Prevalence of OSA in chilean children and adolescents based on subscale of pediatric sleep questionnaire.

Prevalencia de OSA en niños y adolescentes chilenos según la subescala del Cuestionario de sueño pediátrico.

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Abstract: Objectives: We aimed to determine the prevalence of Obstructive Sleep Apnea (OSA) in children and adolescents from four districts of Santiago, Chile by using a six-question subscale from the Sleep-Related Breathing Disorders (SRBD) scale, which measures respiratory symptoms while sleeping. Material and Methods: Cross-sectional observational study. The six-question subscale of the SRBD scale was applied to the parents or guardians of the children and adolescents from four educational establishments in different districts of Santiago. Convenience sampling was used. This subscale allowed to divide the sample into two groups: one group with OSA and one at low risk of OSA. In addition, statistical tests were applied to evaluate the variation between gender and age range. Results: Of the total number of subjects (n=838, 4-18 years, mean: 11.3±4.2), 681 were included. According to the six-question subscale, 2.2% (CI 95% 1.64-2.76%) of the sample had OSA. There is a slight predominance in males, without statistically significant difference (p=0.083). In relation to the age of the participants, there was no statistically significant difference (p=0.512).Conclusion: The prevalence of OSA in Chilean children and adolescents was similar to previous reports. The results obtained by the analysis of the six-question subscale of the SRBD scale allow a more accurate detection of OSA. Future research should promote the translation of this questionnaire into the Chilean context and its use throughout the country.

Keywords: Sleep apnea; obstructive; surveys and questionnaires; diagnosis; child; Chile; sleep.

Resumen: Objetivos: Nuestro objetivo fue determinar la prevalencia de la apnea obstructiva del sueño (AOS) en niños y adolescentes de cuatro distritos de Santiago, Chile mediante el uso de una subescala de seis preguntas de la escala de trastornos respiratorios relacionados con el sueño (Sleep-Related Breathing Disorders, SRBD), que mide los síntomas respiratorios mientras dormido. Material y Métodos: estudio observacional transversal. La subescala de seis preguntas de la escala SRBD se aplicó a los padres o tutores de los niños y adolescentes de cuatro establecimientos educativos en diferentes distritos de Santiago. Se utilizó muestreo de conveniencia. Esta subescala permitió dividir la muestra en dos grupos: un grupo con OSA y otro con bajo riesgo de OSA. Además, se aplicaron pruebas estadísticas para evaluar la variación entre el género y el rango de edad. Resultados: Del número total de sujetos (n=838, 4-18 años, media: 11,3±4,2), se incluyeron 681. Según la subescala de seis preguntas, el 2,2% (IC 95% 1,64-2,76%) de la muestra tenía AOS. Hay un ligero predominio en varones, sin diferencia estadísticamente significativa (p=0,083). En relación con la edad de los participantes, no hubo diferencias estadísticamente significativas (p=0,512). Conclusión: La prevalencia de AOS en niños y adolescentes chilenos fue similar a informes anteriores. Los resultados obtenidos mediante el análisis de la subescala de seis preguntas de la escala SRBD permiten una detección más precisa de OSA. Investigaciones futuras deberían promover la adaptación de este cuestionario al contexto chileno y su uso en todo el país.

Palabras Clave: Apnea del sueño; obstructivo; encuestas y cuestionarios; diagnóstico; niño; Chile; dormir.

INTRODUCTION.

During sleep a series of mechanisms take place that allow for the correct growth and development of a human. Therefore, not having sleep quality will produce a destabilization of the normal growth process, especially in the first years of life.[1]

Sleep-disordered breathing (SDB) is the most common sleeping disorders in children, characterized by an alteration in respiratory function manifested during sleep.[2] The prevalence of these disorders varies between 2 to 20%[3-5] in children associated with certain factors such as obesity, prematurity, adenoid hypertrophy, tonsil hypertrophy, craniofacial malformations, Down's syndrome and certain neuromuscular disorders.[3,6,7]

SDB involves several pathologies, with Obstructive Sleep Apnea (OSA) the most studied, characterized by an obstruction of the upper airway during sleep producing intermittent hypoxia, arousal and an increase in respiratory effort; therefore, altering the architecture of sleep and gaseous exchange.[8,9] If these disorders are maintained, over time there can be associations with cardiovascular, metabolic, cognitive and behavioral disorders, usually reflected in lower school performance in children and adolescents,[10,11] thus it is very important to detect SDB in time, specially OSA, to be able to avoid the negative consequences at an early stage.

The most accurate instrument for detecting SDB is Polysomnography (PSG).[2] Due to the high complexity and cost of the PSG, different questionnaires have emerged as a potential tool for SDB screening, such as the Pediatric Sleep Questionnaire. This questionnaire contains a specific scale of respiratory symptoms, known as the Sleep-Related Breathing Disorders (SRBD) scale. The SRBD scale consists of 22 questions that seek to evaluate snoring, drowsiness and behavioral problems. This scale has a variety of advantages; it has a high specificity and sensitivity, it can be applied to parents of children and adolescents between 2 to 18 years old and it has a validated Spanish version. Also, this scale is a very useful tool in the epidemiological investigation of these disorders.[12-14]

In a recent investigation, Brockmann *et al.*,[21] evaluated the diagnostic accuracy of each question of this questionnaire, comparing the ability to detect OSA between snorers and patients with OSA diagnosed by PSG. Within the 22 questions, there were six that proved to be highly sensitive to detect patients with OSA, allowing differentiation of children who had some type of SDB from those who had diagnosed OSA. This allowed the building of a subscale with these six questions.[15] Obstructive sleep apnea is a syndrome that progresses over time and it is associated with severe cardiovascular and neurophysiological sequelae in adulthood.

In children it is strongly associated with Attention Deficit and Hyperactivity disorders, with growth delay, and might be related with the development of cognitive and behavioral problems in children and adolescents.[16] The severity of the syndrome has a positive relationship with cardiovascular problems, hypertension, right ventricular hypertrophy and pulmonary hypertension.[17] Moreover, OSA is also related to poor performance and job security and is the cause of many motor vehicle collisions.

Due to the multiple negative consequences that this syndrome entails, its high prevalence and the expensive direct and indirect costs of an untreated patient to the health system, OSA is considered an important public health problem, and emphasis should be put on prevention and the timely diagnosis of the syndrome.[16,18] Although studies related to obstructive sleep apnea syndrome in children are insufficient, for some time now this has been a serious public health problem given the impact on the quality of life of the people who suffer from it.[19]

Therefore, considering the multiple negative consequences that have been associated with SDB in children, especially with OSA, it is necessary to obtain information about the prevalence in Chilean children in the context of planning and delivering health care programs.

Even though there are some epidemiological studies of sleep disorders in Chile, they do not cover enough population, in terms of number and heterogeneity, so there is scarce information regarding the prevalence of SDB and OSA in children and adolescents in Chile.[20,21,26] In previous research, we observed a prevalence of 25.30% (CI 95%, 23.80%-26.80%) of SBD in Santiago, based on the SRBD scale.

It seems to be very important to differentiate children who have SDB from those who have OSA considering

the different clinical implications.[22] The objective of this study was to determine the prevalence of OSA in school children at four establishments located in different districts of Santiago, Chile, by using the six-question subscale of this questionnaire.

MATERIALS AND METHODS.

Design and sample

A cross-sectional study was conducted. The research protocol and informed consent form was approved by the Ethics Committee of the Medicine Faculty of Universidad del Desarrollo, Santiago, Chile.

We included all students <18 years from the following schools: Liceo Juan Pablo II, Colegio de la Inmaculada Concepción, Colegio Plus Ultra and children who were treated in the Pediatric Dentistry unit at the Universidad del Desarrollo Clinic, located in the districts of Las Condes, San Bernardo, Recoleta and La Florida, respectively. There was no a priori sample size calculation, and convenience sampling was used.

We excluded all those questionnaires that were not answered correctly, those where two or more questions were omitted or in which gender and/or age of the participant were not indicated.

A total of one thousand thirty-five surveys were given to parents of children and adolescents from schools and at the Universidad del Desarrollo Clinic, but only 838 satisfied the inclusion criteria and were included for the SRBD scale data analysis.

The mean age was 11.3±4.2 with a minimum of 4 and a maximum of 18 years. (Table 1)

Data collection

Immediately after showing the parents or guardians a video specially made for this study about prevention, diagnosis and consequences of SDB in children and how to answer the questionnaire, they were given the informed consent which was signed by all the parents who participated in the study, after which they were asked to answer the 22-items of SRBD Scale of the Pediatric Sleep Questionnaire in relation to their children.

This scale contains 22 questions about symptoms including snoring, daytime sleepiness and related behavioral disturbances. Possible responses for each item were *"yes"*, *"no"*, and *"don't* know".[13]

From the 22-items, the following six items on respiratory symptoms of the SRBD scale were included to detect OSA: *"always snores," "snores loudly," "trouble breathing," "observed apneas," "mouth open during day," and "unrefreshed in morning"*.

To achieve this aim, all questionnaires in which the six questions were answered positively or negatively were included in the analysis. All questionnaires in which the six questions were answered positively were considered positive to OSA. Questions about age and gender were also considered. The sample was separated into three age categories according to Star Child Health[23]: Pre-school (Early Childhood), 2 to 5 years; Grade Schooler (Middle Childhood), 6 to 11 years old; and Teen (Early Adolescence), 12 to 18 years old. The results of the subscale were analyzed in relation to the gender and age group of the participants. A spreadsheet in Excel was used for data collection.

Statistical analysis

Categorical variables were presented as frequency and percentages. As a measure of precision, 95% confidence interval was calculated. Bivariate analysis was made with Fisher's exact test, and a *p*-value of <0.05 was considered statistically significant. Data were analyzed with Stata 12 statistical software.

RESULTS.

For the subscale analysis, 681 questionnaires were included, with the six-questions answered positively or negatively. Demographic characteristics of this sample are presented on Table 2. A total of 15 questionaires, 2.20% (CI 95% 1.64-2.76%), had the six questions answered "yes" and were considered positive for pediatric OSA. In relation to sex, there is a slight predominance for males without reaching statistical significance (*p*=0.083). There was no statistically significant difference in relation to age of the participants (*p*=0.512).

Table 3 shows the frequency of OSA among gender and age group. The prevalence of OSA was evaluated between sexes in the different age categories.

There was a slight predominance in males compared to females in all age groups, but it is not statistically significant. The percentage of males and females who have the condition decreases with age. (Table 4)

Table 1. Demographic characteristics of the total sample.

		Frequency (n)	Percentage
Institution	Inmaculada Concepción School	523	62.41%
	Plus Ultra School	144	17.18%
	Juan Pablo II School	97	11.58%
	UDD Clinic	74	8.83%
Gender	Female	519	61.93%
	Male	319	38.07%
Age	Preschooler	70	8.35%
	Gradeschooler	370	44.15%
	Teenagers	398	47.50%

Table 2. Demographic characteristics of the OSA study sample.

		Frequency (n)	Percentage
Gender	Female	419	61.53%
	Male	262	38.47%
Age	Preschool	59	8.66%
	Gradeschooler	299	43.91%
	Teenagers	323	47.43%

Table 3. OSA frequency related to gender and age category.

Demographic characteristics	Positive for OSA (n= 15)			*p*-value
	Frequency (n)	Percentage	CI 95%	
Males	9	3.44%	2.74%-4.13%	0.083
Females	6	1.43%	0.98%-1-89%	
Preschooler	2	3.39%	2.70%-4.08%	0.512
Gradeschooler	8	2.68%	2.06%-3.29%	
Teenager	5	1.55%	1.07%-2.02%	

CI: confidence interval

Table 4. Prevalence of OSA in females and males according to age categories.

Age categories	OSA	Females		Males		Total		*p*-value
		n	%	n	%	n	%	
Preschooler	Absent	35	97.22	22	95.65	57	96.61	0.99
	Present	1	2.78	1	4.35	2	3.39	
Gradeschooler	Absent	166	98.22	125	96.15	291	97.32	0.30
	Present	3	1.78	5	3.85	8	2.68	
Teenager	Absent	212	99.07	106	97.25	318	98.45	0.34

DISCUSSION.

The present study constitutes one of the first efforts at a regional level to explore the prevalence of OSA in Santiago, Chile. Our study has shown an overall OSA prevalence of 2.2% in children and adolescents from different districts of Santiago, through the subscale of the SRBD scale of the Pediatric Sleep Questionnaire.

Among the strengths of this study, the size and heterogeneity of the surveyed sample stand out, because it involved children and adolescents within a wide age range (4 to 18 years) who belong to institutions located in four very different districts of Santiago in terms of air quality and pollution, socioeconomic level and obesity index. This allowed us to obtain a very varied study population, representative of the city. In addition, the questionnaire used in this investigation has been widely studied and validated against PSG, showing high sensitivity and specificity.[12,14]

A recent systematic review with a meta-analysis concluded that the Pediatric Sleep Questionnaire has the best diagnostic accuracy compared to the other tests evaluated, recommending its use to dentists as a useful tool to detect SDB in pediatric populations, and thus improve the referral process to specialists in sleep disorders.[24]

However, the present investigation has certain limitations. In the first place, it was not possible to implement the gold standard study, PSG, for the definitive diagnosis of the different sleep disorders, because of the large size of the sample and lack of economic resources. However, using this survey based on the SRBD scale has advantages over the PSG in terms of cost, easy access and comfort for parents and children, despite having a lower diagnostic accuracy comparing to the PSG.[14]

The global prevalence of SDB reported in the literature varies between the different studies, mainly due to its multiple conditions and its severity, such as primary snoring and OSA. These can fluctuate between 2-30%[3-5] among populations, with OSA having the lowest frequency (1.2% to 5.7%).[9] Regarding the results obtained according to the analysis of the subscale of six-questions, a OSA prevalence of 2.20% was observed.

To the best of our knowledge, no previous study has measured the prevalence of OSA in Chile. Nevertheless, some studies have estimated the prevalence of SBD in our country using questionnaires, with results ranging from 17.7% to 25.3%.[29,21,26]

Regarding the characteristics of children with sleep disorders, our results were consistent with the findings of Brockmann *et al.*,[21] who had not observed significant differences in age or gender distribution between children with habitual snoring and never snorers in Chile.[20] However, some authors have associated male gender with the presence of OSA in children and adolescents.[4,9,26]

Our finding shows a high difference between SDB and OSA prevalence in Chilean children and adolescents. The above would be related to the fact that these six-questions specifically refer to respiratory signs and symptoms during sleep, which, when present, point to a high risk of OSA; while the reduced version of the Pediatric Sleep Questionnaire also contains questions related to behavior and sleepiness.[15] As OSA has been more frequently associated with negative consequences than other milder stages of SDB, it is necessary to perform a more precise detection of this pathology.

The results found in Chile could be related to some facts such as the difficulty of some parents to answer the survey, certain ambiguities that may have been interpreted in the questions, since this survey is validated for Spanish speakers, but not specifically for Chilean language, it was delivered and collected on the same day, so the parents did not have time to see their children sleeping in order to evaluate in detail each of the items that were asked. Also, the high prevalence of OSA could be associated with high rates of obesity and air pollution in the city of Santiago, both risk factors of OSA.[9,24]

The results of this study intend to alert health professionals, especially general dentists and orthodontists, about the importance of obtaining a comprehensive health history using this type of questionnaire. This will allow health professionals to identify those patients who require more specific diagnostic methods such as PSG, and keep in mind that some young patients may have OSA and, therefore, treatment therapies should focus on improving that condition.

In addition, given the high prevalence of these disorders and the multiple negative consequences they entail, this study aims to encourage the development of improving these detection instruments, with the goal of increasing

their accuracy and understanding by their users, without compromising its simplicity and ease of use.

CONCLUSION.

Our study has shown an overall prevalence of OSA of 2.2% in Chilean children and adolescents, similar to previous reports in other countries perceiving a slight predominance in males. The results obtained by the analysis of the six-question subscale allow a more accurate detection of OSA, separating them from those who have a lower stage of SDB. Future research should promote the translation of this questionnaire into the Chilean context and its use throughout the country. Despite the limitations of the diagnostic instrument, it is important to sensitize the general dentists and orthodontists toward the problem of sleep-related breathing disorders in order to identify children at high risk and to offer a timely treatment.

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