Original Article

Association between Allergic Rhinitis, Sleep Quality and Depression in Patients Attending Public Health Care Facility in Lahore, Pakistan

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Abstract

Background: Allergic rhinitis (AR), a chronic allergy disease caused by dust and pollen, causes sneezing and nasal congestion, increasing the risk of mood disorders and negatively impacting mental health, productivity, and sleep, necessitating medication and allergen avoidance for effective treatment.

Objective: To determine the association between allergic rhinitis, sleep quality, and depression in patients attending public health facility in Lahore, Pakistan.

Method: The cross-sectional study was carried out in the Department of Otorhinolaryngology at Services Hospital in Lahore between July and October of 2024. A total of 351 individuals were surveyed about allergic rhinitis, sleep quality, and depressed symptoms using non-probability convenience sampling. The data was analyzed using t-test and chi-square tests.

Results: The survey showed that the average age was 32.71 ± 12.478, and the majority (68.9%) was males. According to the present study, 52.7% of patients suffer from allergic rhinitis and 82 (44.3%) and 23 (13.8%) allergic rhinitis (AR) patients reported difficulty sleeping and depression, respectively. Allergic rhinitis (AR) was significantly associated with educational status, sleep difficulty, and depressed symptoms (p-value:0.05).

Conclusion: Allergic rhinitis significantly impacts sleep disturbance and depressive symptoms in participants, affecting their overall health. This condition is a significant factor in these symptoms, emphasizing the need for effective therapies to improve sleep and depression among afflicted patients.

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Introduction

Allergic rhinitis (AR) is an inflammatory condition triggered by an immune response to environmental allergens, causing symptoms like nasal irritation, rhinorrhea, nasal congestion, and sneezing.[1] Allergic rhinitis (AR) negatively impacts sleep, memory, quality of life, academic achievement, and job productivity. Allergic rhinitis can be seasonal or perennial, primarily caused by pollen allergies.[2] Perennial forms are triggered by urban air pollution, dust mites, animal dander, and mold spores. Studies show an increase in allergic rhinitis prevalence worldwide, with the United States experien-

cing a prevalence of 3%-19%, affecting 30-60 million people annually.[2,3] A Pakistani study revealed a frequency of 19.2% of healthcare workers experiencing allergic rhinitis.[4]

Allergens like pollen and dust are known the most important risk factors in developing allergic rhinitis. Common medications include corticosteroids, nasal decongestant, oral, intranasal, and ocular antihistamines.[5] Intranasal corticosteroids are a more effective option with fewer side effects. Allergic rhinitis can also cause sinusitis and nasal polyps, which can cause obstruction in the upper airways.[6,7] These symptoms, particularly at night, negatively impact sleep quality. The most common symptom is nasal obstruction. Sleep disturbances, obstructive sleep apnea, insomnia, delayed sleep latency, and sleep disordered breathing have all been associated with adult allergic rhinitis.[8] Increased fatigue and sleepiness are caused by nasal congestion, which is worse at night and in the early morning.[9]

Research suggests that individuals in good health do not feel as fatigued as those with seasonal allergies. Patients with both obstructive sleep apnea (OSA) and allergic rhinitis may experience more fatigue than those with OSA alone.[10] Allergic rhinitis impacts both mental and physical health, with severe symptoms potentially worsening depression. Research suggests a link between psychological illnesses and allergies, with patients with allergies more likely to experience severe depression, anxiety, panic disorder, social phobia, and depression.[11,12] Nasal blockage can also negatively affect psychiatric symptoms and sleep. A hereditary predisposition between depression and allergies may contribute to this link. The inability to control symptoms and limitations on daily activities are associated with depression, while a depressing attitude can lead to decreased productivity.[8,13]

The consequences of allergic rhinitis, particularly in patients who are often exposed to seasonal allergens, on physical and mental health as well as sleep quality have not been thoroughly studied. Productivity can be adversely affected by sleep, exhaustion, and sadness, all of which have been linked to AR.[14] A significant number of cases of allergic rhinitis are seen in Pakistan and the prevalence was found to be 19.2% making a huge impact on their daily performance with a loss of working hour of 35.9%.[15] The duration of an allergy, whether perennial or seasonal, can significantly impact sleep, anxiety, and quality of life.[9,13] Compared to seasonal exposure, a perpetual exposure may have a deeper impact on these parameters due to its persistent and perennial effects. Thus, the study aims to investigate the signs of sadness, sleep difficulties, and sleep quality in patients with and without allergic rhinitis. This research aims to fill the significant information gap regarding allergic rhinitis in Pakistan, thereby improving understanding and treatment strategies for allergic rhinitis complications.

Methods

The analytical cross-sectional study was conducted at the Services Hospital in Lahore. This study was carried out in from July to October, 2024. The sample size was determined using the single population proportion formula:

$$n = (z^2 \times p \times (1-p))/e^2,$$

where z represents the standard normal value corresponding to the desired confidence level (1.96 for a 95% confidence interval), p denotes the expected true proportion, and e indicates the desired margin of error. Based on a previous study reporting that 67.3% of patients with allergic rhinitis experienced impaired sleep quality,[16] and assuming a 5% margin of error, the required sample size at a 95% confidence level was calculated to be 339. To account for a potential 5% nonresponse rate, the sample size was adjusted, resulting in a final required sample of 351 participants.

The study used a non-probability, convenience sampling technique. The study included adult men and women aged 18 and above with basic literacy, Urdu speaking ability, and complaints of nasal symptoms for over three months. Participants with a medical history of pre-existing nasal pathologies, significant deviated nasal septum, or serious psychiatric conditions such as bipolar disorder or schizophrenia, as well as those with other chronic medical or psychiatric conditions known to affect sleep quality or depression (e.g., obstructive sleep apnea, chronic pain disorders, hypothyroidism, neurological diseases), were excluded from the study.

The study utilized pre-tested, self-administered English-language questionnaires for patient data collection, which was daily, verified for completeness and accuracy. The Data collection tool first component comprised socio-demographic factors such as age, sex, education, residence, marital status, religion, employment, monthly income, Body Mass Index, smoking habits, and alcohol consumption.[18] The tool's second section uses the Score for Allergic Rhinitis (SFAR) scale to differentiate between patients with and without allergic rhinitis, with 74% sensitivity and 83% specificity for SFAR (scoring for allergic rhinitis) ≥ 7. After respondents completed the questionnaire, the SFAR (scoring for allergic rhinitis) score was computed, and patients with a score of 7

were classified as having allergic rhinitis.[17,18]

The third segment of the tool focuses on the Jenkins Sleep Questionnaire (JSQ), a tool utilized to evaluate sleep quality. The study involves participants answering four questions about the number of days they experienced difficulty sleeping in the past 30 days, including difficulty falling asleep, frequent waking up, difficulty falling back asleep, and feeling tired even after adequate sleep.[17] The responses are scored on a 6-point Likert scale, ranging from 0 to 20, with higher scores indicating poor overall sleep quality. The summary score is categorized into quintiles, with scores 0-3 indicating very good-quality sleep, 3-6 indicating good-quality sleep, 6-9 indicating poor-quality sleep, and 9+ indicating very poor-quality sleep.[18] The fourth segment of the tool consisted of depression symptoms, assessed using the Patient Health Questionnaire (PHQ-9), which ranges from 0 to 27 and categorizes depression severity into minimal (0-4), mild (5-9), moderate (10-14), moderately severe, and severe depression (≥ 20).[18,19]

The Services Institute of Medical Sciences' Internal Ethics Committee in Lahore, Pakistan, approved a study protocol, with reference number IRB/2024/ 1374/ SIMS ensuring participant autonomy, secrecy, and anonymity, with verbal informed consent. The study used SPSS version 27 to analyze collected data, assessing and fixing inaccuracies in questionnaire data. Quantitative values were reported as mean and standard deviation, while categorical variables were reported as frequency and percentages. Differences in baseline features and associated factors between allergic rhinitis and non-allergic rhinitis groups were analyzed using chi-square and t-tests with a significance level of less than 0.05.

Results

The study included 351 participants, resulting in a 100% response rate. Out of all respondents, 242 (68.9%) were male with a mean age of 32.71 ± 12.478. A mean monthly family income of participants was 39803.42 ± 18264.207. The details of the distribution of the baseline characteristics were shown in Table 1.

The study found a 52.7% (n=185) prevalence of allergic rhinitis among 351 participants, with a significant difference in education level ($x2 = 7.844$, p-value = 0.049) between the AR and no AR group. The details of the baseline characteristics according to Allergic Rhinitis are shown in Table 2.

Table 3 shows the distribution of sleep quality and depressive symptoms among participants and between AR and no AR groups. Overall, depression (score $\geq$

10) was present in 10% of participants without AR and 37% of participants with AR. Poor sleep quality (score > 6) was observed in 31% of participants without AR and 57% of participants with AR. The grades of depression and sleep quality scores by allergic rhinitis are presented in the table 3.

Table 1: *Baseline Characteristics of study participants (n=351)*

Characteristics	Category	n	%
Age	M ± SD	32.71 ± 12.478	—
Sex	Male	242	69
	Female	109	31
Marital Status	Married	191	54
	Single	143	41
	Divorced	13	4
	Widowed	4	1
Religion	Muslim	341	97
	Others	10	3
Education level	No Formal Education	46	13
	Primary	72	21
	Secondary	148	42
	College and above	85	24
Employment	Employed	156	44
	Unemployed	195	56
Residence	Urban	261	74
	Rural	90	26
Monthly Income	M ± SD	39803.42 ± 18264.207	—
Alcohol Consumption	Yes	16	5
	No	335	95
Smoking	Yes	97	28
	No	254	72
BMI	Normal	190	54
	Underweight	85	24
	Overweight	76	22
Family System	Joint	152	43
	Nuclear	199	57

Table 4 shows the differences in sleep disturbances and depression symptoms between the AR and no AR groups. The AR group scored higher on the Jenkins Sleep Questionnaire and the Patient Health Questionnaire (PHQ-9) for depressed symptoms, with a mean score of 6.36 ± 3.471 & 8.2541 ± 4.43127 compared to the no AR group's 3.43 ± 2.950 & 4.4036 ± 3.49542 respec-

tively.

Table 2: *Baseline Characteristics according to Allergic Rhinitis (AR) (n=351)*

Characte-ristics	Category	No AR (N=166) n (%)	AR (N=185) n (%)	t or χ^2	p
Age	M ± SD	33.21 ± 12.890	33.26 ± 12.115	0.706	0.481
Sex	Male	115 (69)	127 (69)	0.016	0.899
	Female	51 (31)	58 (31)	—	—
Marital Status	Married	89 (54)	102 (55)	1.792	0.617
	Single	71 (43)	72 (39)	—	—
	Divorced	4 (2)	9 (5)	—	—
	Widowed	2 (1)	2 (1)	—	—
Religion	Muslim	162 (98)	179 (97)	0.220	0.639
	Others	4 (2)	6 (3)	—	—
Education level	No Education	23 (14)	23 (12)	7.844	0.049
	Primary	41 (25)	31 (17)	—	—
	Secondary	72 (43)	76 (41)	—	—
	College and above	30 (18)	55 (30)	—	—
Employment	Employed	75 (45)	81 (44)	0.069	0.793
	Unemployed	91 (55)	104 (56)	—	—
Residence	Urban	124 (75)	137 (74)	0.019	0.890
	Rural	42 (25)	48 (26)	—	—
Monthly Income	M ± SD	38307.23 ± 17064.109	41145.95 ± 19224.512	1.456	0.146
Alcohol Consumption	Yes	6 (4)	10 (5)	0.645	0.422
	No	160 (96)	175 (95)	—	—
Smoking	Yes	43 (26)	54 (29)	1.544	0.462
	No	123 (74)	131 (71)	—	—
BMI	Normal	89 (54)	101 (55)	1.924	0.382
	Underweight	45 (27)	40 (22)	—	—
	Overweight	32 (19)	44 (24)	—	—
Family System	Joint	68 (41)	84 (45)	0.703	0.402
	Nuclear	98 (59)	101 (55)	—	—

Table 3: *Depression and Sleep Quality Scores by Allergic Rhinitis (AR) (n=351)*

Grades of Sleep Quality	No AR (N=166) n (%)	AR (N=185) n (%)
Very good (0–3)	98 (59)	40 (22)
Good (3–6)	16 (10)	40 (22)
Poor (6–9)	45 (27)	63 (34)
Very poor (9 and above)	7 (4)	42 (23)

Grades of Depression	No AR (N=166) n (%)	AR (N=185) n (%)
Minimal (0–4)	103 (62)	38 (21)
Mild (5–9)	46 (28)	78 (42)
Moderate (10–14)	13 (8)	54 (29)
Moderately-severe (15–19)	4 (2)	13 (7)
Severe (20–27)	0 (0)	2 (1)

Table 4: *Sleep Disturbance and Depressive Symptoms according to Allergic Rhinitis (AR) (n=351)*

Characteristics	No AR (N=166)	AR (N=185)	t	p
Sleep Disturbance Scores	3.43 ± 2.950	6.36 ± 3.471	8.384	< 0.001
Depressive Symptoms Scores	4.4036 ± 3.49542	8.2541 ± 4.43127	9.092	< 0.001

Discussion

Allergic rhinitis (AR) affects millions of people worldwide and can significantly impact quality of life, work productivity and overall health. The rising prevalence of allergic rhinitis has drawn attention to its potential connections with depressive disorders and altered sleep quality.[4] Early diagnosis and management are crucial to prevent complications later in life leading to an increased overall quality of life as a long-term management decreasing significant amount of socioeconomic burden that is beneficial both for quality of life and state.[5] The study aimed to investigate the association between Allergic Rhinitis, sleep quality, and depression in patients attending a public health facility in Lahore, Pakistan.

In the present study, 52.7% of participants were found to have allergic rhinitis. According to research done in 2022 in Teaching Hospital Islamabad, the prevalence of allergic rhinitis has been found to be 73%.[19] Another study (2021) indicated a prevalence of 23.7% in the 21-30 age range in the Saudi population.[20] These discrepancies in prevalence might be attributed to the study population, since our study comprised patients mostly from the ENT (otorhinolaryngology) department who presented with a high frequency of nasal complaints. Geographical variances and methodological differences may also have an impact on potential outcomes.

This current study demonstrates the prevalence of depressed symptoms in allergic rhinitis patients to be 37.2%, substantially greater than non-allergic rhinitis patients. In a previous study in 2023, 88% of allergic rhinitis patients had depression, while a meta-analysis in 2023 revealed a 25% prevalence of depression among

patients.[21,22] This highlights the high psychological burden associated with the illness, with varying severity levels that correspond to the severity of the condition. The reason for the discrepancies could be due to varying time frame of research, cultural factors, measurement tools and access to healthcare services.

The study found that 57.3% of patients with allergic rhinitis had poor sleep quality, significantly higher than non-allergic patients. A previous studies found that 46.1% and 54% of moderate to severe allergic rhinitis patients had insomnia, indicating a high prevalence of poor sleep quality.[23,24] The study found a significant association between individuals' educational level and allergic rhinitis prevalence. Previous research demonstrated that educational attainment associated with a greater likelihood of developing allergic rhinitis.[25,26] Higher education levels may be associated with increased allergic rhinitis prevalence due to greater exposure to urban environments and indoor allergens, as well as higher health awareness and more frequent healthcare-seeking, leading to increased diagnosis rates.

The present study indicates a significant association between the quality of sleep and the presence of depression in individuals with allergic rhinitis. Previous studies also showed that moderate to severe allergic rhinitis leads to higher anxiety and depression, with a strong correlation between sleep quality and symptoms, particularly in those with moderate to severe symptoms.[9,27,28] This association may be explained by the fact that allergic rhinitis symptoms disrupt sleep, and poor sleep quality can exacerbate mood disturbances, thereby increasing the risk of depression.

The study, conducted in a tertiary care government hospital, used validated tools like the PHQ-9 for depression assessment and the JSQ for sleep quality evaluation to enhance the external validity of its findings. It emphasized the importance of common comorbidities in treatment strategies and the broader impact on quality of life, advocating for integrated treatment plans. As this study employed a cross-sectional design, causal inferences regarding the observed associations between allergic rhinitis, sleep quality, and depression cannot be made." The small sample size limits generalization and multiple confounding factors can affect depression. The questionnaire was not validated as a diagnostic tool due to resource restrictions. The study suggests that healthcare providers should screen patients with allergic rhinitis for sleep disturbances and depressive symptoms, recommend lifestyle modifications, advocate for mental health services integration, and encourage public health campaigns to reduce stigma. Future research could explore the biological mechanisms linking allergic rhinitis, sleep disturbances, and depression, potentially leading to targeted therapeutic strategies.

Conclusion

The findings revealed an elevated prevalence of allergic rhinitis among patients at the public health center, with allergic rhinitis being associated with sleep problems and depression. Depression and poor sleep quality are two of todays most overlooked and undertreated issues. The study reveals a strong association between allergic rhinitis severity and depression and poor sleep quality, suggesting that assessing depression prevalence and severity, as well as addressing poor sleep quality, can improve patients' quality of life.

Authors' Contribution:

KJ: Acquisition of data, analysis & interpretation of data, drafting of article

ZK: Critical revision for important intellectual content, final approval

AS: Critical revision for important intellectual content, final approval

MN: Analysis & interpretation of data,

MM: Analysis & interpretation of data,

MS: Analysis & interpretation of data,

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