International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 16; Issue: 8; August 2026
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Assessment of Pulmonary Function Parameters in Bronchial Asthma: A Comparative Cross-Sectional Study

Sharad Kumar[1], Garima Pandey[2], Prince Kumar Patel[3]

[1]Assistant Professor, Department of Physiology, ASMC, Kushinagar, Uttar Pradesh,
[2]Tutor, Department of Physiology, ASMC, Kushinagar, Uttar Pradesh,
[3]Assistant Professor, Department of Community Medicine, ASMC, Kushinagar, Uttar Pradesh

Corresponding Author: Prince Kumar Patel

DOI: https://doi.org/10.52403/ijhsr.20260805

Received: 08/04/2026; Revised: 19/06/2026; Accepted: 31/07/2026

ABSTRACT

Background: Bronchial asthma is a chronic inflammatory airway disease characterized by variable airflow obstruction and bronchial hyperresponsiveness. Pulmonary function tests (PFTs), particularly spirometry, are essential for objective assessment of lung function and evaluation of disease severity. This study was undertaken to assess and compare pulmonary function parameters between bronchial asthma patients and healthy individuals.
Material & Methods: A comparative cross-sectional study was conducted among 80 participants. Comprising 40 diagnosed bronchial asthma patients (cases) and 40 age- and sex-matched healthy controls. Pulmonary function parameters, including Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV_1), and FEV_1/FVC ratio, were measured using a standardized spirometer. Data were analyzed using SPSS version 26, and comparisons between groups were performed using the independent Student's t-test. A p-value < 0.05 was considered statistically significant.
Results: The study demonstrated a significant reduction in pulmonary function parameters among asthma patients compared to healthy controls. The mean FVC (63.5 ± 12.7 vs. 98.2 ± 12.1), FEV_1 (49.8 ± 16.4 vs. 92.4 ± 9.8), and FEV_1/FVC ratio (81.5 ± 14.5 vs. 98.6 ± 8.2) were significantly lower in asthma patients. All differences were highly statistically significant ($p < 0.001$). These findings indicate marked airflow limitation and impaired lung function in bronchial asthma.
Conclusion: Bronchial asthma patients exhibit significantly reduced pulmonary function compared to healthy individuals, reflecting an obstructive pattern of lung impairment. Spirometry remains a valuable tool for early diagnosis, assessment, and monitoring of asthma, emphasizing its importance in clinical practice.
Keywords: Bronchial asthma, pulmonary function test, spirometry, FEV_1, FVC, airflow obstruction

INTRODUCTION

Bronchial asthma is a chronic, heterogeneous respiratory disorder characterized by persistent airway inflammation, variable airflow obstruction and bronchial hyperresponsiveness. Clinically, it is characterized by recurring episodes of coughing, wheezing, dyspnea, and tightness

in the chest that vary in intensity over time and among individuals. Approximately 300–350 million people worldwide suffer with asthma, which continues to place a significant strain on healthcare systems, especially in emerging nations like India [1]. The recent literature also emphasizes the complexity of asthma as a multifactorial disease including genetic predisposition, environmental exposures, and immunological mechanisms which makes its diagnosis and monitoring a multifaceted exercise [2]. Pulmonary function tests (PFTs) particularly spirometry is an important tool in the objective assessment of lung function in patients of bronchial asthma. Spirometry provides quantitative parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), and the FEV1/FVC ratio to diagnose airflow obstruction and assess the severity of disease. Contemporary studies highlight that spirometry remains the cornerstone for detecting reversible airway obstruction and for monitoring treatment response in asthmatic patients [3]. Guidelines advise periodic pulmonary function testing since clinical symptoms might not be a reliable indicator of the severity of lung narrowing, which could result in either overtreatment or undertreatment [4].

Recent developments have expanded the application of pulmonary function evaluation in asthma. To detect airway inflammation and hyperresponsiveness, innovative diagnostic techniques such bronchial challenge tests, peak expiratory flow variability, and measurement of exhaled nitric oxide are being utilized more frequently in addition to traditional spirometry. These techniques are especially helpful when there is a clinical suspicion of asthma but spirometry data seem normal [5]. Spirometry remains the most extensively available and utilized technique in both clinical practice and research settings despite these developments. In some recent national and international studies, pulmonary function parameters in asthmatic patients were consistently lower than in healthy individuals. Significant reductions in FVC, FEV_1, and FEV_1/FVC ratio have been reported, consistent with the obstructive pattern of lung impairment associated with asthma [3]. Environmental pollution, occupational exposure and limited access to healthcare are contributing to the rising prevalence of asthma in India, and there is a need for region-specific data on pulmonary function status of asthmatic patients. Comparing PFT parameters with healthy controls can give important insights into the degree of functional impairment and help in better clinical management. Thus, the present study was conducted to evaluate and compare the pulmonary function parameters in patients with bronchial asthma and healthy individuals, contributing to the existing evidence and improving the understanding of the functional respiratory impairment in asthma.

MATERIAL AND METHODS

Study area and period

The study was carried out at the Department of Physiology in collaboration with the Department of Medicine at *Autonomous State Medical College, Kushinagar, Uttar Pradesh*. The Study was conducted from April 2025 to September 2025.

Study design and participants

The present study was a comparative cross-sectional study which was carried out to evaluate and compare the pulmonary function test (PFT) parameters between the patients of bronchial asthma and healthy individuals. The study included a total of 80 participants, comprising 40 diagnosed bronchial asthma patients (cases) and 40 healthy individuals (controls), aged between 20 and 70 years.

Inclusion Criteria

Cases: Diagnosed cases of bronchial asthma based on clinical evaluation. Age group: 20–70 years. Both males and females.

Controls: healthy people without a history of long-term systemic illness or respiratory

conditions. matching instances by age and sex.

Exclusion Criteria: History of long-term respiratory conditions other than asthma, such as COPD or TB. Acute respiratory illness during the research period. Smokers or people who are heavily exposed to dust or fumes at work. Patients with inadequate spirometry performance.

Sample Size

A total of 80 subjects (40 cases and 40 controls) were included based on feasibility and availability during the study period.

Data Collection Procedure

Both a general physical examination and a thorough clinical history were obtained. A standardized spirometer was used to conduct pulmonary function tests in a controlled environment. Age-matched healthy controls were chosen from the general community.

Using a standardized RMS Helios-401 spirometer (Chandigarh, India), all participants underwent pulmonary function tests (PFTs) in accordance with accepted protocols. The following parameters were recorded for analysis

Forced Expiratory Volume in one second (FEV_1): The volume of air forcibly exhaled during the first second of expiration.

Forced Vital Capacity (FVC): The maximum volume of air that can be forcibly exhaled after full inspiration.

FEV_1/FVC Ratio: The ratio of FEV_1 to FVC, expressed as a percentage, used to assess airflow limitation.

The best of three acceptable moves was recorded for analysis after participants were told to complete the test in accordance with normal protocols.

Statistical Analysis

Data were entered into Microsoft Excel and data were coded, checked, and processed with version 26 Statistical Package for the Social Sciences (SPSS) for analysis. Results were expressed as Mean ± Standard Deviation (SD). Comparison between cases and controls was done using the independent (unpaired) Student's t-test. A p-value < 0.05 was considered statistically significant.

Ethical consideration

We confirm that our research was conducted in accordance with the Declaration of Helsinki. We obtained approval from Institutional Ethics Committee (IEC) of the Autonomous State Medical College, Kushinagar with approval number-ASMC/KUS/EC/2K25/459/4, dated 06/03/2025. Informed consent was obtained from all participants involved in the study. The participants were ensured that their responses would be treated in confidence. Respondents were also assured anonymity and were told they could refuse or end the interview at any time without giving a reason.

OBSERVATION & RESULTS

Table 1: Comparison of pulmonary function test parameters between bronchial asthma patients and healthy subjects.

Parameter	Asthma Patients	Healthy Controls	t-value	p-value
	Cases			
	Mean ± SD	Mean ± SD		
FVC	63.5 ± 12.7	98.2 ± 12.1	-12.64	< .001
FEV_1	49.8 ± 16.4	92.4 ± 9.8	-14.24	< .001
FEV_1/FVC Ratio	81.5 ± 14.5	98.6 ± 8.2	-6.54	< .001

All assessed variables showed statistically significant differences between bronchial asthma patients and healthy controls when the pulmonary function test (PFT) parameters were compared. Asthma patients had a significantly lower mean Forced Vital Capacity (FVC) (63.5 ± 12.7) than healthy controls (98.2 ± 12.1), and this difference

was highly significant ($t = -12.64$, $p < .001$). Similarly, asthma patients had a significantly lower mean Forced Expiratory Volume in one second (FEV_1) (49.8 ± 16.4) than controls (92.4 ± 9.8), with a highly significant difference ($t = -14.24$, $p < .001$). The statistical test revealed that asthma patients had a considerably lower FEV_1/FVC ratio (81.5 ± 14.5) than healthy individuals (98.6 ± 8.2) ($t = -6.54$, $p < .001$).

Overall, these results show that patients with bronchial asthma have significantly lower lung function than healthy controls, which is consistent with an obstructive pattern of pulmonary impairment. The observed differences are extremely statistically significant and unlikely to have happened by chance, as shown by the consistently low p-values (<0.001) across all parameters.

DISCUSSION

In the current study, we compared PFT parameters in bronchial asthma patients and healthy controls. The study results indicated a statistically significant decrease in all measured variables in asthma patients. The results clearly indicate impaired lung function compatible with an obstructive pattern of airway disease.

In this study, the mean Forced Vital Capacity (FVC) was significantly lower in asthma patients compared to healthy controls. This decrease could be explained by bronchoconstriction, air trapping, and inflammation of the airways, which restrict full expiration and lower lung capacities. Similar findings have been observed in previous studies, wherein asthma patients' lower FVC was associated with higher airway resistance and lower lung compliance.

The Forced Expiratory Volume in one second (FEV_1), a key indicator of airway obstruction, was markedly reduced in asthma patients. This finding reflects the characteristic narrowing of airways in bronchial asthma due to smooth muscle constriction, mucosal edema, and mucus hypersecretion. The highly significant difference in FEV_1 between cases and controls in the present study is in agreement with earlier research, which consistently identifies FEV_1 as the most sensitive parameter for assessing the severity of airflow limitation in asthma.

Furthermore Additionally, compared to healthy persons, asthma sufferers had a considerably lower FEV_1/FVC ratio. A decreased FEV_1/FVC ratio, which denotes a disproportionate decrease in expiratory flow in relation to lung volume, is a characteristic of obstructive lung disorders. This validates the obstructive nature of pulmonary impairment seen in the study population and supports the existence of airflow limitation.

The current study's observed decrease in FEV_1 and FEV_1/FVC ratio is highly consistent with worldwide literature. According to a large population-based study, FEV_1 and FEV_1/ were significantly lower among asthmatics.FVC ratios in comparison to those without asthma, demonstrating that airflow restriction persists even after controlling for confounders **[6]**. The obstructive nature of asthma was further supported by a recent cross-sectional study (2024) that evaluated spirometric parameters in asthmatics and found significantly lower FVC, FEV_1, and FEV_1/FVC ratio compared to expected or normal values ($p < 0.05$) **[3]**. The magnitude of reduction observed in the present study (FVC: 63.5 vs. 98.2; FEV_1: 49.8 vs. 92.4; FEV_1/FVC: 81.5 vs. 98.6) is comparable with global findings, although slightly more pronounced. This could be explained by variations in the severity of the illness, exposure to the environment, a delayed diagnosis, or treatment compliance. Further, studies have shown that FEV_1 is one of the most sensitive indicators of airway obstruction and disease severity in asthma. Previous research indicates that abnormalities in FEV_1 and FVC can distinguish between people with and without asthma, with higher anomaly rates observed in situations of severe asthma **[7]**. Recent research has also emphasized the clinical importance of FVC. In individuals with asthma–COPD overlap, a decrease in FVC is linked to worse clinical outcomes and more

exacerbations, according to a study published in Scientific Reports in 2022, this suggests that decreased lung volumes may represent the severity and course of the disease **[8]**. This supports the significantly lower FVC observed in the present study. according to a new South Asian study, in comparison to healthy individuals, asthmatic patients showed considerable impairment in FEV_1, FVC, and other spirometric indices, underscoring the diagnostic utility of these metrics in clinical practice **[9]**. The similarity of findings across regional studies suggests that the burden and pattern of airway obstruction in asthma are consistent across developing countries.

Strengths and Limitations

A key strength of this study is the inclusion of a control group, which allows for direct comparison and strengthens the validity of the findings. However, certain limitations should be considered. The results may not be as broadly applicable as they could be due to the study's small sample size and single-center setting. Furthermore, environmental exposures, treatment status, and the length and severity of asthma were not thoroughly examined.

CONCLUSION

The current study shows that individuals with bronchial asthma have significantly lower lung function metrics than healthy controls. The observed decrease in FVC, FEV_1, and FEV_1/FVC ratio confirms the presence of an obstructive pattern of lung impairment. These findings highlight the importance of pulmonary function testing in the diagnosis, monitoring, and management of bronchial asthma.

Declaration

Ethical Approval: Approved

Acknowledgement: The authors are grateful to the all-study subjects for their voluntary participation in this study.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Xing S, Feng S, Zeng D. Effect of exercise intervention on lung function in asthmatic adults: a network meta-analysis. Ann Med. 2023;55(2):2237031. doi: 10.1080/07853890.2023.2237031.
2. Gohal G, Moni SS, Bakkari MA, Elmobark ME. A Review on Asthma and Allergy: Current Understanding on Molecular Perspectives. J Clin Med. 2024 Sep 27;13(19):5775. doi: 10.3390/jcm13195775.
3. Rathod MB, Budensab A, Bhalla S, Mahesh NK, Alex E, Jesudas M. Spirometric Assessment of Pulmonary Function Tests in Asthma Patients. Cureus. 2024 Feb 26;16(2): e54979. doi: 10.7759/cureus.54979.
4. Evidence reviews for pulmonary function monitoring in asthma: Asthma: diagnosis, monitoring and chronic asthma management (update): Evidence review M. London: National Institute for Health and Care Excellence (NICE); 2024 Nov. (NICE Guideline, No. 245.) Available from: https://www.ncbi.nlm.nih.gov/books/NBK612148/
5. Malinovschi A, Kjellberg S, Romberg K, Wollmer P. Lungfunktionsundersökningar vid utredning av astma [Pulmonary function testing in asthma]. Lakartidningen. 2025 May 15; 122:24156. Swedish.
6. Chen, Y., Rennie, D.C., Pahwa, P. et al. Pulmonary function in adults with recent and former asthma and the role of sex and atopy. BMC Pulm Med 12, 32 (2012). https://doi.org/10.1186/1471-2466-12-32
7. Ratageri VH, Kabra SK, Lodha R, Dwivedi SN, Seth V. Lung function tests in asthma: which indices are better for assessment of severity? J Trop Pediatr. 2001 Feb;47(1):57-9. doi: 10.1093/tropej/47.1.57.

8. An TJ, Rhee CK, Park YB, Yoo KH, Yoon HK. FVC, but not FEV1, is associated with clinical outcomes of asthma-COPD overlap. Sci Rep. 2022 Aug 15;12(1):13820. doi: 10.1038/s41598-022-15612-w.
9. Baig MMA, Baig MU, Imran MM. FEF2575 percentage reversibility and its comparison with FEV1 Reversibility in diagnosis of asthma. Pak J Med Sci. 2025 Sep;41(9):2623-2627. doi: 10.12669/pjms.41.9.11535.

How to cite this article: Kumar S, Pandey G, Patel PK. Assessment of pulmonary function parameters in bronchial asthma: a comparative cross-sectional study. *Int J Health Sci Res.* 2026; 16(8):49-54. DOI: *10.52403/ijhsr.20260805*

******