**Immunol Genet J, Vol. 7, No. 2, June 2024, pp.60-65** **DOI: https://doi.org/10.18502/igj.v7i2.17851**

**Original Article**

# Relationship between Asthma and Allergic Rhinitis in Terms of Prevalence and Severity in East-Azerbaijan, Iran

**Azar Dastranji[1], Yalda Jabbri Moghaddam[2], Mahsa Hesamifard[2], Mahnaz Sadeghi-Shabestari[3*]**

*[1] Pediatric pulmonology, Pediatric Health Research Center of Mardany Azar Tabriz Children Hospital, Tabriz University of Medical Sciences, Tabriz, Iran*

*[2] Tabriz University of Medical Sciences, Tabriz, Iran*

*[3] Tuberculosis and Lung Disease Research Center, Immunology Research Center of Tabriz, Mardany Azar Children Hospital, Tabriz University of Medical Sciences, Tabriz, Iran*

Received: 17 December 2023; Accepted: 23 April 2024

## Abstract

**Background:** Asthma and Allergic rhinitis (AR) are frequently concurrent diseases. Epidemiological, immunological, and clinical studies reported increasing evidence of the links between AR and asthma. Epidemiologically, up to 40% of patients with AR also have asthma, and up to 80% of patients with asthma experience nasal symptoms. Furthermore, patients with AR are at three times the risk of developing asthma compared with those without AR.

**Method:** This cross-sectional study was carried out during one year from all patients between 0-16 years who were referred to allergy and ENT clinics with symptoms of chronic cough (more than four weeks) or upper respiratory tract symptoms such as sneezing, runny nose, and nasal congestion. Data and diagnosis were classified according to the Global Initiative for Asthma (GINA) and the AR criteria and its Impact on Asthma guidelines (ARIA), respectively.

**Results:** 190 (120 individuals with asthma and 70 individuals with AR) were enrolled in the study. The mean age of patients with asthma was 9.14±3.13, and 43.3% were female. The severity of asthma was classified as mild (20%), moderate (70.8%), and severe (9.2%). The mean age of patients with rhinitis was 10.13±3.45 years, and 35.7% were female. Rhinitis was classified as intermittent (40%) and persistent (60%). The prevalence of AR in the asthma group was 42 individuals (35%). Twenty-nine cases of them (24.2%) had intermittent AR, and 13 (10.8%) cases had persistent AR. The prevalence of asthma in AR was 18 cases (25.7%) 3 cases (4.3%) had mild asthma, 12 cases (17/1%) had moderate asthma, and 3 cases (4.3%) had severe asthma. A significant correlation was found ($P$<0.0001) between the severity of AR and asthma.

**Conclusion:** Based on the findings of our study, there is a significant relationship between the severity of asthma and AR in patients with asthma and AR. The results show that asthma prevalence is high in patients with AR. Also, the frequency of AR in patients with asthma is significantly higher.

**Keywords:** Allergic Rhinitis; Asthma; Children; Severity

***Corresponding Author:** Mahnaz Sadeghi-Shabestari, MD

Tuberculosis and Lung Disease Research Center, Immunology Research Center of Tabriz, Children Hospital, Tabriz University of Medical Sciences, Tabriz, Iran

E-mail: drsadeghim2004@yahoo.com

**How to cite this article**

*Dastrani A, Jabbari Moghaddam Y, Hesamifard M, Sadeghi-Shabestari M. Relationship between Asthma and Allergic Rhinitis in Terms of Prevalence and Severity in East-Azerbaijan, Iran. Immunology and Genetics Journal, 2024; 7(2): 60-65.* DOI: https://doi.org/10.18502/igj.v7i2.17851

## Introduction

Asthma is one of the most critical health problems in the world, and its prevalence is also increasing, especially in low and middle-income countries and is characterized by various symptoms like chest tightness, wheezing, cough, and breathlessness (1). In children under five years old, asthma is one of the leading causes of hospitalizations and has been increasing in recent years (2). Globally, asthma ranked 28th among the leading causes of disease burden and 27th in low- and middle-income countries. More than half (56%) of the global burden attributable to asthma was due to 13.2 million years lived with disability (YLD) (3). According to geographical variations, asthma prevalence varies among children from 9.1% to 9.5%. Additionally, estimations suggest that more than 400 million people will experience asthma in the future (4). In our country (Iran), the lowest and highest asthma prevalence was reported as 2.7% and 35.4% in Kerman and Tehran, respectively (5).

AR is a disease with an increasing prevalence, similar to asthma (1). AR affects near to 20% of the general population. Several epidemiological studies suspected AR to be a risk factor for the onset of asthma (6-9). The relationship between the upper and lower airways was first clinically noted in the early 1800s. This link was the main focus of AR and its impact on the asthma (ARIA) initiative in cooperation with WHO (10). ARIA has paid particular attention to rhinitis with asthma and stated that patients with asthma should be routinely examined and controlled for rhinitis; because asthma and rhinitis directly impact the quality of life (11). The epidemiological investigations about the relationship between rhinitis and asthma show that nearly all patients with allergic or non-allergic asthma also have rhinitis (10).

Shreds of evidence about rhinitis and asthma accord with ARIA statements and suggest that rhinitis and asthma should always be considered together in diagnosis and management (10). Given the climate of our region, which is mountainous, and the importance of the subject, we hypothesize that if the prevalence of asthma in patients with AR in the community is high, we can prevent asthma through rapid and early treatment of AR.

## Materials and Methods

In this cross-sectional study, we included patients under 16 years who were referred to the Allergy and ENT Clinics of Tabriz Children Hospital, Iran, for a year. Inclusion criteria were symptoms of chronic cough for more than four weeks or symptoms of the upper respiratory tract with sneezing and runny nose, nasal congestion. We excluded patients with a history of corticosteroid and antihistamine therapy. Patients' information, including age, gender, place of residence, main complaint at the time of referral, medical history, frequency of atopy in first-degree and second-degree family members, and clinical symptoms, were recorded. A pediatric allergy specialist diagnosed asthma and AR based on GINA (12) and ARIA (13) criteria, respectively. Then the severity of asthma and AR was determined as follows.

Mild asthma: The patient has symptoms more than once a week but not daily and night symptoms more often than twice a month.

Moderate asthma: Patients have daily symptoms and nighttime symptoms more than once a week.

Severe asthma: The patient has daily symptoms consistent with nighttime symptoms.

Intermittent AR: The disease with seasonally symptomatic, lasting several weeks and resolving spontaneously and recurring the following year.

Persistent AR: The disease recurs throughout the year, or patients always have symptoms.

Statistical analysis

The data were analyzed using descriptive and comparative statistical methods with SPSS V.20 software. The student's t-test was used to compare quantitative findings between the two groups, and the Chi-Square test was used to compare qualitative findings between the two groups. A p-value of less than 0.05 was considered statistically significant.

## Results

In this study, 190 patients under the age of 16 were studied. Seventy patients were in the AR group and one-hundred and twenty were in the asthma group. The demographic findings of patients in both groups are summarized in **Table 1**. The frequency of rhinorrhea, sneezing, itchy nose and throat, and nasal congestion was significantly higher in patients with AR. In contrast, the fre-

**Table 1.** Demographic findings.

| Variable | Asthma (n=120) | AR (n=70) | *p-value* |
|---|---|---|---|
| **Age (years)** | 9.14±3.13 (2-16) | 10.13±3.45 (2-16) | 0.443 |
| **Gender** | | | 0.001 |
| **Male** | 68 (56.7%) | 45 (64.3%) | |
| **Female** | 53 (43.4%) | 25 (35.7%) | |
| **Living place** | | | 0.968 |
| **Urban** | 115 (95.8%) | 67 (95.7%) | |
| **Rural** | 5 (4.2%) | 3 (4.3%) | |
| **Complains** | | | |
| **Rhinorrhea** | 23 (19.2%) | 39 (55.7%) | 0.003 |
| **Sneezing** | 24 (20%) | 50 (71.4%) | 0.001 |
| **Itchy nose and throat** | 27 (22.5%) | 34 (48.6%) | 0.003 |
| **Nasal congestion** | 43 (35.7%) | 45 (64.3%) | 0.003 |
| **Chronic cough** | 112 (93.3%) | 31 (44.3%) | 0.004 |
| **Itchy eyes** | 5 (4.2%) | Activity or sports | 0.002 |
| **Past medical history** | | | |
| **Asthma** | 27 (22.5%) | 1 (1.4%) | 0.012 |
| **AR** | 13 (10.8%) | 30 (42.9%) | 0.021 |
| **Eczema** | 10 (8.3%) | 8 (11.4%) | 0.087 |
| **Atopy history** | 70 (58.3%) | 43 (61.4%) | 0.759 |
| **First-degree Relatives** | | | |
| **Asthma** | 10 (8.3%) | 4 (5.7%) | - |
| **AR** | 42 (35%) | 22 (31.4%) | - |
| **Eczema** | 9 (7.5%) | 7 (10%) | - |
| **Second-degree relatives** | | | |
| **Asthma** | 30 (25%) | 25 (35.7%) | - |
| **AR** | 34 (28.3%) | 20 (28.6%) | - |
| **Eczema** | 1 (0.8%) | 1 (1.4%) | - |
| **Habitual history** | | | |
| **Smoke exposure** | 6 (5%) | 4 (5.7%) | 0.212 |
| **Animal caring** | 8 (6.7%) | 5 (7.1%) | 0.198 |

* Data were in mean±SD and frequency (%).

**Table 2.** Clinical findings.

| Variable | Asthma (n=120) | AR (n=70) | *p-value* |
|---|---|---|---|
| **Apnea** | 0 | 1 (1.4%) | 0.909 |
| **Snoring** | 11 (9.2%) | 14 (20%) | **0.021** |
| **PND** | 79 (65.8%) | 32 (45.7%) | 0.065 |
| **OME** | 3 (2.5%) | 2 (2.9%) | 0.989 |
| **Tonsillar hypertrophy degree** | | | 0.219 |
| **Normal** | 99 (82.5%) | 53 (75.7%) | |
| **I** | 7 (5.8%) | 9 (12.9%) | |
| **II** | 5 (4.2%) | 5 (7.1%) | |
| **III** | 8 (6.7%) | 3 (4.3%) | |
| **IV** | 1 (0.8%) | 0 | |
| **Auscultation** | | | 0.076 |
| **Crackles** | 22 (18.3%) | 3 (4.2%) | |
| **Wheezing** | 36 (30%) | 6 (8.6%) | |
| **Rhonchi** | 10 (8.3%) | 2 (2.9%) | |
| **Normal** | 59 (49.2%) | 61 (87.1%) | |
| **Positive SPT** | 113 (94.2%) | 64 (91.4%) | 0.898 |
| **Abnormal PFT** | 32 (28.6%) | 21 (30%) | 0.709 |
| **Abnormal CXR** | 86 (65%) | 47 (67.2%) | 0.909 |
| **Sinusitis in warts radiography** | 102 (85%) | 58 (82.9%) | 0.760 |

PND: Paroxysmal nocturnal dyspnea; OME: Otitis media with effusion; SPT: Skin prick test; PFT: Pulmonary function test; CXR: Chest X-ray.
* Data were in Frequency (%).

quency of chronic coughs in patients with asthma was significantly higher. Clinical examination findings and clinical signs of patients in the two groups are compared in **Table 2.** The frequency of nighttime snoring was significantly higher in patients with AR. Comparison of other clinical findings between the two groups was not statistically significant.

In this study 35% of the asthma group also had AR; we have 4 cases of persistent AR and 8 intermittent AR in mild asthma patients. Six patients with moderate asthma had persistent AR, and 19 had intermittent AR. Three patients with severe asthma had persistent AR, and 2 had intermittent AR ($P$=0.001). 25.7% of patients with AR also had asthma. Two patients with intermittent AR had mild asthma, six had moderate asthma, and two had severe asthma. Six patients with persistent AR had moderate asthma, one had mild asthma, and one patient had severe asthma ($P$=0.001).

In this study 35% of the asthma group also had AR; we have 4 cases of persistent AR and 8 intermittent AR in mild asthma patients. Six patients with moderate asthma had persistent AR, and 19 had intermittent AR. Three patients with severe asthma had persistent AR, and 2 had intermittent AR ($P$=0.001). 25.7% of patients with AR also had asthma. Two patients with intermittent AR had mild asthma, six had moderate asthma, and two had severe asthma. Six patients with persistent AR had moderate asthma, one had mild asthma, and one patient had severe asthma ($P$=0.001).

## Discussion

Asthma is the most common chronic respiratory disease in children in many geographical areas, especially in developing countries, and it has high morbidity and economic costs for the healthcare system. On the other hand, AR has become one of the leading social health problems in recent decades due to its high prevalence and adverse effects on patients' quality of life. Almost half of children and adults with asthma also have AR. Recent epidemiological studies also show a strong association between asthma and AR. These two diseases are among the inflammatory conditions of the airways. AR with pathophysiology is known to reduce the response to asthma treatment and is a prognostic factor in asthma control.

Our study aimed to investigate the relationship between asthma and AR in 190 patients, 120 patients in the asthma group and 70 patients in the AR group. The mean age of patients in the two groups was 9.14 and 10.13 years, respectively. In the asthma group, 56.7% of patients were male, and in the AR group, 64.3% were male; Thus, the frequency of these two diseases in males was significantly higher. Rahimian et al. (2021) reported that the prevalence of asthma in boys and girls was 9% and 8%, respectively (14). Also, Kusunoki et al. (2009) reported a higher prevalence of asthma in boys (6%) than girls (4%) (15). This gender difference might be related to the narrower caliber of the airways in males than in females due to hormonal effects in the first decade of life. Other reasons include physical and social differences, which can also be evidence of the difference that males in childhood are more exposed to allergens due to playing outside (16).

Skin prick test is also positive in up to 90% of our patients. In line with our results, Ruokonen et al. (2010) reported the close association of asthma, AR and positive SPT in school-aged children (17). This relation is also reported by Koponen et al. (2012) cohort at the age of 5-7 years (18). Given these results, AR with positive SPT at the age of 5 to 7 years might be a significant risk factor for asthma at older ages.

In our study, the overall prevalence of atopy (eczema, AR, and asthma) in the family of patients with asthma was 58.3%, and in patients with AR was 61.4%; But there is not a significant difference between the two groups. Eleven patients (6 in the asthma group and 5 in the AR group) have Tobacco exposure. Verlato et al. (2016) evaluated smoking and new-onset asthma, and they concluded that current smoking was not a risk factor for new-onset asthma unless new-onset wheezing was also considered. The increase in asthma incidence among ex-smokers was likely due to reverse causation (19). The association between asthma and AR appears to be due to progressive allergenicity to allergens as well as inflammation of the airways in childhood (20, 21). However, exposure to allergens in sensitive individuals is insufficient to cause asthma and requires a localized or systemic immune response of the immune system to lead to structural changes in the airways (22, 23). In addition, non-allergic factors that cause respiratory tract inflammation, such

as exposure to secondhand smoke and infectious diseases, can also increase the risk of developing asthma (24). Tara et al. (2018) reported that rhinitis in childhood has significantly increased the risk of asthma, even in the absence of atopy (25). Tomanen et al. (2017) reported that a history of asthma in parents, especially maternal asthma, is a significant early-life risk factor for asthma at 11-13 years of age (26).

In the present study, most patients had moderate asthma (70.8%). Also, among patients with asthma, 35% had AR, and the frequency of intermittent rhinitis was significantly higher than the persistent (24.2% vs. 10.8%; *P*=0.001). On the other hand, most of our AR patients had a persistent type (60%). The prevalence of asthma in AR patients was 25.7%, and moderate asthma was significantly higher than mild and severe types (17.1%, *P*=0.001). In line with our findings, Tohidinik et al. (2019), in a meta-analysis, evaluated 274489 subjects, and the results show that AR is strongly associated with asthma. They also indicated that relieving airway allergic manifestations may need dual control of AR and asthma (27).

## Conclusion

Based on the findings of our study, there is a significant relationship between the severity of asthma and AR in patients with asthma and AR. The results show that asthma prevalence is high in patients with AR. Also, the frequency of AR in patients with asthma is significantly higher. Finally, Rhinitis frequently precedes asthma and treating AR has beneficial effects on the control of asthma, suggesting that upper airway disease is a risk factor for asthma.

## Conflict of interest

The authors have no conflicts of interest.

## Acknowledgments

The ethics committee has approved the present study with the code (90/1-10/12) in Tabriz University of Medical Sciences.

## References

1. Asher MI, Montefort S, Bjorksten B, Lai CK, Strachan DP, Weiland SK, et al. Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. Lancet. 2006;368(9537):733-43.
2. Bush A, Fleming L. Diagnosis and management of asthma in children. BMJ. 2015;350:h996.
3. Caminati M, Morais-Almeida M, Bleecker E, Ansotegui I, Canonica GW, Bovo C, et al. Biologics and global burden of asthma: A worldwide portrait and a call for action. World Allergy Organ J. 2021;14(2):100502.
4. Ferrante G, La Grutta S. The Burden of Pediatric Asthma. Front Pediatr. 2018;6:186.
5. Heidarnia MA, Entezari A, Moein M, Mehrabi Y, Pourpak Z. Prevalence of asthma symptom in Iran: a meta-analysis. J Fac Med-Shaheed Beheshi Univ Med Sci Health Serv. 2007;31(3):217-25.
6. Pawankar R, Canonica GW, Holgate ST, Lockey RF, Blaiss M. WAO white book on allergy: update 2013. World Allergy Organ J. 2013;248.
7. Leynaert B, Bousquet J, Neukirch C, Liard R, Neukirch F. Perennial rhinitis: An independent risk factor for asthma in nonatopic subjects: results from the European Community Respiratory Health Survey. J Allergy Clin Immunol. 1999;104(2 Pt 1):301-4.
8. Jacob L, Keil T, Kostev K. Comorbid disorders associated with asthma in children in Germany - National analysis of pediatric primary care data. Pediatr Allergy Immunol. 2016;27(8):861-66.
9. Shaaban R, Zureik M, Soussan D, Neukirch C, Heinrich J, Sunyer J, et al. Rhinitis and onset of asthma: a longitudinal population-based study. Lancet. 2008;372(9643):1049-57.
10. Demoly P, Bousquet J. The relation between asthma and allergic rhinitis. The Lancet. 2006;368(9537):711-13.
11. Bousquet J, Schunemann HJ, Togias A, Bachert C, Erhola M, Hellings PW, et al. Next-generation Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines for allergic rhinitis based on Grading of Recommendations Assessment, Development and Evaluation (GRADE) and real-world evidence. J Allergy Clin Immunol. 2020;145(1):70-80 e3.
12. Chipps BE, Murphy KR, Oppenheimer J. 2020 NAEPP Guidelines Update and GINA 2021-Asthma Care Differences, Overlap, and Challenges. J Allergy Clin Immunol Pract. 2022;10(1S):S19-S30.
13. Klain A, Indolfi C, Dinardo G, Decimo F, Tosca MA, Miraglia Del Giudice M, et al. Comparing available treatments for pollen-induced allergic rhinitis in children. Expert Rev Clin Immunol. 2022;18(8):835-43.

14. Rahimian N, Aghajanpour M, Jouybari L, Ataee P, Fathollahpour A, Lamuch-Deli N, et al. The Prevalence of Asthma among Iranian Children and Adolescent: A Systematic Review and Meta-Analysis. Oxid Med Cell Longev. 2021;2021:6671870.
15. Kusunoki T, Morimoto T, Nishikomori R, Yasumi T, Heike T, Fujii T, et al. Changing prevalence and severity of childhood allergic diseases in kyoto, Japan, from 1996 to 2006. Allergol Int. 2009;58(4):543-8.
16. Almqvist C, Worm M, Leynaert B, working group of GALENWPG. Impact of gender on asthma in childhood and adolescence: a GA2LEN review. Allergy. 2008;63(1):47-57.
17. Ruokonen M, Kaila M, Haataja R, Korppi M, Paassilta M. Allergic rhinitis in school-aged children with asthma–still under-diagnosed and under-treated? A retrospective study in a children‘s hospital. Pediatr Allergy Immunol. 2010;21(1-Part-II):e149-e54.
18. Koponen P, Helminen M, Paassilta M, Luukkaala T, Korppi M. Preschool asthma after bronchiolitis in infancy. Eur Respir J. 2012;39(1):76-80.
19. Verlato G, Nguyen G, Marchetti P, Accordini S, Marcon A, Marconcini R, et al. Smoking and New-Onset Asthma in a Prospective Study on Italian Adults. Int Arch Allergy Immunol. 2016;170(3):149-57.
20. Sly PD, Boner AL, Bjorksten B, Bush A, Custovic A, Eigenmann PA, et al. Early identification of atopy in the prediction of persistent asthma in children. Lancet. 2008;372(9643):1100-6.
21. Pinart M, Benet M, Annesi-Maesano I, von Berg A, Berdel D, Carlsen KC, et al. Comorbidity of eczema, rhinitis, and asthma in IgE-sensitised and non-IgE-sensitised children in MeDALL: a population-based cohort study. Lancet Respir Med. 2014;2(2):131-40.
22. Borish L. The immunology of asthma: asthma phenotypes and their implications for personalized treatment. Ann Allergy Asthma Immunol. 2016;117(2):108-14.
23. Jones AC, Troy NM, White E, Hollams EM, Gout AM, Ling KM, et al. Persistent activation of interlinked type 2 airway epithelial gene networks in sputum-derived cells from aeroallergen-sensitized symptomatic asthmatics. Sci Rep. 2018;8(1):1511.
24. Voraphani N, Stern DA, Wright AL, Guerra S, Morgan WJ, Martinez FD. Risk of current asthma among adult smokers with respiratory syncytial virus illnesses in early life. Am J Respir Crit Care Med. 2014;190(4):392-98.
25. Carr TF, Stern DA, Halonen M, Wright AL, Martinez FD. Non‐atopic rhinitis at age 6 is associated with subsequent development of asthma. Clin Exp Allergy. 2019;49(1):35-43.
26. Tormanen S, Lauhkonen E, Riikonen R, Koponen P, Huhtala H, Helminen M, et al. Risk factors for asthma after infant bronchiolitis. Allergy. 2018;73(4):916-22.
27. Tohidinik HR, Mallah N, Takkouche B. History of allergic rhinitis and risk of asthma; a systematic review and meta-analysis. World Allergy Organ J. 2019;12(10):100069.