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ORIGINAL ARTICLE

Prevalence of sleep-related breathing disorders among school children in Kars Turkey

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Abstract Sleep-related breathing disorders (SRBDs) are highly prevalent and gradually increasing in school-aged children due to technological and social "jetlag" worldwide. This study aimed to determine the prevalence and associated factors of SRBDs among school children in Kars, Turkey. A total of 1,421 school-aged children (6–13 years old) were included. SRBDs were evaluated with the Pediatric Sleep Questionnaire (PSQ). This study also examined the children's socio-demographic characteristics and their relationships with SRBDs. The prevalence of SRBDs was 17.2%. The study group's mean age was 9.37 ± 1.91 years, and 54.2% were girls. There was a significant relationship between "positive" (≥0.33) PSQ results and low educational levels of the parents, household smoking, frequent infections, chronic diseases, poor relationships with friends and teachers, and academic success. A strong relationship was found between academic success and snoring, breathing problems, attention deficit/hyperactivity disorder, nocturnal enuresis, morning headaches, delayed growth, and parental obesity. The SRBDs risk was 1.504-fold higher in boys than in girls. The risk of SRBDs with frequent infections was 1.921-fold higher than without frequent infections. Chronic diseases were associated with a 2.212-fold increase in the risk of SRBDs. SRBDs increased the risk of poor academic success by 4.673 fold (1/0.214). This was the first study conducted with school children in this region. We believe it is important to evaluate the prevalence and associated factors of SRBDs in school-aged children because of their effects on academic success, especially in developing parts of Turkey that require well-educated human resources more than the developed areas.

Keywords Children · Pediatric sleep questionnaire · Prevalence · Sleep-related breathing disorders.

Introduction

Sleep is one of the most important necessities for healthy living in every age group. Sleep disorders affect one's ability to sleep well and can range from sleep movement disorders to insomnia, hypersomnia, sleep-related breathing disorders (SRBDs), sleep-wake disorders, and parasomnias [1]. The prevalence of sleep problems has ranged from 12 to 40% in previous studies [2–4]. Various types of sleep problems are common in pre-school and school-aged children [5, 6]. SRBDs are one of these problems that are common in both children and adults worldwide. Sleep problems during childhood have negative consequences on health and academic success. There are strong associations between sleep disorders and concentration. Several studies have demonstrated that persistent sleep problems in children may cause and exacerbate somatic, cognitive, and psychiatric problems [5, 7]. It is well known that inadequate sleep impairs a child's learning capacity. Poor school performance and impaired neurocognitive skills have also been reported in school-aged children who experience sleep disturbances [1, 7, 8]. Recently, it has been shown that children who sleep one hour less than the average may be at risk of conduct problems [9]. Besides neurocognitive skills, sleep disorders are strongly associated with asthma, obesity, anxiety/depression, behavioral problems, and poor

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mental and psychological health [10–12]. Persistent and incident sleep problems have predicted the poorest health-related quality of life, behavior, language, and learning scores, whereas the ability to resolve problems have shown intermediate outcomes [13]. Eckerberg et al. reported that wellbeing and negative daytime behaviors were improved when night awakenings were solved [14]. The objectives of this study were to determine the prevalence of SRBDs and associated factors among school-aged children in a developing province in Turkey [15].

Materials and methods

Setting

This study was conducted in six different elementary schools in the Kars Province of Turkey.

Sample size

There are 41 elementary schools (for children aged 6–13 years) in Kars. The total number of children in all elementary schools in the Kars Province were 11,553 according to the Turkey Statistic Institute in 2013 (the universe of the study) [15]. Using the Epi Info Statcalc package 2000, the sample size was calculated as 768 for a 95% cluster interval, a 25% observation frequency, a 10% deviation (sample error), and a 20% backup. The sample size was not limited to 768 and reached 1421 participants for an increased power in this study. The sample size was divided among six schools. In this study, non-random, convenience sampling was used because of the homogeneity of the study universe [15].

Design of study

This cross-sectional survey was conducted in the educational year of 2015 to 2016 and examined 1,421 children (6–13 years old) in six different schools. The Kafkas University Medical Faculty Ethics Committee (Protocol Number: 80576354-050-99/77) and the Regional Director of Education in the Kars Province approved the study and all participants provided their verbal informed consent. Prior to this study, an educational seminar program concerning sleep disorders was organized by the researchers at the schools. Parents and children attended this seminar. Pediatric Sleep Questionnaires (PSQs) were used to determine SRBDs. It has been reported that the PSQ can be administered to parents of children aged 2–18 years [16]. The participants were examined in eight main categories [snoring, breathing problems, daytime sleepiness, attention deficit/hyperactivity disorder (ADHD), nocturnal enuresis, morning headache, delayed growth, and obesity]. Parents answered the PSQ and socio-demographic data form. Data were also collected through the teachers.

Scoring method of the scale

The PSQ consists of 22 items [16]. Responses to the items are yes, no, and I don't know, which are scored as 1, 0, and missing (0), respectively. The total PSQ score is calculated by dividing the sum of the scores by 22 (the number of items). The cutoff value is 0.33 [17]. The score interpretation was $\geq$0.33 indicating a positive PSQ, and $\leq$0.32 indicating a negative PSQ. For comparisons, the results were dichotomized as "positive" and "negative." The PSQ was translated into Turkish and analyzed for its validity and reliability in 2011 [17].

Socio-demographic characteristics

We used 14 items to evaluate socio-demographic characteristics of the participants. These items included age, gender, mother's education level, father's education level, mother's work, father's work (these questions were asked to understand the family's economic level indirectly because of the children's sensitivity), number of siblings, household smoking, frequency of infection, chronic diseases, relationship with friends, relationship with teachers, academic success, and parents reported obesity problems of their children. These were mostly closed-ended (yes or no) socio-demographic data. Parents also completed the demographic data form. Age groups were dichotomized as 8 and younger (6–8 years) and 9 and older (9–13 years) according to the participants' mean age (mean: 9.37 ± 1.91 years). The number of siblings were evaluated as continuous data and dichotomized as $\leq$2 and $\geq$3 in accordance with the mean number of siblings (mean 2.83 ± 1.29). Parents' education levels were classified as middle school and lower or high school and higher. Social integrity was assessed by "good relationships with friends and teachers" and dichotomized as either yes or no. The academic success was evaluated due to parental comments as "good" or "not good." Parents also reported on their children's obesity problems, and the weight and height measurements were determined to calculate the body mass index (BMI).

BMI

The BMI was classified according to the World Health Organization guidelines in five categories: underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), preobese (overweight; 25–29.9 kg/m^2), obesity class I (moderate obesity; 30–34.9 kg/m^2), and obesity class II (severe

obesity; ≥35 kg/m^2). For comparisons, BMI was classified as non-obese (≤29.9 kg/m^2) and obese (≥30.0 kg/m^2) [18].

Statistical analysis

SPSS 23.0 (University of Kafkas, IP number: 194.27.41.6) software was used for the data analysis. The percentage distributions, frequencies, arithmetic means, and standard deviations (SD) were examined as descriptive statistics. The characteristics of the participants were described by means and SD or frequencies and percentages according to the type of variable (continuous or categorical variable, respectively). Pearson's chi-squared and Fisher's exact tests were used to compare variables. Logistic regression analysis was used to identify independent variables affecting the SRBDs. The data were adjusted to age and gender. The Hosmer–Lemeshow test was used for measures of the fit of the data for logistic regression analysis and the Omnibus test was used for determining the significance of model coefficients. The odds ratio (OR) values were calculated between the categorical variables for risk evaluation; the 95% confidence interval (CI) of the OR values were also determined. The threshold for statistical significance was set at $p < 0.05$.

Results

The prevalence of SRBDs was 17.2% in the study group. The study group's age ranged from 6 to 13 years (mean: 9.37 ± 1.91 years; 54.2% girls). The frequencies of SRBDs according to age and gender are summarized in Table 1. The percentage of SRBDs according to various characteristics in children 6–13 years of age were 8.0% usually snore, 3.7% always snore, 4.6% snore loudly, 7.0% had heavy breathing, 6.1% had trouble breathing, 2.0% had witnessed apnea, 25.8% had their mouth open during the day, 36.3% had dry mouth on awakening, 5.1% had nocturnal enuresis, 35.7% were not refreshed in the morning, 13.7% had problems with sleepiness, 3.1% were sleepy per the teacher, 28.6% were hard to wake up, 22.0% did not listen, 15.4% had difficulty organizing, 42.4% were easily distracted, 32.8% fidget, 27.6% were on the go, 27.8% interrupt, 7.6% had morning headache, and 9.4% had delayed growth. According to the BMI levels, 2.4% were obese in this study group.

The frequency and distribution results of the sociodemographic characteristics are summarized in first two columns of Table 2. The mean PSQ was 15.98 ± 14.35 (min: 0, max: 72). The mean number of siblings was 2.83 ± 1.29 (min: 1, max: 9). The parents' education level of more than high school was 44.6% in mothers and 60.0% in fathers. The parents who were working included 24.1% of mothers and 94.3% of fathers. The ratio of household smoking was 38%. There were 14.2% of the children who had frequent infections. The percentage of chronic diseases was 8.3% among the children. Parent-reported academic success was 93.9%, a good relationship with friends was 96.8%, and a good relationship with teachers was 97.9%. According to the parents, 5.8% of children were obese in this study group.

A significant relationship was found between gender and "positive" results for the PSQ. The PSQ scores were significantly higher in boys. There was a significant relationship between age groups and positive PSQ results. PSQ scores were also significantly higher in the older age group (9–13 years). There was no significant relationship between age groups and the frequency of snoring. Loud snoring was significantly more common in the older age group. No significant relationship was identified between age groups and heavy breathing, witnessed apnea, and open-mouth breathing during the day. The characteristics of trouble breathing, dry mouth on awakening, difficulty organizing, fidgets, on the go, interrupts, enuresis, and morning headache

Table 1 Frequency of sleep-related breathing disorders according to age and gender

SRBDs[a] $n = 1421$ (participant)	SRBDs[a] n, %	Age n[b]		Gender n[c]	
		6–8	9–13	Girl	Boy
Usually snores	$n = 113$, 8.0%	43	70	48	65
Always snores	$n = 53$, 3.7%	18	35	27	26
Snores loudly	$n = 65$, 4.6%	31	34	32	33
Heavy breathing	$n = 100$, 7.0%	31	69	44	56
Trouble breathing	$n = 87$, 6.1%	23	64	47	40
Witnessed apnea	$n = 28$, 2.0%	10	18	14	14
Month open during day	$n = 367$, 25.8%	124	243	184	183
Dry month on awakening	$n = 515$, 36.3%	163	352	281	234
Not refreshed in morning	$n = 506$, 35.7%	123	383	298	208
Problem with	$n = 195$, 13.7%	38	157	118	77
Sleepy per teacher	$n = 44$, 3.1%	9	35	17	27
Hard to wake up	$n = 406$, 28.6%	101	305	223	183
Does not listen	$n = 313$, 22.0%	114	199	151	162
Difficulty organizing	$n = 218$, 15.4%	89	129	102	116
Easily distracted	$n = 601$, 42.4%	216	385	312	290
On the go	$n = 392$, 32.8%	153	239	159	233
Fidgets	$n = 485$, 27.6%	187	278	215	251
Interrupt	$n = 392$, 27.8%	153	239	159	233
Nocturnal enuresis	$n = 73$, 5.1%	40	33	37	36
Morning headache	$n = 108$, 7.6%	29	79	70	38
Delayed growth	$n = 133$, 9.4%	49	84	62	71
Parents reported obesity	$n = 82$, 5.8%	20	62	34	48

[a] Sleep-Related Breathing Disorders (n: frequency; %: percentage)

[b] Age was dichotomized as 6–8 and 9–13

[c] Gender was classified as girl and boy

Table 2 Socio-demographic characteristics of the participants and their relationship with PSQ Scores

Characteristic	*n* (1421)	%	Min	Max	Mean	SD	*p* (PSQ)
Age							
6–8	504	35.5	6	13	9.37	±1.91	**0.018**
9–13	917	65.5					
Gender							
Girl	770	54.2					**0.001**
Boy	651	45.8					
Mother's education level							
Middle school&↓	788	55.5					**0.001**
High school&↑	633	45.5					
Father's education level							
Middle school&↓	569	40.0					**0.001**
High school&↑	852	60.0					
Mother's work							
Yes	342	24.1					0.116
No	1079	75.9					
Father's work							
Yes	1340	94.3					**0.027**
No	81	5.7					
Number of siblings							
≤2	610	42.9	1	9	2.83	±1.29	0.107
≥3	811	57.1					
Household smoking							
Yes	540	62.0					**0.003**
No	881	38.0					
Frequency of infection							
Yes	202	85.8					**<0.0001**
No	1219	14.2					
Chronic diseases							
Yes	118	91.7					**<0.0001**
No	1303	8.3					
Relationship with friends							
Yes (good)	1375	96.8					**<0.0001**
No (not good)	46	3.2					
Relationship with teachers							
Yes (good)	1391	97.9					**<0.0001**
No (not good)	30	2.1					
Academic success							
Good	1335	93.9					**<0.0001**
Not good	86	6.1					
BMI							
≤29	1387	97.6					0.113
≥30	34	2.4					

Bold values indicates $p < 0.05$

PSQ Scores: ≥0.33 "positive" results, ≤0.32: "negative" results. The mean PSQ: 15.98 ± 14.35 (min:0, max:72)

n frequency, % percentage, *SD* standard deviation, *p* level of significance, Data are shown as mean ± 1 SD

were significantly higher in the younger age group. The characteristics of not refreshed in the morning, sleepiness, sleepy per teacher, hard to wake up, and obesity were more common in the older age group. Significant findings are presented in the last column of Table 2.

We examined the study group with regard to gender and found a significant difference between boys and those in

the usually snores category. There were no significant relationships between gender and the always snores and snores loudly categories. The heavy breathing category was significantly higher in boys. No significant relationships were observed between gender and the trouble breathing and observed apnea categories. There was a significant relationship between boys and the mouth open during the day category. There was no significant relationship between gender and dry mouth on awakening. A significant relationship was found between girls and the not refreshed in the morning and problem with sleepiness categories. We observed a significant relationship between boys and being sleepy per the teacher. No significant relationship was identified between gender and being hard to wake up. There were significant differences between boys and the does not listen, difficulty organizing, fidgets, on the go, and interrupt categories. There was a difference that was close to being significant between boys and the easily distracted characteristic ($p = 0.070$). No significant relationship was identified between gender and enuresis. However, a significant relationship was found between girls and morning headache. A significant relationship was also identified between boys and delayed growth and obesity (Table 2).

The positive PSQ score ratio was 17.2%. The results also identified a significant relationship between the "less education level of parents" (both mother and father) and positive PSQ scores of the children. There were no significant relationships between the PSQ score and sibling number or obesity. A significant relationship was observed between a positive PSQ score and household smoking, frequent infections, chronic diseases, not having good relationships with friends and teachers, and not having good academic success (Table 2). The relationships between SRBDs and socio-demographic characteristics are presented extensively in Table 3. To refrain from repetition, the only important point here is the strong relationship identified between academic success and the categories of snoring and breathing problems, ADHD, nocturnal enuresis, morning headache, delayed growth, and parental-reported obesity. The Omnibus test showed that the model coefficients were statistically significant ($p < 0.0001$). The Hosmer–Lemeshow test showed a data goodness of fit for the logistic regression analysis ($p > 0.05$) (Table 4). In the logistic regression analysis results, we observed a significant relationship between SRBDs and the characteristics of gender, frequent infections, chronic diseases, and academic success (Table 5). The exponentials of the other independent variables were not significant according to the logistic regression analysis. The SRBDs risks were 1.504-fold (95% CI 1.120–2.020) higher in boys than girls. The risk of SRBDs with frequent infections was 1.921-fold (95% CI 1.306–2.827) higher than having no frequent infections. Chronic diseases increased the risk of SRBDs 2.212-fold (95% CI 1.413–3.464). SRBDs increased the risk of not having good academic success by 4.673-fold (1/0.214) (95% CI, 95% 0.126–0.361) higher. The risks and 95% CI of SRBDs with gender, frequent infections, chronic diseases, and academic success are shown in Table 5.

Discussion

The prevalence of SRBDs according to the PSQ was relatively low among school-aged children in the Kars Province of Turkey. In studies from different parts of the world, prevalence rates of sleep disorders range from 12 to 40% in the pediatric population [2–4]. This variation could be due to different methods used in the studies for determining sleep disorders or sample size. In a recent study, the authors reported that the prevalence of sleep disorders in Thai children is very high [19]. In a study from Norway, the prevalence of sleep disorders in preschoolers was reported to be 19.2% [6]. The prevalence of sleep disorders has been reported at between 30 and 40% in Germany [20]. Furthermore, almost 25% of all children have reported some form of sleep disorder during childhood [21]. Previous studies have demonstrated that frequent infections, asthma, and allergy were important risk factors for SRBDs [22, 23]. Consistent with these studies, the results of the current study showed an association between frequent infections and SRBDs. In our study, we found that boys had a higher prevalence of SRBDs than girls. This is similar to previous reports [19, 24]. The most striking relationship in the current study was observed between low academic success and ADHD, snoring, breathing problems, and nocturnal enuresis; these results are consistent with previous studies [25–27]. A strong association has been reported between obesity and sleep-related disorders in several studies [28, 29]. However, no relationship was observed between BMI and PSQ scores in our study. Similarly, in a recent study, the authors reported no significant effects of obesity on SRBDs [30]. The purpose of the current study was to establish the prevalence of SRBDs and identify associations between SRBD and socio-demographic factors. Interestingly, we observed that almost all socio-demographic characteristics investigated in this study, except for the number of siblings, were associated with positive PSQ scores. Only 22.8% of the families in this study were identified as being at a good economic level, and we observed a strong relationship between the family economic level and ADHD in the participants. Also, we observed a significant relationship between parents' low education levels and ADHD symptoms. No previous studies have reported any relationships with the parents' economic or educational levels and ADHD symptoms of children. The PQS scores were higher in boys and older age groups in our study.

Table 3 Sleep-related breathing disorders and their relationship with socio-demographic characteristics

Characteristic	Age	Gender	MEL[a]	FEL[a]	EL[a]	NS[a]	HS[a]	FI[a]	CD[a]	RWF[a]	RWT[a]	AS[a]	BMI[a]
	p	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*
SRBDs[a]													
Usually snores	0.310	**0.006**	0.170	**0.021**	0.477	0.345	0.095	**<0.001**	**0.020**	0.495	0.432	**0.002**	0.127
Always snores	0.469	0.365	0.277	0.111	0.430	0.309	0.166	**0.005**	**0.003**	0.481	0.309	**0.037**	0.385
Snores loudly	**0.026**	0.244	0.345	0.079	0.349	**0.026**	0.316	**0.001**	**0.015**	0.648	0.154	**0.004**	0.066
Heavy breathing	0.194	**0.022**	**0.006**	**0.002**	0.140	0.534	**0.013**	**<0.001**	**0.006**	0.099	0.355	**0.014**	**0.002**
Trouble breathing	**0.042**	0.531	**0.032**	**0.026**	0.188	0.341	0.216	**<0.001**	**0.001**	0.057	0.106	**0.005**	0.052
Witnessed apneas	0.562	0.397	0.357	0.305	0.168	0.282	0.030	0.090	0.076	0.606	0.547	0.171	0.504
Month open during day	0.233	**0.040**	0.056	**0.003**	**0.049**	0.194	0.130	0.136	0.094	0.183	0.125	0.006	0.243
Dry month on awakening	**0.012**	0.430	**<0.001**	**<0.001**	**0.001**	**0.011**	**<0.001**	**0.001**	**0.002**	0.068	**0.006**	**<0.001**	0.388
Not refreshed in the morning	**<0.001**	**0.006**	**<0.001**	**<0.001**	**0.021**	**0.002**	**0.009**	**0.008**	**0.001**	**0.015**	0.074	0.089	0.281
Problem with sleepiness	**<0.001**	**0.034**	**0.027**	**0.008**	0.176	**0.019**	**0.005**	0.147	**0.003**	0.088	0.221	0.399	0.320
Sleepy per teacher	**0.022**	**0.026**	0.490	0.367	0.184	0.422	0.090	0.438	**0.008**	0.579	0.385	0.122	0.716
Hard to wake up	**<0.001**	0.384	**0.035**	**0.012**	**0.253**	**0.030**	**0.004**	0.096	0.274	**0.004**	0.212	0.074	0.522
Does not listen	0.373	**0.010**	**<0.001**	**0.003**	**0.001**	0.342	**0.002**	**0.003**	**0.005**	**<0.001**	**0.001**	**0.001**	**0.022**
Difficulty organizing	**0.045**	**0.011**	**<0.001**	**0.016**	**0.001**	0.391	**0.002**	**0.016**	**<0.001**	**0.001**	**<0.001**	**0.001**	0.137
Easily distracted	0.403	0.070	**0.007**	0.313	**<0.001**	0.329	**0.011**	**<0.001**	**0.004**	**0.001**	**0.002**	**0.001**	0.483
Fidgets (fidgetiness)	**0.006**	**<0.001**	0.414	0.241	0.069	**0.004**	**0.022**	**0.002**	**0.024**	**0.004**	**0.015**	**<0.001**	0.109
On the go (restlessness)	**0.049**	**<0.001**	**<0.001**	**0.001**	**<0.001**	0.416	**0.049**	0.069	**0.046**	0.267	**0.007**	**<0.001**	0.115
Interrupt (others)	**0.049**	**<0.001**	**<0.001**	**0.001**	**<0.001**	0.416	**0.049**	0.069	**0.046**	0.267	**0.007**	**<0.001**	0.115
Nocturnal enuresis	**<0.001**	0.309	0.166	0.122	**<0.001**	**0.024**	0.076	0.082	**0.014**	0.083	0.197	**0.010**	0.470
Morning headache	**0.031**	**0.013**	**0.001**	**<0.001**	0.160	0.082	**0.016**	**0.001**	**<0.001**	**0.020**	0.189	**0.025**	0.110
Delayed growth	0.400	**0.040**	**0.001**	**<0.001**	**0.007**	**0.002**	0.228	**0.002**	**<0.001**	**0.001**	**0.017**	**0.00**	0.368
Parents reported obesity	**0.018**	**0.012**	0.128	0.296	0.192	0.224	0.106	0.108	**0.034**	**0.045**	0.475	**0.022**	**<0.001**

Bold values indicates $p < 0.05$

[a]*SRBDs* sleep-related breathing disorders, *MEL* mother's education level, *FEL* father's education level, *EL* economic level, *NS* number of siblings, *HS* household smoking, *FI* frequency of infection, *CD* chronic diseases, *RWF* relationship with friends, *RWT* relationship with teachers, *AS* academic success, *BMI* Body Mass Index

Table 4 Results of Omnibus and Hosmer–Lemeshow tests

Dependent variables	Independent variables	−2 Log-likelihood	Chi-square $\chi 2$	Omnibus p
SRBDs (No: 0, Yes: 1)	Age	1181.711	139.138	**0.000*****
	Gender			
	Mother education			
	Father education			
	Number of siblings			
	Economic level			
	BMI			
	Household smoking			
	Frequent infection			
	Chronic diseases			
	Academic success			
	Relationship with friends			
	Relationship with teachers			
Hosmer–Lemeshow	$\chi 2$ (Chi-square)	*df*		*p*
	11.839	**8**		**0.159**

Bold values indicates $p < 0.05$

df degree of freedom

Table 5 Logistic regression analysis between the socio-demographic characteristics and sleep-related breathing disorders

Socio-demographic characteristics	Exp (*B*)	*B*	SD standard deviation	*p*	95% confidence interval	
					Minimum	Maximum
Constant (9–13)[a]	2.412	0.881	0.573	0.125	–	–
Age (9–13)[a]	1.304	0.266	0.161	0.100	0.951	1.789
Gender (boy)	**1.504**	0.408	0.150	**0.007**[a]	1.120	2.020
Mother's education (HS&↑)	0,702	−0.354	0.202	0.080	0.472	1.043
Father's education (HS&↑)	0.733	−0.310	0.183	0.090	0.513	1.049
Economic level (Good)	0.830	−0.186	0.526	0.723	0.296	2.325
Number of siblings (≥ 3)	0.284	−1.259	1.406	0.370	0.018	4.465
BMI (≥ 30)	1.416	0.348	0.426	0.415	0.614	3.266
Household smoking (yes)	1,278	0.245	0.152	0.107	0.948	1.722
Frequent infection (yes)	**1.921**	0.653	0.197	**0.001**[a]	1,306	2.827
Chronic diseases (yes)	**2.212**	0.794	0.229	**0.001**[a]	1.413	3.464
Academic success (good)	**0.214**	**−1.543**	0.268	**0.000**[a]	0.126	0.361
Relationship with friends (good)	0.507	−0.680	0.399	0.088	0.232	1.107
Relationship with teachers (good)	0.639	−0.448	0.522	0.391	0.229	1.779

Bold values indicates $p < 0.05$

[a]The data were adjusted to age and gender, Education level including high school and more

These results are consistent with previous studies [2, 3]. In another study from Turkey, the authors also reported that sleep disorders in men are more prevalent than in women in the adult population [31]. In our study, a significant relationship was found between the PSQ scores and household smoking. This result was not a surprise. The associations between household smoking and sleep-disordered breathing have been reported in previous studies [24, 32]. In the current study, SRBDs were defined with the PSQ without using any objective measures like polysomnography. This is one of the limitations of our study. Another limitation is the subjective measurement of certain characteristics such as academic success and the relationships with teachers and friends. We noticed that almost all parents answered this question as "good," which is doubtful. The sample of this study is limited to a certain area, not random sampling.

Therefore, it can be said that the sample's national representation is poor. The authors state that a major limitation of the present paper is the setting of the local area and non-random sampling. The power of this study was its broad sample size. This work is the first study conducted in this geographical region. The current study was also targeted to increase the awareness about the importance of sleep disorders in the population, especially in parents who are responsible for the growth of a healthy generation. However, this can be achieved provided that such a training with the parents would encourage practicing good sleep hygiene and support this behavior with their children. Because of its impact on the academic performance of children, good sleep behavior must be acquired at an early age. Parents must be careful with technological and industrial advances including social media and computer games, which could impair good sleep hygiene in their children. For productivity and health of the next generation, it is important to remember that good sleep can increase children's academic success, but insufficient or fragmented sleep may impair the physical and mental health of children [11, 33]. Unfortunately, sleep disturbances are often ignored among medical practitioners and do not receive the attention they deserve in Turkey, as with other countries [4]. The current study provides data-based evidence for practitioners and health care services. It is expected that our findings will enhance the awareness of the need for sufficient (good) sleep for living healthy lives among individuals, societies, and health care providers.

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Compliance with ethical standards

Conflict of interest Hülya Çakmur declares that she has no conflict of interest. Sadık Ardıç declares that he has no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study.

References

1. Moturi S, Avis K. Assessment and treatment of common pediatric sleep disorders. Psychiatry (Edgmont) 2010;7:24–37.
2. Mindell JA, Meltzer LJ. Behavioural sleep disorders in children and adolescents. Ann Acad Med Singapore. 2008;37:722–28.
3. Alfano CA, Zakem AH Costa NM, Taylor LK, Weems CF. Sleep problems and their relation to cognitive factors, anxiety, and depressive symptoms in children and adolescents. Depress Anxiety. 2009;26:503–12.
4. Blunden S, Lushington K, Lorenzen B, Ooi T, Fung F, Kennedy D. Are sleep problems under-recognised in general practice? Arch Dis Child. 2004;89:708–12.
5. Simola P, Laitalainen E, Liukkonen K, Virkkula P, Kirjavainen T, Pitkäranta A, Aronen ET. Sleep disturbances in a community sample from preschool to school age. Child Care Health Dev. 2012;38:572–80.
6. Steinsbekk S, Berg-Nielsen TS, Wichstrøm L. Sleep disorders in preschoolers: prevalence and comorbidity with psychiatric symptoms. J Dev Behav Pediatr. 2013;34:633–41.
7. Ravid S, Afek I, Suraiya S, Shahar E, Pillar G. Sleep disturbances are associated with reduced school achievements in first-grade pupils. Dev Neuropsychol. 2009;34:574–87.
8. Wilhelm I, Diekelmann S, Born J. Sleep in children improves memory performance on declarative but not procedural tasks. Learn Mem. 2008;15:373–77.
9. Holley S, Hill CM, Stevenson J. An hour less sleep is a risk factor for childhood conduct problems. Child Care Health Dev. 2011;37:563–70.
10. Calhoun SL, Vgontzas AN, Fernandez-Mendoza J, Mayes SD, Tsaoussoglou M, Maria Basta BS, Bixler EO. Prevalence and risk factors of excessive daytime sleepiness in a community sample of young children: the role of obesity, asthma, anxiety/depression, and sleep. Sleep. 2011;34:503–7.
11. Turnbull K, Reid GJ, Morton JB. Behavioral sleep problems and their potential impact on developing executive function in children. Sleep. 2013;36:1077–84.
12. Fauroux B, Aubertin G, Clément A. What's new in paediatric sleep in 2007? Paediatr Respir Rev. 2008;9:139–43.
13. Quach J, Hiscock H, Canterford L, Wake M. Outcomes of child sleep problems over the school-transition period: Australian population longitudinal study. Pediatrics. 2009;123:1287–92.
14. Eckerberg B. Treatment of sleep problems in families with young children: effects of treatment on family well-being. Acta Paediatr. 2004;93:126–34.
15. TurkStat. Turkish Statistical Institute, Statistics of Demography (in Turkish) (cited 2016 January 8). http://www.tuik.gov.tr/. Accessed 8 Jan 2016.
16. Cherwin RD, Hedger K, Dillon JE, Pituch KJ. Pediatric sleep questionnaire (PSQ): validity and reliability of scales for sleep disordered breathing, snoring, sleepiness, and behavioral problems. Sleep Med. 2000;1:21–33.
17. Yüksel H, Söğüt A, Yılmaz Ö, Kutluay K. Reliability and validity of the Turkish version of the pediatric sleep questionnaire: a tool for prediction for prediction of sleep related breathing disorders (in Turkish). Tüberküloz ve Toraks Dergisi 2011;59:236–41.
18. World Health Organization. Expert Committee on Physical Status. The use and interpretation of anthropometry. Report of a World Health Organization Expert Committee. Geneva: World Health Organization; 1995. **Technical Support, Series 854**.
19. Veeravigrom M, Desudchit T. Prevalence of Sleep Disorders in Thai Children. Indian J Pediatr. 2016;83:1237–41.
20. Fricke-Oerkermann L, Plück J, Schredl M, Heinz K, Mitschke A, Wiater A, Lehmkuhl G. Prevalence and course of sleep problems in childhood. Sleep. 2007;30:1371–77.
21. Owens J. Classification and epidemiology of childhood sleep disorders. Prim care. 2008;35:533–46.
22. Jeon YJ, Song JJ, Ahn JC, Kong IG, Kim JW, Park GH, Won TB. Immediate and sustained improvement in behavior and life quality by adenotonsillectomy in children with sleep-disordered breathing. Clin Exp Otorhinolaryngol. 2016;9:136–42.
23. Strom MA, Silverberg JI. Asthma, hay fever and food allergy are associated with caregiver reported speech disorders in US children. Pediatr Allergy Immunol. 2016;27:604–11.

24. Ersu R, Arman AR, Save D, Karadag B, Karakoc F, Berkem M, Dagli E. Prevalence of snoring and symptoms of sleep disordered breathing in primary school children in Istanbul. Chest. 2004;126:19–24.
25. Choudhary B, Patil R, Bhatt GC, Pakhare AP, Goyal A, Dhingra AP, Tamaria KC. Association of sleep disordered breathing with mono-symptomatic nocturnal enuresis: a study among school children of central India. PLoS One. 2016;11(5):e0155808. doi:10.1371/journal.pone.0155808.
26. Spruyt K, Gozal D. Sleep disturbances in children with attention-deficit/hyperactivity disorder. Expert Rev Neurother. 2011;11:565–77.
27. Sung V, Hiscock H. Sleep problems in children with attention-deficit/hyperactivity disorder prevalence and the effect on the child and family. Arch Pediatr Adolesc Med. 2008;162:336–42.
28. Xu S, Xue Y. Pediatric obesity: Causes, symptoms, prevention and treatment. Exp Ther Med. 2016;11:15–20.
29. Hargens TA, Kaleth AS, Edwards ES, Butner KL. Association between sleep disorders, obesity, and exercise: a review. Nat Sci. Sleep. 2013;5:27–35.
30. Raman VT, Splaingard M, Tumin D, Rice J, Jatana KR, Tobias JD. Utility of screening questionnaire, obesity, neck circumference, and sleep polysomnography to predict sleep-disordered breathing in children and adolescents. Paediatr Anaesth. 2016;26:655–64.
31. Ardıç S, Demir AU, Uçar ZZ, Fırat H, Itıl O, Karadeniz D, Aksu M, Sevim S, Yılmaz H, Oktay B. Prevalence and associated factors of sleep disordered breathing in the Turkish adult population. Sleep Biol Rhythms 2013;11:29–39.
32. Urschitz MS, Eitner S, Wolff J, Guenther A, Urschitz-Duprat PM, Schlaud M, Poets CF. Risk factors for sleep-related hypoxia in primary school children. Pediatr Pulmonol. 2007;42:805–12.
33. Martikainen S, Pesonen AK, Jones A, Feldt K, Lahti J, Pyhälä R, Heinonen K, Kajantie E, Eriksson J, Strandberg T, Räikkönen K. Sleep problems and cardiovascular function in children. Psychosom Med. 2013;75:682–90.