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Sleep Disorders and Restless Legs Syndrome in School-age Pediatric Population

Okul Çağındaki Pediyatrik Popülasyonda Uyku Bozuklukları ve Huzursuz Bacaklar Sendromu

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Abstract

Objective: Diagnosis of sleep disorders (SD) and restless legs syndrome (RLS) in school-age pediatric population and finding their relevant factors are important to prevent disease dependent complications such as growth-development retardation, loss of neurocognitive function and school failure. The aim of the present study was to determine whether there is a relationship between socio-demographic characteristics, SD and RLS in school children.

Materials and Methods: Middle and high school students aged between 13 and 17 were questioned about socio-demographic data, RLS survey and pediatric sleep questionnaire (PSQ).

Results: The study included 3.568 appropriately completed surveys. The total PSQ score was 4.3±3.3 for female students and 3.9±3.3 for male students. PSQ score was ≥8 in 326 of 1.992 female students (16.4%), in 215 of 1.576 male students (13.6%) and in 541 of all students (15.2%). The RLS frequency was 4.4% for all students, 4.6% for female students and 4.1% for male students. Total PSQ score, snoring, sleepiness and behavior subscale score had significant correlation with RLS in both genders. A weak but significant correlation was found between PSQ total score and BMI Z score (r=0.256, p<0.001). There was a strong correlation between PSQ score and RLS. The odds ratio of RLS was 2.04 (95% confidence interval: 1.87-2.22) for PSQ score.

Conclusion: RLS has close relationships with sleep-related breathing disorders, daytime sleepiness and behavioral problems irrespective of socio-demographic data.

Keywords: School, child, sleep disorder, restless legs syndrome

Öz

Amaç: Okul çağındaki çocuklarda uyku bozuklukları (UB) ve huzursuz bacaklar sendromunun (HBS) tanısını koymak ve ilişkili faktörleri saptamak bu hastalıklara bağlı büyüme geriliği, nörobilişsel kayıp ve okul başarısızlığı gibi komplikasyonları önlemek için önemlidir. Bu çalışmanın amacı okul çağındaki çocuklarda sosyo-demografik özellikler, UB ve HBS arasında bir ilişki olup olmadığını araştırmaktır.

Gereç ve Yöntem: Yaşları 13 ile 17 arasında değişen ortaokul ve lise öğrencilerinin sosyo-demografik verileri kaydedildi ve bu öğrencilere HBS ve pediyatrik uyku ölçeği (PUÖ) anketleri uygulandı.

Bulgular: Uygun doldurulmuş 3,568 anket incelemeye alındı. Total PSS skoru kız öğrencilerde 4,3±3,3, erkek öğrencilerde ise 3,9±3,3 saptandı. Bin yüz doksan iki kız öğrencinin 326'sında (%16,4), 1,576 erkek öğrencinin 215'inde (%13,6), toplam öğrenci sayısının ise 541'inde (%15,2) PSS skoru ≥8 saptandı. HBS sıklığı genel olarak %4,4, kız öğrencilerde %4,6 ve erkek öğrencilerde %4,1 olarak saptandı. Her iki cinsiyette total PUÖ skoru, horlama, uykululuk ve davranışsal alt başlıklarla HBS arasında istatistiksel olarak anlamlı farklılık saptandı. Total PUÖ skoru ile vücut kitle indeksi Z-skoru arasında zayıf fakat anlamlı bir farklılık saptandı (r=0,256, p<0,001). PUÖ skoru ile HBS arasında güçlü bir korelasyon saptandı. Her bir PUÖ skoru için HBS odds oranı 2,04 (%95 güven aralığı: 1,87-2,22) olarak saptandı.

Sonuç: Uykuda solunum bozuklukları, gündüz uykululuk ve davranışsal problemler ile HBS arasında sosyo-demografik verilerden bağımsız olarak yakın bir ilişki bulunmaktadır.

Anahtar Kelimeler: Okul, çocuk, uyku bozukluğu, huzursuz bacak sendromu

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Introduction

Sleep-related breathing disorders (SRBDs) are common in children in a spectrum varying from simple snoring due to increased resistance in the upper respiratory tract to obstructive sleep apnea (OSA) (1,2). The frequency of simple snoring in children ranges from 1.5 to 27.6%, while the frequency of OSA ranges from 1.2 to 5.7% (3). OSA etiology includes adenotonsillar hypertrophy, allergic rhinitis, obesity, mid-line facial disorders, mandible hypoplasia, cerebral palsy, Down syndrome, Prader-Willi syndrome and prematurity (4). If SRBDs are not treated, they may cause retardation in growth/development due to recurrent hypoxia, systemic blood pressure increase, pulmonary hypertension and cor pulmonale. Besides, SRBDs can lead to disorders such as learning disabilities, behavioral disorders and hyperactivity in children (4). Early diagnosis and treatment of SRBDs is very important to prevent the onset of all these disorders (1).

Although the polysomnography (PSG) is the gold standard for diagnosis of SRBDs, this test is both expensive to perform and requires technical equipment and experience. Moreover, this test cannot detect cognitive and behavioral disorders originating from sleep disorders (5,6). Therefore, the implementation of sleep questionnaire is useful for early diagnosis and treatment of SDB in children. A literature survey revealed that validation studies of Pittsburg sleep quality survey were conducted in adults (7,8) but not in children. Epworth sleep scale, on the other hand, evaluates only daytime sleepiness. Therefore, we decided to use pediatric sleep questionnaire (PSQ), a 22-item questionnaire which was developed by Chervin et al. (6) and was found to have a sensitivity of 81% and a specificity of 87%. The reliability and validity of the Turkish version of this survey was conducted by Yüksel et al. (9) and Cronbach alpha values showed that all sub-scales were successful.

Restless legs syndrome (RLS) is a sensorimotor disorder characterized by a feeling of discomfort and an irresistible need for movement in the legs. RLS symptoms are partially or completely relieved by walking and moving the legs while they increase during resting, sitting or lying down. Symptoms typically worsen at night (10-12). The feeling of discomfort can also be on the wrists, ankles and arms as well as on feet (10-12). The exact etiology of the disease has not been revealed yet. Assuming that the dopaminergic dysfunction and low iron storage is responsible for this condition, dopaminergic drugs and iron supplementation are used in the treatment of this disease (13).

Although RLS was long thought of as a disease that occurs only in adults, it was revealed in the mid-1990s that children also suffer from this disease (14,15). Pediatric diagnostic criteria are used in children between the ages of 2 and 12 while adult diagnostic criteria are used in children between the ages of 13 and 18 (16,17). There are no biochemical markers associated with the diagnosis of RLS. Its diagnosis is based on a questionnaire. Therefore, there may be difficulty in making a definitive diagnosis (10).

In the present study, we aimed to determine whether there was a relationship between SRBDs and RLS in school children. In addition, we investigated possible associations of these diseases with socio-demographic characters.

Materials and Methods

Study design and subjects

The study included middle and high school students between the ages of 13 and 17 in a central town of a province. For this purpose, an approval (no: 18-KAEK-161) was obtained from the local ethics committee of our university. Then, another approval was obtained from the Provincial Directorate of National Education for the implementation of surveys in schools. After meeting with the school principals, an appropriate time was determined to distribute the forms and inform the students. After informing the student about the survey, the questionnaire was given to the students and they were asked to fill it out with their parents at home. The questionnaire was not given to students who had diseases such as deep vein thrombosis, venous stasis and muscle-joint disorder, which can cause discomfort, pain and numbness in their legs. Similarly, the questionnaire was not given to students with cranial, cardiogenic and/or pulmonary diseases that may cause respiratory disorders. Finally, students who took any medications that would affect sleep rhythm and depth were also not surveyed.

It was mentioned to the parents who agreed to participate in the study that they should fill out the form with the student and submit it within a week. In the survey, the families who participated in the study were asked about the age, gender, height, weight of the student, how many siblings student had, child's order of birth, education status of parents and average annual household income. Student and parent guarding the student were then asked to complete the RLS survey and the PSQ. The body mass index (BMI) of the students was calculated as ''Z- score'' based on the height, weight and gender of the student. The parents' education status was evaluated in four different categories: ''Primary school'', ''secondary school'', ''high school'' and ''college''. Annual household income was determined in Turkish Liras, and converted to the USD at the time of the study (Table 1).

In our study, the International Restless Legs Syndrome Study Group (IRLSSG) 2012 criteria were used for the diagnosis of RLS (17). The four criteria used for the diagnosis of RLS in children were:

1. Sudden desire to move due to uncomfortable sensation in legs
2. Regression of disturbing feelings with movement
3. Worsening of symptoms while resting or in sedentary condition
4. Worsening of symptoms at night.

In order to rule out other diseases that could be confused with RLS, we added as the fifth question ''Do you have any medical or behavioral problems (myalgia, venous stasis, edema in the leg, arthritis, cramping of the leg, positional discomfort, leg shaking habit) that may cause the abovementioned conditions in your

legs?'' We made RLS diagnosis for children who answered ''Yes'' to the first four questions and ''No'' to question 5.

PSQ generally consists of three subscales and there are a total of 22 questions. The first subscale includes six questions about sleep-related respiratory disorders related to snoring and apnea. The second subscale has 10 questions mostly related to daytime sleepiness and the third subscale has six questions mostly about behavioral/cognitive problems related to sleep disorders. Each question is answered as ''Yes'', ''No'' or ''I don't know''. Eight or more ''Yes'' answers are considered sleep disorders. The last question of the first subscales of PSQ ''Have you ever seen your child stop breathing at night?'' describes apnea and this question is of particular importance for pediatric sleep apnea disease.

Statistical Analysis

Comparisons of genders for continuous and ordinal variables such as age, BMI Z-score, yearly income, total sibling count, birth order, PSQ score and its subscale scores were performed using Mann-Whitney U test. The genders were compared for the categorical variables of RLS using chi-square test. Spearman's rho test was used for analyzing the correlations between RLS and PSQ by gender. Spearman's rho was also performed for analyzing RLS, PSQ and sleep apnea correlations with socio-demographic data (age, BMI Z-score, total siblings, birth order of child, education status of parents and annual household income). Binomial logistic regression was performed to identify predictors of RLS. The type 1 error rate of <0.05 was considered statistically significant. All statistical analyses were conducted using JAMOVI 1.2.22 statistical software (The Jamovi Project, Sydney, Australia).

Results

A total of 4.200 surveys were distributed for the study. However, some of these surveys were not brought in and some were incompletely filled out. Therefore, 3.568 surveys were evaluated. Of the 3.568 students who participated in the study, 1.576 were male and 1.572 female. The mean age was 14.9±1.3 years for female students and 15.1±1.5 years for male students. Total number of siblings was higher among female students than among males (p<0.01). Data regarding BMI, birth order of students, mother's education status, father's education status and annual household income of male and female students are summarized in Table 1.

The total PSQ score was 4.3±3.3 for female students and 3.9±3.3 for male students. PSQ score of ≥8 was observed in 326 of 1.992 female students (16.4%), 215 of 1.576 male students (13.6%) and in 541 of all students (15.2%). Snoring, sleepiness and behavior subscales were 0.3±0.8, 2.3±1.8 and 1.6±1.6 for female students, and 0.3±0.8, 2.0±1.7 and 1.6±1.7 for male students, respectively. There was no significant difference between the genders for total PSQ score, snoring, sleepiness and behavior subscales (p>0.05).

The frequency of RLS was 4.4% overall, 4.6% among female students and 4.1% among male students. RLS syndrome frequency was not significantly different between the genders (p=0.052) (Table 2).

Total PSQ score, snoring, sleepiness and behavior subscale score had significant correlation with RLS in both genders (Table 3). There was a weak but significant correlation between PSQ total score and BMI Z-score (r=0.256, p<0.001) (Table 4). In binomial regression model, there was a strong correlation between PSQ score and RLS (Figure 1). According to the Logistic Regression Analysis, each one-point increase in PSQ score increased RLS risk by 2.04 times (95% confidence interval: 1.87-2.22; X^2: 631; R^2_{McF}: 0.492).

Discussion

SRBDs and RLS are common diseases, but they are difficult to diagnose in children because their clinical manifestations differ from those of adults. While the typical finding in adults with SRBDs is excessive sleep during the day, the same disease in children manifests itself as waking up without resting from night sleep, oral breathing and daytime attention deficit-behavioral disorder. Snoring is the most common symptom for SRBDs in children and is the most important marker for pronounced OSA (18). Children with SRBDs also exhibit unusual sleep positions such as neck hyperextension and knee-chest position (18). Similarly, in children with RLS, symptoms are often incorrectly attributed to growth pains, positional discomforts and leg cramps (18). It was reported that symptoms such as crying, rubbing legs and difficulty falling asleep may be

Table 1. Socio-demographic data of male and female students

	Mean BMI (Z-score)	Mean total sibling number	What number sibling is the student	Mother's education situation	Father's education situation	Family's annual income ($)
Male	0.44±1.16	2.7±0.9	1.9±1.0	Primary sch: 641 Secondary sch: 338 High sch: 385 Collage: 208	Primary sch: 343 Secondary sch: 324 High sch: 549 Collage: 376	7.471±4.933
Female	0.21±1.10	2.9±1.1	2.0±1.1	Primary sch: 862 Secondary sch: 390 High sch: 473 Collage: 247	Primary sch: 465 Secondary sch: 364 High sch: 655 Collage: 508	7.125±4.273
p	**<0.001**	**<0.001**	0.312			0.053

BMI: Body mass index, $: Dollar, sch: School, Mann-Whitney U test, BMI: Body mass index

RLS symptoms in six-month to two-year-old children (18). It was mentioned that in 25-40% of RLS patients diagnosed in adulthood, symptoms begin in childhood or adolescence (11). RLS should be suspected if freezing and tickling feelings in the legs occur in the evening or at rest (19). Therefore, in order to diagnose RLS in children, it is necessary to ask what they feel in an understandable language and listen well. Descriptions by children such as ''My legs don't seem to stand still'', ''My legs want to move'', ''My legs are ticklish'', ''I feel like running'', ''It is like insects or ants roaming on my legs'', or ''I have a lot of energy in my legs'' describe RLS. It can be difficult in children to get the anamnesis of ''sudden desire to move'' or ''discomfort'' feeling used for the definitive diagnosis. Instead, it would be appropriate to try to get easier expressions from children about their ailments (20). For example, when you get a positive answer to the question of ''Do your legs bother you when you go to bed in the evening?'' the question of ''Can you explain more?'' can be asked. In this way, three other basic diagnostic findings of RLS can be obtained. If a negative response is received, the parent is asked if the child has leg pains or ''growth pains'' in the evenings to try to reveal if the child has RLS-like sensations. One can ask if feeling in the leg is a good one or a bad one. If it is described as growth pain, it should be tried to clarify whether this pain is associated with RLS (20-22). Picchietti and Stevens (21) reported that 55.5% of children diagnosed with RLS had previously been told that their complaints were growth pain. Per et al. (22) found that 23.4% of patients (n=33) diagnosed with RLS were given painkillers due to their previous complaints, and 24 of these patients were diagnosed with growth pain. However, it was stated that 87% of the patients did not benefit from this treatment (22). Nevertheless, RLS and growth pains can also be overlapping diagnoses. Both ailments can be improved by rubbing the legs against each other or rubbing by hands, but the reduction of complaints by walking is achieved only in RLS (23).

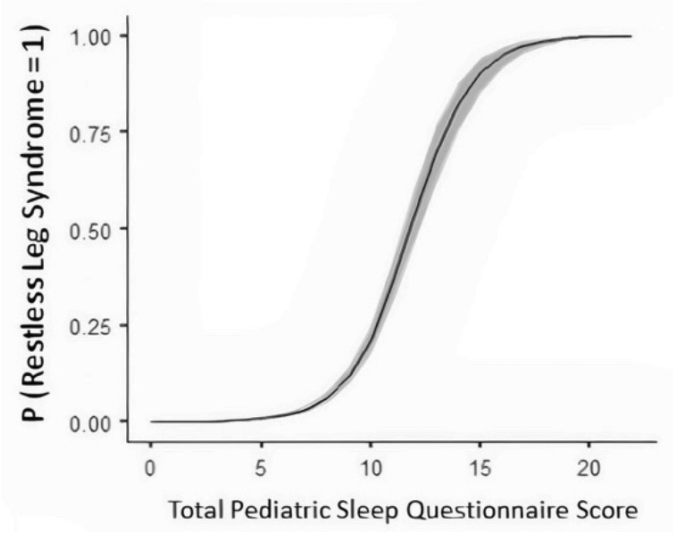

Figure 1. Estimated marginal means table for restless leg syndrome and pediatric sleep questionnaire score

Table 2. Frequency of restless leg syndrome (RLS) between genders			
Gender	**Not RLS (%)**	**RLS (%)**	
Female	1901 (95.4%)	91 (4.6%)	p=0.52
Male	1511 (95.9)	65 (4.1%)	
Total	3412 (95.6)	156 (4.4%)	

Table 3. Pediatric sleep questionnaire (PSQ) and frequency of restless legs syndrome (RLS) correlation in children				
	Total PSQ	**Snoring**	**Sleepiness**	**Behavior**
RLS (n=3568)	0.330	0.277	0.282	0.301
Male RLS (n=1576)	0.317	0.256	0.266	0.302
Female RLS (n=1992)	0.34	0.292	0.294	0.299

It is useful to know the diseases that can mimic RLS. Prolonged sitting or cross-legged sitting causes temporary nerve compression. Muscle pain may also occur after intense physical activity. Diseases such as eczema, psoriasis, contact dermatitis and insect bites can also cause pain in the legs, but hyperemia is present on the skin above the disease. Disorders such as foot sprains, patellofemoral disorders, Osgood-Schlatter disease, arthralgia and arthritis can also be confused with RLS. However, unlike RLS, these ailments worsen with movement. It is also worth keeping in mind diseases such as peripheral neuropathy, radiculopathy and myopathy that may occur more rarely (20). Indeed, the final question of the RLS survey aimed to exclude diseases that could mimic RLS.

It has been found in recent studies that children with SRBDs have evident attention and behavioral problems as a result of disrupted circadian rhythm. It was reported that attention deficit/hyperactivity disorder (ADHD) can be as high as 33% in children with habitual snoring (24). Poor sleep quality disrupts neurocognitive development and prevents the development of language and thinking skills. This leads to low academic progression in children (9). In addition, it was observed that the quality of life was impaired in 60% of children with SRBDs (3,25). Children with RLS may also experience cognitive and behavioral changes due to inability to fall asleep, waking up at night and non-resting sleep. RLS was found to be common in adults with ADHD as a child (18). Kadmon et al. (26) developed a six-question questionnaire to get a preliminary idea of the diagnosis of SRBDs and rated each question between 0 and 4 on the Likert scale. They also applied PSG to all 85 children in this survey whose average age was 9.3 years. With the survey, they achieved high sensitivity (83%) and fair specificity (64%) in determining moderate to severe sleep apnea (OSA). They reported that possibility of OSA diagnosis was higher among those who had higher BMI (p=0.04) and among males (p=0.007) (26). The questions in that study were very similar to the six questions under the first heading of the PSQ questionnaire we used. Since the Turkish validation of the questionnaire used in the present study was previously conducted by Yüksel et al. (9), we did not evaluate PSG. We considered that the number of patients in the present study (n=3.598) was sufficient. In addition to SRBDs, daytime sleepiness (the second part) and

behavioral disorder (the third part) were also evaluated in our questionnaire. We received the feedback that the questions in the questionnaire regarding the socio-demographic data, RLS and PSQ were all answered within 10 to 15 minutes. Per et al. (22) examined the relationship between Epworth sleepiness scale (ESS) which questions daytime sleepiness corresponding to the second subscale of the PSQ survey used in the present study, and RLS. They studied the data of 4.792 adolescent students between the ages of 13 and 16 in the 7-10th grades in Kayseri province of Turkey. ESS scores of 10 or higher were considered as sleepiness during the day (22). ESS score was higher in RLS cases (11.4±3.9 vs. 6.3±4.0) ($p<0.001$). Similarly, Yilmaz et al. (27) found ESS score of 4.9±2.9 in RLS patients and 3.9±2.8 in the other group. Per et al. (22) found daytime sleepiness (ESS score >10) in 73% of RLS patients, compared to 19.4% in the other group ($p<0.001$). It was reported that the RLS symptoms caused trouble falling asleep in 64% of those with RLS (22). Snoring and witnessed apnea were found to be higher in those with RLS compared to the control group (18.7 vs. 11.2% and 11.3 vs. 5.7%, respectively). However, the effect of RLS on daytime sleepiness was found to be independent of snoring, witnessed apnea and obesity. ADHD symptoms were detected in 15% in those with RLS, which was only 2.2% in those without RLS ($p<0.001$) (22) In two different studies conducted with pediatric patient groups in Turkey, ADHD was observed in 15.3% 28 and 25% 27 of RLS patients. One of the most striking findings in the present study was the strong relationship between RLS and PSQ, regardless of other variables. For example, although there was a relationship between BMI and total PSQ score, there was no correlation between BMI and total PSQ score when the father's educational status was college ($r=0.187$). However, the significant correlation between RLS and PSQ continued in college graduate fathers ($r=0.275$). We found that RLS had associations with total PSQ score, SRBDs, daytime sleepiness and behavioral disorder. In the present study, we found that every one-point increase in PSQ score increased the likelihood of RLS by 2.04 times. This close relationship between SRBDs and RLS could be due to the effects of cyclic hypoxia and hypercarbia on brain dopaminergic system regulation.

RLS is a common disease. Indeed, in their extensive epidemiological study, Picchietti et al. (29) emphasized that the prevalence of RLS was higher than epilepsy and diabetes. Its prevalence in school-age children and adolescent period was reported to be between 1.7 and 4% (27-30). The frequency observed in the present study (4.4%) was slightly higher than this value. The reason for this high frequency could be the understandable and detailed explanation of the RLS symptoms given to children in the classroom before handing out the questionnaire. These frequencies confirmed that RLS is a common disease.

Similar to our finding that RLS was not associated with gender, Per et al. (22), Picchietti et al. (29) and Yilmaz et al. (27) did not find any association of RLS with gender. However, Turkdogan et al. (28) found 1.7 times higher RLS frequency in females. While in the present study the age was found to have no effect on the frequency of RLS in the group between the ages of 13 and 17, Per et al. (22) found that age was effective in the prevalence of RLS among almost the same age group. RLS prevalence was reported to be significantly lower in 13-year-olds compared to other age groups (22). The highest prevalence of RLS was observed in 15 years of age ($p<0.001$) (22). In the present study, we found that age did not have any significant effect on RLS incidence and on PSQ's total score and sub-scores.

In the present study, boys had significantly higher BMI than girls. This could be due to the fact that the average age of boys, though not significant, was 0.2 years higher than that of girls, and that they were not as careful in eating habits as girls. BMI was found to cause an increase in total PSQ score in both girls and boys. However, BMI did not significantly affect RLS frequency and sub-scales of PSQ. Similar to what was reported by Per et al. (22) and Baran et al. (30), higher BMI was associated with higher incidence of sleep disorders in the present study. Unlike Per et al. (22) and Baran et al. (30), on the other hand, we found no relationship between BMI and RLS. Significantly higher number of siblings for female students in the present study could indicate the traditional desire in some parts of society for having a boy. Therefore, those families that had daughter/daughters may have had the desire to have more children in order to have a son. However, the number of children in the family and birth order of the students were not associated with RLS frequency and PSQ score. In our study, the education levels of mothers of both female and male students were more commonly primary and secondary schools, while fathers were predominantly high school or college graduates.

Table 4. Restless leg syndrome (RLS), pediatric sleep questionnaire (PSQ) and sleep apnea correlation with socio-demographic data

	RLS	Total PSQ	Snoring	Sleepiness	Behavior	Sleep-apnea
Age	0.023	0.085	0.047	0.193	-0.063	0.003
Gender	0.011	0.059	0.013	0.083	0.022	-0.021
BMI z	0.179	**0.256 (p<0.001)**	0.215	0.227	0.197	0.092
Total siblings	0.022	0.053	0.054	0.089	-0.011	-0.002
Order of child	-0.005	0.023	0.042	0.044	-0.015	-0.007
Mother education	-0.009	-0.076	-0.08	-0.07	-0.05	-0.018
Father education	-0.072	-0.158	-0.161	-0.137	-0.114	-0.048
Income	-0.023	-0.098	-0.076	-0.085	-0.077	-0.023

BMI: Body mass index

Unfortunately, this situation is based on the fact that girls were not sent to higher education for traditional reasons in the past. Similar to the study of Per et al. (22), no correlation was found between the parents' education status and the RLS or PSQ score in the present study. In our study, there was no significant difference between the average annual household income of male and female students. In the light of the data obtained from the students in our province, the average monthly household income was above the minimum wage. This can be attributed to the fact that both parents worked or had additional sources of non-civil service incomes such as agriculture and livestock production. Although there were households with considerably different income levels in the study, in parallel with Per et al. (22), income level was not significantly associated with RLS and sleep respiratory disorders in the present study.

Conclusion

SRBDs and RLS are common conditions in school-age children. Short questionnaires help us to diagnose these conditions early. Thus, complications such as growth-development retardation, loss of neurocognitive function and school failure can be prevented.

Another important finding in our study was that there was a close relationship between sleep-related breathing disorder and RLS, irrespective of all variables. It is a well-known fact that patients cannot sleep efficiently due to RLS symptoms. In addition, the question of "Are SRBDs among the etiological reasons that triggers RLS?" come to the fore. Prospective, randomized, controlled studies could be useful to elucidate this question.

Ethics

Ethics Committee Approval: For this purpose, an approval (no: 18-KAEK-161) was obtained from the local ethics committee of our university.

Informed Consent: Informed consent was obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: İ.E., A.G., Concept: İ.E., İ.K., A.G., Design: İ.E., İ.K., A.G., Data Collection or Processing: İ.E., İ.K., E.S., Analysis or Interpretation: İ.K., E.S., Literature Search: İ.E., E.S., A.G., Writing: İ.E., E.S., İ.K.

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