



Prevalence and Awareness of Restless Leg Syndrome in Medical Students and Associated Self Reported Sleep Problems

Tıp Fakültesi Öğrencilerinde Huzursuz Bacaklar Sendromu Sıklığı ile Farkındalığı ve Bildirilen İlişkili Uyku Sorunları

İD Tuğba Yıldız, İD Didem Kafadar, İD Ayşen Kutan Fenercioğlu, İD Gülçin Benbir Şenel*, İD Nurver Turfaner Sipahioğlu

Istanbul University-Cerrahpaşa, Cerrahpaşa Faculty of Medicine, Department of Family Medicine, Istanbul, Turkey

*Istanbul University-Cerrahpaşa, Cerrahpaşa Faculty of Medicine, Department of Neurology, Istanbul, Turkey

Abstract

Objective: Restless legs syndrome (RLS) symptoms may cause stress and anxiety, which lead to functional disturbances. In several studies, awareness about RLS was found to be low in physicians and medical students who live through a rigorous educational period. In this study, we aimed to investigate the frequency, risk factors, and awareness of RLS in medical students and associated sleep problems.

Materials and Methods: This cross-sectional analytical study included third- and fourth-year medical students. A questionnaire about sociodemographic characteristics and RLS parameters, including risk factors, diagnostic criteria, awareness, and sleep problems was applied to 354 students in a period of two months. Data were evaluated using chi-square, Fisher's exact test, Kolmogorov-Smirnov test, student's t-test, and Mann-Whitney U test.

Results: There were 39 participants (11.1%) who fulfilled diagnostic criteria A of RLS based on the international classification of sleep disorders 3. The female-to-male ratio was 1.6:1. Lower income and family history were associated with RLS symptoms ($p=0.003$, $p=0.041$). Self-reported symptoms of anxiety and stress as well as functional impairment were associated with RLS ($p=0.003$, $p=0.004$). Depression and sleep problems were more frequent in participants experiencing RLS symptoms ($p=0.005$, $p=0.005$). Awareness about RLS was observed in those with probable RLS ($p=0.003$), attending their neurology rotation did not affect awareness, and web sources were reported as the main sources about RLS-related data.

Conclusion: In this study, lower income, family history, depression as a comorbidity, poor sleep quality, anxiety, stress, and daytime dysfunctionality were associated with RLS symptoms. Awareness about RLS was quite low in medical students. To enhance the diagnosis, treatment, and appropriate referrals concerning RLS, awareness should be increased in medical students.

Keywords: Restless legs syndrome, awareness, sleep, medical students, questionnaire

Öz

Amaç: Huzursuz bacak sendromu (HBS) semptomları, stres ve anksiyeteye neden olarak fonksiyonel bozukluklara neden olabilir. Çeşitli çalışmalarda, yoğun bir eğitim süreci geçiren tıp öğrencilerinde ve hekimlerde HBS konusundaki farkındalığın düşük olduğu bulunmuştur. Bu çalışmada tıp öğrencilerinde HBS sıklığını, risk faktörlerini, farkındalığını ve buna bağlı uyku problemlerini araştırmayı amaçladık.

Gereç ve Yöntem: Çalışma kesitsel, analitik bir çalışma olarak planlanmış ve üçüncü ile dördüncü sınıf tıp öğrencilerini kapsamaktadır. Sosyodemografik özellikler ile risk faktörlerini, tanı kriterlerini, farkındalığı ve uyku sorunlarını içeren HBS parametrelerinden oluşan anket 354 öğrenciye iki aylık sürede uygulanmıştır. Veriler ki-kare, Fisher's exact testi, Kolmogorov-Smirnov testi, students's t-testi ve Mann-Whitney U Testi ile değerlendirildi.

Bulgular: Çalışmamızda katılımcıların 39'u (%11,1) uluslararası uyku bozuklukları sınıflamasının üçüncü versiyonuna (*international classification of sleep disorders 3*) göre HBS tanı kriterleri A'yı karşılamıştı. Kadın-erkek oranı 1,6:1 idi. HBS belirtileri düşük gelir ve aile öyküsü ile ilişkiliydi ($p=0,003$, $p=0,041$). Katılımcının bildirdiği anksiyete ve stres semptomlarının yanı sıra fonksiyonel bozulma da HBS ile ilişkiliydi ($p=0,003$, $p=0,004$). HBS belirtileri yaşayan katılımcılarda depresyon ve uyku sorunları daha sıkı ($p=0,005$, $p=0,005$) idi. Olası HBS olanlarda HBS farkındalığı gözlendi ($p=0,003$), nöroloji rotasyonuna katılmak farkındalığı etkilemedi ve HBS ile ilgili verilerle ilgili ana kaynağın web kaynakları olduğu belirtildi.

Sonuç: Bu çalışmada, düşük gelir, aile öyküsü, komorbidite olarak depresyon, düşük uyku kalitesi, anksiyete, stres ve gündüz işlev bozukluğu HBS semptomlarıyla ilişkilendirilmiştir. Tıp öğrencilerinde HBS konusundaki farkındalık oldukça düşüktü. HBS ile ilgili tanı, tedavi ve uygun yönlendirmelerin artırılması için geleceğin hekimi olan tıp öğrencilerinde farkındalığın artırılması gerekmektedir.

Anahtar Kelimeler: Huzursuz bacak sendromu, farkındalık, uyku, tıp öğrencisi, anket

Address for Correspondence/Yazışma Adresi: Prof. Dr. Nurver Turfaner Sipahioğlu, Istanbul University-Cerrahpaşa, Cerrahpaşa Faculty of Medicine, Department of Family Medicine, Istanbul, Turkey

Phone: +90 532 496 17 73 **E-mail:** nurver@iuc.edu.tr **ORCID-ID:** orcid.org/0000-0002-0957-134X

Received/Geliş Tarihi: 20.09.2023 **Accepted/Kabul Tarihi:** 27.11.2023



Introduction

In restless legs syndrome (RLS), also known as “Willis Ekbohm disease”, there is an urge to move the legs, which is usually accompanied by an uncomfortable or unpleasant sensation or the presence of this sensation is thought to be the result of this urge and these symptoms begin or worsen during the rest period, are relieved by movements such as walking and stretching, and often occur in the evening and at night and these symptoms cannot be explained by another medical or behavioral condition.^{1,2} The current criteria used for diagnosis of RLS have been established by the international RLS study group, with some modifications by the American Academy of Sleep Medicine in international classification of sleep disorders 3 (ICSD-3).³⁻⁶ Genetic predisposition and mechanisms related to iron metabolism, dopamine metabolism, circadian rhythm, as well as melatonin and neurotransmitters such as glutamate and gamma-aminobutyric acid, are present in the pathophysiology of RLS.⁷⁻⁹ RLS is categorized into two groups: primary and secondary. For primary RLS diagnosis, there should not be any pathologies in physical, neurophysiological, or neuroradiological examinations or laboratory findings of the individuals presenting with RLS symptoms.⁶ In the secondary form, various clinical conditions may accompany the RLS symptoms. The most frequent among them are iron deficiency, pregnancy, end-stage renal disease (uremia), thyroid dysfunction, parkinsonism, depression, rheumatoid arthritis, fibromyalgia, diabetes mellitus, and multiple sclerosis.^{3,6} The age of onset of the secondary form is late and its progression is rapid.^{6,7}

RLS is more frequent in women, and family history is also a risk factor.³ In literature, many studies have investigated RLS in different populations and age groups.⁶ In a review article, it is mentioned that RLS diagnostic criteria are based on self-reported symptoms by the participants of the studies, and this may be behind the various prevalence rates of RLS reported in the literature.¹⁰ In an earlier population-based study conducted by Sevim et al.¹¹ the prevalence of RLS was reported as 3.19%. In a large-scale study conducted in primary care practices across Europe, the estimated prevalence of physician-diagnosed RLS was found to be 3.5-4.4% in adult patients.¹² The prevalence was found to be 4.5% in a study of the general population, and the frequency increased in the fourth decade in women and in the sixth decade in men.¹³ Sleep disturbances are considered to support the diagnosis of RLS.^{5,6} In a study, it is reported that difficulty in falling asleep, which negatively affects quality of life, is associated with RLS symptoms.¹⁴ RLS symptoms are associated with stress and anxiety, which may lead to functional disturbances.¹⁵ This condition negatively effects functionality in many areas, such as school performance, social life, and mental status.¹⁴ In patients whose RLS diagnosis is delayed due to late or misdiagnosis or inappropriate referrals and treatments, sleep quality deteriorates, which results in an increase in stress and anxiety levels.⁴⁻⁶ In some studies, the awareness of RLS was found to be quite low in university students.^{16,17} In our study, the objective was to reveal the awareness and the frequency of RLS, the risk factors of the disease, sleep problems, and coexisting

conditions, in a group of medical students who have attended and have not attended the sleep disorders course in a neurology curriculum.

Materials and Methods

This cross-sectional analytical study was conducted at İstanbul University-Cerrahpaşa, Cerrahpaşa Faculty of Medicine in two months, which comprised the end period of the academic year. The “sleep disorders” course was in the neurology curriculum of the fourth-year students. We planned to include both the third- and fourth-year students, as the study plan was to differentiate between students who took the “sleep disorders” course and those who did not. The total number of third-year students was 513, and there were 567 fourth-year students. After a literature review, the researchers developed a 31-item questionnaire about sociodemographic characteristics, lifestyle (smoking, alcohol, and lack of regular exercise) and comorbid chronic diseases (iron deficiency anemia, chronic renal failure, diabetes mellitus, rheumatological diseases, thyroid disorders, multiple sclerosis, depression, and others). The rest of the questionnaire was about the RLS diagnostic criteria according to the ICSD-3, awareness of RLS, and presence of sleep disturbances. Preceded by a brief explanation about the study, the questionnaires were distributed to students in lecture halls and were collected after approximately 15 minutes. Awareness was defined as both having had the clinical rotation in the neurology department as an undergraduate and having prior knowledge about RLS. Students who fulfilled all of ICSD-3’s criteria A were considered as having RLS symptoms.³ Fulfilment of criteria A meant the respondent probably experienced RLS. The participants provided their written informed consent to participate, and the study was conducted in accordance with the principles of the Declaration of Helsinki. The ethical committee approval was obtained from the Clinical Research Ethics Committee of Cerrahpaşa Faculty of Medicine (approval number: 54542, date: 08.02.2018).

Statistical Analysis

Data were analyzed using the SPSS 21.0 computer package program. Numerical data were expressed as mean \pm standard deviation and median (minimum-maximum), categorical data were expressed as frequencies (n) and percentages (%). Chi-square test and Fisher’s exact test were used where necessary for categorical variables to evaluate the difference between the groups. Kolmogorov-Smirnov test was used for testing normal distribution of numerical data, student’s t-test was used in normal distribution conditions for the comparison of continuous variables between two independent groups; when the data was not normally distributed, Mann-Whitney U test was used. A p-value of <0.05 was accepted for statistical significance.

Results

A total of 354 students consisting of 206 third-year and 148 fourth-year students participated. Among the participants, 166 were male (46.9%) and 188 were female (53.1%) and the median age was 21. The sociodemographic features of the participants are presented in Table 1.

Variables	Study group; n (%) n=354 (100.0)	RLS absent; n (%) n=315 (89.0)	RLS present; n (%) n=39 (11.0)	p
Age				
Mean ± SD	20.86±1.63	20.86±1.67	20.87±1.23	0.838
Median (min-max)	21 (19-39)	21 (19-39)	21 (19-26)	
Gender				0.145
Male	166 (46.9)	152 (91.6)	14 (8.4)	
Female	188 (53.1)	163 (86.7)	25 (13.3)	
Third grade	206 (58.2)	181 (87.9)	25 (12.1)	0.428
Fourth grade	148 (41.8)	134 (90.5)	14 (9.5)	
Married	10 (2.8)	8 (80.0)	2 (20.0)	0.357
Family income				0.003
Low	21 (5.9)	16 (76.2)	5 (23.8)	
Medium	165 (46.6)	140 (84.8)	25 (15.2)	
High	168 (47.5)	159 (94.6)	9 (5.4)	
Housing style				0.208*
Dormitory and guest-house	120 (33.0)	104 (86.7)	16 (13.3)	
Shared with friends	122 (34.5)	113 (92.6)	9 (7.4)	
Shared with family	85 (24.0)	75 (88.2)	10 (11.8)	
Alone in house	25 (7.1)	22 (88.0)	3 (12.0)	
Other	2 (0.6)	1 (50.0)	1 (50.0)	
Family history of RLS	26 (7.3)	20 (76.9)	6 (23.1)	0.041
Smoker	30 (8.5)	26 (86.7)	4 (13.3)	0.672
Alcoholic beverages consumer	78 (22)	72 (92.3)	6 (7.7)	0.288
Exercising regularly	87 (24.6)	80 (92.0)	7 (8.0)	0.308
Presence of comorbid conditions				0.005
Depression	11 (3.1)	7 (63.6)	4 (36.4)	
Rheumatologic disease	2 (0.6)	2 (100.0)	0	
Iron deficiency	19 (5.4)	17 (89.5)	2 (10.5)	
Thyroid disorders	12 (3.4)	10 (83.3)	2 (16.7)	
Diabetes mellitus	2 (0.6)	2 (100)	0	
Multiple sclerosis	1 (0.3)	0	1 (100.0)	
Other*	26 (7.3)	22 (84.6)	4 (15.4)	
Regular medication use**	45 (12.7)	40 (88.9)	5 (11.1)	0.983

Chi-square test and *Fisher's exact test were used

*: Gilbert syndrome, lumbar disc herniation, migraine, polycystic ovary syndrome, acne, seasonal allergic rhinitis, supraventricular tachycardia

** : Antidepressants, antihistamines, vitamins and iron supplements etc. for the comorbid conditions

SD: Standard deviation, min: Minimum, max: Maximum, RLS: Restless legs syndrome

RLS frequency did not differ between third-year and fourth-year students. There were no differences between mean age, marriage status, housing style, and frequency of genders in RLS-present and RLS-absent groups. Students living with their friends in student houses comprised 34.5%. Those coming from a high-income family reported fewer RLS symptoms ($p=0.003$). Participants with a family history of RLS were significantly more frequent in the group with RLS ($p=0.041$). In this group, family members with RLS included mostly the mother and the mother's sister, with frequencies of 2.5% and 1.4%, respectively (Table 1). In the present study, participants who reported fulfilled criteria A were considered to have RLS symptoms/sensations (Table 2). Lifestyle risk factors such as smoking and lack of regular exercise were not significant between those experiencing

criteria A symptoms and those who were not (Table 1). Twelve participants had medical conditions that explained their RLS symptoms. Among them, two (0.6%) were diagnosed with RLS, two (0.6%) tapped their feet habitually, one (0.3%) had a lumbar disc herniation, two (0.6%) experienced nocturnal leg cramps, two (0.6%) experienced myalgia, one (0.3%) had edema and two (0.6%) experienced venous stasis. Among those in whom RLS sensations were present, 20 (37%) students reported that their RLS symptoms caused significant anxiety and stress ($p=0.003$). Functional interference in social, work, behavioral, and mental issues were significantly reported by eight (38.1%) students in the RLS sensations present group ($p=0.004$) (Table 3). Sleep problems were significant in those with RLS symptoms ($p=0.005$). Anxiety and stress were reported

in 15.3% students. Among those who did not report anxiety and stress symptoms, 6.3% were diagnosed with RLS ($p=0.003$). Among 11 students who reported to have depression, there were four diagnosed with RLS ($p=0.005$). Among participants who fulfilled the RLS criteria, two students reported to have diabetes mellitus, one student had multiple sclerosis, two had iron deficiency anemia, and two had thyroid disorders. Association between sleep problems and RLS is shown in Table 4. Presence of RLS was significantly more frequent in participants with sleep problems ($p=0.005$). Participants were asked to indicate if they had problems other than those mentioned with RLS criteria regarding sleep. A total of 13 (3.7%) people stated that they had other sleep problems apart from these. Among these people, only one (7.7%) person had RLS, and no significant relationship was found ($p=0.696$). Individuals were asked whether they have consulted a physician at any time about their sleep problems. There was no significant relationship between referral to a physician and the presence of RLS ($p=0.357$) (Table 4). A total of 157 (44.4%) participants stated that they had knowledge about RLS, and among them 25 (15.9%) participants were diagnosed with RLS. A statistically significant relationship was found between having knowledge about the disease and having RLS ($p=0.008$). Information sources of the participants about RLS were questioned. The internet (64 people, 18.1%) was the most frequent information source (Table 5). No statistically significant relationship was found between the information source used and RLS presence ($p=0.959$). As far as we know, there is no scale to assess awareness about RLS. Both participating in a

neurology clerkship and having prior knowledge about RLS were considered as presence of awareness. There were no differences between third- and fourth-year students in terms of presence of all criteria for RLS, presence of risk factors, and awareness. Among the 131 (37%) participants who had awareness, 23 (17.6%) fulfilled criteria A. A statistically significant correlation was found between awareness and the presence of RLS sensations in criteria A ($p=0.003$).

Discussion

In the present study, the presence of symptoms, risk factors, and awareness related to RLS in medical students were investigated, and RLS criteria A were met in 11.1% of the third- and fourth-year medical students, which is compatible with the literature. In studies conducted with medical students, RLS prevalence was found to be 16.9% in Turkey, 8% in Pakistan, and 10% in Egypt.¹⁷⁻¹⁹ In another recent study conducted with both medical students and residents in Turkey, RLS was present in 9% of the participants.²⁰ The female gender has a greater risk concerning RLS.³ In a population-based study, Sevim et al.²¹ have reported that the prevalence of RLS is 3.9% for females and 2.45% for males, and the female-to-male ratio is 1.6:1.²¹ In another study in Turkey among medical faculty students, the frequency of RLS symptoms was found to be 18.4%, and they were more frequent in females than males: 23% vs 13%.¹⁶ In the present study, the median age of the students was 21, and no differences were found between genders in terms of frequency of RLS. The female-to-male ratio of RLS presence was 1.6:1, supporting the literature. In a study conducted with young people, RLS affected 1% of participants, and family history was found to be associated with RLS.¹⁵ Family history of RLS was present in 23.1% of our participants diagnosed with RLS, which is significant and consistent with related literature. This may be associated with the involvement of genetical factors in RLS etiology.⁵ In our study, RLS symptoms were observed less frequently in medical students from high-income families. In other studies also, low socioeconomic status was found to be associated with RLS presence.¹⁰ Some studies have revealed a significant association between RLS and smoking, alcohol and caffeine intake, pregnancy, diet, and inadequate exercise.¹⁰ In our study, there were no significant relationships with these risk factors. Iron deficiency anemia also plays a role in pathophysiology.³ RLS risk increases in patient groups who are at risk for insufficient iron levels.²² In our study, two of 19 (5.4%) students who reported to have iron deficiency anemia had probable RLS, and only two out of 354 medical students had diabetes mellitus, and none of them had RLS. RLS is associated with type 2 diabetes mellitus, and in diabetic patients polyneuropathy has been found to be a risk factor for RLS.²³ Studies have reported that the prevalence of RLS in diabetic patients is 17.7% or 27%.^{23,24} In this current study, RLS sensations were more frequent in medical students with depression. The secondary causes of RLS involve a broad range of chronic conditions. Our study group consisted of young people with a median age of 21, so accompanying chronic conditions were not frequent and presence of RLS was not

Table 2. Presence of RLS sensations (criteria A*) in participants	
Criteria A	Study group, n (%)
	n=354 (100.0)
Criteria A Do you feel an urge to move the legs usually because of an uncomfortable sensation?	
Yes	160 (45.2)
No	194 (54.8)
Criterion A1 Does this urge to move begin or worsen during rest?	
Yes	87 (24.6)
No	267 (75.4)
Criterion A2 Does this urge to move relieved by walking or stretching?	
Yes	175 (49.4)
No	179 (50.6)
Criterion A3 Does this urge to move at rest occur or worsen in the evening or night?	
Yes	70 (19.8)
No	284 (80.2)
*Criteria A (A1, A2, A3) is fulfilled in 39 (11%) participants	
RLS: Restless legs syndrome	

Criteria B and C	Study group; n (%) n=354 (100.0)	RLS criteria A sensations has not been fulfilled; n (%) n=315 (89.0)	RLS criteria A sensations present; n (%) n=39 (11.0)	p
Criterion B* Do you have a medical condition which you think will explain RLS symptoms?*** Yes No	12 (3.4) 342 (96.6)	10 (83.3) 305 (89.2)	2 (16.7) 37 (10.8)	0.525
Criterion C*** Does any of present RLS symptoms cause anxiety and stress? Yes No	54 (15.3) 300 (79.4)	34 (63.0) 281 (93.7)	20 (37.0) 19 (6.3)	0.003
Does any of present RLS symptoms cause functional interference? Yes No	21 (5.9) 333 (94.1)	13 (61.9) 302 (90.7)	8 (38.1) 31 (9.3)	0.004
Do you have sleep problems? Yes No	102 (28.8) 252 (71.2)	80 (78.4) 235 (93.3)	22 (21.6) 17 (6.7)	0.005
*Criterion B: To differentiate RLS from other conditions mimicking RLS **Another medical condition (e.g., myalgia, venous stasis, leg edema, arthritis, leg cramps, positional discomfort, habitual foot tapping) ***Criterion C: Clinically significance of RLS: RLS symptoms causing concern, distress, sleep disturbance, or impairment in mental, physical, social, occupational, educational, behavioral, or other important areas of functioning RLS: Restless legs syndrome				

Questions	Study group; n (%) n=354 (100.0)	RLS (criteria A) absent; n (%) n=315 (89.0)	RLS (criteria A) present; n (%) n=39 (11.0)	p*
Do you feel urge to move or an uncomfortable sensation in legs which prevents falling asleep? Yes No	24 (6.8) 330 (93.2)	13 (54.2) 302 (91.5)	11 (45.8) 28 (8.5)	0.001
Do you wake up at night with leg cramps? Yes No	21 (5.9) 333 (94.1)	16 (76.2) 299 (89.9)	5 (23.8) 34 (10.2)	0.54
Do you have leg pain in the morning? Yes No	11 (3.1) 343 (96.9)	7 (63.6) 308 (89.8)	4 (36.4) 35 (10.2)	0.006
Does your sleeping partner tell that you have many kicks at night? Yes No	16 (4.5) 338 (95.5)	9 (56.3) 306 (90.5)	7 (43.7) 32 (9.5)	0.001
Have you consulted a physician about your sleep problems? Yes No	10 (2.8) 344 (97.2)	8 (80) 307 (89.2)	2 (20) 37 (10.8)	0.357
*Chi-square test is used RLS: Restless legs syndrome				

Table 5. RLS awareness

Participant activities	Study group; n (%) n=354	RLS (criteria A) absent; n (%) n=315	RLS (criteria A) present; n (%) n=39	p
Rotation in neurology department /yes	268 (75.7)	235 (87.7)	33 (12.3)	0.169
Prior knowledge about RLS/yes	157 (44.4)	132 (84.1)	25 (15.9)	0.008
Neurology rotation and prior knowledge about RLS (both)	131 (37.0)	108 (82.4)	23 (17.6)	0.003
Sources of information about RLS				
School lectures	46 (13.0)	37 (80.4)	9 (16.9)	0.959
Web sources	64 (18.1)	54 (84.4)	10 (15.6)	
Visual media (radio - TV)	14 (4.0)	12 (85.7)	2 (2.2)	
Books and journals	10 (2.89)	9 (90.0)	1 (10.0)	
Health professionals	14 (4.0)	12 (85.7)	2 (14.3)	
RLS: Restless legs syndrome				

significant in those with chronic conditions except depression. Only the presence of depression in our participants was found to be associated with RLS symptoms. However, according to some studies, this relationship could be due to the side effects of antidepressants resulting in secondary RLS, or depression itself could be a result of RLS.^{25,26}

RLS is a serious cause of sleep disturbances, and it decreases total sleep time. It has been reported that patients with RLS have increased symptoms of sleep deprivation and anxiety compared with individuals without RLS symptoms.²⁷ Sariaydin et al.¹⁸ have also found that the sleep quality of students who have RLS is worse than that of healthy students.¹⁸ In our study group, the presence of sleep disturbances, an urge to move or an uncomfortable sensation in the legs that prevents individuals from falling asleep, leg pain in the morning, and kicking at night were associated with low sleep quality and were significantly more frequent in those who had RLS. Difficulties in falling asleep, waking up frequently at night, and having difficulty in getting up in the morning were the most common problems mentioned by our participants. The sleep quality of people whose RLS diagnosis has been delayed due to misdiagnosis and misreferrals deteriorates with time and results in increased anxiety and stress levels.¹² We found that RLS symptoms are rare in students who do not experience anxiety or stress, and it may be possible that the presence of RLS symptoms is a reason for anxiety and stress. In a study conducted by Silva et al.¹⁴ in adolescents and young adults, the reported frequency of RLS was 8.4%, and the quality of life of this group was worse. Moreover, in advanced cases, depression may accompany RLS because of impaired sleep quality and quality of life.^{5,26,28} Sleep problems were reported by 102 of our participants, and only 10 (10%) of them had consulted a physician, which may be attributed to inadequate awareness. Previous studies have found awareness about RLS insufficient in both physicians and medical school students. In a former study, the rate of medical students who would consult a doctor for RLS symptoms was 23.3%.¹⁶ In our study, participants with RLS reported symptoms that caused functional effects in various aspects of life. With the appropriate diagnosis, treatment, and guidance, the quality of life, sleep quality, and functionality of RLS patients can be enhanced. Nonpharmacological interventions like pneumatic compression and enabling sleep hygiene in addition

to mind and body exercises constitute an important part of the treatment to help relieve RLS symptoms.²⁸⁻³⁰ Awareness did not differ between third- and fourth- year medical students. In the group with awareness, RLS symptoms were more frequent either in themselves or in their relatives than those with less awareness. This may be interpreted as the presence of RLS symptoms have alerted the students to learning more about RLS. In addition to lectures attended at school, the internet was the most frequent source of information, which is a matter of fact in this group of young scholars. Screening for RLS symptoms may enhance early diagnosis, treatment, and referral of patients with RLS. Early management of patients with RLS may improve their quality of life and functionality in many aspects.²⁹ RLS has been defined for years and can only be diagnosed using the diagnostic criteria; therefore, awareness should be increased in medical students, who will become future physicians.

Study Limitations

The health-related problems of medical students are not discussed sufficiently in medical literature, so one of the strengths of this study is that it will add to the relevant literature. The large number of medical students participating in the study group is another strength of this study. There are some limitations of this study. A scale evaluating the sleep problems was not used, but the presence of any sleep problems was questioned. It is a single-center cross-sectional study and results cannot be generalized. Screening for RLS with questionnaires may lead to underdiagnosis or overdiagnosis, so patients who have RLS symptoms should be further examined by neurologists.

Conclusion

Awareness and knowledge about RLS was quite low among our participants, and this supports the results of the studies conducted with other medical students. In our study, depression, family history of RLS, lower familial income, sleep problems, and awareness about RLS were found to be associated with the presence of RLS. This study may lead to new studies being conducted to manage differential diagnosis. Consultations about nonpharmacological treatments in appropriate cases, primary care interventions related to comorbidities, and risk factors such as iron replacement and referrals after screening

are the main interventions that family physicians can suggest in the management of RLS in primary care.

Ethics

Ethics Committee Approval: The ethical committee approval was obtained from the Clinical Research Ethics Committee of Cerrahpaşa Faculty of Medicine (approval number: 54542, date: 08.02.2018).

Informed Consent: The participants provided their written informed consent to participate.

Authorship Contributions

Concept: T.Y., G.B.Ş., N.T.S., Design: T.Y., N.T.S., Data Collection or Processing: T.Y., N.T.S., Analysis or Interpretation: T.Y., D.K., A.K.F., N.T.S., Literature Search: T.Y., D.K., A.K.F., G.B.Ş., Writing: T.Y., D.K., A.K.F., N.T.S.

Conflict of Interest: Gülçin Benbir Şenel is Editor-in-Chief in European Journal of Turkish Sleep Medicine. She had no involvement in the peer-review of this article and had no access to information regarding its peer-review. Other authors declared no conflict of interest.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Ekblom KA. Restless legs: a clinical study. *Acta Med Scan.* 1945;158:1-123.
2. Ekblom K, Ulfberg J. Restless legs syndrome. *J Intern Med.* 2009;266(5):419-431.
3. American Academy of Sleep Medicine. International classification of sleep disorders, 3rd ed. Darien, IL: American Academy of Sleep Medicine; 2014.
4. Allen RP, Picchietti D, Hening WA, et al. Restless legs syndrome: diagnostic criteria, special considerations, and epidemiology. A report from the restless legs syndrome diagnosis and epidemiology workshop at the National Institutes of Health. *Sleep Med.* 2003;4:101-119.
5. Allen RP, Picchietti DL, Garcia-Borreguero D, et al. Restless legs syndrome/Willis-Ekbom disease diagnostic criteria: updated International Restless Legs Syndrome Study Group (IRLSSG) consensus criteria--history, rationale, description, and significance. *Sleep Med.* 2014;15(8):860-873.
6. Merlino G, Valente M, Serafini A, Gigli GL. Restless legs syndrome: diagnosis, epidemiology, classification and consequences. *Neurol Sci.* 2007;28(Suppl 1):37-46.
7. Paulus W, Dowling P, Rijsman R, Stiasny-Kolster K, Trenkwalder C, de Weerd A. Pathophysiological concepts of restless legs syndrome. *Mov Disord.* 2007;22(10):1451-1456.
8. Winkelmann JW, Schoerning L, Platt S, Jensen JE. Restless legs syndrome and central nervous system gamma-aminobutyric acid: preliminary associations with periodic limb movements in sleep and restless leg syndrome symptom severity. *Sleep Med.* 2014;15:1225-1230.
9. Baier PC, Trenkwalder C. Circadian variation in restless legs syndrome. *Sleep Med.* 2007;8(6):645-650.
10. Yeh P, Walters AS, Tsuang JW. Restless legs syndrome: a comprehensive overview on its epidemiology, risk factors, and treatment. *Sleep Breath.* 2012;16(4):987-1007.
11. Sevim S, Dogu O, Camdeviren H, et al. Unexpectedly low prevalence and unusual characteristics of RLS in Mersin, Turkey. *Neurology.* 2003;61(11):1562-1569.
12. Allen RP, Stillman P, Myers AJ. Physician-diagnosed restless legs syndrome in a large sample of primary medical care patients in western Europe: Prevalence and characteristics. *Sleep Med.* 2010;11(1):31-37.
13. Altunayoglu Cakmak V, Koc B, Nuhoglu I, et al. Prevalence of restless legs syndrome in Trabzon in the northeast Black Sea Region of Turkey: co-morbidities, socioeconomic factors and biochemical parameters. *Neurol Res.* 2015;37(9):751-762.
14. Silva GE, Goodwin JL, Vana KD, Vasquez MM, Wilcox PG, Quan SF. Restless legs syndrome, sleep, and quality of life among adolescents and young adults. *J Clin Sleep Med.* 2014;10:779-786.
15. Pienczk-Ręclawowicz K, Pilarska E, Olszewska A, Ręclawowicz D, Konieczna S, Sławek J. The prevalence of the restless legs Syndrome/Willis-Ekbom disease among teenagers, its clinical characteristics and impact on everyday functioning. *Sleep Med.* 2022;89:48-54.
16. Aydemir Özcan T, Meral H, Özcan H. The prevalence and awareness of restless legs syndrome in students at Ordu University. *Arch Neuropsychiatry.* 2013;50(2):175-179.
17. Ishaq M, Riaz SU, Iqbal N, et al. Prevalence of Restless Legs Syndrome among Medical Students of Karachi: An Experience from a Developing Country. *Sleep Disord.* 2020;2020:7302828.
18. Saraydın M, Günay E, Ünlü M. [Frequency of restless legs syndrome and relationship between depression, anxiety and sleep quality among medical school students]. *Tuberk Toraks.* 2018;66(3):217-223.
19. Shalash AS, Elrassas HH, Monzem MM, Salem HH, Abdel Moneim A, Moustafa RR. Restless legs syndrome in Egyptian medical students using a validated Arabic version of the Restless Legs Syndrome Rating Scale. *Sleep Med.* 2015;16(12):1528-1531.
20. Ergin N, Kılıç BB, Ergin A, Varlı S. Sleep quality and related factors including restless leg syndrome in medical students and residents in a Turkish university. *Sleep Breath.* 2022;26(3):1299-1307.
21. Sevim S, Dogu O, Kaleagasi H, Aral M, Metin O, Camdeviren H. Correlation of anxiety and depression symptoms in patients with restless legs syndrome: a population based survey. *J Neurol Neurosurg Psychiatry.* 2004;75(2):226-230.
22. Patrick L. Restless legs syndrome: pathophysiology and the role of iron and folate. *Altern Med Rev.* 2007;12(2):101-112.
23. Merlino G, Fratticci L, Valente M et al. Association of restless legs syndrome in type 2 diabetes: a case-control study. *Sleep.* 2007;30(7):866-871.
24. Lopes LA, Lins Cde M, Adeodato VG, et al. Restless legs syndrome and quality of sleep in type 2 diabetes. *Diabetes Care.* 2005;28(11):2633-2636.
25. Weber FC, Danker-Hopfe H, Dogan-Sander E, et al. Restless Legs Syndrome Prevalence and Clinical Correlates Among Psychiatric Inpatients: A Multicenter Study. *Front Psychiatry.* 2022;3:846165.
26. Cho SJ, Hong JP, Hahm BJ, et al. Restless legs syndrome in a community sample of Korean adults: prevalence, impact on quality of life, and association with DSM-IV psychiatric disorders. *Sleep.* 2009;32(8):1069-1076.
27. Becker PM. The biopsychosocial effects of restless legs syndrome (RLS). *Neuropsychiatr Dis Treat.* 2006;2(4):505-512.
28. Winkelmann JW, Armstrong MJ, Allen RP, et al. Practice guideline summary: Treatment of restless legs syndrome in adults: Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology. *Neurology.* 2016;87(24):2585-2593.
29. Hening WA. Current guidelines and standards of practice for restless legs syndrome. *Am J Med.* 2007;120(1 Suppl 1):22-27.
30. Wijemanne S, Jankovic J. Restless legs syndrome: clinical presentation diagnosis and treatment. *Sleep Med.* 2015;16(6):678-690.