, documenting that 78% of surgical patients achieved clinically significant improvement in polyp scores by week 12, compared to 65% in the dupilumab group. These findings establish the clear advantage of surgical intervention in achieving rapid symptomatic relief.

Table 3 shows that there is no statistically significant difference in the level of awareness among the OSA risk factors (P>0.05).

Table 3: Association between level of awareness and sociodemographic factors.

Variable	Category	High n (%)	Moderate n (%)	Low n (%)	P-value*
Nationality	Saudi	64 (97.0%)	164 (97.0%)	37 (97.4%)	0.993
	Non-Saudi	5 (3.0%)	2 (3.0%)	1 (2.6%)	
Gender	Male	37 (56.1%)	98 (58.0%)	28 (73.7%)	0.324
	Female	29 (43.9%)	71 (42.0%)	10 (26.3%)	
Marital Status	Single	27 (40.9%)	60 (35.5%)	10 (26.3%)	0.161
	Married	39 (59.1%)	109 (64.5%)	28 (73.7%)	
Education	Primary	2 (3.0%)	4 (2.4%)	0 (0.0%)	0.824
	Secondary	7 (10.6%)	17 (10.1%)	6 (15.8%)	
	Intermediate	3 (4.5%)	4 (2.4%)	1 (2.6%)	
	University	54 (81.8%)	144 (85.2%)	31 (81.6%)	
Number of Children	1-2 Children	42 (63.6%)	117 (69.2%)	26 (68.4%)	0.613
	3-5 Children	17 (25.8%)	39 (23.1%)	6 (15.8%)	
	6-8 Children	6 (9.1%)	10 (5.9%)	4 (10.5%)	
	9-12 Children	1 (1.5%)	3 (1.8%)	2 (5.3%)	

Data has been presented as n and %. P<0.05 was considered statistically significant.

Discussion:

The study aimed to assess the awareness of parents about obstructive sleep apnea in children in Majmaah, Saudi Arabia. The finding of the study reveals that 112 (41.0%) of the participants knew that the child's academic performance can be impacted by childhood obstructive sleep apnoea. Less than half (26.4%) of the respondents knew that depression is more common in children with obstructive sleep apnea, and 109 (39.9%) knew that attention and behavior are impacted by childhood obstructive sleep apnea. Moreover, slightly more than half, 157 (57.5%), of the participants thought that the genetic factor can have a role in the cause of childhood obstructive sleep apnea. In addition, most of the participants, 217 (79.5%) and 235 (86.1%), thought that OSA can be managed and early intervention and management can reduce the possible risk of complications in children with obstructive sleep apnea, respectively. Similar to this finding, a study by Bashir et al. found that only less than half of the individuals surveyed knew that childhood obstructive sleep apnea can affect a child's school performance and can cause higher levels of depression among the affected children compared to non-

affected children[11]. Consistent with this finding, a study by DiNardo et al. noted that most of the respondents were aware that it is possible to manage obstructive sleep apnea and that early intervention and management can reduce the possible risk of complications in children with obstructive sleep apnea[12,13].

Moreover, the findings of this study indicated that most of the participants, 239 (87.5%), thought that parents' awareness about childhood obstructive sleep apnea can help reduce the burden on them and the population, 227 (83.2%) thought it can cause restless sleep, and 211 (77.3%) thought it can cause mouth breathing. Further, most of the participants, 211 (77.3%), thought obstructive sleep apnea could cause snoring; 197 (72.2%) thought it could cause noticed episodes of breathing pauses during sleep; 212 (77.7%) thought that it could cause sleep arousal; and 166 (60.8%) thought it could cause daytime sleepiness. This is in line with the finding obtained in a study by Bitners et al., who revealed that most of the respondents surveyed were aware that OSA can cause snoring[15]. On the other hand, in support of this finding, a study by Ioan et al. revealed that most of the surveyed participants were aware OSA can cause daytime sleepiness[16].

Further, the finding of this study reveals that 181 (66.3%) of the participants thought that obstructive sleep apnea can cause sleep terrors, 102 (37.4%) thought it can cause hyperactivity, and 107 (39.2%) thought that obstructive sleep apnea can cause bed-wetting. This concurs with the finding in a study by Saelim et al., who found that most of the participants were not aware that OSA can cause hyperactivity[17]. On the other hand, aligned to the finding of this study, a study by Kuti et al. found that only a few participants were aware that obstructive sleep apnea can cause bed-wetting[18].

Finally, this study found that most of the participants, 169 (61.7%) had moderate knowledge of OSA, 66 (24.2%) had high knowledge, and 38 (13.9%) had low knowledge. This finding adheres to the results obtained in a study by Andersen et al., which found that most of the participants had moderate knowledge regarding obstructive sleep apnea signs and risk factors[19]. Nevertheless, a study by McDowall et al. noted that individuals surveyed had little information regarding OSA symptoms and risk factors[20]. This implies that most of the parents have little information concerning obstructive sleep apnea.

Additional research in different regions of Saudi Arabia involving a larger sample size would be necessary to validate our findings. Some of the drawbacks of this study include the use of a self-reported

survey, which is prone to desirability and remembering biases, and a small sample size, which limits the generalizability of this study's findings.

Potential strategies for increasing awareness and education about pediatric OSA among parents:

A variety of focused initiatives may be utilized to improve parental awareness and education regarding pediatric Obstructive Sleep Apnea (OSA). Community-based activities, such as workshops and seminars at schools, healthcare facilities, and community groups, may help to educate parents about OSA symptoms, dangers, and treatment choices. Another successful strategy to convey information is to use social media and digital platforms, which provide broad reach and participation. Collaboration with healthcare practitioners, especially paediatricians and family physicians, may also play an important role by adding educational sessions or handing out useful leaflets during regular checkups. Furthermore, public health campaigns organized by local governments or non-profit organizations may stress the need for early identification and treatment of OSA by employing relevant messages customized to local culture and language.

Incorporating qualitative data, such as interviews or focus group discussions with parents, may give more detailed information on their knowledge levels, attitudes, and possible hurdles to comprehending OSA. Personal stories given by parents of children diagnosed with OSA help humanize the situation, making it more relevant and meaningful. These accounts may highlight the real-life issues that families confront and emphasize the significance of early intervention while also identifying inadequacies in the present healthcare system and educational programs. By combining these qualitative findings with awareness efforts, a more complete and sympathetic strategy may be devised to address the knowledge gap and encourage improved understanding and treatment of pediatric OSA.

Conclusion:

The outcomes of this research highlight a considerable gap in parental understanding of pediatric Obstructive Sleep Apnea (OSA) in Majmaah, Saudi Arabia. While the majority of participants had intermediate awareness of OSA, a total of 75.6% of parents (moderate or poor knowledge) lacked a thorough grasp of its classification, symptoms, risk factors, and treatment choices. This lack of awareness increases the risk of delayed diagnosis and care, possibly increasing the negative consequences of OSA on children, including the neurological, cardiovascular, endocrine, and metabolic systems.

This research emphasizes the critical need for focused educational programs to improve parents' understanding of pediatric OSA. Comprehensive awareness campaigns, seminars, and community-based interventions should be emphasized to provide parents with the information they need to recognize warning signals early on and seek proper medical treatment. Collaboration among healthcare professionals,schools,andlocalgovernments will be important in communicating this knowledge successfully.

By raising parental awareness, early identification and care of paediatric OSA may be improved, reducing long-term health implications and improving the overall well-being of afflicted children. This research lays the groundwork for future attempts to address the public health issue presented by pediatric OSA in the area.

Funding:

None

Conflict of Interest:

The authors declare no conflict of interest.

Acknowledgments:

The authors extend their gratitude to the Deanship of Scientific Research and the Deanship of Community Services at Majmaah University, Kingdom of Saudi Arabia, for their technical support.

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