CLINICAL STUDY

EFFECTS OF TREATMENT COMPLIANCE ON QUALITY OF LIFE AND MENTAL HEALTH IN CHILDREN WITH ALLERGIC RHINITIS

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SUMMARY

Objective: This study aims to assess how adherence to treatment in children with allergic rhinitis (AR) affects their quality of life, particularly in relation to sleep and other psychiatric symptoms.

Method: The study included 67 children between the ages of 8 and 18 years who were being followed up with a diagnosis of allergic rhinitis and 67 healthy children presenting to the healthy child outpatient clinic. Parents completed the Strengths and Difficulties Questionnaire, while the children completed the State-Trait Anxiety Inventory, the Quality of Life Scale for Children, the Pittsburgh Sleep Quality Index and the Morisky Medication Adherence Scale.

Results: In the allergic rhinitis (AR) group, the SDQ total score, peer problems and emotional symptoms subscale scores were significantly higher and the social skills score was lower ($p<0.001$). In the PedsQL scale, all subscales except emotional functioning and total score were significantly lower in the AR group ($p<0.05$). Sleep total score was significantly higher in the AR group ($p=0.002$). According to the MMAS-8 score, the AR group was divided into two subgroups; a negative correlation was found between emotional symptoms, behavioral problems and SDQ total scores and a positive correlation was found between physical health, emotional and psychosocial functioning and MMAS-8 in the low adjustment group ($p<0.05$). There was a negative correlation between sleep score and MMAS-8 ($p=0.011$). A significant difference was found only in MMAS-8 scores according to the type of medication use; medication adherence was significantly higher in the montelukast group than in the inhaled steroid group ($p=0.009$).

Conclusion: In conclusion, we observed that decreased adherence to treatment in children with allergic rhinitis negatively affects children's quality of life, sleep quality, and social and psychological functioning. This emphasizes the importance of developing structured intervention programs to increase adherence to treatment and improve sleep quality in children with allergic rhinitis.

Keywords: Allergic rhinitis, child, treatment adherence, quality of life

ALERJİK RİNİTLİİ ÇOCUKLARDA TEDAVİ UYUMUNUN YAŞAM KALİTESİ VE RUH SAĞLIĞI ÜZERİNE ETKİLERİ

ÖZET

Amaç: Bu araştırmanın amacı, alerjik rinitli (AR) çocukların tedaviye uyum düzeylerinin uyku ve diğer psikiyatrik belirtilerle ilgili yaşam kalitelerini nasıl etkilediğini belirlemektir.

Materyal ve Metod: Çalışmaya Çalışmaya alerjik rinit tanısı ile takip edilen 8-18 yaş arası 67 çocuk ve sağlıklı çocuk polikliniğine başvuran 67 sağlıklı çocuk dahil edilmiştir. Ebeveynler Güçler ve Güçlükler Anketi'ni, çocuklar ise Durumluk-Sürekli Kaygı Envanteri, Çocuklar için Yaşam Kalitesi Ölçeği, Pittsburgh Uyku Kalitesi İndeksi ve Morisky İlaç Uyum Ölçeği'ni doldurdu.

Bulgular: AR grubunda SDQ toplam puanı, akran sorunları ve duygusal semptomlar alt ölçek puanları anlamlı derecede yüksek, sosyal beceriler puanı ise düşüktü ($p<0.001$). PedsQL ölçeğinde, duygusal işlevsellik ve toplam puan hariç tüm alt ölçekler AR grubunda anlamlı olarak daha düşüktü ($p<0,05$). Uyku toplam puanı AR grubunda anlamlı olarak daha yüksekti ($p=0,002$). MMAS-8 puanına göre AR grubu iki alt gruba ayrılmıştır; düşük uyum grubunda duygusal belirtiler, davranış sorunları ve SDQ toplam puanları arasında negatif korelasyon, fiziksel sağlık, duygusal ve psikososyal işlevsellik ve MMAS-8 arasında pozitif korelasyon bulunmuştur ($p<0,05$). Uyku skoru ile MMAS-8 arasında negatif bir korelasyon vardı ($p=0.011$). İlaç kullanım türüne göre sadece MMAS-8 skorlarında anlamlı bir fark bulunmuştur; montelukast grubunda ilaç uyumu inhale steroid grubuna göre anlamlı olarak daha yüksektir ($p=0.009$).

Sonuç: Sonuç olarak, alerjik rinitli çocuklarda tedaviye uyumun azalmasının çocukların yaşam kalitesini, uyku kalitesini ve sosyal ve psikolojik işlevselliğini olumsuz etkilediğini gözlemledik. Bu durum, alerjik rinitli çocuklarda tedaviye uyumu artırmak ve uyku kalitesini iyileştirmek için yapılandırılmış müdahale programlarının geliştirilmesinin önemini vurgulamaktadır.

Anahtar Sözcükler: Alerjik rinit, çocuk, tedavi uyumu, yaşam kalitesi

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INTRODUCTION

Allergic rhinitis (AR) is a chronic disease characterized by inflammation of the nasal mucosa caused by IgE-mediated hypersensitivity reactions that occur in both the early and late stages.[1] Common symptoms include nasal congestion, excessive runny nose, itchy nose and frequent sneezing. These symptoms are often accompanied by allergic conjunctivitis manifested in itching, red, aqueous, or swollen eyes, but AR was once recognized as a mild disease.[2]

Although AR was once perceived as a minor ailment due to its typically non-life-threatening nature, it is now widely acknowledged that, if left inadequately managed, it can significantly impair quality of life, emotional stability, sleep patterns, daily functioning, and work or academic productivity.[3-4]

Symptoms of AR often begin in childhood or adolescence, with nearly 40% of affected individuals exhibiting signs by the age of six, and most developing the condition before reaching 20 years of age.[5] While AR is especially prevalent among children and adolescents, its global incidence is estimated to range from 5% to 50%.[6]

During adolescence (ages 10-17), a developmental stage marked by substantial physical, emotional, and social transformation, AR is one of the most frequently encountered chronic disorders.[7] This stage of firfy life also includes increased emotional sensitivity, psychological sensitivity, and increased need for adaptation.[8]

Research indicates that AR can negatively influence learning capabilities, cognitive performance, memory retention, and academic outcomes. Furthermore, it was associated with psychiatric symptoms such as anxiety, irritability, fear, depression, and reduced quality of life and challenges in psychosocial functioning.[9-11]

Therefore, it is important for the child, family and society to understand how AR affects children's quality of life and how the disease shapes their physical, mental and social development. Children exhibiting these symptoms are often prescribed long-term medications such as nasal steroids and antihistamines. However, adherence to these treatment regimens remains challenging. The objective of our study was to assess the impact of treatment compliance on the quality of life in children with allergic rhinitis (AR), particularly concerning sleep and other psychiatric symptoms.

MATERIAL and METHODS

Our study included 67 pediatric patients aged 8 to 18 years diagnosed with allergic rhinitis and followed in a pediatric allergy and immunology outpatient clinic, as well as 67 age-matched healthy controls who attended a well-child clinic for routine follow-up. Children in both groups and their parents were evaluated by a child psychiatrist using the "Screening Schedule for Mood Disorders and Schizophrenia for School-Age Children: Current and Lifetime Version (K-SADS-PL)" by a semi-structured interview.[12,13] Parents completed the Strengths and Difficulties Questionnaire, and children completed the State-Trait Anxiety Inventory for Children, Quality of Life Scale for Children, Pittsburgh Sleep Quality Index and Morisky Medication Adherence Scale.

A voluntary consent form was signed by the patient, control group and their parents. The study included individuals between the ages of 8 and 18 who were diagnosed with allergic rhinitis by a pediatric allergist through clinical evaluation and/or allergy tests. The criteria for inclusion in both the patient and control groups were as follows: no known history of psychiatric disorder, no history of neurological, cardiovascular or chronic systemic disease, no regular medication use due to a medical or psychiatric disease, no diagnosis or history of obesity, metabolic disease, insulin resistance or dyslipidemia. In addition to the control group, the condition of not having any diagnosis of allergic disease was also added.

Pittsburgh Sleep Quality Index (PSQI): A self-assessment questionnaire that evaluates sleep quality and disturbances in the last month, consists of seven subcomponents and is scored between 0 and 21.[14] Turkish validation was conducted in Turkey and Cronbach -Alpha coefficient was determined as 0.80.[15] PSQI I consists of seven subcomponents including sleep relaxation, subjective sleep quality, duration of sleep, sleep disorders, habitual sleep efficiency, sleep therapy use, and daily dysfunction. Each component is evaluated between 0 and 3, with a total number of points between 0 and 21. An overall rating of PSQI below 5 is considered to be excellent sleep quality whereas a score of 5 or higher suggests poor sleep quality.

Strengths and Difficulties Questionnaire (SDQ): This scale, developed to screen for mental problems in children and adolescents, consists of five subscales and a total of 25 items: behavioral problems, attention deficit and hyperactivity, emotional symptoms,

peer relations and social skills. The total difficulty score is calculated with the scores obtained from the first four subscales.[16] Turkish validity and reliability study was conducted by Güvenir et al. and Cronbach's alpha coefficient was 0.84 in parent form and 0.73 in child form.[17]

Pediatric Quality of Life Inventory Child Versions (PedsQL-C): This scale, which was developed to measure general quality of life, includes a total score for physical health, sub-sections assessing emotional, social and school-related functioning, and a psychosocial health score formed by the combination of these three sub-sections. The overall scale is maintained by integrating the total number of physical health assessments with the comprehensive psychosocial evaluation.[18] The Cronbach's alpha coefficient for PedsQL is 0.93.[19]

State-Trait Anxiety Inventory for Children (STAI-I) - Trait Anxiety Inventory for Children (STAI-II): The State and Trait Anxiety Inventory, developed by Spielberger, is used to measure the level of anxiety. The STAI is divided into two subgroups of 20 questions each. One is when there is an anxiety state and characteristic time. Questions were rated on a 4-point Likert scale, with some being asked about positive emotions for negative emotions. If reviews are added to both subgroups, the total number of points between 20 and 80 is stored.[20]

Morisky Medication Adherence Scale (MMAS-8): The scale consists of questions specifically formulated to avoid a "yes" bias. In particular, point 5 is structured in the opposite direction to reduce the tendency for respondents to answer all questions in a similar way. The first seven elements of the scale are answered with the "Yes" or "No" option. The eighth element is rated on a 5-point Likert scale. The answers given in this article are rated as follows: "Never." 1 point, "occasionally" 0.75 points", often "0.5 points", "very often" 0.25 points, "always" 0 points. The total value for MMAS-8 is 0 to 8. A total score of less than 6 indicates that children have poor medication adherence, while a score of 6 or higher indicates good adherence.[21,22]

Statistical Methods

SPSS 24.0 (SPSS, Inc.;Chicago, USA) program was used for statistical analysis in our study. Kolmogrov-Simirnov and Shapiro Wilk tests were used for conformity to normal distribution. Chi-square test and Monte Carlo simulation test were used to analyze categorical variables. Descriptive statistics were given as mean ± standard deviation and median (minimum-maximum) values for continuous variables and as number and percentage (%) for categorical variables. In the comparison of continuous variables between groups, independent sample t test was used for normally distributed data and Mann-Whitney U test was used for non-normally distributed data. Kruskal-Wallis H test was used to compare three or more groups and Mann-Whitney U test was used for pairwise comparisons in cases where significant differences were found. Spearman correlation analysis was used to evaluate the relationships between variables. Significance level was accepted as $p<0.05$ in all analyzes.Statistical power analysis was performed assuming 80% power (1- β), 5% significance level ($\alpha = 0.05$) and moderate effect size (Cohen's $d = 0.5$) to evaluate the differences between two independent groups. According to the power analysis results, it was determined that at least 64 participants were sufficient for each group. In the study, 67 participants for the patient group and 67 participants for the control group were included, reaching an adequate sample size of 134 participants in total.

RESULTS

In the allergic rhinitis (AR) group, there were 32 males (47.8%) and 35 females (52.2%), whereas the control group (CG) consisted of 37 males (55.2%) and 30 females (44.8%). The mean age in the AR group was 11.88 ± 2.84 years, while the mean age in the control group was 12.08 ± 2.27 years. No statistically significant differences were observed between the two groups related to age and gender ($p=0.067$, $p=0.489$). Regarding comorbidities in the AR group, 30 individuals (44.78%) had allergic conjunctivitis, 14 (20.90%) had asthma, and 23 (34.33%) had no comorbidities. Among the 67 participants, 42 (62.7%) were diagnosed with atopy.

It was observed that SDQ total score, peer problems and emotional symptoms subscale scores were significantly higher in the AR group compared to the CG group, while the social skills subscale score was significantly lower ($p=0.005$, $p<0.001$, $p<0.001$, $p<0.001$) (Table 1).

In the AR group, the average total value of PEDSQL was found to be 75.90±13.92. When evaluating the subscales. The mean physical health was 75.38 ± 17.59, the mean psychosocial health was 76.42 ± 14.48, the middle school function subscalar was 70.16 ± 19.43, the mean social function subscalar was 86.70 ± 15.75, and the average emotional functional fragment was 72.38 ± 20.84. In the control group (CG), the mean number of PEDSQL scales was 81.90 ± 9.93. The mean physical health was 82.08 ± 12.05, the mean psychosocial health was 81.71 ± 9.73, the functioning subscalar for middle school was 76.71 ± 12.35, the mean social functioning subscalar for 91.79 ± 9.71, and the mean emotional functional dropout was 76.71 ± 14.70.In the AR group, the total score and other subscalar scores of the PedsQL scale were found to be statistically significantly lower compared to the CG group, except for the emotional functioning subscalar score (total score: p = 0.002; physical health: p = 0.006; psychosocial health: p = 0.007; school functioning: p = 0.011; social functioning: p = 0.013).

As a result of the assessment of children's STAI-1 and STAI-2 values between the two groups, no statistically significant differences between the AR and CG groups were associated with condition and characteristic values (P = 0.309, P = 0.109).

The total sleep score (mean: 5.58±2.87) was found to be significantly higher in the AR group than in the CG (mean: 4.09±2.09) (z=-3.061, p=0.002). The evaluation of the PSQI components across the sleep test and between groups is shown in Table 2.

The AR group was partitioned based on their scores on the MMAS-8 scale; those 6 and above on the MMAS-8 scale (n: 25, 37.3%) and those who scored below 6 (n: 42, 62.7%). Comparison of treatment adherence and scale scores is presented in Table 3.

Significant negative correlations were found between the MMAS-8 and SDQ affective symptoms (r = -0.305, p = 0.006), behavioral problems (r = -0.371, p < 0.001), and total scores (r = -0.357, p = 0.002). Additionally, there was a notable positive correlation between MMAS-8 and physical health (r = 0.265, p = 0.015), emotional functioning (r = 0.498, p < 0.001), psychosocial health (r = 0.501, p < 0.001), and overall scale scores (r = 0.550, p < 0.001). However, a significant negative correlation was also observed between MMAS-8 and the sleep total score (r = -0.278, p = 0.011).

Among the patients with AR, 25 individuals (37.3%) were administered only nasal steroids, 28 individuals (41.8%) were treated with a combination of nasal steroids and montelukast, and 14 individuals (20.9%) received both nasal and inhaled steroids. A comparison of all scales and subscale scores across groups using single and dual medication was conducted utilizing the Kruskal-Wallis H test. Significant differences were observed solely in the MMA 8 scaling values between the groups (H = 7.101; p = 0.029). Pair comparisons showed that among the groups that consisted of this difference in the Mann-Whitney-U test, the group using montelukast in addition to nasal steroids (mean: 5.16 ± 1.78) had significantly higher MMAS-8 scores compared to the group that used inhaled steroids in addition to nasal steroids (mean: 3.60 ± 1.28) (z = -2.614; p = 0.009).

When the scale scores of 44 patients with atopy and 23 patients without atopy were compared, no significant differences were found between the total and subscalar scores of SDQ, total and subscalar scores of PedsQL, STAI I and STAI II scores, sleep total scores and MMAS-8 scale scores (p > 0.05).

Table 1: Comparison of SDQ scale and subscale scores of patient and control groups

groups	scale	N	x̄±SD	Median	z	P
AR	**SDQ - emotional symptoms**	67	5,14±2,70	5,0	-4,172	**<0,001**
CG		67	3,16±2,28	4,0		
AR	**SDQ -behavior problems**	67	2,23±2,14	2,0	-1,753	0,080
CG		67	1,44±1,28	1,0		
AR	**SDQ - ADHD symptoms**	67	3,43±1,95	3,0	-1,717	0,086
CG		67	2,73±1,56	3,0		
AR	**SDQ - peer problems**	67	3,52±2,03	3,0	-4,529	**<,001**
CG		67	2,00±1,51	2,0		
AR	**SDQ - social skills**	67	5,92±3,19	6,0	-4,054	**<,001**
CG		67	8,14±1,88	9,0		
AR	**SDQ - Total**	67	12,31±4,77	12,0	-2,810	**0,005**
CG		67	9,59±4,52	10,0		

AR: Allergic rhinitis group, CG: Control group, SDQ: Strengths and Difficulties Questionnaire, ADHD: attention deficit hyperactivity disorder, N: Number, x̄: Mean, SD: Standard deviation, z: Mann Whitney U test value p: Statistical significance value.

Table 2: Examination of the patient and control groups in terms of sleep pathologies

	AR(n=67,%)	CG(n=67,%)	χ^2	p
Good sleep quality	34 (%50,7)	51 (%76,12)	8,23	**0,004[a]**
Poor sleep quality	33 (%49,2)	16(%23,8)		
Subjective sleep quality				
Very good	14(%20,9)	21 (%31.3)		
Quite good	37(%55,2)	43(%64,2)	10,74	**0,004[b]**
Quite bad	16(% 23,9)	3(%4,5)		
Very bad	0	0		
Time to fall asleep				
Under 15 minutes	17(%25,4)	32(%47,8)		
16-30 minutes	30(%44,8)	18 (%26,9)		
31-60 minutes	18(%26,9)	12 (%17,9)	10,07	**0,017[b]**
Over 60 minutes	2(%3,0)	5(%7,5)		
Sleep Duration				
Over 7 hours	48(%71,6)	53 (%79,1)		
6- 7 hours	17(%25,4)	10(%14,9)	8,06	**0,044[b]**
Less than 5 hours	2(%3,0)	4(%6,0)		
Sleep Efficiency				
Over 85%	40(%59,7)	56(%83,6)		
%75-84	21(%31,3)	11(%16,4)	11,79	**0,008[b]**
%65-74	4(%6,0)	0		
64% and below	2(%3,0)	0		
Sleep Disorders				
Never happened	8 (%11,9)	3(%4.5)		
Less than once a week	25(%37,3)	45(%67,2)	16,47	**0,009[b]**
Once or twice a week	21(%31,3)	17(%25,4)		
Three or more times a week	13(%19,4)	2(%3,0)		
Daytime Dysfunction				
Never happened	61 (%91,0)	65(%97,0)		
Less than once a week	4 (%6,0)	2 (%3,0)	2,79	0,1525[b]
Once or twice a week	2(%3,0)	0		
Use of Sleeping Medications				
Never uses it	25(%37,3)	30(%44,8)		
Less than once a week	22(%32,8)	21(%31.3)	5,27	0,2474[a]
Once or twice a week	20(%29,9)	16(%23,9)		
Three or more times a week	0	0		

AG: Asthma group, CG: Control group, n: number, p[a]: Chi-square statistical significance value, p[b]: Monte Carlo simulation statistical significance value.

Table 3: Comparison of scales related to the level of treatment compliance in the patient group

Gruplar	Parametreler	n	ort± ss	Median	z	P
ARI	**PedsQL - FHTS**	25	78,48 ± 16,82	81	-1,063	0,286
ARC		42	73,55 ± 17,99	75		
ARI	**PedsQL-emotional functioning**	25	86,0 ± 11,90	90	4,070	**<0,001**
ARC		42	64,29 ± 20,88	60		
ARI	**PedsQL -social functioning**	25	90,4 ± 12,07	95	-1,419	0,146
ARC		42	84,52 ± 17,35	92,5		
ARI	**PedsQL-school functionality**	25	79,6 ± 13,38	80	-2,910	**0,003**
ARC		42	64,55 ± 20,41	70		
ARI	**PedsQL- PHTS**	25	85,33 ± 8,63	88,3	-3,837	**<0,001**
ARC		42	71,12 ± 14,73	70		
ARI	**PedsQL -Total**	25	81,91 ± 10,18	79,6	-2,722	**0,006**
ARC		42	72,33 ± 14,72	75,75		
ARI	**SDQ - emotional symptoms**	25	4,20±3,08	3,0	2,411	**0,015**
ARC		42	5,71±2,32	5,71		
ARI	**SDQ -behavior problems**	25	1,32±1,95	1,0	3,195	**0.001**
ARC		42	2,79±2,09	2,5		
ARI	**SDQ - ADHD symptoms**	25	3,12±2,05	3	0,830	0.399
ARC		42	3,62±1,90	3		
ARI	**SDQ - peer problems**	25	3,36 ± 2,31	3	0,998	0,314
ARC		42	3,62 ± 1,87	3		
ARI	**SDQ - social skills**	25	5,52 ± 2,54	6	1,000	0,312
ARC		42	6,17 ± 3,53	7		
ARI	**SDQ - Total**	25	10,08 ± 3,64	9	3,04	**0,002**
ARC		42	13,64 ± 4,9	13		
ARI	**STAI-I**	25	30,04 ± 6,35	29	1,789	0,073
ARC		42	33,93 ± 8,24	31		
ARI	**STAI-II**	25	35,04 ± 7,33	32	3,422	**<0,001**
ARC		42	41,86 ± 6,98	42		
ARI	**Sleep total**	25	4,16 ± 2,52	4,0	-3,208	**0,001**
ARC		42	6,42 ± 2,75	7,0		

ARI: allergic rhinitis medication adherence good group, ARC: allergic rhinitis medication adherence poor, PedsQL: quality of life scale for children, FHTS: physical health total score, PHTS: psychosocial health total score, SDQ: Strengths and Difficulties Questionnaire , STAI-I: State Anxiety Inventory for Children STAI-II: Trait Anxiety Inventory for Children n: Number, mean: Mean, SD: Standard deviation, z: Mann Whitney U test value p: Statistical significance value.

DISCUSSION

In our study, we observed that the quality of life in children with allergic rhinitis was significantly lower compared to the healthy control group. Determining sleep quality, increasing emotional symptoms, weakening of the same age relationship, and decreasing social functioning. Additionally, low adherence to treatment significantly reduced the general, physical and psychosocial subdimensions of quality of life, increasing to both emotional withdrawal and behavioral issues.

In the AR group, compared to the CG group, the SDQ total scale score, emotional symptoms and peer problems were higher and social skills subscale scores were lower, indicating that children diagnosed with AR had significant difficulties in the field of internalized and externalized behavior problems and social competence. Nanda et al. found that children diagnosed with allergic rhinitis at age 4 faced an increased risk of internalizing problems by the time they reached age 7.[23] Grande et al. conducted a study on allergic diseases in children aged 6 to 11 years; showed that children diagnosed with exhibited higher scores on both internalizing and externalizing problems, as well as an increased risk of developing behavioral problems compared to their healthy pers.[24] It has also been reported that nasal symptoms (e.g.,

nose wounds, tissue wear, medication use) can cause children to feel discomfort and embarrassment towards their peers, which can lead to children avoiding activities and social isolation.[25] Research emphasizes that not only neuroinflammatory mechanisms, but also various stress factors should be taken into account in the formation of psychological symptoms associated with allergic rhinitis and other allergic diseases.[26] It has been reported that these disorders can be a significant source of stress not only for children but also for caregivers. Overprotective parental attitudes, inadequate social support and impaired sleep quality may negatively affect parent-child relationships and lead to deterioration in psychosocial and cognitive functions. In addition, it is thought that early stress may negatively affect brain development by affecting neuroendocrine systems, which may pave the way for the development of psychiatric disorders.[27-32]

In our study, the overall quality of physical health, psychosocial health, school functioning, and quality of life were significantly lower in the AR group compared to the CG group. Similarly, Meltezer et al. found that children with allergic rhinitis exhibited less positive mood ($p<0.001$), lower energy levels ($p<0.001$), reduced happiness ($p<0.05$), more restricted social lives ($p<0.001$), and reduced school attendance ($p<0.001$) in a study involving 500 children with allergic rhinitis aged 4-17 years and 504 healthy controls[5]. Patients with allergic rhinitis consistently report a lower quality of life than non-allergic individuals.[33] This condition not only imposes limitations on work, school, and leisure activities but also affects children physically and socially, leading to decreased academic performance, reduced life satisfaction, and impaired sleep quality.[5,33,34] These findings indicate that allergic rhinitis extends beyond physical symptoms, adversely impacting children's overall quality of life. Accordingly, a comprehensive psychiatric evaluation is recommended for children with a diagnosis of allergic rhinitis.

The AR group showed significantly more disrupted patterns in sleep quality, longer sleep latency, shorter total sleep duration, lower sleep efficiency, and increased prevalence of general sleep disturbances in comparison to the control group.It has been reported that sleep, which is critical for children's growth, development and learning ability, is significantly impaired in children with allergic rhinitis.[5] Allergic rhinitis can manifest itself with symptoms such as sleep disorders, nasal congestion, snoring, breathing difficulties, daytime sleepiness and obstructive sleep apnea.[35] Disrupted nighttime sleep in children can result in daytime fatigue and drowsiness, which are linked to a broad spectrum of adverse outcomes. These may include weakened immune response, heightened anxiety, difficulties with attention and memory, behavioral and emotional challenges such as irritability and depressive symptoms, as well as growth delays, hormonal irregularities, elevated blood pressure, poor academic performance, greater likelihood of accidents, a higher tendency toward substance use, and increased vulnerability to cardiovascular and metabolic disorders. Collectively, these issues contribute to a significant decline in both general well-being and health-related quality of life.[11,36,37] Therefore, we believe that monitoring sleep quality and intervening when necessary to prevent cognitive development disorders and psychiatric and metabolic comorbidities in children with allergic rhinitis is very important in clinical practice.

The internal assessment of the AR group revealed that externalized behaviors and general difficulty symptoms were higher in children with low medication adherence. A significant correlation was found between the decrease in medication adherence scale scores and the increase in affective symptoms, behavioral problems and symptoms in the total difficulty domain. In addition, it was observed that emotional, school, psychosocial and general quality of life scores were lower in the group with low medication adherence. It was determined that there was a significant and positive relationship in the areas of physical, emotional, psychosocial and general quality of life with increasing medication adherence. In addition, it was found that trait anxiety levels and total sleep disturbance scores were higher in the group with low medication adherence and sleep problems increased as medication

adherence decreased. Based on the results of our study and supporting evidence from the literature, it can be inferred that untreated or insufficiently managed allergic rhinitis may lead to a significant decline in quality of life and increase the risk of developing serious comorbidities.[38] In a study conducted with a total of 102 participants (53 patients diagnosed with allergic rhinitis and 49 healthy controls), Singh et al. administered medical treatment to both groups and provided additional interventions such as education, medication charting and counseling to the case group. The most common reasons for non-adherence were forgetfulness, cost of medication and concern that treatment would last a lifetime. Medication adherence increased by 84.9% in the intervention group; it was shown that the rate of adherence decreased with increasing age and that men had higher medication adherence than women.[39] In addition to the importance of medication adherence in terms of symptom management and comorbidities, it has been stated that the psychological effects of treatment differences on patients may also vary. Among the reasons for medication non-adherence, it was stated that perceived lack of efficacy and perceived discomfort make it difficult to comply with treatment protocols, leading to psychological stress and frustration in patients. Patient education about the course of treatment, potential side effects and the need for close follow-up is of great importance to improve adherence and treatment outcomes.[40,41]

Medication adherence was found to be significantly greater among patients receiving a combination of nasal steroids and leukotriene receptor antagonists compared to those treated with nasal and inhaled steroids. Leukotriene receptor antagonists have been associated with symptom reduction and improved quality of life in allergic rhinitis patients, relative to placebo. In addition, the method of use and dosing frequency increase medication adherence.[42,43] Although inhaled corticosteroids are used in the treatment of allergic rhinitis and asthma, there are some difficulties related to drug use in the pediatric population. In particular, inhaler technical inadequacies, irregularities in adherence to treatment and concerns about long-term side effects may reduce medication adherence.[44,45] In the treatment of allergic rhinitis, the management of comorbidities and measures to improve adherence to treatment should be evaluated with a holistic approach.

Although previous studies have suggested a potential link between allergic rhinitis and elevated anxiety levels in children, our findings did not reveal any significant differences between the AR group and the control group with respect to either trait or state anxiety. Consistently, Maddah et al., in a study involving children aged 7 to 12, also reported no significant association between allergic rhinitis diagnosis and anxiety symptoms.[47,48] We anticipate that longitudinal studies with larger samples in which the factors (social support, family support, general physical health, psychological resilience) that cause anxiety to reach a level that affects mental health in children with AR will contribute to explain this difference.

The main limitation of this study is cross-sectional and data were collected through self-report scales, which makes it difficult to establish cause and effect relationships. However, the use of multidimensional assessment scales increases the power of the study. In conclusion, we observed that decreased adherence to treatment in children with allergic rhinitis negatively affects children's quality of life, sleep quality, and social and psychological functioning. This emphasizes the importance of developing structured intervention programs to increase adherence to treatment and improve sleep quality in children with allergic rhinitis.

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