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The Effects of Allergic Rhinitis on Sleep Quality

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ABSTRACT

Objective: This study aimed to examine the effects of allergic rhinitis (AR) on sleep quality (SQ).

Methods: This prospective study evaluated the AR symptoms and skin prick tests (SPT) in all participants. The AR group was composed of 65 male patients with AR symptoms and positive SPT, whereas the control group was composed of 65 healthy male individuals. SQ was evaluated using the Sleep Quality Scale (SQS). The AR group was asked whether AR affects their sleep, and those who answered yes were asked for the symptoms that affect their SQ. The SQS scores and the effect of symptoms on SQ were statistically compared.

Results: The mean SQS score of the groups was 68.68±13.15 in the AR group and 47.72±9.3 in the control group. The SQS score was significantly higher in the AR group compared to that of the control group ($p=0.002$, $p<0.05$). Of the patients, 30 (46.1%) had their sleep affected. The distribution of symptoms, which affect the SQ of these patients, was determined. Congestion is the most common symptom that affects the SQ, which was statistically significantly higher compared to other symptoms ($p=0.0001$, $p<0.05$).

Conclusion: AR is a risk factor for poor SQ. Patients with sleep disturbances should be questioned for AR and they should be provided with necessary treatment.

Keywords: Allergic rhinitis, quality of life, sleep, sleep-wake disorders, questionnaires

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INTRODUCTION

Allergic rhinitis (AR) is the most common allergic disease that affects up to 40% of the worldwide population (1). The classic AR symptoms include nasal congestion, rhinorrhea, sneezing, and itching (2). AR affects the patients' quality of life (QOL) in many areas, such as academic, athletic, and work performance (3-5).

Sleep quality (SQ) is a term without a precise definition but is defined as not having problems in initiating and maintaining sleep, having a satisfactory level of sleep experience and amount, and not having insomnia during the day (6). SQ evaluation differs, as well as its definition. Objective tests, such as polysomnography or subjective questionnaires, can be used to evaluate the SQ that affects the QOL (7,8). The SQ was commonly measured by the Pittsburgh Sleep Quality Index (PSQI) in the previous studies (9,10). The Sleep Quality Scale (SQS) is a self-reported questionnaire that consists of 28 questions and 6 factors, including difficulty in falling asleep, maintaining sleep, and getting up, restoration after sleep, sleep satisfaction, and daytime dysfunction, which is strongly correlated with PSQI results (10,11).

SQ is affected by many physiological and pathological conditions, such as nutrition, exercise, obesity, and asthma (8,12-14). Prior studies have shown that AR is related to SQ, and sleep disorders, such as obstructive sleep apnea, sleep-disordered breathing (SDB), enuresis nocturna, shorter sleep, and daytime dysfunction (15). This study aimed to examine the relationship between AR and SQ and discuss its related literature.

METHODS

The present study was conducted on patients and volunteers at İstanbul University-Cerrahpaşa Medicine Faculty Hospital and İnegöl State Hospital between November 2020 and September 2021 with the approval of the Cerrahpaşa Faculty of Medicine Clinical Research Ethics Committee (decision no: 604.01.02-177955, date: 08.09.2021). The study design was a prospective cohort.

Study Population, Inclusion, and Exclusion Criteria

All study participants were followed at the Otorhinolaryngology Clinic of the Cerrahpaşa Medicine Faculty Hospital and Inegol State Hospital. SQ and AR are known to be affected by gender, thus only males were included in the study (10,16). Male patients with AR symptoms and positive skin prick test (SPT) for nonseasonal allergens (negative in SPT for grass, cereal, weed, and tree pollen extracts) were included as a patient group.

The exclusion criteria were as follows: ages below 18 or over 59 years, insufficient mental capacity, previous or active psychiatric disorders (e.g., depression), chronic disease (especially asthma), regular use of any medication (including anti-allergic drugs in the past 6 months), body mass index (BMI) of ≥30 kg/m^2, alcohol dependence, smoking, and refusal to enter the study or to complete the questionnaire.

Healthy males, who applied to the hospital for routine recruitment procedures, were included as the control group, with similar exclusion criteria as the patient group. Informed consent forms were obtained from patients and healthy individuals.

Sample Size and Sampling Technique

The minimum sample size was estimated based on the study of Kim et al. (17). The minimum sample size with an 80% confidence interval and 5% tolerable error assumptions was 65 for each group. Thus, 65 patients were included in the study group and 65 healthy individuals in the control group.

Procedures and Data Collection

All patients with AR were evaluated for allergic symptoms, with endoscopic nasal examinations, as well as BMI and SPTs. The SPT was performed according to the European Academy of Allergology and Clinical Immunology guidelines to support the diagnosis of allergy and determine the allergen or allergens in disease etiology (18). The SPT has been performed with mite (Dermatophagoides pteronyssinus and Dermatophagoides farinae), fungi (Cladosporium, Aspergillus, Penicillium, and Alternaria), weeds (Plantago Lanceolata, Artemisia Vulgaris, Taraxacum Vulgare, and Urtica Dioica), animal fluff (dog and cat), grasses (Dactylis Glomerata, Phleum Pratense, Hulcus Lanatus, Poa Pratensis, Lolium Perenne, and Festuca Pratensis), tree pollens (Fraxinus Excelsior, Quercus Robur, Ulmus Scabra, Alnus Glutinosa, and Olea Europaea), grains (Secale Cerela, Hordeum Vulgare, Triticum Sativum, and Avena Sativa) and food allergens (banana, cocoa, egg, fish, and nuts), and latex and cockroach extracts (Prick test kit, Stallergenes Greer, France). Histamine (10 mg/mL) was used as a positive control. The reactions were reported after 20 min by the investigator who performed the test. SPT was evaluated according to the induration diameter, wherein diameters of 3 mm and larger were accepted as positive.

SQ was assessed using the SQS, which consists of 28 questions. The scoring was done using a four-point, Likert-type scale, and respondents indicate how frequently they exhibit certain sleep behaviors (0= few, 1= sometimes, 2= often, and 3= almost always). Scores on items in factors 2 and 5 (restoration after sleep and sleep satisfaction) are reversed before being tallied. Total scores can range from 0 to 84. The higher scores show more acute sleep impairments (11).

The patient group was asked whether AR affects their SQ, and those who answered yes were asked for the symptoms (nasal congestion, rhinorrhea, sneezing, and itching) that affect their sleep. The frequency was calculated according to the responses and symptoms. The effect of symptoms on SQ was statistically compared.

Statistical Analysis

The minimum sample size was calculated using the G* Power software version 3.1 (19). The Statistical Package for the Social Sciences software version 21.0 (SPSS Inc, USA) was used for

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statistical analysis. Normal distribution of data was analyzed with the Kolmogorov-Smirnov test and Levene's tests to assess homogeneity. The independent samples t-tests (for continuous variables) and the Pearson chi-square test (for categorical variables) were used to compare the groups. The statistically significant level was accepted as a p-value of <0.05.

RESULTS

All individuals in the AR (group 1) and control (group 2) groups have completed the study. The mean ages of groups were 32.35±8.86 years in group 1 and 32.29±9.32 years in group 2. The mean BMI was 23.42±1.67 in group 1 and 23.10±1.37 in group 2. No statistically significant difference was found between the groups according to age and BMI (p>0.05) (Table 1). The evaluation of AR symptoms revealed nasal congestion in 45 (69.2%) patients, rhinorrhea in 35 (53.8%), itching in 27 (41.5%), and sneezing in 20 (30.8%).

The mean SQS score was 68.68±13.15 in group 1 and 47.72±9.3 in group 2. The SQS score was statistically significantly higher in group 1 compared to group 2 (p=0.002, p<0.05) (Table 2).

The frequency of "YES" answer for the question "Does your rhinitis affect your SQ?," is 30 (46.1%). The distribution of symptoms, which affect the SQ of these patients, was determined. Congestion is the most common symptom that affects the SQ, which was, statistically significantly higher compared to other symptoms (p=0.0001, p<0.05) (Table 3).

Table 1. Investigation of age and body mass index in groups

Group	Age Mean ± SD (min-max)	BMI Mean ± SD (min-max)
Group 1	32.35±8.86 (18-48)	23.42±1.67 (68-98)
Group 2	32.29±9.32 (18-49)	23.10±1.37 (68-98)
p*	0.291	0.346

*Independent samples t-test, BMI: body mass index, SD: standard deviation, min: minimum, max: maximum

Table 2. Evaluation of groups according to the Sleep Quality Scale

	Group 1	Group 2	p-value
SQS Mean ± SD (min-max)	68.68±13.15 (40-84)	47.72±9.3 (31-72)	0.002*

*Independent sample t-test, p<0.05. SQS: Sleep Quality Scale, SD: standard deviation, min: minimum, max: maximum

DISCUSSION

Sleep, which is very important for human psychology, cognitive functions, and the immune system, is necessary for body renewal and energy restoration (20,21). SQ is sometimes used to express measurement values that are obtained from objective tests, such as total sleep time, sleep onset latency, total wake time, sleep efficiency, and sleep disruptive events, and it is sometimes used to express the onset of sleep, the ability to continue sleep, the duration of sleep, and sleep-related problems during the day, which are stated by the person (22). Poor SQ or sleep disorders, which are related to chronic diseases, such as diabetes mellitus and cardiac diseases, even an increased risk of mortality, directly affect daytime performance and QOL (23-25). SQ is affected by many factors of the person or the environment. AR is one of the factors that have been shown to affect sleep in previous studies (15). Our study evaluated the SQ of patients with AR using the SQS

Table 3. Symptoms and sleep quality

Symptom		Entity			p-value
		Yes	No	Total	
Congestion	Count	25	5	30	0.0001*
	% within symptom	83.3%	16.7%	100.0%	
	% within entity	43.9%	7.9%	25.0%	
Rhinorrhea	Count	20	10	30	
	% within symptom	66.7%	33.3%	100.0%	
	% within entity	35.1%	15.9%	25.0%	
Sneeze	Count	5	25	30	
	% within symptom	16.7%	83.3%	100.0%	
	% within entity	12.3%	36.5%	25.0%	
Itching	Count	7	23	30	
	% within symptom	23.3 %	76.7%	100.0%	
	% within entity	12.3%	36.5%	25.0%	
Total	Count	57	63	120	
	% within symptom	47.5%	52.5%	100.0%	
	% within entity	100.0%	100.0%	100.0%	

*Pearson chi-square: 38.329, df: 3, p<0.001, df: degree of freedom

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questionnaire and compared it with the SQ of healthy individuals and a statistically significantly poor SQ in the AR group.

Many studies have been conducted with many different methods to evaluate the SQ, which affects every aspect of QOL. Polysomnography, which is the gold standard for sleep assessment, and actigraphy can be given as examples of objective tests. However, the objective methods are expensive and complex, with longer test times. Therefore, self-report methods, such as sleep diary and sleep questionnaires, in which SQ is evaluated by the individual, were used in various studies (7,8). SQS is one of these questionnaires whose validity has been demonstrated by previous studies (10,11) Our study used the SQS questionnaire to examine the relationship between AR and SQ as first in the literature. SQ is affected by age, gender, BMI, and psychological health (10). Study groups with people of the same sex, age, and BMI were formed to avoid these effects and ensure standardization.

Previous studies revealed that AR-associated sleep problems frequently include sleep apnea, SDB, shorter sleep duration, snoring, and poor SQ, and these problems are more common in patients with perennial AR than seasonal AR, and the presence of these problems indicates treatment inadequacy. Additionally, sleep problems are associated with all AR symptoms and are more common in patients with more severe symptoms. However, these problems are most commonly associated with the presence of nasal congestion (15,26). Our study, consistent with the literature, revealed nasal congestion as the most common symptom and the symptom that most affects the SQ in patients with AR.

AR is known to affect SQ; however, the underlying mechanisms of sleep disorders are still undetermined. Additionally, this effect is thought to be caused by the inflammatory mediators that increase in AR, the direct effects of AR symptoms on sleep, and the autonomic nervous system changes seen in patients with AR (15). Previous studies have shown that inflammatory mediators, especially histamine, which increases in AR, directly affect the central nervous system and cause sleep disorders, such as daytime sleepiness (15,27). Moreover, the decrease in cytokines, such as interleukin (IL)-4, IL-6, and IL-10 in AR, which is known to have positive effects on the REM period, and is the most important stage of sleep, is associated with SQ deterioration (28). Nasal congestion, which is the most common symptom of AR, causes increased nasal resistance, and nasal obstruction (15). Therefore, it is the most common AR symptom associated with sleep disorders, especially snoring (29). Cough and sputum production, along with other common symptoms of AR, also contribute to poor SQ (30). The trigeminocardiac reflex is one of the most powerful autonomic reflexes and is thought to be directly related to nasal congestion and sleep apnea (31).

Study Limitations

The present study has some limitations. First, in this study, the frequency of symptoms and how often they affect the SQ was determined. However, the severity of AR and the duration of symptoms, perineal or seasonal, which are directly related to the SQ, were not examined. Secondly, a subjective method, the SQS questionnaire, was used in determining the SQ. Finally, we only included males in the study to avoid gender-related effects.

CONCLUSION

A relationship was found between AR, which is the most common allergic disease and increasing in prevalence in the community, and SQ, one of the most important factors that affect the QOL. Investigating the presence of AR in patients with sleep disorders and questioning the SQ of patients with AR is necessary. The repetition of the obtained data with larger numbers of subjects and comprehensive clinical studies are required to support the present findings.

Ethics Committee Approval: The present study was conducted on patients and volunteers at Istanbul University-Cerrahpaşa Medicine Faculty Hospital and İnegöl State Hospital between November 2020 and September 2021 with the approval of the Cerrahpaşa Faculty of Medicine Clinical Research Ethics Committee (decision no: 604.01.02-177955, date: 08.09.2021).

Informed Consent: Informed consent forms were obtained from patients and healthy individuals.

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