



Original Article

## Impact of Allergic Rhinitis on Sleep Quality and Daytime Functioning in Adolescents

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### ABSTRACT

**Background:** Allergic rhinitis is a common disorder in adolescents and may adversely affect sleep and daytime functioning. This study assessed its impact on sleep quality and daytime functioning in adolescents.

**Methods:** This hospital-based observational study included 200 adolescents with allergic rhinitis attending Malla Reddy Institute of Medical Sciences from October 2024 to January 2026. Symptom severity, sleep disturbance, and daytime impairment were assessed using structured scoring systems. Associations between allergic rhinitis severity and functional impairment were analyzed.

**Results:** Of the 200 participants, 102 (51.0%) had severe sleep disturbance and 80 (40.0%) had severe daytime impairment. Mean sleep disturbance score increased from  $4.95 \pm 3.61$  in mild allergic rhinitis to  $14.16 \pm 3.48$  in severe disease, while mean daytime impairment score increased from  $3.02 \pm 3.50$  to  $9.88 \pm 3.72$ . Total nasal symptom score showed a strong positive correlation with sleep disturbance ( $\rho = 0.697$ ,  $p < 0.001$ ) and a moderate positive correlation with daytime impairment ( $\rho = 0.568$ ,  $p < 0.001$ ).

**Conclusion:** Allergic rhinitis has a significant negative effect on sleep quality and daytime functioning in adolescents, especially in those with more severe symptoms. Assessment of sleep and daytime impairment should form an important part of clinical evaluation in these patients.

**Keywords:** Allergic rhinitis, Adolescents, Sleep quality, Daytime functioning, Nasal obstruction.

### INTRODUCTION

Allergic rhinitis is a common chronic condition in adolescents and is increasingly recognized as an important cause of impaired well-being and reduced daily functioning. Although it is often viewed as a minor allergic disorder, its burden extends beyond nasal symptoms alone. Adolescents with allergic rhinitis may experience disturbed sleep, fatigue, impaired concentration, reduced participation in daily activities, and lower quality of life [1].

The effect of allergic rhinitis on quality of life during adolescence is particularly relevant because this period is marked by rapid physical, emotional, and educational development. Persistent symptoms such as sneezing, rhinorrhea, nasal itching, and nasal blockage may interfere with routine activities and social functioning. Previous studies have shown that allergic rhinitis has a measurable negative impact on the quality of life of adolescents and should not be underestimated in clinical practice [2,4,7].

Among the different symptoms of allergic rhinitis, nasal obstruction appears to have a major effect on overall well-being. Persistent nasal blockage may impair normal breathing, promote mouth breathing, and disturb sleep. Valls-Mateus et al. reported that nasal obstructive disorders significantly impair health-related quality of life in adolescents with persistent allergic rhinitis, highlighting the importance of symptom burden beyond the classic allergic profile [3].

Sleep quality is an important but often overlooked domain in adolescents with allergic rhinitis. Poor sleep may result from nasal obstruction, nocturnal symptoms, and difficulty in maintaining comfortable breathing during the night. Disturbed sleep can present as difficulty in falling asleep, repeated night awakenings, non-restorative sleep, and morning tiredness. Previous studies have shown that greater disease severity is associated with worse sleep quality in patients with allergic rhinitis [6]. Poor sleep has also been shown to be strongly associated with house dust mite allergic rhinitis in both children and adults [8].

Sleep disturbance in adolescents has consequences that extend into the daytime. Reduced alertness, daytime sleepiness, fatigue, irritability, and poor concentration may affect academic performance and daily participation. Jauregui et al. observed that allergic rhinitis can negatively influence school performance, emphasizing the functional burden of the disease in this age group [5]. This relationship between nasal symptoms, sleep quality, and daytime functioning is clinically important, especially in adolescents who are expected to maintain regular school attendance and academic performance.

Despite the high prevalence of allergic rhinitis, many clinical studies focus mainly on symptom control and pharmacological management. Comparatively fewer studies evaluate its effect on sleep quality and daytime functioning together in adolescent patients. A more focused assessment of these domains may provide a better understanding of the overall burden of the disease and may help guide more comprehensive management strategies.

The present study was therefore undertaken to assess the impact of allergic rhinitis on sleep quality and daytime functioning in adolescents attending a tertiary care teaching hospital.

## **AIM AND OBJECTIVES**

### **Aim**

To assess the impact of allergic rhinitis on sleep quality and daytime functioning in adolescents.

### **Objectives**

1. To evaluate the pattern and severity of sleep disturbance in adolescents with allergic rhinitis.
2. To assess the effect of allergic rhinitis on daytime functioning, including daytime sleepiness, concentration, and daily activity.
3. To determine the association between severity of allergic rhinitis symptoms and impairment in sleep quality and daytime functioning.

## **MATERIALS AND METHODS**

### **Study design**

This was a hospital-based observational study.

### **Study setting**

The study was conducted in the Department of Otorhinolaryngology at Malla Reddy Institute of Medical Sciences.

### **Study duration**

The study was carried out from October 2024 to January 2026.

### **Study population**

The study included adolescent patients diagnosed with allergic rhinitis who attended the outpatient department during the study period.

### **Sample size**

A total of 200 patients were included in the study.

### **Sampling method**

A consecutive sampling method was used. All eligible adolescents fulfilling the inclusion criteria during the study period were enrolled until the required sample size was achieved.

### **Inclusion criteria**

Adolescents aged 10 to 19 years with clinically diagnosed allergic rhinitis were included in the study. Patients who were willing to participate and whose parents or guardians provided consent, wherever required, were enrolled.

### **Exclusion criteria**

Patients with acute upper respiratory tract infection at the time of evaluation were excluded. Adolescents with chronic sinusitis, adenoid hypertrophy, bronchial asthma with uncontrolled symptoms, obstructive sleep apnea already diagnosed

due to another primary cause, significant psychiatric illness, neurological disorders, or chronic systemic disease affecting sleep were excluded. Patients unwilling to participate were also excluded.

### **Diagnostic criteria**

Diagnosis of allergic rhinitis was made based on history and clinical examination. Typical symptoms included sneezing, watery nasal discharge, nasal obstruction, and nasal itching. Relevant personal and family history of atopy was also recorded. Diagnosis was supported by anterior rhinoscopic or nasal examination findings suggestive of allergic rhinitis, such as pale or bluish nasal mucosa, turbinate hypertrophy, and watery secretions.

### **Data collection procedure**

A predesigned and pretested case record proforma was used to collect data. Demographic details such as age and sex were recorded. Clinical details including duration of symptoms, seasonal or perennial pattern, family history of allergy, and associated symptoms were noted.

Symptom severity of allergic rhinitis was assessed using a structured symptom score. The major symptoms evaluated were:

- sneezing
- rhinorrhea
- nasal obstruction
- nasal itching

Each symptom was graded on a **0–3 scale** as follows:

- **0 = absent**
- **1 = mild**
- **2 = moderate**
- **3 = severe**

A total nasal symptom score was calculated by adding the scores of the four symptoms, giving a possible score range of **0 to 12**.

### **Assessment of sleep quality**

Sleep quality was assessed using a structured questionnaire-based approach. The following domains were evaluated:

- difficulty in falling asleep
- frequent night awakenings
- mouth breathing during sleep
- snoring
- non-restorative sleep
- morning tiredness

Each parameter was graded on a **0–3 scale**:

- **0 = absent**
- **1 = occasional**
- **2 = frequent**
- **3 = persistent**

A total sleep disturbance score was calculated. Higher scores indicated poorer sleep quality.

### **Assessment of daytime functioning**

Daytime functioning was assessed through clinical interview and questionnaire. The following parameters were recorded:

- daytime sleepiness
- fatigue
- poor concentration
- irritability
- reduced participation in school or daily activities

Each parameter was graded on a 0–3 scale:

- 0 = absent
- 1 = mild
- 2 = moderate
- 3 = severe

A total daytime functioning impairment score was calculated. Higher scores reflected greater daytime dysfunction.

### Classification of allergic rhinitis severity

For analysis, allergic rhinitis severity was categorized on the basis of total nasal symptom score into:

- Mild
- Moderate
- Severe

This categorization was used to study the association between severity of allergic rhinitis and impairment in sleep quality and daytime functioning.

### Outcome measures

The main outcome measures of the study were:

1. prevalence and severity of sleep disturbance in adolescents with allergic rhinitis
2. degree of impairment in daytime functioning
3. association between allergic rhinitis symptom severity and sleep/daytime impairment scores

### Data collection tools

Data were collected using:

- case record proforma
- symptom severity score sheet
- sleep quality assessment questionnaire
- daytime functioning assessment questionnaire

### Statistical analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Quantitative variables were expressed as mean and standard deviation. Qualitative variables were presented as frequency and percentage.

Association between allergic rhinitis severity and sleep quality or daytime functioning was assessed using the chi-square test for categorical variables. Comparison of mean scores between groups was performed using the independent t-test or one-way ANOVA, as appropriate. For non-normally distributed data, corresponding non-parametric tests were used. Correlation between total nasal symptom score and sleep/daytime functioning scores was assessed using the Pearson or Spearman correlation coefficient. A p-value of less than 0.05 was considered statistically significant.

### Ethical considerations

Approval was obtained from the Institutional Ethics Committee before the commencement of the study. Informed consent was obtained from participants and from parents or guardians wherever applicable. Confidentiality of all patient information was maintained throughout the study.

## RESULTS

### 1. Study population and clinical profile

The study population had a mean age of  $14.40 \pm 2.07$  years, with a near-equal sex distribution. Perennial symptoms were more common than seasonal symptoms, and around two-fifths of participants had a family history of allergy. Associated eye symptoms were present in 42.0%, whereas asthma-related symptoms and eczema were less frequent. These baseline characteristics are summarized in Table 1.

**Table 1. Baseline demographic and clinical characteristics of the study population (N=200).**

Characteristic	Value
Age (years), mean $\pm$ SD	14.40 $\pm$ 2.07
Age (years), median (IQR)	15 (13–16)
Sex: Male	104 (52.0)
Sex: Female	96 (48.0)
Duration of symptoms (months), mean $\pm$ SD	13.55 $\pm$ 9.93
Duration of symptoms (months), median (IQR)	11 (7–17)
Pattern: Seasonal	82 (41.0)
Pattern: Perennial	118 (59.0)
Family history of allergy: Yes	82 (41.0)
Associated eye symptoms: Yes	84 (42.0)
Associated asthma symptoms: Yes	40 (20.0)
Associated eczema: Yes	29 (14.5)

## 2. Allergic rhinitis symptom profile and severity classification

Sneezing was the most prominent nasal symptom, followed by rhinorrhea and nasal obstruction. Using the total nasal symptom score, 20.0% of adolescents were classified as having mild allergic rhinitis, 42.0% moderate disease, and 38.0% severe disease. The nasal symptom profile and severity distribution are shown in Table 2.

**Table 2. Nasal symptom profile and allergic rhinitis severity distribution.**

Nasal symptom	Mean $\pm$ SD score	Moderate-to-severe n (%)	Severe n (%)
Sneezing	1.91 $\pm$ 1.05	134 (67.0)	74 (37.0)
Rhinorrhea	1.78 $\pm$ 1.07	124 (62.0)	65 (32.5)
Nasal obstruction	1.69 $\pm$ 1.06	119 (59.5)	54 (27.0)
Nasal itching	1.56 $\pm$ 1.07	103 (51.5)	50 (25.0)

AR severity category	n (%)
Mild	40 (20.0)
Moderate	84 (42.0)
Severe	76 (38.0)

## 3. Sleep disturbance in adolescents with allergic rhinitis

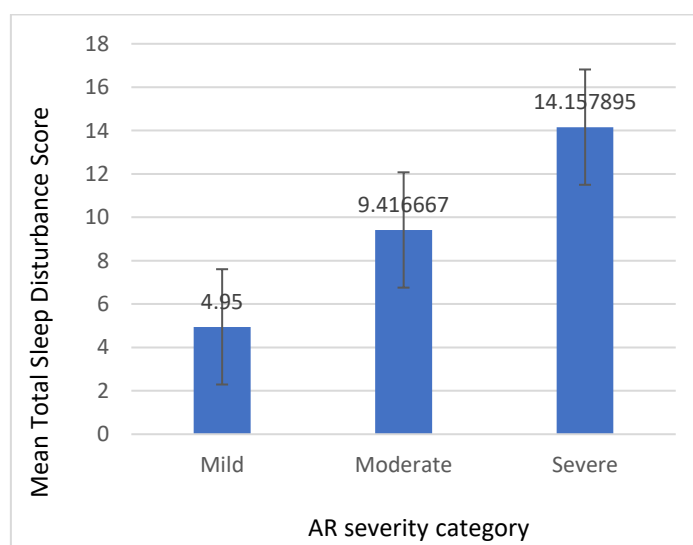
The mean total sleep disturbance score was 10.32  $\pm$  5.26. Mouth breathing during sleep and morning tiredness were the most affected domains, each showing persistent symptoms in more than one-third of participants. Overall, 51.0% of adolescents fell into the severe sleep-disturbance category, indicating a substantial sleep-related burden in this cohort (Table 3).

**Table 3. Sleep disturbance domains and total sleep disturbance category.**

Sleep domain	Mean $\pm$ SD score	Frequent/persistent n (%)	Persistent n (%)
Difficulty falling asleep	1.64 $\pm$ 1.08	112 (56.0)	54 (27.0)
Night awakenings	1.65 $\pm$ 1.10	114 (57.0)	57 (28.5)
Mouth breathing during sleep	1.94 $\pm$ 1.03	133 (66.5)	77 (38.5)
Snoring	1.45 $\pm$ 1.10	94 (47.0)	46 (23.0)
Non-restorative sleep	1.77 $\pm$ 1.07	121 (60.5)	65 (32.5)
Morning tiredness	1.88 $\pm$ 1.07	124 (62.0)	78 (39.0)

Total sleep disturbance category	n (%)	Total sleep disturbance score, mean $\pm$ SD
Mild/none	44 (22.0)	
Moderate	54 (27.0)	
Severe	102 (51.0)	

**Overall total sleep disturbance score: 10.32  $\pm$  5.26**



**Figure1. Mean total sleep disturbance score across allergic rhinitis severity categories.**

#### 4. Daytime functioning impairment

The mean total daytime impairment score was  $6.85 \pm 4.96$ . Fatigue, daytime sleepiness, and poor concentration were the most prominent daytime consequences. Severe daytime impairment was present in 40.0% of participants, highlighting the functional impact of allergic rhinitis beyond nocturnal symptoms (Table 4).

**Table 4. Daytime functioning domains and total daytime impairment category.**

Daytime domain	Mean $\pm$ SD score	Moderate-to-severe n (%)	Severe n (%)
Daytime sleepiness	$1.42 \pm 1.16$	94 (47.0)	50 (25.0)
Fatigue	$1.45 \pm 1.16$	96 (48.0)	51 (25.5)
Poor concentration	$1.45 \pm 1.13$	93 (46.5)	49 (24.5)
Irritability	$1.32 \pm 1.12$	93 (46.5)	37 (18.5)
Reduced participation in school/daily activities	$1.22 \pm 1.16$	82 (41.0)	39 (19.5)

Total daytime impairment category	n (%)
Mild/none	80 (40.0)
Moderate	40 (20.0)
Severe	80 (40.0)

**Overall total daytime impairment score:**  $6.85 \pm 4.96$

#### 5. Association of allergic rhinitis severity with sleep quality and daytime functioning

There was a clear gradient between allergic rhinitis severity and both outcome domains. Mean sleep disturbance scores increased from  $4.95 \pm 3.61$  in the mild group to  $14.16 \pm 3.48$  in the severe group, and mean daytime impairment scores increased from  $3.02 \pm 3.50$  to  $9.88 \pm 3.72$  across the same severity categories. The between-group differences were statistically significant for both sleep disturbance (one-way ANOVA,  $F=73.07$ ,  $p < 0.001$ ) and daytime impairment (one-way ANOVA,  $F=37.66$ ,  $p < 0.001$ ). These findings support a dose-response relationship between nasal symptom burden and impairment in sleep quality and daytime functioning (Table 5).

**Table 5. Mean sleep and daytime impairment scores according to allergic rhinitis severity.**

AR severity category	n	Total sleep disturbance score, mean $\pm$ SD	Total daytime impairment score, mean $\pm$ SD
Mild	40	$4.95 \pm 3.61$	$3.02 \pm 3.50$
Moderate	84	$9.42 \pm 4.58$	$5.93 \pm 4.95$
Severe	76	$14.16 \pm 3.48$	$9.88 \pm 3.72$

Comparison	Test	Statistic	p value
Total sleep disturbance score across AR severity categories	One-way ANOVA	$F = 73.07$	$<0.001$
Total daytime impairment score across AR severity categories	One-way ANOVA	$F = 37.66$	$<0.001$

When categorical severity groupings were examined, severe sleep disturbance and severe daytime impairment were disproportionately concentrated in adolescents with severe allergic rhinitis. The association between allergic rhinitis severity and sleep-disturbance category was significant (chi-square = 77.79,  $p < 0.001$ ), as was the association with daytime-impairment category (chi-square = 58.93,  $p < 0.001$ ) (Table 6).

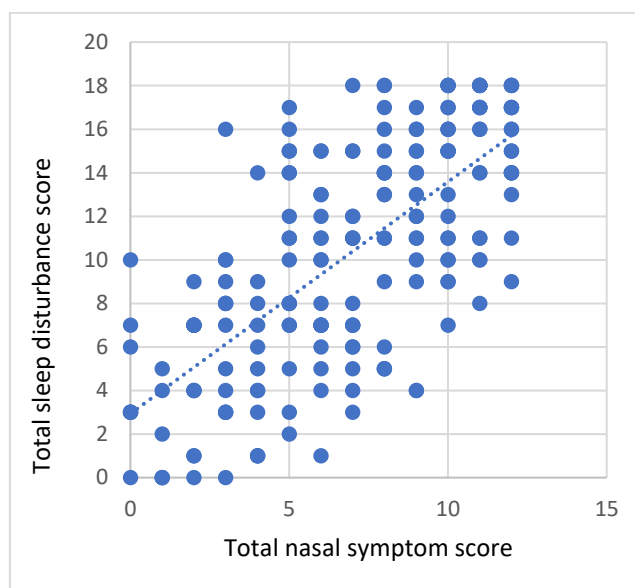
**Table 6. Categorical association of allergic rhinitis severity with sleep disturbance and daytime impairment.**

**Table 6A. Association of AR severity with sleep disturbance category**

AR Severity Category	Mild/none	Moderate	Severe
Mild	23	16	1
Moderate	19	27	38
Severe	2	11	63

**Table 6B. Association of AR severity with daytime impairment category**

AR Severity Category	Mild/none	Moderate	Severe
Mild	30	7	3
Moderate	43	14	27
Severe	7	19	50



**Figure 2. Scatter plot showing the relationship between total nasal symptom score and total sleep disturbance score**

The scatter plot demonstrates a significant positive correlation between allergic rhinitis symptom severity and sleep impairment, with higher total nasal symptom scores associated with higher total sleep disturbance scores (Spearman rho = 0.697,  $p < 0.001$ ).

#### 6. Correlation between allergic rhinitis symptom severity and outcome scores

Total nasal symptom score showed a strong positive correlation with total sleep disturbance score (Spearman rho = 0.697,  $p < 0.001$ ) and a moderate positive correlation with total daytime impairment score (Spearman rho = 0.568,  $p < 0.001$ ). This indicates that higher allergic rhinitis symptom burden was consistently associated with poorer sleep quality and worse daytime functioning (Table 7).

**Table 7. Correlation of total nasal symptom score with sleep disturbance and daytime impairment.**

Outcome	Spearman rho with total nasal symptom score	p value
Total sleep disturbance score	0.697	<0.001
Total daytime impairment score	0.568	<0.001

#### DISCUSSION

The present study showed that allergic rhinitis has a considerable impact on both sleep quality and daytime functioning in adolescents. More than half of the participants had severe sleep disturbance, and 40.0% had severe daytime impairment. Mouth breathing during sleep, morning tiredness, fatigue, daytime sleepiness, and poor concentration were the most prominent problems. These findings indicate that the burden of allergic rhinitis in adolescents extends beyond nasal symptoms and affects important aspects of daily life.

The high burden of sleep disturbance observed in this study is consistent with previous reports. Colás et al., in the SOMNIAAR study of 2275 patients with allergic rhinitis, reported poor sleep quality in 52.8% of patients and excessive daytime somnolence in 21.1% [12]. In the present study, 51.0% of adolescents had severe sleep disturbance, which is comparable and supports the view that sleep impairment is a common feature of allergic rhinitis. Nasal obstruction appears to play an important role in this relationship. Thompson et al. highlighted nasal congestion as a major contributor to sleep-disordered breathing, daytime somnolence, fatigue, and reduced productivity [13]. Similarly, Wang et al. found higher rates of mouth breathing, snoring, and restless sleep in children with allergic rhinitis than in controls [14].

Daytime functioning was also significantly affected in the present study. Severe daytime impairment was seen in 40.0% of adolescents, with fatigue, daytime sleepiness, and poor concentration being the most frequent complaints. These

findings are in agreement with previous literature showing that allergic rhinitis may impair attention, school performance, and daily efficiency. Jauregui et al. and Mir et al. both emphasized the adverse effect of allergic rhinitis on school performance and classroom functioning [5,15]. The present findings support the clinical relevance of this association in adolescents.

An important observation in this study was the clear relationship between allergic rhinitis severity and functional impairment. Mean sleep disturbance scores increased from  $4.95 \pm 3.61$  in mild disease to  $14.16 \pm 3.48$  in severe disease, while mean daytime impairment scores increased from  $3.02 \pm 3.50$  to  $9.88 \pm 3.72$ . These findings are similar to those of Colás et al., who reported poorer sleep quality in moderate-severe and especially severe allergic rhinitis [12]. Muñoz-Cano et al. also showed that symptom severity was more strongly associated with poor sleep and quality of life than seasonality or persistence [16]. The strong positive correlation between total nasal symptom score and sleep disturbance in the present study further supports this relationship.

The study has certain limitations. It was hospital-based and may therefore reflect a more symptomatic population. Sleep and daytime functioning were assessed using structured scoring systems rather than objective sleep studies or validated psychological tools. However, the consistency of the findings and their agreement with earlier studies support their clinical significance.

Overall, the present study shows that allergic rhinitis in adolescents is associated with marked sleep disturbance and daytime dysfunction, particularly in those with more severe symptoms. These findings highlight the need for clinicians to assess sleep quality and daytime functioning routinely in adolescents with allergic rhinitis, in addition to focusing on nasal symptom control.

## CONCLUSION

Allergic rhinitis has a significant negative impact on sleep quality and daytime functioning in adolescents. Sleep disturbance and daytime impairment were more severe in those with greater symptom burden. These findings highlight the need for routine assessment of sleep and daytime symptoms in adolescents with allergic rhinitis.

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