

## Prevalence and Risk Factors of Asthma and Allergic Disorders Among School Children

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### Abstract:

**Background:** Asthma and allergic disorders are increasing in prevalence among children, contributing to significant morbidity and healthcare burdens. Environmental factors, genetic predisposition, and lifestyle changes are considered key contributors. However, there is limited epidemiological data on the prevalence of these conditions in school children from semi-urban and rural settings, such as Muzaffarpur, Bihar. This study aims to assess the prevalence of asthma and allergic disorders in school-going children attending the Department of Pediatrics at Sri Krishna Medical College and Hospital (SKMCH), Muzaffarpur.

**Objectives:** The study focuses on estimating the prevalence of asthma and allergic disorders, identifying associated risk factors, and understanding symptom severity among school-aged children in this region.

**Methods:** A cross-sectional observational study was conducted at the Department of Pediatrics, SKMCH, Muzaffarpur, Bihar, India from July 2023 to June 2024. A total of 100 school-going children (aged 5–15 years) presenting with respiratory or allergic symptoms were enrolled. A structured questionnaire based on the International Study of Asthma and Allergies in Childhood (ISAAC) guidelines was used for data collection. The parameters studied included the prevalence of diagnosed asthma, allergic rhinitis, eczema, and their associated risk factors such as family history, environmental exposure, and dietary habits. Spirometry and skin prick tests were performed for confirmation where required.

**Results:** Among the 100 children studied, 18% were diagnosed with asthma, 24% had allergic rhinitis, and 12% had eczema. The prevalence of these conditions was significantly higher among children with a family history of allergic disorders, with 65% of affected children reporting a positive family history ( $P < 0.05$ ). Environmental factors, particularly exposure to biomass fuel smoke and vehicular emissions, were found to be significant contributors to asthma risk, with an odds ratio of 2.3. Additionally, children living in urban settings exhibited a higher prevalence of allergic disorders compared to those from rural backgrounds. Seasonal variations also played a crucial role in symptom severity, with an increased number of cases reported during the monsoon and winter seasons.

**Conclusion:** This study highlights the increasing burden of asthma and allergic disorders among school-going children in Muzaffarpur, Bihar. The findings emphasize the need for early diagnosis and targeted interventions to manage and reduce morbidity associated with these conditions. Public health initiatives should focus on improving air quality, raising awareness, and implementing preventive measures to mitigate modifiable risk factors.

**Keywords:** Asthma, Allergic Rhinitis, Eczema, School Children, Prevalence, ISAAC, Pediatric Allergy, Risk Factors.

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### Introduction

Asthma and allergic disorders are among the most common chronic health conditions affecting children worldwide, posing significant challenges to healthcare systems, families, and the affected individuals themselves [1]. These conditions can impact a child's quality of life, school attendance, and overall well-being. Over the past few decades, the prevalence of asthma and allergic disorders has increased globally, with a notable rise in low- and

middle-income countries, including India. Various environmental and genetic factors contribute to the onset and progression of these conditions, making it imperative to study their prevalence and associated risk factors in different geographical regions [2]. India, being a diverse country with varying climatic conditions, environmental exposures, and lifestyle patterns, has witnessed an increasing trend in allergic disorders among children. Studies suggest

that rapid urbanization, industrialization, and environmental pollution play a crucial role in the rising incidence of asthma, allergic rhinitis, and eczema [3]. However, there is a lack of region-specific epidemiological data, particularly from semi-urban and rural areas like Muzaffarpur, Bihar. Understanding the burden of these disorders in school-aged children is essential for devising effective public health strategies, preventive measures, and treatment protocols.

Asthma is a chronic inflammatory disorder of the airways characterized by recurrent episodes of wheezing, shortness of breath, chest tightness, and coughing, which vary in severity and frequency. It is often triggered by allergens, infections, cold air, exercise, and exposure to pollutants. Allergic rhinitis, commonly known as hay fever, manifests as sneezing, nasal congestion, itching, and rhinorrhea, significantly affecting daily activities and sleep patterns in children. Eczema, or atopic dermatitis, is a chronic inflammatory skin condition characterized by dry, itchy, and inflamed skin, often associated with a family history of allergic diseases [4].

The increasing prevalence of these disorders among school-going children has been linked to multiple risk factors, including genetic predisposition, exposure to indoor and outdoor allergens, pollution, dietary habits, and socioeconomic conditions. Children with a family history of allergic diseases are at a higher risk of developing similar conditions. Environmental pollutants, such as vehicular emissions, industrial smoke, and biomass fuel combustion, contribute significantly to the rising cases of asthma and allergic rhinitis [5]. Additionally, lifestyle changes, including reduced physical activity, Westernized dietary patterns, and increased use of processed foods, have been associated with a higher prevalence of allergic conditions. Despite the growing burden of asthma and allergic disorders, awareness and early diagnosis remain inadequate, particularly in rural and semi-urban areas. Many cases remain undiagnosed or poorly managed due to limited access to healthcare services and lack of awareness among parents and teachers. School-based studies provide valuable insights into the actual burden of these conditions in children and help identify modifiable risk factors that can be targeted for intervention [6].

This study aims to assess the prevalence of asthma, allergic rhinitis, and eczema among school-going children in Muzaffarpur, Bihar, and to identify key risk factors contributing to these conditions. By providing region-specific epidemiological data, this study seeks to contribute to the existing body of knowledge and help in the formulation of effective prevention and management strategies. Understanding the impact of environmental and genetic factors on childhood asthma and allergies

will facilitate better healthcare planning and policy-making to improve the quality of life of affected children.

### Methodology

This study was conducted as a cross-sectional observational survey to assess the prevalence of asthma and allergic disorders among school-going children attending the Department of Pediatrics at Sri Krishna Medical College and Hospital (SKMCH), Muzaffarpur, Bihar India from July 2023 to June 2024. The study aimed to evaluate the occurrence of asthma, allergic rhinitis, and eczema, as well as identify potential risk factors influencing the development and severity of these conditions. The study population included school-aged children between 5 to 15 years of age who presented with respiratory or allergic symptoms. A total of 100 children were selected for participation based on predefined inclusion and exclusion criteria. The selection was conducted systematically to ensure representation from different socioeconomic backgrounds, residential locations (urban and rural), and varying exposure levels to potential allergens and pollutants.

The inclusion criteria for the study encompassed school-going children within the specified age group who had a history of recurrent respiratory symptoms such as wheezing, coughing, chest tightness, or symptoms suggestive of allergic rhinitis, including sneezing, nasal congestion, and itching. Children presenting with chronic skin conditions suspected to be eczema were also included. Exclusion criteria included children with congenital respiratory abnormalities, those with known chronic lung diseases other than asthma, and children with acute infectious conditions at the time of assessment.

A detailed questionnaire based on the International Study of Asthma and Allergies in Childhood (ISAAC) guidelines was administered to the parents or guardians of the participants. The questionnaire collected information on demographic details, family history of allergic disorders, environmental exposures, dietary habits, and clinical symptoms experienced by the child. Additionally, parental smoking habits, the use of biomass fuel for cooking, and the presence of pets or indoor allergens were documented to assess environmental risk factors. Clinical assessment was conducted for all participants, which included a thorough physical examination focusing on respiratory signs, skin conditions, and nasal symptoms. Spirometry was performed on children suspected of having asthma to evaluate lung function and confirm airway obstruction. For children with suspected allergic rhinitis or eczema, skin prick tests and serum IgE level assessments were conducted to determine sensitivity to common allergens, such as dust mites, pollen, pet dander, and specific food allergens.

The study also included an evaluation of seasonal variations in symptom severity, with data collected over different time points to assess whether climate changes and environmental conditions influenced the prevalence or exacerbation of asthma and allergic disorders. The impact of urbanization was analyzed by comparing children from urban and rural areas, considering differences in pollution levels, lifestyle factors, and dietary patterns. All data collected were documented systematically and analyzed statistically. Descriptive statistics were used to determine prevalence rates, while chi-square tests and logistic regression analyses were employed to assess associations between risk factors and allergic conditions. The odds ratio was calculated to quantify the influence of specific environmental and genetic factors on disease occurrence.

Ethical approval for the study was obtained from the institutional ethics committee of SKMCH, and written informed consent was secured from the parents or legal guardians of all participating children. Confidentiality and anonymity of the participants were strictly maintained throughout the study.

**Results:** This study investigated the prevalence of asthma and allergic disorders among school children in Muzaffarpur, Bihar, and analyzed the associated risk factors. The findings revealed that 18% of the children had asthma, 24% were diagnosed with allergic rhinitis, and 12% had eczema. The prevalence varied based on age, gender, family history, environmental exposure, diet, and physical activity levels. Additionally, seasonal variations and medication adherence were found to influence the severity and control of these conditions.

**Table 1: Prevalence of Asthma and Allergic Disorders Among School Children**

Condition	Number of Cases (n=100)	Prevalence (%)
Asthma	18	18.0
Allergic Rhinitis	24	24.0
Eczema	12	12.0

**Table 2: Age-wise Distribution of Asthma and Allergic Disorders**

Age Group (Years)	Asthma (%)	Allergic Rhinitis (%)	Eczema (%)
5-7	5.0	6.0	3.0
8-10	7.0	9.0	5.0
11-13	4.0	6.0	3.0
14-15	2.0	3.0	1.0

**Table 3: Gender Distribution of Asthma and Allergic Disorders**

Gender	Asthma (%)	Allergic Rhinitis (%)	Eczema (%)
Male	10.0	13.0	7.0
Female	8.0	11.0	5.0

**Table 4: Family History and Prevalence of Asthma and Allergies**

Family History	Asthma (%)	Allergic Rhinitis (%)	Eczema (%)	p-value
Present	12.0	16.0	8.0	<0.05
Absent	6.0	8.0	4.0	<0.05

**Table 5: Environmental Exposure and Asthma Prevalence**

Environmental Factor	Asthma Prevalence (%)	p-value
Exposure to Biomass Fuel	10.0	<0.05
Passive Smoking	5.0	<0.05
Urban Pollution	3.0	<0.05

**Table 6: Seasonal Variation in Asthma and Allergic Disorders**

Season	Asthma (%)	Allergic Rhinitis (%)	Eczema (%)	p-value
Summer	4.0	5.0	3.0	<0.05
Monsoon	7.0	9.0	5.0	<0.05
Winter	7.0	10.0	4.0	<0.05

**Table 7: Urban vs Rural Prevalence of Asthma and Allergies**

Residence	Asthma (%)	Allergic Rhinitis (%)	Eczema (%)	p-value
Urban	12.0	15.0	7.0	<0.05
Rural	6.0	9.0	5.0	<0.05

**Table 8: Association of Dietary Factors with Allergic Disorders**

Dietary Habit	Asthma Prevalence (%)	Allergic Rhinitis (%)	Eczema (%)	p-value
Processed Food Intake	9.0	11.0	6.0	<0.05
Low Fruit & Vegetable Intake	7.0	10.0	4.0	<0.05

**Table 9: Impact of Physical Activity on Asthma Prevalence**

Physical Activity Level	Asthma Prevalence (%)	p-value
Low	12.0	<0.05
Moderate	5.0	<0.05
High	1.0	<0.05

**Table 10: Medication History and Control of Asthma**

Medication Usage	Well-Controlled Asthma (%)	Poorly-Controlled Asthma (%)	p-value
Regular Inhaler Use	14.0	4.0	<0.05
Occasional Inhaler Use	6.0	12.0	<0.05
No Medication	2.0	16.0	<0.05

This study highlights a high prevalence of asthma, allergic rhinitis, and eczema among school children in Muzaffarpur, Bihar, with a strong association between family history and allergic disorders. Environmental factors such as biomass fuel exposure, passive smoking, and urban pollution significantly contributed to asthma prevalence, while seasonal variations, particularly during monsoon and winter, exacerbated allergic conditions. Urban children had higher allergy rates than rural children, likely due to pollution and lifestyle differences, and dietary habits also played a role, with higher allergy prevalence in children consuming processed foods and fewer fruits and vegetables. Low physical activity was linked to increased asthma severity, reinforcing the importance of an active lifestyle. Medication adherence was crucial for asthma control, as children using inhalers regularly had better symptom management, while those with poor adherence experienced worsened conditions. These findings stress the need for preventive strategies, early detection, and better asthma management policies to reduce the burden of allergic disorders in children.

## Discussion

Asthma and allergic disorders have emerged as significant public health concerns, particularly among children, due to their increasing prevalence and long-term impact on quality of life. This study provides valuable epidemiological insights into the burden of asthma, allergic rhinitis, and eczema among school-going children in Muzaffarpur, Bihar. The findings reinforce global and national trends indicating a steady rise in allergic disorders among children, largely influenced by genetic predisposition, environmental factors, and lifestyle changes [7]. One of the key findings of this study is the high prevalence of asthma (18%), allergic rhinitis (24%), and eczema (12%) among school children. These numbers are consistent with previous studies conducted in India, which have

reported similar or slightly higher prevalence rates in urban settings [8]. The increase in allergic disorders can be attributed to a complex interplay of factors, including urbanization, pollution, dietary modifications, and sedentary lifestyles. Children exposed to biomass fuel smoke, passive smoking, and vehicular pollution were found to be at a significantly higher risk of developing asthma [9]. These environmental factors function as persistent irritants that lead to airway inflammation and hypersensitivity reactions, exacerbating the onset and severity of respiratory conditions.

A strong association between family history and allergic disorders was observed in this study, with children having a parental history of asthma or allergies being more likely to develop similar conditions. Genetic predisposition is a well-established risk factor, as allergic disorders tend to run in families due to inherited immune system responses to environmental triggers [10]. This finding underscores the importance of screening and early intervention in children with a positive family history to prevent disease progression and complications. Another important observation was the seasonal variation in asthma and allergic disorders, with monsoon and winter seasons witnessing a spike in cases. Increased humidity, temperature fluctuations, and a rise in airborne allergens during these seasons are known to contribute to respiratory distress in asthmatic children. Additionally, viral infections, which are more common during these seasons, can exacerbate asthma symptoms and trigger acute episodes [11]. Seasonal variations should be considered in asthma management strategies, with proactive measures such as pre-emptive medication, flu vaccinations, and avoidance of known allergens helping to reduce the severity of symptoms [12].

The study also highlighted a higher prevalence of allergic disorders in urban children compared to their rural counterparts. This could be attributed to

increased exposure to vehicular emissions, industrial pollutants, and indoor allergens such as dust mites and mold, which are more prevalent in urban environments. Additionally, urban children tend to have reduced exposure to natural microbial diversity due to highly sanitized living conditions, a phenomenon known as the hygiene hypothesis. This hypothesis suggests that excessive cleanliness and lack of early exposure to infections and microbes may lead to an overreactive immune system, increasing the risk of allergic disorders [13]. Dietary patterns also played a significant role in disease prevalence. Children with higher consumption of processed foods and lower intake of fresh fruits and vegetables exhibited increased rates of asthma and allergic conditions. Processed foods contain preservatives, artificial additives, and high levels of refined sugars, which are known to trigger inflammatory responses. In contrast, fruits and vegetables are rich in antioxidants and essential nutrients that support immune function and reduce inflammation. These findings emphasize the need for dietary interventions in asthma and allergy management, promoting a balanced diet rich in natural, unprocessed foods [14].

Another crucial finding was the impact of physical activity on asthma prevalence. Children with lower levels of physical activity were found to have a higher prevalence of asthma compared to those with moderate or high activity levels. Regular physical activity has been shown to improve lung function, enhance airway clearance, and reduce the severity of asthma symptoms. However, many children with asthma tend to avoid physical exertion due to fear of exacerbating their symptoms. This creates a cycle of reduced fitness levels and increased vulnerability to respiratory issues. Encouraging safe, supervised exercise routines such as swimming and breathing exercises can help asthmatic children maintain better respiratory health. Medication adherence emerged as another critical determinant of asthma control. Children who used inhalers regularly had significantly better symptom management compared to those who used medication occasionally or not at all. Poor medication adherence is a common challenge in asthma management, often due to a lack of awareness, misconceptions about inhaler use, or fear of dependency [15]. Parental education and regular follow-ups with healthcare providers are essential to ensuring that children receive consistent and effective asthma treatment.

These findings have important public health implications. The high prevalence of asthma and allergic disorders calls for urgent awareness programs and preventive strategies at the community level. Schools, healthcare centers, and policymakers should work together to implement screening programs for early diagnosis, promote clean air initiatives, and encourage lifestyle

modifications such as improved nutrition and increased physical activity. Furthermore, healthcare providers should emphasize personalized asthma action plans, allergen avoidance strategies, and proper medication use to help children manage their conditions effectively.

## Conclusion

This study provides crucial insights into the burden of asthma and allergic disorders among school-going children in Muzaffarpur, Bihar. The findings emphasize the significant impact of environmental exposure, genetic predisposition, seasonal variations, and lifestyle factors on the prevalence and severity of these conditions. Children from urban areas and those exposed to high levels of pollutants showed a higher prevalence of asthma and allergic disorders, highlighting the need for improved air quality management and preventive healthcare measures. Early detection and timely interventions are key to reducing the long-term impact of these conditions. Family history screening, dietary improvements, physical activity promotion, and strict adherence to medication regimens can help in better disease management. Public health initiatives should focus on raising awareness, implementing preventive strategies, and promoting better healthcare access for children with asthma and allergic conditions.

Future research should aim to explore longitudinal trends in allergic disorders, assess the effectiveness of different treatment modalities, and evaluate the role of emerging environmental factors such as climate change on respiratory health. By adopting a multi-faceted approach involving healthcare professionals, schools, policymakers, and families, we can work towards reducing the burden of allergic diseases and improving the quality of life for affected children.

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