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Original Article

Prevalence and clinical predictors of sleep disturbances in children with seasonal allergic rhinitis

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ABSTRACT

Objective: Seasonal allergic rhinitis (SAR) is one of the most common allergic diseases in childhood and is characterized by nasal congestion, rhinorrhea, sneezing, and itching. Beyond these classical nasal symptoms, SAR may also be associated with sleep disturbances. The present study aimed to determine the prevalence of sleep disturbances in children with SAR and to evaluate potential clinical predictors, including symptom severity, symptom timing, and comorbid allergic diseases.

Material and Methods: Children aged 6–16 years with seasonal allergic rhinitis (SAR) who were followed at the Pediatric Allergy and Immunology Department of Ankara City Hospital were enrolled in the study. An age- and demographically matched control group was also recruited. Sleep disturbances were assessed using the Sleep Disturbance Scale for Children (SDSC). SAR severity was classified according to the Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines, and symptom intensity was further evaluated using a visual analog scale (VAS). Logistic regression analysis was performed to identify independent predictors of SDSC-defined sleep disturbances.

Results: A total of 115 children with SAR (mean age: 11.6±3.2 years; 61.7% male) and 115 healthy controls were included. According to SDSC, 43.3% of children with SAR had clinically significant sleep disturbances. Compared with controls, children with SAR had significantly higher SDSC total scores (63.4±15.5 vs. 53.9±12.2; $p < 0.001$) and higher scores across all subscales. In multivariate logistic regression, an elevated nasal VAS score remained an independent predictor of sleep disturbances (OR: 1.86; 95% CI: 1.06-2.41; p=0.020).

Conclusion: Sleep disturbances were more prevalent in children with SAR than in healthy controls, and greater nasal symptom severity was independently associated with impaired sleep quality. Incorporating routine sleep quality assessment into the clinical evaluation of children with SAR may improve disease management and contribute to better overall quality of life.

Keywords: Seasonal allergic rhinitis, sleep disturbances, visual analogue scale

Introduction

Allergic rhinitis (AR) is an IgE-mediated inflammatory condition characterized by one or more symptoms, including nasal congestion, rhinorrhea (anterior or posterior), sneezing, and nasal itching (1,2). When accompanied by ocular symptoms, the condition is referred to as allergic rhinoconjunctivitis (ARC).

AR is a common disease. Its prevalence has been reported to range from 10% to 30% in children and adults (3,4). Findings indicate that in the majority of cases, AR symptoms begin before the age of 20, and in almost half of patients, the first symptoms appear around the age of 6 (5).

AR imposes a substantial disease burden and has been associated with fatigue, attention and learning difficulties, memory problems, and depressive symptoms (6,7). Previous studies have demonstrated that AR-related nasal obstruction contributes to sleep-related breathing disorders (8,9). Quality of life has been shown to be reduced in adolescents with AR or ARC, largely due to increased nasal symptoms, nasal congestion, impaired daily functioning,

and sleep disturbances (10,11). In addition, AR is frequently associated with asthma, another condition that may adversely affect sleep (12). In patients with AR, treatments targeting nasal congestion and inflammation have been shown to improve sleep quality and daytime alertness (8,13). Collectively, these findings underscore the clinical importance of assessing sleep disturbances in children with seasonal allergic rhinitis (SAR).

The aim of this study was to evaluate sleep disturbances in children with SAR and to examine their relationship with disease severity and associated clinical factors.

Materials and Methods

A total of 115 children aged 6–16 years with pollen sensitization who were diagnosed with seasonal allergic rhinitis (SAR) and followed at the Pediatric Allergy and Immunology Department of Ankara Bilkent City Hospital between May and July 2025 were included in the study. Patients with chronic or psychiatric diseases were excluded. All participants were evaluated during the same pollen season to minimize the potential impact of seasonal variations in pollen exposure on symptom severity and sleep outcomes. The control group consisted of children within the same age range and with comparable demographic characteristics who had no history of chronic, allergic, or psychiatric diseases. These children were recruited from the general pediatric outpatient clinic during routine health examinations

Demographic and clinical characteristics

Patients were evaluated during routine follow-up visits using the Sleep Disturbance Scale for Children (SDSC) and the Visual Analog Scale (VAS) to assess the severity of nasal and ocular symptoms (14,15). Medical histories were obtained, and physical examination findings were recorded.

The diagnosis and classification of SAR were made according to the Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines, based on symptom duration (intermittent or persistent) and severity (mild or moderate–severe). Symptoms occurring on fewer than four days per week or for less than four weeks were classified as intermittent, whereas symptoms present on more than four days per week and for more than four weeks were classified as persistent. Disease severity was categorized as mild in the absence of impaired sleep quality, impairment of daily activities, work or school performance, and troublesome symptoms. Moderate-to-severe disease was defined by the presence of at least one of the following: impaired sleep quality, limitation of daily activities, work or school impairment, or troublesome symptoms (16).

Demographic characteristics, exposure to cigarette, concomitant atopic diseases, aeroallergen sensitization, peripheral blood eosinophil counts, and total immunoglobulin E (IgE) levels were obtained from the patients' medica records.

Aeroallergen sensitivities

Aeroallergen sensitivities were determined by specific IgE (sIgE) and/or skin prick testing (SPT).

SPTs were performed in accordance with the guidelines of the European Academy of Allergy and Clinical Immunology (EAACI) (17). Antihistamines were discontinued at least 10 days prior to testing. DPTs were applied to the flexor surface of the forearm using commercial extracts (Lofarma, Milan, Italy, 1945). Grass pollens, rye, Aspergillus, Alternaria, tree mix (oak, maple, hazel), olea, birch, Artemisia, Dermatophagoides farinae, Dermatophagoides pteronyssinus, cat and dog epithelia, and cockroach extracts were used. The manufacturer's diluent (sodium chloride, sodium bicarbonate, phenol, and glycerol) was used as the negative control, and histamine as the positive control. Results were evaluated 15–20 minutes after application. Induration with a diameter of at least 3 mm surrounded by erythema was considered positive.

Serum sIgE levels were measured using the Immulite 2000 Immunoassay System (Siemens Healthcare Diagnostics, Tarrytown, NY, USA). A result equal to or greater than 0.35 kU/L was considered positive.

Sleep Disturbance Scale for Children (SDSC)

Sleep disturbances were assessed using the Sleep Disturbance Scale for Children (SDSC), developed by Bruni et al.(18) and validated in Turkish. The SDSC is a 26-item Likert-type questionnaire completed by parents to assess sleep disturbances in children aged 6–16 years over the previous six months. It comprises six subscales: disorders of initiating and maintaining sleep (DIMS) (items 1, 2, 3, 4, 5, 10, and 11), sleep breathing disorders (SBD) (items 13, 14, and 15), disorders of arousal (DA) (items 17, 20, and 21), sleep–wake transition disorders (SWTD) (items 6, 7, 8, 12, 18, and 19), disorders of excessive somnolence (DOES) (items 22, 23, 24, 25, and 26), and sleep hyperhidrosis (SHY) (items 9 and 16). Each item is scored on a 5-point Likert scale (1 = never, 5 = always), yielding total scores ranging from 26 to 130. A T-score is calculated based on the total score, with higher scores indicating more severe sleep disturbances. A T-score above 70 is considered indicative of clinically significant sleep disturbances (14,18).

Visual Analogue Scale (VAS)

Symptom severity was assessed using a 10-cm VAS, as recommended by the ARIA guidelines, where 0 indicated "no symptoms" and 10 represented "maximum severity" (15,16).

Statistical Analysis

Data obtained from medical records were analyzed using IBM SPSS Statistics 26.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics (frequency, percentages, mean, standart deviation, median and interquartile range) were calculated for demographic variables. The percentage of patients meeting the threshold value for sleep disorders on the SDSC was determined. Data were presented as mean and standard deviation (SD) or median [25–75% interquartile range (IQR)]. Groups were compared using the Mann–Whitney U test. Logistic regression analysis was performed to identify risk factors for sleep disorders. Variables with $p \leq 0.200$ in univariate analysis were included in the multivariate model. Results were reported as odds ratios (Exp(B)) with 95% confidence intervals. Statistical significance was set at $p < 0.050$.

Results

Demographic and clinical characteristics of patients

A total of 115 patients diagnosed with SAR were included in the study during the study period. The mean age of the patients was 11.6±3.2 years, and 61.7% (n=71) were male. Sensitization to aeroallergens other than pollen was detected in 46.1% of patients (n = 53), most commonly to cat dander (33.0%, n=38) and house dust mite (13.9%, n=16). At least one concomitant allergic disease was present in 48.7% of patients (n=56), with asthma (34.8%, n=40) and atopic dermatitis (13.9%, n=16) being the most common. Cigarette exposure was reported in 53.9% of patients (n=62), and a family history of allergic disease was present in 49.6% (n=57).

According to the ARIA classification, 54.8% of patients (n=63) had moderate-to-severe persistent rhinitis. The most commonly used treatments were nasal steroids (73.9%, n=85) and oral antihistamines (66.9%, n=77). The median absolute eosinophil count was 280 cells/mm³ (IQR: 142.5–440), and the total IgE level was 216 kU/L (IQR: 108–677.5). According to the SDSC, sleep disorder was detected in 44.3% of patients (n=51) (Table I).

Table I: Demographic and clinical characteristics of patients with seasonal allergic rhinitis

Variables	Values
Total number of patients	115
Male*	71 (61.7)
Age(year)†	11.6±3.2
Polisensitizatiion*	53 (46.1)
Cat	38 (33.0)
House Dust Mite	16 (13.9)
Dog	10 (8.7)
Mold	4 (3.5)
Cochroach	1 (0.9)
Concomitant allergic disease*	56 (48.7)
Asthma	40 (34.8)
Atopic dermatitis	16 (13.9)
Food allergy	4 (3.5)
Chronic urticaria	2 (1.7)
Drug allergy	1 (0.9)
Passive smoking exposure*	62 (53.9)
Familial history of allergic disease*	57 (49.6)
ARIA Classification*	
Moderate-severe/ persistant	63 (54.8)
Mild/ intermittant	32 (27.8)
Mild/persistant	11 (9.6)
Moderate-severe/intermittant	9 (7.8)
Treatment*	
Intranasal corticosteroids	85 (73.9)
Antihistaminic	77 (67.9)
Montelukast+levocetirizin combination	18 (15.7)
Oculer antihistaminic	12 (10.4)
Montelukast	6 (5.2)
Immunotherapy	1 (0.9)
AEC, cells/mm³‡	280 (142.5-440)
Total IgE,kU/L‡	216 (108-677.5)
Sleep disturbances according to SDSC*	51 (44.3)

***: n(%), †: mean± SD, ‡:** median (IQR), **AEC:** Absolute eozinophil count, **SDSC:** Sleep disturbance scale for children*

A control group consisting of 115 individuals was included in the study. The mean age of the control group was 11.3±3.4 years, and 59.1% (n=68) were male. The age and gender characteristics of the control group were similar to those of the patients (p=0.510 and p=0.590, respectively).

Comparison of sleep disorders between SAR patients and healthy controls

When comparing the SAR group with healthy controls in terms of SDSC total scores and subscale scores, significantly higher

Table II: Comparison of SDSC scores between children with SAR and healthy controls

Variable	SAR*	Control*	p†
Total number of patients	115	115	-
DIMS T score	15.2 ±4.7 56.2±10.5	13.8±4.6 53.2±10.4	0.310
SBD T score	7.2±3.3 66.1±10.3	4.3±2.1 51.4±11.5	<0.001
DA T score	5.1±2.4 64.2±17.2	4.0±1.5 55.2±13.8	<0.001
SWTD T score	11.8±4.7 57.1±14.2	10.2±3.9 52.4±12.6	<0.001
DOES T score	10.4±4.2 59.5±13.9	8.8±4.1 53.8±13.6	0.030
SHY T score	4.8±2.4 56.9±11.3	3.3±1.5 49.4±8.1	<0.001
Total score T score	54.8±16.6 63.4±15.5	44.8±12.3 53.9±12.1	<0.001

***: mean± SD, †: Mann Whitney U test, SDSC:** Sleep disturbance scale for children, **SAR:** Seasonal allergic rhinitis, **DIMS:** disorders of initiating and maintaining sleep, **SBD:** sleep breathing disorders, **DA:** disorders of arousal, **SWTD:** sleep–wake transition disorders, **DOES:** disorders of excessive somnolence, **SHY:** sleep hyperhidrosis*

Table III: Comparison of clinical parameters according to the presence of sleep disorders in patients with seasonal allergic rhinitis

Variable	Sleep Disorders		p
	Yes	No	
Number of total patients	51	64	-
Male*	30 (58.8)	41(64.6)	0.700
Passive smoking exposure*	30 (58.8)	32 (50)	0.100
Polisensitization*	27 (52.9)	26 (40.6)	0.250
Concomitant allergic disease*	26 (50.9)	30 (46.8)	0.710
Asthma*	16 (31.3)	24 (37.5)	0.550
Moderate-severe rhinitis*	38 (74.5)	34 (53.1)	0.020
Persistant rhinitis*	39 (76.4)	35 (54.6)	0.020
Familial history of allergic disease*	25 (49.1)	32 (50)	1.000
AEC, cells/mm³†	305 (143-357)	255(140-430)	0.190
Total IgE,ku/L†	227(115.1-796.7)	216(93.2-639.4)	0.810
Nasal VAS score†	7 (5-8)	4 (3-6)	<0.001
Ocular VAS score†	7 (3-8)	2 (1-5)	<0.001

***: n(%), †: median(IQR), AEC:** Absolute eozinophil count*

Table IV: Risk factors for sleep disorders in patients with seasonal allergic rhinitis

	Univariate			Multivariate		
	OR	CI (95%)	p	OR	CI (%95)	p
Gender	1.28	0.78– 1.71	0.800	-	-	-
Asthma	0.76	0.35-1.65	0.490	-	-	-
Concomittant allergic disease	1.17	0.56-2.46	0.660	-	-	-
Passive smoking exposure	1.42	0.68-3.0	0.340	-	-	-
Polisensitization	1.76	0.92-2.98	0.190	1.08	0.62-1.72	0.210
Moderate-severe rhinitis	1.25	1.02-1.40	0.020	1.07	0.40-2.85	0.830
Persistant rhinitis	1.49	1.13-1.91	0.010	1.03	0.35-3.05	0.780
Nasal VAS score	2.79	1.19-6.87	<0.001	1.86	1.06-2.41	0.020
Ocular VAS score	2.57	1.16-5.37	0.020	1.12	0.89-1.42	0.320

scores were observed in the SAR group. The SBD (p<0.001), DA (p<0.001), SWTD (p<0.001), DOES (p=0.03), and SHY (p <0.001) subscales were significantly higher in the SAR group. The total SDSC score was 54.8±16.6 in the SAR group and 44.8±12.3 in the control group (p<0.001) (Table II).

Comparison of SAR Patients with and without Sleep Disorders

When SAR patients were divided into two groups based on the presence of sleep disorders (those with sleep disorders: 44.3%, n=51; those without: 55.7%, n=64), the group with sleep disorders had a higher prevalence of moderate-severe rhinitis [74.5% (n=38) vs. 53.1% (n=34); p=0.020], persistent rhinitis [76.4% (n=39) vs. 54.6% (n=35); p=0.020], nasal VAS score [median: 7 (IQR: 5–8) vs. 4 (IQR: 3–6); p<0.001], and ocular VAS score [median: 7 (IQR: 3–8) vs. 2 (IQR: 1–5); p<0.001)] were significantly higher (Table III).

Risk Factors for Sleep Disorder

In univariate analysis, moderate-severe rhinitis (OR=1.25; 95% CI: 1.02–1.40; p=0.020), persistent rhinitis (OR=1.49; 95% CI: 1.13–1.91; p=0.010), nasal VAS score (OR=2.79; 95% CI: 1.19–6.87; p<0.001), and ocular VAS score (OR=2.57; 95% CI: 1.16–5.37; p=0.020) were significantly associated with sleep disorder. In multivariate analysis, only the nasal VAS score was identified as an independent risk factor (OR=1.86; 95% CI: 1.06–2.41, p=0.020) (Table IV).

Discussion

Allergic rhinitis in childhood is not limited to nasal and ocular symptoms but can also have adverse effects on sleep (8,9). As disease severity increases, problems such as sleep-related breathing disorders and decreased daytime performance are reported to occur more frequently (10,11). This finding indicates that the burden of AR on quality of life in children extends beyond what was previously recognized. In our study, sleep disturbances were detected in nearly half of the children diagnosed with SAR. Notably, sleep disturbances were more common in this group compared with a similar group of children without chronic or allergic diseases. Similar findings have been reported in the literature. In a study conducted by Roxbury et al. (19) in an adult population in the United States, individuals with allergic rhinitis were found to have longer sleep onset latency and significantly higher rates of insomnia, sleep apnea, nighttime awakenings, excessive daytime sleepiness, and sleep medication use. Similarly, in a study by Meltzer et al.(5), 40% of parents reported that their children's nasal allergies negatively affected sleep; 32% reported difficulty falling asleep, 26% reported nighttime awakenings, and 29% reported insufficient sleep quality. Comparable results were also observed in a study conducted in Latin America (20). In addition, a meta-analysis by Liu et al. (21) demonstrated poorer sleep quality and a higher prevalence of sleep disorders among individuals diagnosed with AR. Collectively, these findings indicate that allergic rhinitis has a significant impact on sleep quality and that consistent results have been observed across different populations.

When the SAR group was compared with healthy controls, significant differences were observed in the SDSC total score as well as in the subscales of sleep-related breathing disorders, disorders of arousal, sleep–wake transition disorders, excessive daytime sleepiness, and sleep-related excessive sweating. Obstructive sleep apnea (OSA) is the sleep pathology most frequently associated with SAR in the literature, and numerous studies have demonstrated this relationship (22,23). However, current evidence indicates that sleep impairment in SAR is not limited to OSA. Previous studies have shown that allergic rhinitis in children is associated with multidimensional sleep disturbances, ranging from difficulties in initiating and maintaining sleep to excessive daytime sleepiness, as well as arousal disorders, parasomnias, and sleep-related sweating (24). The higher scores observed in multiple SDSC subscales in the SAR group compared with healthy controls support the notion that sleep disturbances in SAR manifest across a multidimensional spectrum. This finding extends beyond studies in the literature that focus primarily on obstructive sleep apnea, underscoring the need for a comprehensive assessment of sleep health in children with SAR.

Our study found that the most important determinant of sleep disturbances in children with SAR was the severity of nasal symptoms. Specifically, higher nasal VAS scores were significantly associated with higher SDSC total scores. The key role of nasal symptoms has also been demonstrated in previous studies. In a randomized controlled trial involving children with sleep-related breathing disorders, intranasal budesonide treatment was shown to improve symptoms and quality of life, along with significant improvements in sleep parameters (25). Similarly, nasal irrigation has been reported to improve sleep quality in children with rhinitis symptoms, highlighting the importance of controlling nasal congestion for sleep health (26). Mansfield et al.

(27) also reported significant improvements in both sleep-related breathing disorders and daytime quality of life in children with SAR treated with intranasal corticosteroids. Collectively, these findings suggest that nasal symptom severity plays a central role in the pathophysiology of sleep disturbances in SAR and that effective symptom control directly contributes to improved sleep health.

Our study also demonstrated that ocular symptoms increase the risk of sleep disturbances in children with SAR. Li et al. (28) reported impaired sleep quality, more frequent nighttime awakenings, and increased daytime fatigue in patients with allergic conjunctivitis. These findings indicate that ocular symptoms adversely affect not only daytime quality of life but also sleep integrity. Consistently, our results show that the presence of ocular symptoms in children with SAR is associated with an increased risk of sleep disturbances, supporting the importance of the multidimensional symptom burden of SAR in the impairment of sleep health.

Our finding that persistent and moderate–to–severe rhinitis in children with SAR is associated with increased risk of sleep disturbances highlights the importance of disease severity in sleep health. Lee et al. (29) reported that sleep problems were more common in children with moderate–to–severe AR and that symptom severity was a key determinant of sleep quality. Similarly, Da Silva et al. (30) demonstrated that sleep-related breathing disorders were both more frequent and more severe in cases of moderate–to–severe rhinitis. When considered together with our results, these findings indicate that sleep disturbances become more pronounced in persistent and severe forms of SAR and that effective disease control plays a critical role in maintaining sleep health.

Limitations

Our study has several limitations. First, its single-center design and the assessment of sleep disturbances using a questionnaire, without objective methods such as polysomnography, may limit the strength of the findings. In addition, as our institution is a tertiary care center, the higher prevalence of persistent and more severe SAR phenotypes in our study population may limit the generalizability of the results. However, the use of standardized data collection forms and the evaluation of all patients by the same allergy–immunology specialists helped minimize potential measurement and assessment variability.

Conclusion

Sleep disturbances are common and multidimensional in children with SAR. Persistent and more severe rhinitis phenotypes, as well as ocular symptoms, were identified as risk factors for sleep disturbances, with nasal symptom severity playing a particularly important role. These findings suggest that childhood SAR is not limited to nasal and ocular complaints but also imposes a substantial burden on sleep health. In clinical practice, incorporating the assessment of sleep disturbances into routine follow-up for children with SAR may facilitate more comprehensive disease management.

Ethics committee approval

This study was conducted in accordance with the Helsinki Declaration Principles. The study was approved by Ankara Bilkent City Hospital (12.03.2025, reference number: TABED 1-25-1104).

Contribution of the authors

Study conception and design: EDM, ZŞE, FAG; Data collection: EKK, AKK, TTKG, FAG; Analysis and interpretation of results: FAG, EDM, ZŞE; Draft manuscript preparation: FAG, EDM, ZŞE; All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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