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Research Article

**OBSTRUCTIVE SLEEP APNEA AMONG CHILDREN IN SAUDI ARABIA**

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**Article Received:** August 2020**Accepted:** September 2020**Published:** October 2020**Abstract:**

**Background:** Obstructive sleep apnea (OSA) is defined as a breathing disorder during sleep characterized by sustained partial obstruction of the airway and/or total intermittent obstruction (obstructive apnea) interrupting regular sleep ventilation and regular sleep patterns which result with resultant oxygen desaturation and hypercapnia, leading to increasing respiratory effort and attendant changes in intrathoracic pressures, ultimately culminating in subcortical or cortical arousals. OSA can lead to significant morbidity among affected children. **Objective:** The study aims to identify prevalence, risk factors and results of obstructive sleep apnea among children in Saudi Arabia. **Methods:** This is a community based cross-sectional study conducted in different regions of Saudi Arabia from the period of 1 May to 30 August 2020. Study population included randomly selected infants and children less than 13 years. Data was analyzed using statistical package for the social sciences (SPSS, version 16) and results were analyzed with frequencies and Chi-squared test as appropriate. **Results:** 5.8% of parents reported occurrence of OSA sometimes in their infants or children. 17.6% of children with OSA have family history in one of their parents of OSA, 23.5% of cases were overweight, 51.8% have been diagnosed with enlarged tonsils or nasal polyps, 22.4% suffer from chronic asthma and 18.8% have neuromuscular disorder. Snoring was a common symptom 56.5% and 31.8% have nocturnal enuresis. **Conclusion:** In conclusion; 5.8% prevalence of obstructive sleep apnea considered a big problem and must take more attention from decision makers and physicians. Health education sessions and training courses for junior physicians and parents should be conducted to increase health awareness about this growing problem.

**Key Words:** obstructive sleep apnea in children, OSA in Saudi Arabia, epidemiology of OSA

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**INTRODUCTION:**

Sleep associated disorders are frequently identified during the early stages of the childhood [1]. Obstructive sleep apnea (OSA) is defined as a breathing disorder during sleep characterized by sustained partial obstruction of the airway and/or total intermittent obstruction (obstructive apnea) interrupting regular sleep ventilation and regular sleep patterns which result with resultant oxygen desaturation and hypercapnia, leading to increasing respiratory effort and attendant changes in intrathoracic pressures, ultimately culminating in subcortical or cortical arousals [2].

OSA can lead to significant morbidity among affected children. Estimates of prevalence differ based on the populations surveyed and the rigor of the diagnostic tests, but are commonly estimated to range from 1 % to 5%, with peak prevalence ranging from 2 to 8 years old [3].

The main risk factor for OSA development in younger children is adenotonsillary hypertrophy. Studies also suggest that OSAS has been linked with many controversial risk factors, including allergic rhinitis (AR), premature delivery, parental smoking, poor socio-economic status, and ethnicity of African-American (AA) [4]. Breastfeeding has been described as it may provide long-term protection against the severity of childhood sleep-disordered breathing [5].

OSA's distinctive symptoms in children are remarkably scarce, and usually require a high level of suspicion or, alternatively, systematic implementation of exploratory screening questions to enable detection [6]. Common symptoms at night include snoring, excessive sweating, restless sleep, breathing in the mouth, apneas, gasping, laborious or paradoxical breathing, and hyperextension of the neck during sleep. Difficulty concentrating, behavioral and mood problems, morning headaches, excessive daytime sleepiness (EDS), and failure to thrive have been described as daytime symptoms [7].

Untreated OSA is associated with cardiovascular issues, impaired growth, learning difficulties and problems with behavior. Early diagnosis of the condition can reduce the incidence of systemic complications over time, although OSA is, unfortunately, often late in diagnosis [8]. Pediatric OSA diagnosis consists of careful historical evaluation, clinical examination and ultimately endoscopic and instrumental evaluation. It has been stated that history and clinical review have a positive predictive value of 65% and 46% respectively for OSA diagnosis. Medical evaluation is nevertheless

helpful in identifying patients for instrumental examinations, such as PSG. Polysomnography (PSG). Presently, PSG represents the gold standard to diagnose OSA in children [9].

Treatment goal of OSA is providing space for ventilation, improvement of cranio-facial growth, improvement all symptoms, and preventing the development of adult OSA [10]. The decision to initiate treatment and the choice of treatment depends on the age of the child, clinical symptoms, presence of co-morbidities, risk factors and PSG outcomes if carried out. Surgery in young children should be performed as early as possible to avoid the subsequent morphological changes and risks of neurobehavioral, neurological, endocrine and metabolism. Equally important is closer postoperative follow-up to monitor for residual disease [11].

A previous study estimated population prevalence are as follows: parent-reported "always" snoring, 1.5 to 6%; parent-reported apneic events during sleep, 0.2 to 4%; SDB by varying constellations of parent-reported symptoms on questionnaire, 4 to 11%; OSA diagnosed by varying criteria on diagnostic studies, 1 to 4%. Overall prevalence of parent-reported snoring by any definition in meta-analysis was 7.45% [12].

**Objective:**

The study aims to identify prevalence, risk factors and results of obstructive sleep apnea among children in Saudi Arabia

**METHODOLOGY:**

This is a cross sectional study conducted in different regions of Saudi Arabia during the period of 1 June to 30 August 2020.

Data was collected by online questionnaire from parents of targeted children to define prevalence and other risk factors of obstructive sleep apnea. Questionnaire was distributed until the sample size was covered. The used questionnaire had a brief introduction explaining the idea of the research to parents and definition of obstructive sleep apnea to patients to clarify the prevalence precisely without mistaken other respiratory disorders. Pre-testing of the questionnaire was on 20 respondents, after which necessary changes were done, and the questionnaire will be re-administered.

Sociodemographic and clinical data was obtained from parents by filling out the questionnaire. Sample size was calculated using the equation;  $N = (Z\alpha)^2 \times ([p(1-p)]/d^2)$  where n = estimated sample size,  $Z\alpha$  at 5% level of significance = 1.96, d = level of precision

and is estimated to be 0.05, and  $p =$  High awareness levels in two previous studies (30%). The expected response rate is estimated to be 80%.

The collected data was entered and analyzed using the Statistical Package for the Social Science (SPSS Inc. Chicago, IL, USA) version 23. Percentages were given for qualitative variables. The determinant factors were determined using the Chi-square test. P-value was considered significant if  $P < 0.05$ .

#### Ethical Considerations:

An ethical approval was obtained from King Fahd Medical City. Questionnaire introduction explained the purpose and procedure of the study to all participants. Participants were informed of their freedom to decline participation if they chose to and or join study and withdraw at any point. All data was kept safe.

#### RESULTS:

**Table (1)** illustrating sociodemographic characteristics of parents of studied children reporting; 51.7% of fathers aged 45 or more and 37.9% of mothers aged between 35- 44 years old.

62% of fathers and 61.9% of mothers were university educated.

**Table (2)** discussing Parent knowledge and prevalence of OSA; 52.2% of parents haven't heard of OSA before and 34.7% have heard about a child died of OSA. 5.8% of parents reported occurrence of OSA sometimes in their infants or children.

**Table (3)** shows risk factors of OSA among children suffering of OSA as 17.6% of children with OSA have family history in one of their parents of OSA, 23.5% of cases were overweight, 51.8% have been diagnosed with enlarged tonsils or nasal polyps, 22.4% suffer from chronic asthma and 18.8% have neuromuscular disorder

Regarding symptoms of OSA in **Table (4)**; the snoring was a common symptom 56.5%, breathing from mouth during sleep 74.1%, 47.1% of children sweat during sleep, 28.2% have lethargy or lack of activity and 31.8% have nocturnal enuresis.

**Table (1): Sociodemographic characteristics of parents of studied children (N=1463)**

	Frequency	Percent
<b>Age of father:</b>		
15-24	21	1.4
25-34	258	17.6
35-44	427	29.2
45 or more	757	51.7
<b>Age of mother:</b>		
15-24	113	7.7
25-34	349	23.9
35-44	555	37.9
45 or more	446	30.5
<b>Educational level of father:</b>		
uneducated	18	1.2
primary	46	3.1
Intermediate	112	7.7
Secondary	380	26.0
University or more	907	62.0
<b>Educational level of mother:</b>		
uneducated	28	1.9
primary	48	3.3
Intermediate	112	7.7
Secondary	370	25.3
University or more	905	61.9
<b>Father working status:</b>		
Work	1202	82.2
No Work	261	17.8
<b>Mother working status:</b>		
Work	535	36.6

No Work	928	63.4
<b>Social status:</b>		
Married	1392	95.1
Divorced	30	2.1
Widower	41	2.8
<b>Place of residence in the Kingdom of Saudi Arabia:</b>		
Southern Region	41	2.8
Eastern Region	660	45.1
The northern Region	71	4.9
Western Region	207	14.1
Central Region	484	33.1

Table (2): Parent knowledge and prevalence of OSA among their children (N=1463)

	Frequency	Percent
<b>Have you ever heard of obstructive sleep apnea in children</b>		
Yes	700	47.8
No	763	52.2
<b>Have you ever heard of a child died of sleep apnea:</b>		
Yes	508	34.7
No	955	65.3
<b>Do you have a background on this condition and its causes:</b>		
Yes	260	17.8
No	1203	82.2
<b>Has this condition happened to your child before:</b>		
Sometimes	85	5.8
never	1032	70.5
I did not notice	346	23.7

Table (3): Risk factors of OSA among children suffering of OSA (N=85)

<b>How old was your child at the occurrence of this condition:</b>		
From 3 to 9 months	30	35.3
From one to three years	55	64.7
<b>Is your child overweight:</b>		
Yes	20	23.5
No	65	76.5
<b>Has your child been diagnosed with Down syndrome:</b>		
Yes	10	11.8
No	75	88.2

<b>Is there a family history of sleep apnea:</b>		
Yes	15	17.6
No	70	82.4
<b>How often does this condition recur?</b>		
Almost every day	8	9.4
Three to four times a week	6	7.1
One to two times a week	18	21.2
Once to twice a month	24	28.2
Rarely or never	29	34.1
<b>Does the child suffer from neuromuscular disorders?</b>		
Yes	16	18.8
No	69	81.2
<b>Have you noticed an irregular heartbeat on your child?</b>		
Yes	12	14.1
No	73	85.9
<b>Does your child suffer from chronic asthma that requires bronchodilators?</b>		
Yes	19	22.4
No	66	77.6
<b>Has your child been diagnosed with enlarged tonsils or nasal polyps as a result of persistent infections, which the doctor advised to remove?</b>		
Yes	44	51.8
No	41	48.2
<b>If yes, is an adenoids / tonsil removal surgery performed?</b>		
Yes	21	47.7
No	23	52.3
<b>Have you noticed that your child has stunted growth compared to his peers of the same age?</b>		
Yes	17	20.0
No	68	80.0

Table (4): Symptoms and frequency of occurrence of OSA (N= 85)

<b>Does the child suffer from snoring during sleep?</b>		
Yes	48	56.5
No	37	43.5
<b>How often does your child feel tired or tired after waking up?</b>		
Almost every day	9	10.6
Three to four times a week	7	8.2
One to two times a week	18	21.2

Once to twice a month	19	22.4
Rarely or never	32	37.6
<b>What are the factors that increase symptoms</b>		
Sleeping position	40	47.1
Make an effort before bed	3	3.5
Room temperature	13	15.3
There is no	29	34.1
<b>Is the child breathing from his mouth during sleep?</b>		
Yes	63	74.1
No	22	25.9
<b>Does the child have frequent infections?</b>		
Yes	21	24.7
No	64	75.3
<b>Does the child suffer from nocturnal enuresis?</b>		
Yes	27	31.8
No	58	68.2
<b>If the answer to the previous question is yes, does this situation recur continuously?</b>		
Yes	19	70.4
No	8	29.6
<b>Have you noticed any lethargy or lack of activity on your child?</b>		
Yes	24	28.2
No	61	71.8
<b>Have you noticed your baby sweating during sleep?</b>		
Yes	40	47.1
No	45	52.9
<b>Has your child complained of any eye pain or a headache?</b>		
Yes	34	40.0
No	51	60.0
<b>Has your child's playing style changed?</b>		
Yes	16	18.8
No	38	44.7
I do not know	31	36.5
<b>Has your child ever told you that he woke up without breathing and afraid to go back to sleep for this reason?</b>		
Yes	19	22.4
No	66	77.6
<b>Have you ever noticed hyperactivity and movement in your child with a lack of focus and attention?</b>		
Yes	24	28.2

No	42	49.4
I do not know	19	22.4
<b>Do these symptoms accompany the diagnosis of weak heart muscle in your child?</b>		
Yes	11	12.9
No	74	87.1
<b>Do you notice a lack of concentration in your child when receiving assignments or while studying, based on a complaint from a teacher?</b>		
Yes	21	24.7
No	64	75.3
<b>Does the child suffer from disturbances on a personal level?</b>		
Behavioral problems	8	9.4
Poor academic performance	3	3.5
Difficulty concentrating	15	17.6
Hyperactivity	19	22.3
Other	13	15.3
None of the above	39	85.9
<b>Has your child received sleep apnea treatment?</b>		
Yes	26	30.6
No	59	69.4
<b>If the previous answer is yes, has there been any improvement in the treatment?</b>		
Yes	24	92.3
No	2	7.7

Table (5): Relation between risk factors and occurrence of obstructive sleep apnea in child (N=2663)

		Occurrence of obstructive sleep apnea in child			Total (N=2663)
		Never	I did not notice	Sometimes	
<b>age at the occurrence of OSA</b>	Never happened	1032	346	0	1378
		100.0%	100.0%	0.0%	94.2%
	3 -9 Month	0	0	30	30
		0.0%	0.0%	35.3%	2.1%
	1-3 years	0	0	55	55
		0.0%	0.0%	64.7%	3.8%

<b>overweight</b>	yes	9	6	19	34
		0.9%	1.7%	22.4%	2.3%
	No	1023	340	66	1429
		99.1%	77.7%	98.3%	97.7%
<b>Down syndrome</b>	yes	2	3	10	15
		0.2%	0.9%	11.8%	1.0%
	No	1030	343	75	1448
		99.8%	99.1%	88.2%	99.0%
<b>family history of sleep apnea</b>	yes	7	3	15	25
		0.7%	0.9%	17.6%	1.7%
	No	1025	343	70	1438
		99.3%	99.1%	82.4%	98.3%
<b>neuromuscular disorders</b>	yes	10	4	16	30
		1.0%	1.2%	18.8%	2.1%
	No	1022	342	69	1433
		99%	98.8%	81.2%	97.9%
<b>chronic asthma</b>	yes	9	1	19	29
		0.9%	0.3%	22.4%	2.0%
	No	1023	345	66	1434
		99.1%	99.7%	77.6%	98%
<b>weak heart muscle</b>	yes	9	1	10	20
		0.9%	0.3%	11.8%	1.4%
	No	1023	345	75	1443
		99.1%	99.7%	88.3%	99.7
<b>enlarged tonsils or nasal polyps</b>	yes	28	13	44	85
		2.7%	3.8%	51.8%	5.8%
	No	1004	333	41	1378
		97.3%	96.3%	48.3%	94.2%

**DISCUSSION:**

OSA in infants and children is a common health problem that can result in significant morbidity. Estimates of prevalence vary, depending on the populations studied and on the stringency of the diagnostic criteria. According to our findings; prevalence of obstructive sleep apnea among children and infants reported by parents was 5.8%. This was higher than many other studies around the world. Most studies support a prevalence of between 0.2 and 4.0% for similar definitions. The reported prevalence of apnea of children in Singapore was 1.2% [13], China 0.2% [14], Korea 0.9% [15], Greece 1.0% [16], Hong Kong 1.5% [17], Iran 0.4% [18], Turkey 1.6% [19], United States 0.4% [20], United Kingdom 4.0% [21], and Spain 2.9% [22]. One study showed a prevalence of 18.6% for “breathing cessation” [23]. Another study reported 1.5 to 6%; parent-reported apneic events during sleep [24]. Another study reported OSA prevalence was 4% [25].

Snoring and trouble breathing during sleep are the most frequent problems from parents of children with OSA, with records of such symptoms in more than 96% of cases. Overall prevalence of parent-reported snoring was 7.45% (7.3% developed OSA at age 16–19) [24]. However, the background of snoring alone cannot differentiate between children with OSA and children with primary snoring.

Many characteristics of children in previous studies are associated with OSA like male sex, obesity, and history of tonsillectomy or adenoidectomy. According to our findings, 51.8% of children with OSA were diagnosed with enlarged tonsils or nasal polyps. Another study reported five of 21 children whose OSA remitted by adolescence underwent a tonsillectomy or adenoidectomy between examinations [25]. Another study report estimated that 49% of 5- to 9-y-old tonsillectomy candidates randomized to watchful waiting had remission of PSG evidence for OSA after 7 months [26].

Univariate studies found that snoring occurred for children older than 3 months, male gender, preterm delivery, breastfeeding, obesity, tonsillar hypertrophy and adenoid hypertrophy is correlated with OSAS [27]. However, in the same study; family history of OSA, parental educational level, ETS, and AR were not associated with OSA. [27]. These results disagreed with our findings that family history of OSA was associated with occurrence in children.

Hypertrophy of the tonsil and/or adenoid results in upper airway narrowing and, when superimposed with other factors (e.g., reduced muscle tone), can lead to a clinically significant dynamic airway

obstruction during sleep [28]. Our study was in agreement with these previous studies showing that adenoid and tonsillar hypertrophy are associated with OSA in children.

Obesity is another known risk factor for OSA in children that has been identified in several previous studies [29- 31]. It has been reported that for every increment in body mass index (BMI) of 1 kg/m<sup>2</sup> beyond the mean BMI for age and gender, the risk of OSA increased by 12% [32]. Similar studies indicating an increased risk of OSA among obese and overweight children have been reported from all over the world [32]. In our results; 23.5% of children suffering from OSA were overweight. There was also a significant correlation between obesity and OSA occurrence (P= 0.001). Rosen and her colleague observed a significant association between obesity levels and OSAS severity [33]. However, several other studies did not demonstrate an association between obesity and OSAS in children [34]. Weinstock didn't find an association between obesity and AHI in the overall sample [35]. Similarly, the correlation of obesity with OSA development has been documented in children with primary snoring [36]. While the correlation between asthma and OSA has been partly correlated with obesity and sex, higher OSA rates in children with asthma are consistent with previous evidence [37]. In our study 22.4% of participants were diagnosed with asthma with a significant correlation between asthma and OSA (P=0.0001).

A high prevalence of nocturnal enuresis was reported in children with OSA in many previous studies. This may be explained by the inhibitory effects of OSA on arousal responses to changes in bladder pressure, or effects of elevated BNP levels which affect the renin-angiotensin pathway, vasopressin, and excretion of sodium and water [38, 39]. According to our results; 31.8% of children having OSA suffer from nocturnal enuresis.

Regarding child behavior and cognitive function; 28.2% of cases have OSA suffer from lethargy and lack of activity. It has been shown in many previous studies that childhood OSA is associated with a negative effect on cognition and behavior [40- 42]. Several studies demonstrate the deleterious association between OSA and cognitive output with IQ, which has been proposed to be up to 10 points lower than the stable population except in those with moderate OSA [43- 45]. Furthermore, increased rates of inattention and hyperactivity and difficulties with peer interaction and emotional lability<sup>34</sup> are also reported in children with OSA [46].

**CONCLUSION:**

In conclusion; 5.8% prevalence of obstructive sleep apnea considered a big problem and must take more attention from decision makers and physicians. Health education sessions and training courses for junior physicians and parents should be conducted to increase health awareness about this growing problem. We also recommend large scale and more detailed national researches about this catastrophe.

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