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Sleep-Related Breathing Disorders in Adolescents Aged 12 to 16 Years*

Clinical and Polygraphic Findings

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Study objectives: **To determine the frequency, symptoms, and polygraphic features of sleep-related breathing disorders (SRBD) in adolescents aged 12 to 16 years.**
Design: **Cross-sectional study.**
Setting: **Randomly selected secondary schools in the city of Seville, Spain.**
Participants: **A general population sample of adolescents (n = 101; mean [± SD] age, 13.2 ± 0.8 years).**
Interventions: **An 82-item questionnaire regarding anthropometric data and nocturnal and daytime symptoms suggestive of SRBD was administered. Symptoms were evaluated according to a 4-point frequency scale. Snorers answered "sometimes" or "often" in the question about snoring, and nonsnorers answered "never" or "rarely." All subjects underwent an overnight cardiorespiratory polygraphy at home.**
Results: **Twenty-nine percent of the subjects were snorers. Excessive daytime sleepiness was present in 14% of subjects, and sleep apnea was present in 3%. Polygraphy showed a respiratory disturbance index ≥ 10 in 18 subjects (17.8%), but concurrent symptoms highly suggestive of SRBD were found in only 2 subjects (1.9%). Snorers had higher waist-to-hip ratios and a higher frequency of witnessed apnea or labored breathing as well as higher values of respiratory events as compared with nonsnorers. However, oximetry data were similar in both groups.**
Conclusions: **In a nonselected group of adolescents aged 12 to 16 years, the frequency of symptoms potentially associated with SRBD was similar to that reported for younger children. Snoring was associated with a higher occurrence of other nocturnal symptoms, a more central pattern of body fat distribution, and a higher respiratory disturbance index as compared with nonsnorers. Although polygraphic abnormalities were mild, two cases of probable SRBD were found with a prevalence rate of 1.9%.** ***(CHEST 2001; 119:1393–1400)***

Key words: adolescence; cardiorespiratory polygraphy; sleep-related breathing disorders

Abbreviations: CT_{90} = percentage of total recording time with arterial oxygen saturation < 90%; ENT = ear, nose, and throat; ODI = oxygen desaturation index; OSA = obstructive sleep apnea; RDI = respiratory disturbance index; RDIa = automatic RDI; RDIm = manual analysis RDI; RDIsp = time in supine position RDI; SaO_2 = arterial oxygen saturation; SRBD = sleep-related breathing disorders; TRT = total recording (sleep) time; TRTsp = TRT in the supine position

Clinical features of sleep-related breathing disorders (SRBD) have been documented extensively in adults and include a wide range of symptoms, from slight snoring to severe cases of obstructive sleep apnea (OSA) syndrome.[1] The relationship between SRBD in adults and certain factors such as age, obesity, some craniofacial alterations, and hormonal disorders, is also well known.[2,3] SRBD in childhood have clinical, diagnostic, and therapeutic characteristics that are different from those found in adults.[4] In younger children, adenotonsillar hypertrophy is the most frequent leading cause, although obesity, craniofacial malformations, or other anatomic alterations of the upper airway may also play an important etiologic role for SRBD.[5] In these two age groups, previous studies[6–8] have been conducted, allowing us to know their frequency and clinical characteristics. The polysomnographic fea-

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tures of SRBD in adults and prepubertal children are also reasonably well established.[9–11] In the adolescent population, however, as far as we are aware, the prevalence, clinical expression, and polysomnographic features of SRBD have not been previously examined.

Some of the underlying factors in the development of SRBD in adults, such as obesity or a narrowed upper airway, could be present to a degree in younger subjects. Moreover, during adolescence, sex hormones, testosterone in particular, start to play a significant role in the development of muscular mass in the body, including the pharynx.

Therefore, by detecting SRBD in adolescents and correcting these disorders whenever possible, the quality of life in these subjects can be improved, and preventive intervention (improving diet habits, correcting hormonal unbalances, or suppressing obstruction via orthodontia or corrective surgery of the upper airway) can be developed toward later manifestations of more severe sleep respiratory disorders.

To date, there have been no studies of SRBD conducted exclusively in the adolescent age group. This study was therefore performed to determine the frequency, symptoms, and polygraphic features of SRBD in adolescents aged 12 to 16 years recruited from the secondary school population in the city of Seville, Spain.

Materials and Methods

Subjects

Between May 1997 and June 1998, a cross-sectional study was carried out in a sample of adolescents of both genders ranging in age from 12 to 16 years. A total of 12 schools were selected at random using the official directory of public and private secondary schools in the city of Seville, Spain. The study was approved by an institutional review board and by the local education authorities. After a full explanation of the purpose of the study, written informed consent was obtained from those adolescents who voluntarily agreed to take part. Written informed consent from their parents or legal guardians was also obtained. No inclusion or exclusion criteria according to the absence or presence of a history of medical problems or chronic disease were established. The study included the administration of a questionnaire for the investigation of SRBD symptoms and measurement of anthropometric parameters, and an overnight home polygraphy.

Questionnaire

The questionnaire consisted of 82 items and was administered by a nurse at the adolescent's home on the same night as the polygraphic recording. Questions were answered by the subject and by his/her parents or guardians. The following data were recorded: (1) demographics; (2) family history of obesity and ear, nose, and throat (ENT) disorders; (3) personal history of substance abuse, including alcohol consumption and cigarette smoking, past and current medications, obesity, ENT disorders, craniofacial anomalies, hypertension, and chronic neurologic, psychiatric, cardiac, or respiratory disease; (4) school performance; and (5) nocturnal and daytime symptoms suggestive of SRBD according to a 4-point frequency scale, from "never" to "rarely" (equal to or less than once a week), "sometimes" (twice a week), or "often" (equal to or more than three times a week). Anthropometric measurements included weight, height (in percentiles), BP, neck circumference (in the standing position at the level of the cricothyroid membrane), waist circumference (at the midpoint between the anterior superior iliac spine and the lower costal arch), hip circumference (at the level of the greater trochanters), and biceps circumference (with the subject standing up, with the arm relaxed and slightly separated from the trunk). The body mass index, defined as the weight in kilograms divided by the square of the height in meters, and the waist-to-hip perimeter ratio were calculated. Subjects weighing > 95th percentile of their ideal weight for height and gender were considered obese. Subjects who did not agree to undergo polygraphic recording completed a few items of the questionnaire that included demographics, weight, height, history of ENT disorders, and main SRBD symptoms, *ie*, snoring, witnessed apneas, and daytime sleepiness. Snorers answered "sometimes" or "often" for the question on snoring, and nonsnorers answered "never" or "rarely." Stoppage of breathing while sleeping, labored breathing, hyperextended head during sleep, enuresis, and mouth breathing were considered to be present for any answer but "never." Other symptoms, such as nocturia, restless sleep, awakenings, excessive daytime sleepiness, headache, cognitive impairment, and behavior and temper alterations were considered to be present when subjects answered "sometimes" or "often."

Overnight Polygraphy

The overnight home polygraphy was performed using a portable ambulatory device (Apnoescreen II; Erich Jaeger GmbH & CoKG; Wuerzburg, Germany) with continuous monitoring of oronasal airflow (thermistor), chest and abdominal respiratory movements (thoracic and abdominal belts), arterial oxygen saturation (Sao_2; digital pulse oxymetry), heart rate (finger probe), ECG, body position (mercury sensor), and actigraphy (wristband with activity sensor). Tracheal sounds (microphone) were not registered. According to the characteristics of the device, data sampling was performed with a frequency of 128/s, and data were stored in a database every 0.5 s (LabManager V4.05; Erich Jaeger), which allowed the playback of 10-min sleep recordings. Analysis was carried out both automatically and manually.

The following parameters were assessed: respiratory event, defined as a decrease in oronasal airflow below a fixed threshold (established in a value of flow whose intensity corresponds to 35 bytes in the computer graphical scale) during ≥ 5 s; oxygen desaturation, defined as a drop ≥ 4% in Sao_2 during ≥ 8 s; cardiac event, defined as a change in heart rate of ≥ 10 beats/min over ≥ 10 s; and awakening, defined as ≥ 50% increase in the actigraphy curve. Cardiac events or awakenings were considered to be related to respiratory events and/or desaturations if they occurred simultaneously. Variables analyzed were total recording (sleep) time (TRT); total recording time in the supine position (TRTsp); Sao_2 baseline, obtained from the automatic analysis during the first minutes of recording; Sao_2 nadir (lowest value during TRT); percentage of TRT with Sao_2 < 90% (CT_{90}); oxygen desaturation index (ODI), number of oxygen desaturations per hour in the manual analysis; and respiratory disturbance index (RDI): automatic analysis RDI (RDIa), manual analysis RDI (RDIm), and time in the supine position RDI (RDIsp).

Statistical Analysis

All results are expressed as mean ± SD when appropriate. Differences in the frequency of clinical and polygraphic variables between snorers and nonsnorers were analyzed with the χ^2 test (with Fisher's Exact Test and Yates correction when necessary) and the unpaired two-tailed *t* test.

Results

Study Population

Of a total of 327 adolescents interviewed at schools, 136 subjects (42%) refused to participate in the study. Of the remaining 191 subjects, 90 subjects (27.5%) refused to undergo overnight polygraphy and completed a few items of the questionnaire. Therefore, the study population included 101 subjects (43 boys and 58 girls) with a mean age of 13.2 ± 0.8 years. Subjects who completed a few items of the questionnaire and subjects included in the study were similar in relation to the following variables: mean age (13.6 ± 0.7 years vs 13.2 ± 0.8 years), male/female ratio (47/43 vs 43/58), weight (64.6 ± 20.1 percentile vs 68.3 ± 27.6 percentile), and frequency of snorers (11% vs 15%), of apnea while sleeping (5.5% vs 3%), and of excessive daytime sleepiness (20% vs 14%).

Twenty-three of the 101 adolescents were obese. One subject was unable to answer the question of whether she snored or not. Of the remaining 100 subjects, 71 subjects were classified as nonsnorers and 29 as snorers. Fifteen subjects (14.8%) snored "often" and were considered habitual snorers. Anthropometric data, frequency of nocturnal and daytime clinical manifestations suggestive of SRBD, and polygraphic findings are shown in Tables 1 and 2. In 18 subjects (17.8%) there was an RDI (RDIm, RDIa, or RDIsp) ≥ 10. In 11 of these subjects, the RDIsp was the one > 10. In 2 of these 18 patients, the symptoms were suggestive of SRBD (snoring, witnessed sleep apneas, and excessive daytime sleepiness), with a prevalence of SRBD of 1.98%.

Snorers vs Nonsnorers

The snorer group included 29 subjects who answered "sometimes" (n = 14) or "often" (n = 15) to the question about snoring, and the nonsnorer group included 71 subjects who answered "never" (n = 62) or "rarely" (n = 9). Both groups were similar in relation to mean age, gender, and neck circumference. Snorers showed higher mean weight (72.1 ± 27.1 percentile) and percentage of obese subjects (27.6%) than nonsnorers (weight, 66.6 ± 28 percentile; obese, 21.4%), but differences were not statistically significant. The waist-to-hip ratio was significantly higher among snorers than among nonsnorers (0.82 ± 0.07 vs 0.77 ± 0.006, p = 0.002).

Table 1—*Frequency Distribution of Anthropometric Parameters and Symptoms of SRBD in 101 Adolescents

Variables	Data
Anthropometric parameters	
Age, yr	13.2 ± 0.8
12–13 yr	62
14–16 yr	39
Body mass index, kg/m^2	21.2 ± 3.8
Weight, percentile	68.3 ± 27.6
Neck circumference, cm	31.9 ± 3.6
Waist/hip index	0.79 ± 0.07
Obesity present	23 (22.7)
Nocturnal symptoms	
Snoring†	29 (28.7)
Sleep apneas‡	3 (2.9)
Nocturia†	23 (22.8)
Awakenings†	24 (23.7)
Enuresis‡	5 (4.9)
Restless sleep†	22 (21.8)
Labored breathing‡	18 (17.9)
Hyperextended head‡	11 (10.9)
Daytime symptoms	
Excessive sleepiness†	14 (13.9)
Headache†	14 (13.9)
Mouth breathing‡	55 (54.5)
Cognitive alteration†	61 (60.3)
Attitude alteration†	61 (60.3)
Temper alteration†	70 (69.3)

*Data are presented as mean ± SD or No. (%). Neck circumference was measured at the level of the cricothyroid membrane. Weight percentile was calculated according to the corresponding age and gender. Waist/hip index was calculated by dividing the waist circumference by the hip circumference. Obesity is weight > 95th weight percentile.

†Symptoms considered to be present if the subject admitted to having them "sometimes" or "often."

‡Symptoms considered to be present if the subject admitted to having them even if "rarely" so.

As shown in Figure 1, nocturnal symptoms suggestive of SRBD, except for enuresis, occurred more frequently in the snorer group, with statistically significant differences in the percentage of subjects with witnessed apneas (10.3% vs 0%, p = 0.036), nocturia (37.9% vs 16.9%, p = 0.024), sleep with neck extended (24.1% vs 5.6%, p = 0.016), and labored breathing (31% vs 12.6%, p = 0.019). With respect to daytime symptoms, only cognitive impairment (questions 23, 24, and 25 of the questionnaire [Table 4]) was significantly more frequent in snorers (75.8%) than in nonsnorers (53.5%; p = 0.039). The frequency of daytime sleepiness, headache, behavior dysfunction, and temper disorders was similar in both groups (Fig 2).

Oximetry data (Sa_{O_2} baseline, Sa_{O_2} nadir, CT_{90}, and ODI) were similar in snorers and in nonsnorers. However, significantly higher values of respiratory events (RDIa, RDIm, and RDIsp) were found

Table 2—*Polygraphic Findings in 101 Adolescents

Parameters	Data
TRT, min	546.3 ± 59.8 (424–758)
TRTsp, %	52.6 ± 18.4 (19.3–99.5)
Sa_{O_2} baseline, %	97 ± 0.6 (96–98)
Sa_{O_2} nadir, %	89.6 ± 3.7 (77–95)
CT_{90}, %	0.06 ± 0.1 (0–1)
ODI	1.1 ± 1.3 (0–8.5)
RDIm	2.7 ± 2.4 (0.1–15.2)
RDIsp	5.1 ± 4.8 (0.3–25.5)
RDIa	3.8 ± 2.3 (0–12.5)
Total cardiac events, No.	83.7 ± 41.6 (30–252)
Associated†	18.7 ± 14.2 (1–87)
Total awakenings, No.	14.1 ± 10.8 (0–52)
Associated‡	4.4 ± 4.08 (0–18)

*Data are presented as mean ± SD (range). Sa_{O_2} baseline = basal Sa_{O_2} (from the first recording minutes); Sa_{O_2} nadir = lowest value of Sa_{O_2} obtained during all TRT.

†Cardiac event concurrent with respiratory event and/or oxygen desaturation.

‡Awakening concurrent with respiratory event and/or oxygen desaturation.

among snorers. There were more respiratory events during the time spent in supine position (RDIsp) in both groups (Table 3).

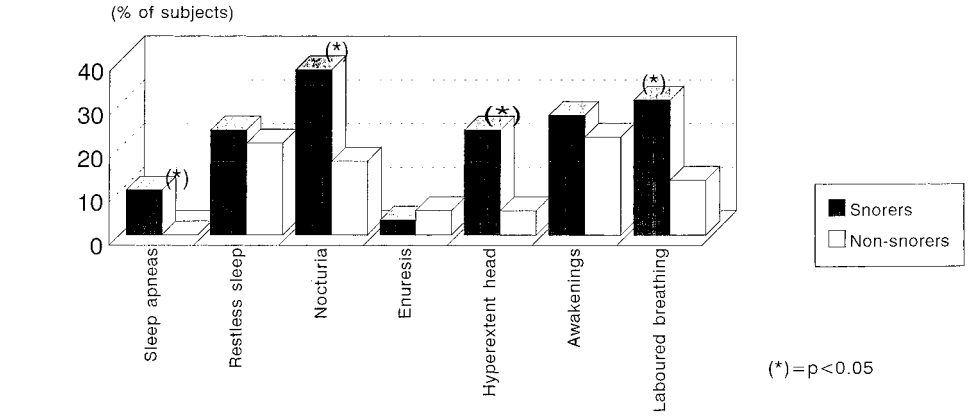
Discussion

Participation in the study was proposed to 327 subjects; 191 accepted (participation rate of 58.4%) and 101 were included (acceptance rate of 30.8%). In two population-based studies[12,13] in which only questionnaires were used for assessing the prevalence of snoring and SRBD, response rates of 65% and 97% were obtained. In two other studies[6,14] in which polysomnography was performed, acceptance rates of 26.6% and 43% were similar to ours. A selection bias in our study seems unlikely because anthropometric data and frequency of main symptoms suggestive of SRBD showed a similar distribution between subjects who took part in the study and those who did not.

In this group of 101 adolescents, we found that symptoms potentially associated with SRBD have a similar frequency to the one described for younger children. Snoring is associated with a higher frequency in other nocturnal symptoms and a more central pattern in body fat distribution. Although the oximetric parameters are similar in both groups, snorers have a higher number of respiratory events in polygraphy than nonsnorers do. In the whole group, we found only mild polygraphic abnormalities, but two cases (1.98%) of probable SRBD were detected.

With regard to methodologic aspects, the use of polysomnography in subsets considered at high risk for SRBD according to questionnaire scores[6,7] would have been inappropriate in our study since clinical features of SRBD in adolescence are unknown. For this reason, overnight polygraphy was performed in all subjects. The design of the questionnaire was similar to that used in other studies.[12,15,16] On the other hand, the tracheal sound recording of the Apnoescreen II polygraph has been technically unreliable in our experience, so that in the present study, as in the study by Corbo et al,[17] snoring was assessed from questionnaire answers. This was a limitation of this study, but we think that it is better to assess the frequency of snoring during some months or years by subjective means than to evaluate this symptom during a single night with a technique of doubtful reliability. In fact, the frequency of snoring is usually assessed from questionnaire answers.[18] Finally, the Apnoescreen II device is a cardiorespiratory polygraph designed for simplified home studies, and data on arousals or upper airway resistance cannot be obtained because neither neurophysiologic parameters nor intraesophageal pressure are recorded.

It has been shown that snoring is influenced by age. Studies in younger children reported a percentage of snorers between 10% and 15.3%, with 7.3% being habitual snorers.[13,19] The prevalence in adults is higher, between 4% and 29% in men and between 3% and 14% in women.[20] This study shows that the prevalence of snoring in the adolescent group is high (28.7%), although habitual snoring was detected in only 14.8% of subjects. Regarding the frequency of other nocturnal symptoms, it is difficult to compare our findings with results of other studies[21–23] in which younger children with suspected OSA were included. Snoring, witnessed apneas, labored breathing, and hyperextended head during sleep are main symptoms reported in children referred for assessment of SRBD.[21,23] Besides snoring, unspecific nocturnal symptoms were common in our series, which may be due to many causes other than SRBD. Sleep-related apneas were found in only 2.9% of subjects. This is a much lower percentage than that found in the polysomnographic study of Young et al[6] in adults, in which 9% of women and 24% of men fulfilled the minimal diagnostic criteria for the sleep apnea syndrome (an apnea-hypopnea score ≥ 5). That difference could be in part due to the fact that the majority of the adolescents sleep alone. In relation to daytime symptoms, cognitive impairment (learning disabilities) as well as temper alterations and abnormal behavior were commonly referred by adolescents and by their parents. It is not surprising that parents think that their adolescent sons and daughters show a lack of interest or are bad at paying



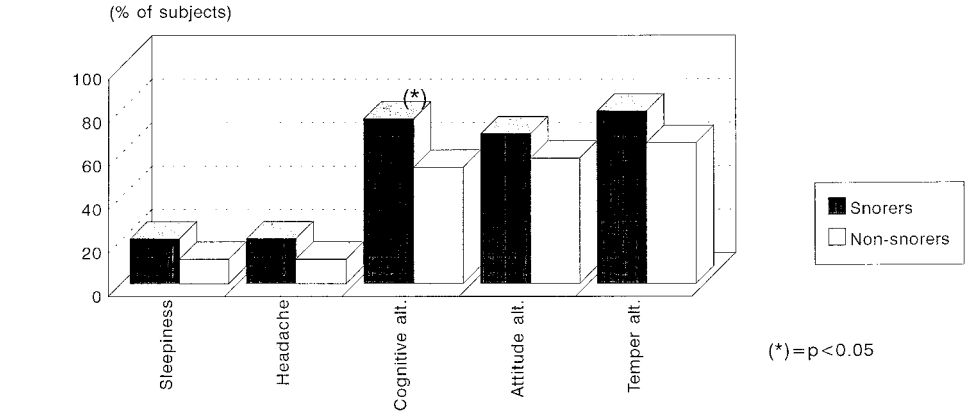
Snorers	10,3	24,1	37,9	3,4	24,1	27,5	31
Non-snorers	0	21,1	16,9	5,6	5,6	22,5	12,6

FIGURE 1. Frequency of nocturnal symptoms suggestive of SRBD in snorers (n = 29) and nonsnorers (n = 71). Results given as percentages.

attention (Table 4). On the other hand, daytime sleepiness was found in 14% of the subjects. It is known that adolescence delays the "sleep-on" setting in the biological clock with a trend to go to bed and to wake up late, which cannot be done with the scholarly timetable, and results in a cumulative sleep debt, leading to adolescent daytime sleepiness.[24] Daily mean sleep time was 8.5 ± 0.7 h, which may be insufficient at that age. Most of these subjects cannot take a nap except during the weekend. By contrast, daytime hyperactivity is particularly frequent in younger children with OSA syndrome.[25]

Polysomnography is the key diagnostic test for OSA. However, a full overnight polysomnography study is technically difficult and can be performed only by technicians in sleep laboratories. Other simplified methods have been suggested, especially for epidemiologic investigations.[26] Previous studies[16,27] of our group have demonstrated the usefulness of polygraphic findings with the Apnoescreen II equipment for reasonably excluding SRBD when results of the test are negative. Respiratory events were quantitated as episodes lasting ≥ 5 s instead of ≥ 10 s accepted for adults,[6,9] as we have previously observed that these shorter events can cause desaturations[23] and that they disappear from the polysomnographic recording after adenotonsillectomy in children with SRBD.[28] The clinical significance of short apneas has been also emphasized by others.[10]

Few data are available regarding normal respiratory parameters during sleep in healthy children and adolescents. Marcus et al[10] studied 32 nonobese children and 18 teenagers and recommended that more than one obstructive apnea of any length per



Snorers	20,6	20,6	75,8	68,9	79,3
Non-snorers	11,2	11,2	53,5	57,7	64,7

FIGURE 2. Frequency of daytime symptoms suggestive of SRBD in snorers (n = 29) and nonsnorers (n = 71). Results given as percentages.

Table 3—*Polygraphic Findings for Snorers and Nonsnorers

Parameters	Snorers (n = 29)	Nonsnorers (n = 71)	p Value
TRT, min	543.4 ± 50.2	548.3 ± 63.5	NS
TRTsp, %	47.3 ± 18.4	46.8 ± 17.5	NS
Sa_{O_2} baseline, %	96.6 ± 0.5	97.01 ± 0.6	NS
Sa_{O_2} nadir, %	89.7 ± 2.8	89.6 ± 4	NS
CT_{90}, %	0.04 ± 0.1	0.08 ± 0.1	NS
ODI	1.16 ± 1.5	1.22 ± 1.3	NS
RDIm	3.83 ± 3.1	2.22 ± 1.18	0.014
RDIsp	6.97 ± 5.1	4.37 ± 4.4	0.012
RDIa	5.13 ± 2.7	3.26 ± 1.9	0.002
Total cardiac events, No.	89.1 ± 41.8	83.2 ± 40.8	NS
Total awakenings, No.	13.4 ± 10.8	15 ± 10.7	NS
Associated awakenings, No.	4.03 ± 4.49	4.73 ± 3.91	NS

*Data are presented as mean ± SD. NS = no significant difference. See Table 2 for expansion of abbreviations not defined in text.

hour of sleep should be considered abnormal. In the study of Acebo et al,[29] in which 45 healthy and nonobese adolescents were included, normative values for the RDI were 1.3 ± 1.3 in boys and 1.1 ± 0.7 in girls. In the present study, the mean RDIm (2.7 ± 2.4) was slightly higher, probably because we studied a nonselected population, *ie*, not restricted to healthy nonobese adolescents, and because children were not included. In agreement with previous observations[30] in male adults, supine position worsens respiratory events in our series. Regarding Sa_{O_2} values, the lowest mean value during TRT was 89.6 ± 3.7%, which is lower than that reported by Marcus et al[10] perhaps due to differences in the study populations. Sa_{O_2} nadir ranged between 77% and 95%, with values < 80% in only two subjects. One of them was a snorer but had a history of asthma, and the other was a nonsnorer with no history of chronic respiratory disease and normal values in ODI and in CT_{90}, so that it may be interpreted as an isolated fall of Sa_{O_2}.

Young et al[6] found that 9% of female subjects and 24% of male subjects had an RDI ≥ 5, but when SRBD was diagnosed according to the apnea-hypopnea index together with daytime hypersomnolence, the prevalence decreased to 2% in women and 4% in men. In our series, 18 of the 101 subjects (17.8%) showed an RDI (RDIm, RDIa or RDIsp) ≥ 10, but in only 2 subjects were there clinical features highly suggestive of SRBD (snoring, apnea while sleeping, and excessive daytime sleepiness). Thus, the estimated prevalence of SRBD in our group of adolescents was 1.98%. These results are similar to SRBD prevalence rates of 2.9% in healthy children 6 months to 6 years old,[31] and between 0.7% and 1.1% in children from 4 to 5 years old.[7]

When the groups of snorers and nonsnorers were compared, differences in age in gender were not found. In contrast with adult SRBD with a clear predominance of snoring in men, in children there is an equal prevalence of affected boys and girls.[7,13,32] The fact that 62 of our subjects were < 14 years of age could explain the results since sexual development is usually not complete at this age. We also found a tendency for a higher weight percentile, neck circumference, and obesity in the snorer group. Although the difference between both groups did not achieve statistical significance, it is interesting to highlight it because the relationship between these anthropometric parameters and snoring has been previously established in adults.[33] With regard to waist-to-hip ratio, snorers had a significantly higher values than nonsnorers, which probably indicates the relationship between central obesity and snoring.[34,35] In the evaluation of SRBD-associated symptoms, it is important to consider that adolescents usually sleep alone, so nocturnal symptoms can go unnoticed except snoring. Anyway, in agreement with other reports,[23,36] symptoms more closely related to SRBD, such as apnea, hyperextended head, or labored breathing while sleeping, were more frequent in snorers than in nonsnorers. The frequency of excessive daytime sleepiness was almost double in snorers than in nonsnorers (20.6% vs 11.2%), although the difference was not statistically significant. This fact probably means that factors other than snoring also influence the level of somnolence, like the degree of delay of the biological clock. In younger children[7,37] and adults,[1] the frequency of sleepiness was higher in snorers than in nonsnorers. In the present study, cognitive impairment (learning or concentrating problems) was also more frequently found in the snorer group than among nonsnorers, which agrees with the fact that snoring has been associated with a worsening of both the emotional situation and the cognitive sphere.[12]

As it has been previously discussed, both groups did not shown differences in any of the oximetry

Table 4—*Symptomatology Associated With SRBD

Symptoms	Responses
Nocturnal	
1 Does he/she snore?	Do not know, never, rarely, sometimes, often
Only in supine position?	Yes, no
Intensity?	Slight, moderate, high, years ago
2 Does he/she stop breathing while sleeping?	Do not know, never, rarely, sometimes, often, years ago
3 Has he/she had awakenings at night?	Do not know, never, rarely, sometimes, often
With shortness of breath?	Yes, no
With whistle?	Yes, no
With acidity?	Yes, no
4 Does he/she move his/her arms and legs while asleep?	Do not know, never, rarely, sometimes, often
5 Has he/she had nocturnal profuse sweating?	Do not know, never, rarely, sometimes, often
6 Has he/she had restless sleep?	Do not know, never, rarely, sometimes, often
7 Has he/she had labored breathing while asleep?	Do not know, rarely, sometimes, often
8 Does he/she have head hyperextended while asleep?	Do not know, never, rarely, sometimes, often
9 Does it get worse with respiratory infections?	Do not know, never, rarely, sometimes, often
10 Does he/she get up at night to urinate?	Do not know, never, rarely, sometimes, often
No. of times a night?	_____
11 Does he/she unwillingly urinate in bed?	Do not know, never, rarely, sometimes, often
12 Is he/she a sleepwalker?	Do not know, never, rarely, sometimes, often
13 Does he/she rub teeth while sleeping?	Do not know, never, rarely, sometimes, often
14 Has he/she had nightmares?	Do not know, never, rarely, sometimes, often
Daytime	
15 Does he/she complain about sleepiness?	Do not know, never, rarely, sometimes, often, years ago
Sleepiness?	Slight, moderate, severe
16 How many hours does he/she sleep per night?	_____
Does he/she sleep naps?	No, yes (No. of hours ____; days/week ____)
17 If he/she sleeps <6 h/night, why?	_____
18 Has he/she had a headache when getting up or at night?	Do not know, never, rarely, sometimes, often
19 Has he/she usually had mouth breathing?	Do not know, never, rarely, sometimes, often
20 Has he/she had throat disturbances?	Do not know, never, rarely, sometimes, often
What kind?	_____
21 Is he/she excessively active?	Do not know, no, yes
22 Does he/she generally show lack of interest?	Do not know, no, yes
23 Does he/she forget things?	Do not know, never, rarely, sometimes, often
24 Is he/she bad at concentrating or paying attention?	Do not know, never, rarely, sometimes, often
25 Has he/she had difficulties in learning?	Do not know, never, rarely, sometimes, often
26 Has he/she had difficulties in interaction with others?	Do not know, never, rarely, sometimes, often
27 Does he/she get angry easily or without reason?	Do not know, never, rarely, sometimes, often
28 Has he/she had sudden sleep attacks?	Do not know, never, rarely, sometimes, often
29 Has he/she felt paralyzed when waking up?	Do not know, never, rarely, sometimes, often
30 Has he/she had hallucinations when waking up?	Do not know, never, rarely, sometimes, often
31 Does he/she complaint about sudden loss of strength (legs)?	Do not know, never, rarely, sometimes, often

*Never = 0 times; rarely = once a week or less; sometimes = twice a week; often = three or more times a week; slight sleepiness = in passive situations at home (watch TV, read, study); moderate sleepiness = in passive situations outside their house (cinema, in class); severe sleepiness = in active situations (talking, eating, standing up).

parameters, but snorers had a higher values of RDI indexes. However, even in the snorer group, these values are still within the normal range established by Acebo et al,[29] who obtained a mean RDI of 1.3 (SD, 1.3), which means that the upper limit would be 3.9, and our average RDI for the snorers was 3.8.

In summary, in a nonselected group of healthy adolescents between 12 years and 16 years old, symptoms potentially associated with SRBD showed a similar frequency to that reported for younger children. Snoring was associated with a higher occurrence of other nocturnal symptoms, a more central pattern of body fat distribution, and a higher RDI as compared with nonsnorers. Although polygraphic abnormalities were mild, two cases of probable SRBD were found with a prevalence rate of 1.9%.

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