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EPIDEMIOLOGICAL CHARACTERISTICS AND COMORBIDITIES IN CHILDREN WITH ASTHMA

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ABSTRACT

Background: The global prevalence of pediatric asthma, along with its associated morbidity and mortality, has been on the rise. Managing asthma in children is often complicated by the presence of comorbidities, which presents a unique clinical challenge. This study was designed to investigate the epidemiological characteristics and comorbidities of children aged 6–18 years with asthma.

Materials and Methods: This cross-sectional study was conducted on children aged 6–18 years with an asthma diagnosis who were referred to the Allergy Clinic at Motahari Hospital, affiliated with the Urmia University of Medical Sciences. A structured questionnaire was used to collect demographic data, including age, sex, weight, height, body mass index (BMI), and place of residence. The medical history of each participant was also obtained, with a specific focus on comorbidities such as rhinitis, sinusitis, and gastrointestinal disorders such as gastroesophageal reflux.

Results: Among the 212 participants, the mean age was 8.4 years. The cohort was predominantly male, with girls accounting for 36.7% of participants, and most children (64.2%) lived in urban areas. The mean body mass index was 17.04 kg/m²; 11.8% of participants were classified as obese, and 4.7% as overweight. No significant relationship was found between asthma severity and obesity ($P = 0.44$). The study also examined the prevalence of several comorbidities: allergic rhinitis (39.6%), gastroesophageal reflux (25.5%), and sinusitis (9.4%). There were no statistically significant associations between asthma severity and any of these conditions ($P = 0.07$ for allergic rhinitis, $P = 0.06$ for reflux, and $P = 0.37$ for sinusitis).

Conclusion: This study demonstrates that the presence of comorbidities does not have a significant correlation with asthma severity. The most frequently observed comorbidities, in descending order, were allergic rhinitis, gastroesophageal reflux, obesity, and sinusitis.

KEYWORDS: asthma, epidemiology, comorbidities, children

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INTRODUCTION

Asthma is a prevalent disease affecting both children and adults, with a global prevalence of 7–10% in children and approximately 5% in adults, making it the fourth most common disease in the latter population [Dharmage S et al., 2019]. The prevalence, severity, and mortality of asthma exhibit significant geographic variability; while prevalence is higher in high-income nations, the majority of asthma-related deaths occur in low-income countries [To T et al., 2017]. A study in Iran reported an asthma prevalence of 8.9% [Fazlollahi M et al., 2018].

Characterized by chronic airway inflammation, asthma leads to bronchial hyperresponsiveness, obstruction, excessive mucus production, and airway remodeling [Hough K et al., 2020]. A distinct phenotype, known as type 2 (Th2) inflammatory asthma, is defined by elevated immunoglobulin E (IgE) levels and eosinophilic inflammation of the airways [Kudo M et al., 2013]. This chronic respiratory disorder can manifest at any age, causing episodic and reversible symptoms such as wheezing, chest tightness, shortness of breath, and coughing [Haktanir A, Phipatanakul W, 2016]. Airway inflammation results in bronchial obstruction, swelling, and increased mucus production. The disorder is more prevalent in boys during the first decade of life. However, after puberty, its prevalence shifts and becomes higher in young women, suggesting that sex hormones may influence asthma development [Ekpruke C, Silveyra P, 2022]. Recent studies have linked asthma severity in children to several factors, including the duration of symptoms, medication use, lung function, socioeconomic status, racial/ethnic background, and a neutrophilic phenotype [Trivedi M, Denton E, 2019].

The natural history of asthma varies with age. For many children, symptom severity decreases and may even resolve completely, particularly in mild cases. Conversely, symptoms may persist in those with severe asthma or recur in early adulthood [Szeffler S, 2014]. Various comorbidities are frequently observed in patients with asthma and can significantly impact disease control and outcomes [Listyoko A, 2024]. The most common of these include rhinitis, sinusitis, gastrointestinal disorders such as gastroesophageal reflux, psychiatric disorders, chronic infections, obstructive

sleep apnea, hormonal disorders, and depression [Boulet L, Boulay M, 2011]. The identification and treatment of these associated conditions can improve asthma management [de Groot E, Duiverman E, 2010]. Overall, knowledge about pediatric asthma and its associated conditions remains limited, though children with asthma may present with similar comorbidities to adults [van Aalderen W, 2012]. Clinicians should be aware of the high likelihood of these associated disorders in the pediatric asthmatic population [Al Ghobain M, 2012].

Inhaled corticosteroids (ICS) are the cornerstone of asthma management and are used to prevent wheezing in school-aged children [Mirabelli M, 2016]. Long-acting β_2 -agonists (LABAs) are not recommended for children under 5 years of age due to a lack of safety data [Licari A, 2022]. According to the Global Initiative for Asthma (GINA) guidelines, if asthma is not controlled with low to medium doses of ICS, clinicians should consider increasing the ICS dose or adding LABAs and/or montelukast [Alith M, 2015; Esmaily M, 2016]. Many children show a positive response to doubling the ICS dose and adding montelukast, which emphasizes the importance of individualized treatment plans [Dondi A, 2017].

Existing research on pediatric asthma has largely focused on children under 6 years of age, resulting in a scarcity of data for the 6–18-year age group. This study seeks to address this gap by investigating comorbidities in children with asthma aged 6–18 years. The goal is to identify factors that contribute to increased morbidity and, through their control or prevention, to reduce the severity of asthma in this specific population.

MATERIALS AND METHODS

A cross-sectional study was conducted at the Allergy Clinic of Shahid Motahari Hospital affiliated with Urmia University of Medical Sciences to assess the prevalence of comorbid conditions among pediatric patients with asthma between 2022 and 2023. The study was conducted after obtaining permission from the Ethics Committee of Urmia University of Medical Sciences (IR.UMSU.REC.1400.055).

The study population consisted of children and adolescents aged 6–18 years. Following coordination with the university and hospital administrative

and ethics committees, participants were enrolled via convenient purposive sampling. Informed consent was obtained from parents or guardians of minor participants, as well as from the patients themselves when applicable. Data were collected by the researcher from eligible patients during their visits to the asthma and allergy clinic.

Inclusion criteria for participation were a confirmed diagnosis of asthma, as determined by standard spirometry criteria, and an age range of 6–18 years. Patients were excluded if they had a history of or were diagnosed with cystic fibrosis, immunodeficiency, bronchiectasis, chronic lung diseases, or cerebral palsy. Patients who died during the study period were also excluded from the final analysis.

A structured questionnaire, developed specifically for this study, was used to collect all necessary data. The questionnaire included two primary sections: demographic information and medical history. Demographic variables recorded were age, sex, weight, height, body mass index (BMI), and place of residence. Medical history included specific questions on comorbid conditions such as rhinitis, sinusitis, and gastrointestinal disorders (e.g., gastroesophageal reflux). Information was gathered via parent-reported data and direct measurements performed by the researcher.

Statistical Analysis: BMI was calculated using the standard formula: weight (*kg*) divided by height squared (m^2). Statistical analysis was performed using SPSS version 22.0. Descriptive statistics were used to determine the frequency of each variable, and further analyses were conducted to evaluate associations between variables and asthma severity.

RESULTS

This study was conducted on 212 children aged 6–18 years with asthma at the Allergy Clinic of Urmia University of Medical Sciences from November 2020 to October 2021. The study aimed to describe the epidemiological characteristics and comorbidities of the cohort. The mean age was 12.2 ± 4.8 years, with mean weight, height, and BMI of 24.8 ± 11.1 *kg*, 117.8 ± 20.8 *cm*, and 17.04 ± 3.1 kg/m^2 , respectively. The cohort was predominantly male (63.2%) and resided in urban areas (64.2%).

Allergic rhinitis was the most common comor-

bidity, affecting 38.1% of children aged 6–11 years and 47.1% of children aged 12–18 years. Other comorbidities included sinusitis, gastroesophageal reflux, and obesity. The prevalence of obesity was 11.4% in the younger group and 14.7% in the older group.

Asthma severity was distributed as follows: mild intermittent (34.0%), mild persistent (31.1%), moderate persistent (25.5%), and severe persistent (9.4%). A chi-square test revealed no statistically significant association between asthma severity and the presence of allergic rhinitis in either age group ($p > 0.05$). The distribution of asthma severity by age group is presented visually in tables 1 and 2.

A chi-square test was used to analyze the relationship between asthma severity and the presence of sinusitis in the study cohort. The analysis was conducted for two distinct age groups: 6–11 years and 12–18 years. The results, as presented in Table 2, showed no statistically significant association between asthma severity and sinusitis in either age group ($p > 0.05$). This indicates that, within this study population, the presence or absence of sinus-

TABLE 1.
Frequency distribution of allergic rhinitis according to asthma severity by age group

Age group	Asthma severity	Allergic rhinitis		P-Value
		Number (percentage)		
		Present	Absent	
6-11	Mild intermittent	28 (46.6%)	32 (53.3%)	0.06
	Mild persistent	16 (28.5%)	40 (71.4%)	
	Moderate persistent	19 (47.5%)	21 (52.5%)	
	Severe persistent	4 (20.0%)	16 (80.0%)	
12-18	Mild intermittent	6 (50.0%)	6 (50.0%)	0.48
	Mild persistent	6 (60.0%)	4 (40.0%)	
	Moderate persistent	5 (35.7%)	9 (64.3%)	
	Mild intermittent	6 (50.0%)	6 (50.0%)	

TABLE 2.
Frequency distribution of sinusitis according to asthma severity by age group

Age group	Asthma severity	Sinusitis		P-Value
		Number (percentage)		
		Present	Absent	
6-11	Mild persistent	4 (6.6%)	56 (93.4%)	0.6
	Moderate persistent	6 (10.7%)	50 (89.3%)	
	Severe persistent	6 (15.0%)	34 (85.0%)	
	Mild intermittent	2 (10.0%)	18 (90.0%)	
12-18	Mild persistent	0	12 (100%)	0.13
	Moderate persistent	0	10 (100%)	
	Asthma severity	2 (14.2%)	12 (85.8%)	

itis did not have a measurable effect on the classification of asthma severity.

According to Table 3, the chi-square test indicated no statistically significant differences between asthma severity and reflux in the age groups ($p > 0.05$).

Twenty-five children (11.8%) were obese, and 10 children (4.7%) were overweight. According to Table 4, the chi-square test was used to examine the relationship between asthma severity and obesity. The results showed no statistically significant association between asthma severity and obesity ($p = 0.44$).

A chi-square test was used to investigate the relationship between asthma severity and obesity,

stratified by gender. As shown in Table 5, the analysis revealed no statistically significant difference between these variables for either male or female participants. This suggests that, within the study population, the presence of obesity was not associated with the severity of asthma, regardless of the child's gender.

DISCUSSION

Asthma is a chronic airway disease characterized by recurrent episodes of coughing, wheezing, shortness of breath, and chest tightness [Novelli F et al., 2018]. Children with asthma are also affected by other underlying conditions, and managing the coexistence of asthma with other chronic diseases presents a unique clinical challenge [Patel MR et al., 2015]. Proper identification and management of chronic comorbidities in children with asthma can improve overall outcomes for these patients [Hossny E et al., 2024]. The present study was designed and conducted to investigate the epidemiological characteristics and comorbidities in children with asthma aged 6–18 years.

The mean age of the study participants was 12.2 years, aligning with similar pediatric asthma cohorts in previous research [Golshan T et al., 2019]. The majority of participants were male and resided in urban areas, a finding consistent with the established epidemiology of childhood asthma. A review by Loftus et al. [Loftus P, Wise S, 2016] and data from the U.S. Centers for Disease Control and Prevention

Frequency distribution of reflux according to asthma severity by age group

TABLE 3.

Age group	Asthma severity	Reflux		P-Value
		Number (percentage)		
	Mild intermittent	Present	Absent	
11-6	Mild persistent	12 (20%)	48 (80%)	0.22
	Moderate persistent	18 (32.1%)	38 (67.9%)	
	Severe persistent	9 (22.5%)	31 (77.5%)	
18-12	Mild intermittent	8 (40%)	12 (60%)	0.12
	Mild persistent	2 (16.6%)	10 (83.4%)	
	Moderate persistent	4 (40%)	6 (60%)	
	Asthma severity	1 (7.0%)	13 (93.0%)	

Frequency distribution of asthma severity according to obesity

TABLE 4.

Asthma severity	Body Mass Index (BMI)				Significance level
	Underweight	Normal	Overweight	Obese	
3 (2.4%)	53 (73.6%)	53 (73.6%)	3 (4.2%)	9 (12.5%)	0.44
4 (1.6%)	48 (72.7%)	48 (72.7%)	2 (3.0%)	6 (9.1%)	
0	39 (72.2%)	39(72.2%)	5 (9.3%)	8 (14.8%)	
0	12 (60.0%)	12(60.0%)	2 (10.0%)	2 (10.0%)	

Relationship between asthma severity and obesity by gender

TABLE 5.

Gender	Asthma severity	Body fat mass index				Significance level
		Underweight	Normal	Overweight	Obese	
Boy	Mild intermittent					0.20
	Mild persistent	0	40 (86.9%)	3 (5.6%)	3 (5.6%)	
	Moderate persistent	2 (8.5%)	30 (88.2%)	2 (8.5%)	0	
	Severe persistent	0	27 (79.4%)	2 (8.5%)	5 (14.7%)	
Girl	Mild intermittent	0	12 (85.7%)	0	2 (14.2%)	0.12
	Mild persistent	5 (20.8%)	13 (54.1%)	0	6 (25.0%)	
	Moderate persistent	2 (7.6%)	18 (69.2%)	0	6 (23.0%)	
	Severe persistent	0	12 (66.6%)	3 (16.6%)	3 (16.6%)	
	Asthma severity	2 (100%)	0	0	0	

(CDC) have shown a higher prevalence of asthma in boys compared to girls, a pattern that contrasts with adult asthma demographics. This gender disparity has been consistently reported in multiple studies, including CDC data from 2008–2010 and 2015 [Moorman J et al., 2012]. The mean age in this study is also comparable to a study by Golshan et al. [Golshan T et al., 2019], which reported a mean age of 8.64 years in their cohort of children with asthma. Furthermore, the higher prevalence of asthma observed in urban residents is a consistent finding in the literature [Rodriguez A et al., 2019; Qin X et al., 2023]. This may be attributed to higher exposure to environmental pollutants, allergens, and other risk factors associated with urban living. The study setting in a tertiary center that primarily serves an urban population may also have contributed to this observation.

In this study, allergic rhinitis was the most prevalent comorbidity, affecting 38.1–47.1% (age-dependent range) of children with asthma. While its high frequency underscores its clinical significance, no statistically significant association was found between allergic rhinitis and asthma severity. This finding aligns with a study by Tay et al. [Tay T et al., 2016], which suggests that allergic rhinitis may play a smaller role in severe asthma compared to milder forms. However, some literature reports significantly higher rates, with prevalence ranging from 60% to 80% among children with asthma [Everhart R et al., 2014; Nafei Z et al., 2023]. Conversely, a study by Brouwer et al. [Brouwer A et al., 2010] reported a lower prevalence of 21%. These discrepancies can be attributed to differences in geographic location, population characteristics, ethnicity, lifestyle, and environmental factors [Asher M et al., 2006]. The high prevalence of allergic rhinitis in this population is notable, particularly given that the condition is often undiagnosed and undertreated in children with asthma.

In this study, gastroesophageal reflux was found in 25.5% of the asthmatic children. While there was a trend toward higher asthma severity in children with reflux, this association was not statistically significant ($p = 0.06$). The prevalence of reflux in this study is consistent with some prior estimates for asthmatic children, which range from 30% to 90% [Broers C et al., 2018]. These values

are notably higher than the estimated prevalence in the general population, which is approximately 20–40% for reflux and approximately 10% for asthma [De Marco R et al., 2010]. The concurrent increase in the prevalence of both conditions in many countries further supports a potential pathophysiological link between them [Broers C et al., 2018; Patti MG et al., 2016]. Longitudinal studies have even suggested that reflux may be a risk factor for the development of asthma [Kim SY et al., 2020]. The high comorbidity of reflux and asthma in this population suggests a complex relationship that is not yet fully understood and warrants further investigation.

In the present study, the prevalence of obesity was 11.8%, with an additional 4.7% of participants classified as overweight. A key finding was the lack of a statistically significant association between obesity and asthma severity. This result aligns with several other studies that also found no significant relationship between body mass index (BMI) and asthma severity in pediatric populations [Ahmadiafshar A et al., 2013; Fang C et al., 2025]. For instance, Peters et al. [Peters J et al., 2011] reported similar findings. However, these results contrast with literature reporting a strong association between obesity and increased asthma prevalence and severity [Liu P et al., 2013; Leinaar E et al., 2016]. For example, Golshan et al. found a significant link between obesity and severe asthma, which differs from the findings of this study. Potential reasons for this discrepancy may include variations in study design, sample size, and environmental and genetic factors. Additionally, socioeconomic factors such as poverty and malnutrition, as well as reduced clinic attendance by obese children with asthma, may also influence these outcomes [Golshan T et al., 2019].

The prevalence of sinusitis in the study population was 9.4%, with no statistically significant association observed between sinusitis and asthma severity. This finding contrasts with some prior research. For example, a similar study [Poddighe D et al., 2018] reported that 27% of children with severe asthma had abnormal sinus findings on radiographs. Similarly, Promsopa et al. [Promsopa C et al., 2016] found that 50% of children with treatment-resistant asthma had evidence of rhinosinusitis on endoscopic examination. Discrepan-

cies across studies may be attributed to differences in study populations and diagnostic methods, including imaging versus clinical evaluation.

CONCLUSION

This study found no statistically significant association between asthma severity and the presence of key comorbidities, including allergic rhinitis, gastroesophageal reflux, obesity, and sinusitis. Our findings highlight the high prevalence of these conditions within the pediatric asthma population, particularly allergic rhinitis and gastroesophageal

reflux. Consistent with global epidemiological patterns, the study cohort was predominantly male and from an urban setting. Given the considerable impact of asthma on quality of life and healthcare expenditures, a more nuanced understanding of the disease characteristics is necessary. We recommend that future research be conducted on a larger scale to better characterize the factors influencing asthma in children. Further investigation into the specific roles of comorbidities and epidemiological factors is essential to enhance patient care and optimize clinical management strategies.

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