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Evaluation of the Clinical Profile, Triggering Factors, Pulmonary Function, and Quality of Life in Children with Bronchial Asthma Receiving Standard Therapy

Dr Vijay Kolhar[1], Dr Pratibha Manjunath Patagar[2]

[1]MBBS, MD, Assistant Professor, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India
[2]MBBS, MD, DNB, Consultant Pediatrician, Darsh Super Speciality Hospital Kalaburagi, Karnataka, India

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Corresponding Author:

Dr Pratibha Manjunath Patagar
MBBS, MD, DNB, Consultant Pediatrician, Darsh Super Speciality Hospital Kalaburagi, Karnataka, India

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ABSTRACT

Background: Bronchial asthma is one of the most common chronic respiratory diseases in children and is associated with recurrent symptoms, impaired pulmonary function, and reduced quality of life. Environmental and infectious triggers play a major role in precipitating asthma exacerbations. Comprehensive evaluation of clinical characteristics, triggering factors, lung function, and quality of life is essential for optimizing long-term management.

Objectives: To evaluate the clinical profile, triggering factors, pulmonary function, and quality of life in children with bronchial asthma receiving standard therapy and to assess the association of asthma severity with pulmonary function and quality-of-life outcomes.

Materials and Methods: This prospective observational study was conducted in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, from January 2025 to June 2026. Fifty-five children aged 5–18 years with clinically diagnosed bronchial asthma receiving standard therapy were enrolled. Demographic details, clinical characteristics, atopic conditions, exacerbation history, treatment adherence, and environmental triggers were recorded. Pulmonary function was assessed using spirometry, including FVC, FEV_1, FEV_1/FVC ratio, PEFR, and $FEF_{25–75}$. Quality of life was evaluated using the Pediatric Asthma Quality of Life Questionnaire (PAQLQ). Statistical analysis was performed using SPSS version 25.0, and a p-value <0.05 was considered statistically significant.

Results: The mean age of the children was 10.2 ± 3.4 years, and 58.2% were males. Wheezing (100%), cough (87.3%), and breathlessness (83.6%) were the most common symptoms. Dust exposure (72.7%), viral respiratory infections (65.5%), and cold weather (56.4%) were the predominant triggering factors. The mean FEV_1 was 74.8 ± 13.2% predicted, and the mean PEFR was 72.9 ± 12.4% predicted. Moderate-to-severe asthma was associated with significantly lower FEV_1 values ($p<0.001$). The overall PAQLQ score was 5.27 ± 0.73 and declined significantly with increasing asthma severity ($p<0.001$). FEV_1 showed a strong positive correlation with overall PAQLQ score ($r=0.68$, $p<0.001$).

Conclusion: Childhood bronchial asthma is associated with substantial symptom burden, impaired pulmonary function, and reduced quality of life. Dust exposure and viral respiratory infections were the most common triggers. Asthma severity was significantly associated with poorer lung function and lower quality-of-life scores. Regular spirometric monitoring, identification and avoidance of triggering factors, adherence to standard therapy, and continuous patient and caregiver education are essential for achieving optimal asthma control and improving quality of life in affected children.

Keywords: *Bronchial asthma, children, pulmonary function, spirometry, triggering factors, quality of life, PAQLQ, pediatric asthma.*

INTRODUCTION

Bronchial asthma is one of the most common chronic respiratory disorders affecting children worldwide and represents a major cause of morbidity, school absenteeism, emergency department visits, and hospitalization. It is a heterogeneous inflammatory disease of the airways characterized by recurrent episodes of wheezing, cough, breathlessness, chest tightness, and variable expiratory airflow limitation. These symptoms frequently vary over time and in intensity and are often associated with reversible airway obstruction and bronchial hyperresponsiveness. Childhood asthma significantly affects physical activity, emotional well-being, academic performance, and overall quality of life of both affected children and their families.[1]

According to the World Health Organization (WHO), asthma affects more than 260 million people globally and accounts for over 450,000 deaths annually, with a considerable proportion occurring in low- and middle-income countries. Children constitute a significant proportion of asthma cases, making it one of the leading chronic diseases during childhood. The Global Burden of Disease Study has demonstrated that asthma continues to contribute substantially to disability-adjusted life years (DALYs), emphasizing the need for improved diagnosis, treatment, and preventive strategies.[2]

The prevalence of childhood asthma has increased steadily over the past few decades because of rapid urbanization, environmental pollution, changing lifestyles, increased allergen exposure, and genetic susceptibility. In India, epidemiological studies have reported a prevalence ranging from 2% to 15%, depending on geographical location, environmental conditions, and diagnostic criteria used. Urban populations generally demonstrate a higher prevalence than rural populations owing to greater exposure to vehicular pollution, industrial emissions, and indoor allergens.[3]

Asthma develops through a complex interaction between genetic predisposition and environmental exposures. Airway inflammation involving eosinophils, mast cells, T-helper type-2 lymphocytes, cytokines, and immunoglobulin E (IgE)-mediated allergic responses leads to airway edema, mucus hypersecretion, smooth muscle hypertrophy, and reversible airflow obstruction. Persistent inflammation may eventually result in airway remodeling and progressive decline in pulmonary function if not adequately controlled.[4]

Several triggering factors have been implicated in precipitating asthma symptoms and exacerbations among children. Common triggers include exposure to house dust mites, pollen, molds, animal dander, tobacco smoke, biomass fuel, outdoor air pollution, viral respiratory tract infections, exercise, cold weather, emotional stress, and occupational or environmental irritants. Identification and avoidance of these triggers form an integral component of asthma management and help reduce the frequency and severity of exacerbations.[5]

The diagnosis of childhood asthma is primarily based on a characteristic clinical history and demonstration of variable expiratory airflow limitation. Spirometry remains the gold standard objective test for assessing pulmonary function in children aged five years and above. Important spirometric parameters include Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV_1), FEV_1/FVC ratio, Peak Expiratory Flow Rate (PEFR), and Forced Expiratory Flow between 25% and 75% of vital capacity ($FEF_{25–75}$). These parameters provide valuable information regarding disease severity, treatment response, and long-term prognosis.[6]

In addition to physiological impairment, asthma substantially affects the health-related quality of life (HRQoL) of children. Frequent symptoms, activity limitations, sleep disturbances, school absenteeism, anxiety, and emotional distress adversely influence physical, psychological, and social functioning. The Pediatric Asthma Quality of Life Questionnaire (PAQLQ) is a validated instrument that evaluates symptom burden, activity limitation, and emotional functioning and is widely used to assess treatment outcomes in pediatric asthma research.[7]

Current asthma management emphasizes a comprehensive approach that includes pharmacological therapy, patient and caregiver education, regular monitoring, correct inhaler technique, adherence to controller medications, and avoidance of triggering factors. Inhaled corticosteroids remain the cornerstone of long-term controller therapy, while short-acting β_2 agonists provide rapid symptom relief during acute exacerbations. Additional therapies such as long-acting β_2 agonists and leukotriene receptor antagonists are prescribed according to disease severity and international treatment recommendations.[8]

Despite advances in asthma management, inadequate disease control remains common because of poor treatment adherence, incorrect inhaler technique, delayed diagnosis, and continued exposure to environmental triggers. Therefore, comprehensive evaluation of clinical characteristics, pulmonary function, triggering factors, and quality of life is essential for optimizing treatment strategies and improving long-term outcomes.

The present prospective observational study was therefore undertaken at ESIC Medical College and Hospital, Kalaburagi, to evaluate the clinical profile, triggering factors, pulmonary function parameters, and quality of life among children with bronchial asthma receiving standard therapy and to determine the relationship between disease severity, lung function, and health-related quality of life.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based prospective observational study was conducted in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, over a period of 18 months from January 2025 to June 2026. The study aimed to evaluate the clinical profile, triggering factors, pulmonary function, and quality of life in children with bronchial asthma receiving standard therapy according to established asthma management guidelines. Standardized assessment tools such as spirometry and pediatric asthma quality-of-life questionnaires are commonly used in pediatric asthma research.

Study Population

A total of 55 children diagnosed with bronchial asthma attending the Pediatric Outpatient Department (OPD) or admitted to the pediatric wards during the study period were enrolled consecutively after obtaining informed written consent from parents or legal guardians and assent from children wherever applicable.

Sample Size

The study included 55 pediatric patients fulfilling the eligibility criteria during the study period.

Inclusion Criteria

Children fulfilling all of the following criteria were included:

- Age between 5 and 18 years.
- Clinically diagnosed bronchial asthma according to standard pediatric diagnostic criteria.
- Receiving standard asthma therapy (controller and/or reliever medications as indicated).
- Ability to perform spirometry (children ≥5 years).
- Parents/guardians willing to provide written informed consent.

Exclusion Criteria

Children with any of the following were excluded:

- Congenital heart disease.
- Chronic lung diseases other than asthma (e.g., cystic fibrosis, bronchiectasis).
- Pulmonary tuberculosis.
- Neuromuscular disorders affecting pulmonary function.
- Severe developmental delay preventing pulmonary function assessment.
- Acute severe illness requiring intensive care at enrollment.
- Refusal to participate.

Data Collection

A detailed predesigned case record form was used for recording patient information.

Demographic Variables

- Age
- Sex
- Residence (urban/rural)
- Socioeconomic status
- Nutritional status
- Family history of asthma or allergy

Clinical Profile

The following clinical details were recorded:

- Age at onset of asthma
- Duration of illness
- Frequency of symptoms
- Nocturnal symptoms
- Wheezing episodes
- Cough
- Breathlessness

- Chest tightness
- Exercise-induced symptoms
- Number of exacerbations during the previous year
- Emergency visits
- Hospital admissions
- Previous ICU admission
- Medication history
- Treatment adherence
- Inhaler technique
- Presence of allergic rhinitis, eczema, or other atopic disorders.

Assessment of Triggering Factors
Potential triggering factors were identified through detailed history taking, including:
- Dust exposure
- House dust mites
- Pollen
- Smoke exposure
- Biomass fuel
- Air pollution
- Seasonal variation
- Cold weather
- Viral respiratory infections
- Exercise
- Emotional stress
- Pet exposure
- Strong odors/perfumes
- Food allergens (where applicable)
- Passive tobacco smoke exposure.

Physical Examination
A comprehensive general and systemic examination was performed including:
- Height
- Weight
- Body Mass Index (BMI)
- Temperature
- Respiratory rate
- Pulse rate
- Blood pressure
- Oxygen saturation (SpO_2)
- Chest examination
- Presence of wheeze
- Use of accessory muscles
- Chest retractions
- Air entry
- Other systemic findings.

Laboratory Investigations
The following investigations were performed whenever clinically indicated:
- Complete Blood Count (CBC)
- Absolute eosinophil count
- Serum IgE (where indicated)
- Chest X-ray (when clinically indicated)
- Peak Expiratory Flow Rate (PEFR)
- Spirometry.

Pulmonary Function Assessment
Pulmonary function testing was performed using a computerized spirometer according to American Thoracic Society/European Respiratory Society recommendations. The following parameters were recorded:

- Forced Vital Capacity (FVC)
- Forced Expiratory Volume in one second (FEV_1)
- FEV_1/FVC ratio
- Peak Expiratory Flow (PEF)
- Forced Expiratory Flow 25–75% ($FEF_{25–75}$)

The best of three acceptable maneuvers was considered for analysis. Pulmonary function was assessed after stabilization of symptoms and while receiving standard therapy. Spirometry remains a key objective tool for monitoring asthma control in children.

Quality of Life Assessment

Health-related quality of life was assessed using the Pediatric Asthma Quality of Life Questionnaire (PAQLQ). The questionnaire evaluated three major domains:

- Symptoms
- Activity limitation
- Emotional function

Each domain was scored according to standard questionnaire guidelines, with higher scores indicating better quality of life. The PAQLQ is a validated instrument widely used in pediatric asthma research.

Standard Therapy

All enrolled children received standard asthma management as prescribed by the treating pediatrician, including:

- Inhaled corticosteroids
- Short-acting β_2 agonists (SABA)
- Long-acting β_2 agonists (LABA) when indicated
- Leukotriene receptor antagonists
- Nebulization during acute exacerbations
- Education regarding inhaler technique
- Trigger avoidance counseling
- Regular follow-up.

Outcome Measures

The primary outcome measures included:

- Clinical profile of bronchial asthma
- Distribution of triggering factors
- Pulmonary function parameters
- Quality-of-life scores

Secondary outcome measures included:

- Relationship between triggering factors and asthma severity
- Association between pulmonary function and quality of life
- Effect of standard therapy on symptom control.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of ESIC Medical College and Hospital, Kalaburagi, Karnataka. Written informed consent was obtained from parents or legal guardians before enrollment. Confidentiality of patient information was maintained throughout the study in accordance with institutional ethical guidelines.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Associations between categorical variables were analyzed using the Chi-square test or Fisher's exact test. Continuous variables were compared using the Student's *t*-test or one-way ANOVA as appropriate. Correlation between pulmonary function parameters and quality-of-life scores was assessed using Pearson's correlation coefficient. A p-value <0.05 was considered statistically significant.

RESULT AND OBSERVATIONS

Table 1. Demographic and Baseline Characteristics (n=55)

Variable	n (%) / Mean ± SD
Age (years), Mean ± SD	10.2 ± 3.4
5–8 years	18 (32.7)
9–12 years	21 (38.2)
13–18 years	16 (29.1)
Male	32 (58.2)
Female	23 (41.8)
Urban residence	34 (61.8)
Rural residence	21 (38.2)
Lower socioeconomic status	18 (32.7)
Middle socioeconomic status	30 (54.5)
Upper socioeconomic status	7 (12.8)
Underweight	10 (18.2)
Normal nutritional status	38 (69.1)
Overweight/Obese	7 (12.7)

Table 2. Clinical Profile and Disease Characteristics

Variable	n (%)
Age at onset <5 years	24 (43.6)
Duration of illness >2 years	37 (67.3)
Family history of asthma	28 (50.9)
Allergic rhinitis	25 (45.5)
Eczema	10 (18.2)
Wheeze	55 (100)
Cough	48 (87.3)
Breathlessness	46 (83.6)
Chest tightness	26 (47.3)
Exercise-induced symptoms	20 (36.4)
Nocturnal symptoms	33 (60.0)
≥2 exacerbations/year	30 (54.5)
Previous hospitalization	16 (29.1)
ICU admission	3 (5.5)

Table 3. Distribution of Triggering Factors

Triggering Factor	n (%)
Dust	40 (72.7)
Viral respiratory infection	36 (65.5)
Cold weather	31 (56.4)
Smoke exposure	24 (43.6)
Air pollution	23 (41.8)
Exercise	20 (36.4)
Seasonal variation	18 (32.7)
Pollen	15 (27.3)
Passive tobacco smoke	13 (23.6)
Pet exposure	8 (14.5)
Emotional stress	7 (12.7)
Food allergy	5 (9.1)

Table 4. Physical Examination and Laboratory Findings

Parameter	Mean ± SD / n (%)
Height (cm)	134.8 ± 15.3
Weight (kg)	29.8 ± 8.7
BMI (kg/m²)	17.3 ± 2.5
Respiratory rate (breaths/min)	26.4 ± 4.8
Pulse rate (beats/min)	96.8 ± 12.1
Oxygen saturation (%)	96.1 ± 1.8
Wheeze on examination	41 (74.5)

Chest retractions	**15 (27.3)**
Accessory muscle use	**9 (16.4)**
Hemoglobin (g/dL)	**11.8 ± 1.3**
TLC (/mm³)	**8920 ± 2210**
Absolute eosinophil count (cells/µL)	**470 ± 180**
Serum IgE (IU/mL)	**325 ± 170**

Table 5. Chest X-ray Findings and Pulmonary Function Tests

Variable	Mean ± SD / n (%)
Normal chest X-ray	**34 (61.8)**
Hyperinflation	**14 (25.5)**
Peribronchial thickening	**6 (10.9)**
Atelectasis	**1 (1.8)**
FVC (% predicted)	**82.6 ± 11.8**
FEV_1 (% predicted)	**74.8 ± 13.2**
FEV_1/FVC (%)	**76.2 ± 6.8**
PEFR (% predicted)	**72.9 ± 12.4**
FEF25–75 (% predicted)	**65.4 ± 14.5**

Table 6. Asthma Severity and Standard Therapy

Variable	n (%)
Mild intermittent	**11 (20.0)**
Mild persistent	**18 (32.7)**
Moderate persistent	**17 (30.9)**
Severe persistent	**9 (16.4)**
Inhaled corticosteroids (ICS)	**55 (100)**
ICS + LABA	**18 (32.7)**
Leukotriene receptor antagonist	**13 (23.6)**
Rescue SABA	**55 (100)**
Good treatment adherence	**42 (76.4)**
Correct inhaler technique	**46 (83.6)**

Table 7. Pediatric Asthma Quality of Life Questionnaire (PAQLQ)

Domain	Mean ± SD
Symptoms	**5.28 ± 0.82**
Activity limitation	**5.12 ± 0.88**
Emotional function	**5.41 ± 0.79**
Overall PAQLQ score	**5.27 ± 0.73**

Table 8. Association Between Asthma Severity and Pulmonary Function

Asthma Severity	n	FEV_1 (% predicted)	p-value
Mild intermittent	**11**	**88.6 ± 5.3**	
Mild persistent	**18**	**79.5 ± 6.8**	
Moderate persistent	**17**	**69.7 ± 7.4**	
Severe persistent	**9**	**58.4 ± 6.2**	**<0.001**

Table 9. Association Between Asthma Severity and Quality of Life

Asthma Severity	Overall PAQLQ Score (Mean ± SD)	p-value
Mild intermittent	**6.18 ± 0.42**	
Mild persistent	**5.61 ± 0.54**	
Moderate persistent	**4.96 ± 0.63**	
Severe persistent	**4.11 ± 0.56**	**<0.001**

Table 10. Correlation Between Pulmonary Function and Quality of Life

Variable	Correlation Coefficient (r)	p-value
FEV_1 vs Overall PAQLQ	**0.68**	**<0.001**
PEFR vs Overall PAQLQ	**0.59**	**<0.001**
FEF25–75 vs Overall PAQLQ	**0.46**	**0.002**

DISCUSSION

The present prospective observational study evaluated the clinical profile, triggering factors, pulmonary function, and quality of life among 55 children with bronchial asthma receiving standard therapy. The findings provide valuable insight into the demographic characteristics, disease severity, environmental risk factors, pulmonary impairment, and treatment outcomes in pediatric asthma.

The majority of study participants belonged to the age group of 9–12 years, with a mean age of 10.2 ± 3.4 years, and males constituted 58.2% of the study population. Male predominance during childhood has been consistently reported in previous studies and is attributed to differences in airway caliber, hormonal influences, and immunological factors. Our findings are comparable with those reported by the International Study of Asthma and Allergies in Childhood (ISAAC), which demonstrated a higher prevalence of asthma among boys before adolescence.[9]

Nearly half of the children had a positive family history of asthma, while allergic rhinitis and eczema were common associated atopic conditions. These findings support the well-established association between asthma and atopy. Genetic predisposition together with allergic sensitization plays an important role in disease development and progression. Similar observations have been reported by Martinez et al. and other longitudinal cohort studies evaluating childhood asthma.[10]

Among the clinical manifestations, wheezing was present in all patients, followed by cough, breathlessness, nocturnal symptoms, and exercise-induced bronchospasm. More than half of the children experienced at least two exacerbations during the previous year, reflecting persistent disease activity despite ongoing therapy. These findings are consistent with previous pediatric asthma studies reporting wheezing and recurrent cough as the predominant presenting symptoms.[11]

Dust exposure emerged as the most common triggering factor, followed by viral respiratory infections, cold weather, smoke exposure, and air pollution. Environmental allergens and respiratory viral infections are recognized as major contributors to asthma exacerbations in children. Exposure to indoor dust mites, environmental tobacco smoke, biomass fuel, and outdoor pollutants has repeatedly been associated with increased asthma morbidity. Similar trigger profiles have been reported by the Global Initiative for Asthma (GINA) and several epidemiological studies from developing countries.[12]

Laboratory evaluation demonstrated elevated absolute eosinophil counts and increased serum IgE concentrations in many children, supporting the predominance of allergic inflammation. Chest radiographs were normal in most patients, while hyperinflation and peribronchial thickening were observed in a smaller proportion during symptomatic periods. These findings are in agreement with previous studies indicating that chest radiographs are often normal in uncomplicated asthma and primarily serve to exclude alternative diagnoses.[13]

Pulmonary function assessment revealed reductions in FEV_1, PEFR, FVC, and $FEF_{25–75}$ values despite ongoing treatment, indicating persistent airflow limitation in several children. Spirometry remains the most reliable objective method for assessing asthma severity and monitoring response to therapy. Reduced FEV_1 and $FEF_{25–75}$ values have been shown to correlate with airway obstruction and future risk of exacerbations.[14]

Most children had mild-to-moderate persistent asthma and received inhaled corticosteroids as recommended by current treatment guidelines. Good treatment adherence and correct inhaler technique were observed in a majority of patients, reflecting the importance of patient education and regular follow-up. Nevertheless, a proportion of children continued to demonstrate impaired pulmonary function, highlighting the multifactorial nature of asthma control and the influence of environmental exposures and disease severity.[12]

Quality-of-life assessment using the Pediatric Asthma Quality of Life Questionnaire demonstrated moderately favorable overall scores. However, children with severe asthma had significantly lower symptom, activity, and emotional domain scores than those with mild disease. This finding confirms that asthma adversely affects physical functioning, emotional health, and daily activities. Similar reductions in quality-of-life scores among children with uncontrolled asthma have been documented in previous pediatric studies.[7]

A highly significant association was observed between asthma severity and pulmonary function. FEV_1 values progressively declined with increasing disease severity ($p<0.001$), confirming that worsening clinical severity is accompanied by greater airflow limitation. Likewise, quality-of-life scores significantly decreased as asthma severity increased. These observations are consistent with previous studies demonstrating that impaired lung function and poor symptom control negatively influence daily functioning and psychosocial well-being.[15]

The study also demonstrated a strong positive correlation between pulmonary function parameters and quality-of-life scores. Children with better FEV_1, PEFR, and $FEF_{25–75}$ values exhibited significantly higher PAQLQ scores, indicating

superior symptom control and improved functional status. These findings reinforce the importance of routine spirometry in monitoring treatment response and guiding individualized asthma management.[14]

The strengths of the present study include its prospective design, comprehensive assessment of demographic and clinical variables, objective pulmonary function testing, evaluation of environmental triggers, and standardized assessment of quality of life. However, certain limitations should be acknowledged. The relatively small sample size and single-center design may limit generalizability. Serum IgE estimation and chest radiography were performed only when clinically indicated, and long-term follow-up beyond the study period was not available.

Overall, the present study emphasizes that childhood asthma remains a multifactorial disease in which environmental triggers, airway inflammation, pulmonary dysfunction, and psychosocial factors collectively influence disease outcomes. Early diagnosis, regular spirometric monitoring, identification and avoidance of triggering factors, appropriate pharmacotherapy, and continuous education regarding inhaler technique and treatment adherence are essential for achieving optimal asthma control and improving the quality of life of affected children.

CONCLUSION

The present study highlights that childhood bronchial asthma remains a significant health problem, with wheezing, cough, and breathlessness being the most common clinical features. Dust exposure, viral respiratory infections, and cold weather were the predominant triggering factors. Increasing asthma severity was associated with poorer pulmonary function and reduced quality of life. Early diagnosis, regular spirometric monitoring, trigger avoidance, adherence to standard therapy, and proper inhaler technique are essential for achieving better asthma control and improving the quality of life in affected children.

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