

Common Comorbidities and Their Clinical Associations in Children with Asthma Aged 5–14 Years: A Cross-Sectional Study from a Tertiary Care Hospital

K. Lakshmi Priya, M. Kulandaivel*, Thambiprabagarane. K, Sivaranjani Tamilarasan, Pradhap. K, Hamsavahini

Department of paediatrics, Sri Venkateshwarra Medical College Hospital and Research Centre, Ariyur, Puducherry

***Corresponding author:** M. Kulandaivel

E mail ID: pmkulandai@gmail.com

ABSTRACT

Background: Bronchial asthma in children frequently coexists with allergic and non-allergic comorbidities that may influence disease control, exacerbations and healthcare utilisation. However, comprehensive data on the pattern of asthma-associated comorbidities in children from Puducherry are limited.

Objective: To determine the prevalence and clinical associations of common comorbidities among children aged 5–14 years with bronchial asthma and to assess selected factors associated with previous hospitalisation and parental willingness for follow-up.

Methods: A descriptive cross-sectional study was conducted in the outpatient and inpatient Departments of Paediatrics in a tertiary care centre at Puducherry. Children aged 5–14 years fulfilling the criteria were recruited by convenience sampling over an 18-month study period. Demographic characteristics, anthropometric measurements, common asthma-associated comorbidities, vital parameters, peak expiratory flow rate (PEFR), previous hospitalisation and parental awareness were assessed.

Results: A total of 118 children, where the mean age was 9.36 ± 2.93 years and 79 (66.9%) were male. Allergic rhinitis was the most frequent comorbidity, occurring in 64 (54.2%) children, followed by obesity in 33 (28.0%), food allergy in 32 (27.1%), gastroesophageal reflux disease in 15 (12.7%), rhinosinusitis in 6 (5.1%) and atopic dermatitis in 1 (0.8%) were included. No significant sex-based difference was observed for individual comorbidities. Food allergy varied significantly across age groups, being most frequent among children aged 5–7 years. Previous hospitalisation was reported in 44 children. Food allergy was significantly associated with previous hospitalisation and only 50.0% parents expressed willingness for regular follow-up.

Conclusion: Comorbidities were common among children with asthma, with allergic rhinitis being the predominant condition. Food allergy was significantly associated with younger age and previous hospitalisation. Systematic screening for comorbidities, particularly allergic rhinitis, obesity and food allergy, together with strengthening parental education and follow-up, may improve comprehensive paediatric asthma care.

Keywords: childhood asthma; allergic rhinitis; food allergy; obesity; comorbidity; hospitalisation; peak expiratory flow rate; paediatrics

How to cite this article: Lakshmi Priya K, Kulandaivel M, Thambiprabagarane K, Tamilarasan S, Pradhap K, Hamsavahini., Common Comorbidities and Their Clinical Associations in Children with Asthma Aged 5–14 Years: A Cross-Sectional Study from a Tertiary Care Hospital. *Int J Drug Deliv Technol.* 2026;16(87s): 198-203; DOI: 10.25258/ijddt.16.87s.24

Source of support: XX

Conflict of interest: XX

INTRODUCTION

Asthma is a chronic inflammatory disease of the airways with variable respiratory symptoms and airflow obstruction. Childhood asthma poses a significant burden worldwide, with high rates of emergency visits, hospitalizations, not reporting to school and impact on quality of life. The disease's morbidity is especially relevant in low and middle income countries such as India, where differences in environmental and healthcare factors are significant predictors of the condition [1-4].

Childhood asthma is often accompanied by various comorbid conditions, which contribute to poorer health outcomes and treatment outcomes. Allergic rhinitis, atopic dermatitis, obesity, GERD, rhinosinusitis, and food allergy are frequently reported comorbid conditions that impact asthma management outcomes [5-7]. Allergic rhinitis, in particular, is closely related to asthma due to the anatomical connection between the upper and lower airways and the similarity of the immunological response [8]. The presence of several allergic conditions simultaneously supports the theory of the “atopic march,” which suggests that most patients

exhibit more than one allergic disorder throughout their life [9].

Furthermore, obesity is a risk factor for asthma and can affect the manifestation of the disease process. An association between childhood obesity and asthma has been established by epidemiological studies [10]. In turn, food allergies are often a predictor of poor asthma control and a factor in severe exacerbations, especially in a pediatric population [11].

Therefore, a cross-sectional study was conducted to assess the prevalence of common comorbidities among children aged 5 to 14 with bronchial asthma visiting a tertiary care hospital in Puducherry. The study aimed to evaluate the association between comorbidities and specific indicators such as the child's height, weight, clinical manifestations of asthma, history of hospitalization, and parental awareness.

MATERIALS AND METHODS

A descriptive cross-sectional study conducted in the outpatient and inpatient Departments of Paediatrics in a tertiary care centre at Puducherry over a period of 18 months following institutional ethics approval (Ref: 111/SVMC/IEC-Cert/Feb24). Children aged 5–14 years with reactive airway symptoms, including wheeze or crackles were included after consent was obtained. The children were excluded when declined participation or when there were congenital anomalies of the lungs or airway or a history of congenital heart disease. Convenience sampling was used with the minimum calculated sample size 104 and 118 children were enrolled.

Data collection: Demographic and anthropometric information was collected. Height, weight and body mass index (BMI) were recorded. Clinical assessment

included pulse rate, respiratory rate, peripheral oxygen saturation (SpO₂) and peak expiratory flow rate (PEFR). Information regarding common comorbidities, previous hospitalisation and parental awareness was obtained using the study questionnaire/proforma.

The comorbidities evaluated included allergic rhinitis, obesity, food allergy, GERD, rhinosinusitis and atopic dermatitis.

STATISTICAL ANALYSIS

Data were entered using Microsoft Excel, analysed using SPSS version 23.0. Categorical variables were presented as frequencies and percentages. Continuous variables were expressed as mean±standard deviation. Associations between categorical variables were assessed using the chi-square test. Independent-samples *t*-test was used for comparison of two groups and one-way ANOVA was used for comparison of three age groups. Pearson correlation was used to assess relationships between continuous variables. A *p* value <0.05 was considered statistically significant.

RESULTS

Demographic and anthropometric characteristics

There were 79 (66.9%) males and 39 (33.1%) females with a male-to-female ratio of 2:1. The largest age group was 11–14 years (44; 37.3%), followed by 5–7 years (39; 33.1%) and 8–10 years (35; 29.7%). The mean age was 9.36±2.93 years.

The mean height was 133.92±9.55 cm, mean weight was 35.91±6.95 kg and mean BMI was 20.38±5.12 kg/m². In the present study, 40 (33.9%) children are underweight, 56 (47.5%) having normal BMI, 19 (16.1%) overweight and 3 (2.5%) are obese given in the table 1.

Table 1: Demographic and anthropometric characteristics of study participants (n=118)

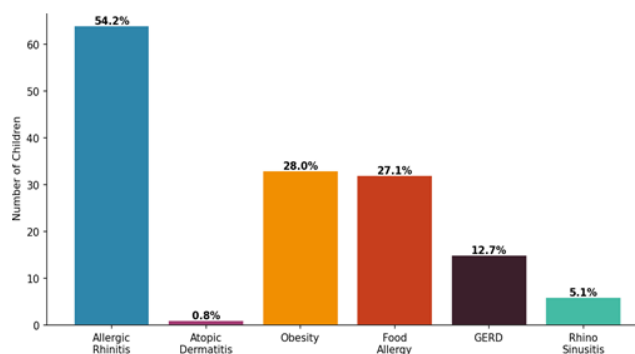
Characteristics	n (%) / Mean±SD
Age, years	9.36±2.93
Age range, years	5–14
Male	79 (66.9)
Female	39 (33.1)
5–7 years	39 (33.1)
8–10 years	35 (29.7)
11–14 years	44 (37.3)
Height, cm	133.92±9.55
Weight, kg	35.91±6.95
BMI, kg/m ²	20.38±5.12
Underweight	40 (33.9)
Normal BMI	56 (47.5)
Overweight	19 (16.1)
Obese	3 (2.5)

SD, standard deviation; BMI, body mass index.

Prevalence of comorbidities

Allergic rhinitis was the most common comorbidity, occurring in 64 (54.2%) children. Obesity was present

in 33 (28.0%), food allergy in 32 (27.1%), GERD in 15 (12.7%), rhinosinusitis in 6 (5.1%) and atopic dermatitis in 1 (0.8%) (Figure 1).

Figure 1: Prevalence of common comorbidities among children with asthma**Comorbidities according to sex and age**

No statistically significant sex-based difference was observed for any of the evaluated comorbidities.

Allergic rhinitis occurred in 54.4% of males and 53.8% of females ($p=0.597$). Obesity occurred in 26.6% of males and 30.8% of females ($p=0.487$). Food allergy

was present in 30.4% of males and 20.5% of females ($p=0.176$).

Food allergy was the only comorbidity with statistically significant variation across age groups. It was present in 41.0% of children aged 5–7 years, compared with 14.3% of those aged 8–10 years and 25.0% of those aged 11–14 years ($\chi^2=6.236$, $p=0.044$) (Table 3).

Table 3: Distribution of major comorbidities by sex and age group

Comorbidity	Male n (%)	Female n (%)	<i>p</i> value	5–7 y n (%)	8–10 y n (%)	11–14y n (%)	<i>p</i> value
Allergic rhinitis	43 (54.4)	21 (53.8)	0.597	17 (43.6)	21 (60.0)	26 (59.1)	0.120
Obesity	21 (26.6)	12 (30.8)	0.487	12 (30.8)	9 (25.7)	12 (27.3)	0.454
Food allergy	24 (30.4)	8 (20.5)	0.176	16 (41.0)	5 (14.3)	11 (25.0)	0.044
GERD	9 (11.4)	6 (15.4)	0.365	6 (15.4)	3 (8.6)	6 (13.6)	0.268
Rhinosinusitis	4 (5.1)	2 (5.1)	0.667	2 (5.1)	2 (5.7)	2 (4.5)	0.665
Atopic dermatitis	1 (1.3)	0	1.000	—	—	—	—

Clinical parameters

The mean pulse rate was 99.21 ± 11.51 and respiratory rate was 25.05 ± 3.90 /min, SpO_2 was $95.30 \pm 2.29\%$ and PEFr 244.40 ± 55.97 L/min. In the present study, 37

(31.4%) children had SpO_2 below 95%, while 9 (7.6%) had SpO_2 below 92%. PEFr ranged from 110 to 400 L/min; 8 (6.8%) children had PEFr below 150 L/min (Table 4&5).

Table 4: Clinical parameters at presentation

Parameter	Mean $\pm$ SD	Range
Pulse rate (beats/min)	99.21 ± 11.51	64–134
Respiratory rate (/min)	25.05 ± 3.90	17–38
SpO_2 (%)	95.30 ± 2.29	88–99
PEFR (L/min)	244.40 ± 55.97	110–400

Table 5: Selected Clinical Associations

Association	Result	<i>p</i> value
Age vs PEFr	$r=0.524$	<0.001
Age vs pulse rate	$r=-0.218$	0.018
BMI vs PEFr	$r=0.312$	0.001
BMI vs SpO_2	$r=-0.089$	0.339

BMI vs pulse rate	$r=0.142$	0.124
BMI vs respiratory rate	$r=0.118$	0.201

PEFR increased significantly with increasing age. A weak positive correlation was also observed between BMI and PEFR.

Previous hospitalisation and comorbidity

There was previous of 44 (37.3%) children with allergic rhinitis was more frequent for hospitalisation than without previous hospitalisation (63.6% vs 48.6%), which was not statistically significant ($p=0.093$).

Obesity was 31.8% of previously hospitalised children compared with 25.7% of those without previous hospitalisation ($p=0.473$). Food allergy, however, showed a statistically significant association with previous hospitalisation; 19 of the 44 previously hospitalised children had food allergy compared with 13 of 74 children without previous hospitalisation ($\chi^2=7.91$, $p=0.005$) (Table 6&7).

Table 6: Association between comorbidities and previous hospitalisation

Comorbidity	Hospitalised, n (%)	Not hospitalised, n (%)	χ^2	p value
Allergic rhinitis	25 (56.8)	39 (52.7)	0.06	0.808
Rhinosinusitis	17 (38.6)	24 (32.4)	0.23	0.628
Atopic dermatitis	1 (2.0)	1 (3.5)	1.26	0.262
Food allergy	19 (43.2)	13 (17.6)	7.91	0.005
Obesity	8 (18.2)	14 (18.9)	0.00	1.000
GERD	8 (18.2)	9 (12.2)	0.40	0.529

Table 7: Two-by-two analysis of food allergy and previous hospitalisation

Food Allergy	Hospitalised	Not hospitalised	Total
Present	19	13	32
Absent	25	61	86
Total	44	74	118
$\chi^2=7.91$; $p=0.005$; OR=3.57; 95% CI 1.53–8.30			

Co-occurrence of comorbidities

Multiple comorbidities were frequent. Only 30 (25.4%) children had no recorded comorbidity, 47 (39.8%) had one, 27 (22.9%) had two, 10 (8.5%) had three and 4 (3.4%) had four or more. Overall, 88 (74.6%) children

had at least one comorbidity and 41 (34.8%) had two or more according to the primary distribution table. The most frequent co-occurrences were allergic rhinitis with obesity ($n=19$) and allergic rhinitis with food allergy ($n=17$) (Table 8).

Table 8: Overall comorbidity burden and selected co-occurrences

Number of comorbidities	n (%)
0	30 (25.4)
1	47 (39.8)
2	27 (22.9)
3	10 (8.5)
≥ 4	4 (3.4)
Total	118 (100)
Co-occurring conditions	Number of children
Allergic rhinitis + obesity	19
Allergic rhinitis + food allergy	17
Allergic rhinitis + GERD	8
Obesity + food allergy	9
Obesity + GERD	7
Food allergy + GERD	4

Parental awareness and follow-up

Although 73 (61.9%) parents reported awareness of allergy symptoms and 67 (56.8%) aware of their child's

illness, only 59 (50.0%) expressed willingness for regular follow-up. No significant difference in parental awareness or willingness for follow-up was observed based on the sex of the child (Table 9).

Table 9: Parental awareness and willingness for regular follow-up

Parameter	Yes, n (%)	No, n (%)
Aware of allergy symptoms	73 (61.9)	45 (38.1)
Aware of child's illness	67 (56.8)	51 (43.2)
Willing for regular follow-up	59 (50.0)	59 (50.0)

DISCUSSION

The present study showed that comorbid conditions are common among children with asthma. Approximately three-quarters of the participants had at least one additional condition which supports that childhood asthma should be approached as a multisystem disease rather than as isolated lower-airway inflammation.

Allergic rhinitis was the predominant comorbidity, occurring in 54.2% of children. This finding is consistent with previous paediatric studies and with the unified airway concept, which recognises shared inflammatory and anatomical characteristics of the upper and lower respiratory tract [6,8]. Kumar et al. reported allergic rhinitis as the most common comorbidity while the other studies shown a high prevalence of rhinitis in paediatric asthma populations [1,2].

The age related difference was not statistically significant in the present though allergic rhinitis was more common in older children. The prevalence increased from 43.6% in children aged 5–7 years to approximately 60% in the older age groups. This pattern may reflect increasing exposure and sensitisation to aeroallergens with age.

Obesity was identified in 28.0% of participants and obesity may affect lung mechanics and systemic inflammatory pathways and may contribute to an asthma phenotype which is more difficult to control [11]. In the current study, obesity was more common among previously hospitalised children though the difference was not statistically significant.

Food allergy was present in 27.1% of participants and associated with the age. Prevalence was highest among children aged 5–7 years (41.0%) and lower among children aged 8–10 years (14.3%). This pattern is compatible with the concept of the atopic march, in which different allergic manifestations may occur at different stages of childhood [10].

Children with food allergy had approximately 3.6 fold higher odds of previous hospitalisation, which is clinically relevant. The food allergy and asthma together may increase the risk of severe respiratory reactions and may warrant careful allergen avoidance counselling and emergency preparedness [12].

The present study identified multiple comorbidities. Allergic rhinitis frequently associated with obesity and food allergy. Such clustering is consistent with the broader concept of shared atopic and inflammatory pathways [6,10]. These observations support routine screening for common comorbidities during paediatric asthma consultations.

PEFR showed a strong positive correlation with age, which is explained by increases in lung volume and airway caliber during childhood. Absolute PEFR was also positively correlated with BMI. However, since PEFR is affected by age and effort, this association cannot be used to infer that increased adiposity improves asthma-related lung function.

A total of 37.3% reported previous hospitalization, suggesting that there is a heavy burden of recurrent or severe asthma-related morbidity in this tertiary-care cohort. Food allergy was the only comorbidity significantly associated with previous hospitalization. Allergic rhinitis and obesity also showed numerical differences, but these were not statistically significant.

Parental knowledge was another important aspect of the study. While more than half of the parents surveyed stated that they would be able to recognize the symptoms of allergies and their child's illness, only a half was ready to participate in a regular follow-up. The strategies that might be needed to make sure the continuation of care happen include counselling, written asthma action plans, reinforcement of inhaler techniques and accessible follow-up services. [13]

CONCLUSION

Common comorbidities were highly prevalent among children aged 5–14 with asthma attending the tertiary-care centre. Allergic rhinitis was the most common comorbidity, followed by obesity and food allergy. Food allergy was more common in children with asthma attending the centre. It was also significantly associated with previous hospitalization.

The results suggest the need for a comprehensive approach to paediatric asthma management that includes screening for allergic rhinitis, food allergy, obesity, and other comorbidities. Parental education and follow-up support are important components of paediatric asthma management.

Further multicentre prospective studies that include standardized assessments of clinical, allergic, and spirometric parameters and long-term follow-up are needed to determine the impact of individual comorbidities and their combination on asthma severity and outcome.

REFERENCES

1. Kumar P, Sing G, Goyal JP, Khera D, Singh K. Association of common comorbidities with asthma in children: a cross-sectional study. *Sudan J Paediatr*. 2019.
2. Boulet LP. Influence of comorbid conditions on asthma. *Eur Respir J*. 2009;33(4):897-906.

3. Indian Academy of Pediatrics. National Guidelines on Asthma in Children. *Indian Pediatr.* 2012;49(4):305-323.
4. Ibrahim Shaj AM. Prevalence of bronchial asthma in 6 to 17 years old school children of urban Chennai in lower middle class/lower income groups. Dissertation. Chennai: Tamil Nadu Dr MGR Medical University; 2017
5. Yuksel H, Dunc G, Sakar A, Yilmaz O, Yorgancioglu A, Celik P, et al. Prevalence and comorbidity of allergic eczema, rhinitis, and asthma in a city in western Turkey. *J Investig Allergol Clin Immunol.* 2008;18(1):31-35.
6. de Groot EP, Duiverman EJ, Brand PLP. Comorbidities of asthma during childhood: possibly important, yet poorly studied. *Eur Respir J.* 2010;36(4):671-678.
7. Paramesh H. Epidemiology of asthma in India. *Indian J Pediatr.* 2002;69(4):309-312.
8. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical practice guideline (update): adult sinusitis. *Otolaryngol Head Neck Surg.* 2015;152(2 Suppl).
9. Bousquet J, van Cauwenberge P, Khaltaev N; ARIA Workshop Group. Allergic rhinitis and its impact on asthma. *J Allergy Clin Immunol.* 2001;108(5 Suppl).
10. Illi S, von Mutius E, Lau S, et al. The natural course of atopic dermatitis from birth to age 7 years and the association with asthma. *J Allergy Clin Immunol.* 2004;113(5):925-931.
11. Dong GH, Qian ZM, Liu MM, Wang D, Ren WH, Bawa S, et al. Obesity was associated with asthma incidence in Chinese children: the Seven Northeast Cities (SNEC) study. *Pediatr Pulmonol.* 2013;48(10):956-963.
12. Schroeder A, Kumar R, Pongracic JA, et al. Food allergy is associated with an increased risk of asthma. *Clin Exp Allergy.* 2009;39(2):261-270.
13. Global Initiative for Asthma. *Global Strategy for Asthma Management and Prevention.* Updated 2023. Available from: GINA.