ORIGINAL ARTICLE

Evaluating the Real-world Effectiveness and Safety of Formoterol Fumarate and Fluticasone Propionate Combination in Asthma: A Prospective, Multicenter Study

Shital Patil[1], Rajesh Venkitakrishnan[2*], Sarat K Behera[3], Rahul K Jalan[4], Manish Kumar Jain[5], Samadarshi Dutta[6], Ronak Panwala[7], Kundan Nivangune[8], Kamlesh Patel[9]

Received: 24 March 2025; *Accepted:* 27 June 2025

Abstract

Background: India bears a significant burden of asthma, and asthma in India is characterized by high mortality rates. Poor adherence to treatment guidelines is observed. Several inhaled corticosteroid (ICS) with long-acting beta (β) 2 agonist (LABA) combinations are commercially marketed in India, formoterol fumarate–fluticasone propionate being one of them. Real-world Indian studies on fluticasone-formoterol from India are scarce. This study aims to evaluate the effectiveness and safety of formoterol fumarate (6 µg) and fluticasone propionate (250 µg) administered through a dry powder inhaler (DPI) or metered-dose inhaler (MDI) in Indian asthma patients.

Materials and methods: This 24-week prospective, multicenter study (CTRI/2023/08/056250) evaluated Formoflo 250 (formoterol fumarate 6 µg with fluticasone propionate 250 µg) transcaps (DPI), and Formoflo 250 transhaler (MDI) in adults aged 18–65 years. The primary endpoint was the mean change in trough forced expiratory volume in 1 second (FEV1) at week-24. Secondary endpoints included changes in trough forced vital capacity (FVC), asthma control test (ACT), and asthma quality of life questionnaire (AQLQ) scores. Safety was assessed through adverse events (AEs) and asthma exacerbations, with appropriate statistical analyses conducted on the modified intention-to-treat (mITT) population.

Results: A total of 503 patients were enrolled, with 495 included in the mITT analysis and all 503 in the safety analysis. At week-24, a mean increase of 312.2 ± 121.1 mL was observed in trough FEV1, while trough FVC improved by 279.3 ± 147.3 mL ($p < 0.0001$). The mean ACT score increased by 11.6 ± 3.7 ($p < 0.0001$), while the mean AQLQ score improved by 2.5 ± 1.2 ($p < 0.0001$) at week-24. Adverse events were reported in 7.0% of patients, primarily mild, with no serious AEs or fatalities. The findings were consistent across both Formoflo DPI and MDI formulations.

Conclusion: The combination of formoterol fumarate and fluticasone propionate significantly improved lung function, asthma control, and quality of life, demonstrating marked effectiveness and safety with both DPI and MDI in Indian asthma patients.

Journal of The Association of Physicians of India (2025): 10.59556/japi.73.1251

Introduction

Asthma is a chronic inflammatory condition of the airways, marked by repeated occurrences of wheezing, shortness of breath, chest constriction, and coughing. These symptoms are typically provoked by exposure to allergens, environmental irritants, or respiratory tract infections.[1] Globally, asthma is a significant public health concern, affecting more than 262 million people annually and causing an estimated 455,000 deaths each year.[2] Asthma ranks as the second most prevalent chronic respiratory disorder globally, with an estimated prevalence of 3.33%.[3] The global burden of disease (GBD) 2019 report highlights India as a major contributor to the global asthma burden, accounting for approximately 34.3 million cases, or 13.09% of the worldwide total. Notably, asthma-related mortality in India is reported to be threefold higher than the global average, with disability-adjusted life years (DALYs) exceeding twice the global figures for asthma.[4–6] The SWORD study showed a huge treatment gap, with 34.8% of patients with poor control and 26.8% of those hospitalized not receiving any treatment. Additionally, only 48.9% of patients underwent spirometry, contributing to increased mortality, DALYs, and a substantial overall healthcare burden.[6] This elevated mortality rate is an offshoot of multiple contributing factors, including the progressive decline in air quality, inadequate public awareness, the persistence of myths and social stigma surrounding asthma, underdiagnosis and misdiagnosis by healthcare professionals, suboptimal prescription and utilization of inhalation therapies, and poor compliance with established evidence-based management guidelines.[5]

Asthma management remains suboptimal on a global scale, with particularly significant challenges observed in developing countries such as India.[7] The treatment options available for asthma are broad, encompassing diverse pharmacological classes such as short-acting β-agonists (SABAs), long-acting β-agonists (LABAs), inhaled corticosteroids (ICS), leukotriene receptor antagonists (LTRAs), and combination therapies.[8] These treatment strategies are tailored to improve symptoms, reduce exacerbations, and enhance the overall quality of life for patients with asthma.

For patients with asthma, except those with the mildest severity, the recommended standard treatment involves a combination of an ICS and a LABA. Currently approved ICS/LABA inhalers for asthma management, including fluticasone propionate–salmeterol, fluticasone furoate–vilanterol, beclomethasone–formoterol, fluticasone

[1]Pulmonologist, Department of Pulmonary Medicine, Venkatesh Chest Hospital and Critical Care Center, Latur, Maharashtra; [2]Pulmonologist, Department of Pulmonary Medicine, Rajagiri Hospital, Kochi, Kerala; [3]Pulmonologist, Department of Pulmonary Medicine, KIDS Multispecialty Hospital, Bhubaneshwar, Odisha; [4]Consultant Interventional Pulmonology & Sleep Medicine, Department of Pulmonary Medicine, Apollo Hospitals International Limited, Gandhinagar; [5]Pulmonologist, Department of Pulmonary Medicine, Maharaja Agrasen Superspecialty Hospital, Jaipur, Rajasthan; [6]Pulmonologist, Department of Pulmonary Medicine, Aashwas Chest and Allergy Clinic, Kolkata, West Bengal; [7]Manager Medical Services; [8]Team Lead, Department of Medical Affairs; [9]Vice President, Department of Medical Services, Lupin Limited, Mumbai, Maharashtra, India; *Corresponding Author

How to cite this article: Patil S, Venkitakrishnan R, Behera SK, *et al.* Evaluating the Real-world Effectiveness and Safety of Formoterol Fumarate and Fluticasone Propionate Combination in Asthma: A Prospective, Multicenter Study. J Assoc Physicians India 2025;73(11):54–63.

propionate–formoterol, mometasone–indacaterol, budesonide–formoterol, and mometasone–formoterol, are well-established for their effectiveness in achieving optimal control when administered once or twice daily.[9–11] Fluticasone propionate combined with formoterol fumarate is an approved ICS/LABA therapy, now available in several countries across Europe and Asia, including India, providing an effective option for asthma management.[12] The 2024 GINA (Global Initiative for Asthma) guidelines also recommend ICS/LABA combination therapy, such as fluticasone and formoterol, as the mainstay of asthma treatment to achieve optimal disease control.[13] Fluticasone propionate, a potent ICS, exerts its effects in asthma management by inhibiting multiple inflammatory pathways, reducing the production of inflammatory mediators, and decreasing airway hyper-responsiveness and swelling.[14] Clinical studies have shown that their relative potency is highest for fluticasone propionate, followed by budesonide, beclomethasone dipropionate, triamcinolone acetonide, and flunisolide.[14,15] Its safety and efficacy are well-documented, and it is approved for use as monotherapy treatment or in combination with LABAs in patients aged above 4 years.[14,16,17] Formoterol fumarate, a LABA, rapidly activates β-2 adrenergic receptors within 1–3 minutes, leading to smooth muscle relaxation and sustained bronchodilation, comparable to short-acting β-agonists such as salbutamol but with a longer duration of action.[18–20] This rapid onset of bronchodilation, comparable to that of SABAs (within approximately 3 minutes), coupled with a prolonged effect lasting up to 12 hours, differentiates formoterol among LABAs and ensures its efficacy in asthma control for 12 years and older patients.[18,21] The fluticasone and formoterol combination effectively targets both airway inflammation and bronchoconstriction, providing a comprehensive approach to asthma management. Its robust efficacy and favorable safety profile, demonstrated in extensive randomized controlled trials, highlight its clinical importance in treating asthma.[22–25]

Despite extensive international research, data on the effectiveness of this combination as a first-line treatment in asthma patients, both globally and in Indian real-world clinical practice, remain limited, particularly over the last 6–8 years. To address this gap, AFFIRM (Asthma management with Formoterol and Fluticasone In a Real-world post-Marketing study), a prospective, multicenter, real-world evidence study, was designed to assess the effectiveness and safety of formoterol fumarate (6 µg) and fluticasone propionate (250 µg) delivered through either dry powder inhaler (DPI) or metered-dose inhaler (MDI) in asthma patient. This is the first real-world study from India to evaluate the change in trough FEV_1 (from baseline) as a primary endpoint in asthmatics with formoterol fumarate and fluticasone propionate combination therapy.

Materials and Methods

Study Design

This prospective, multicenter, real-world clinical study was conducted over 24 weeks at five centers in India and is registered with the Clinical Trials Registry of India (CTRI) under the identifier CTRI/2023/08/056250. The study adhered to the ethical principles of the current Declaration of Helsinki and good clinical practice (GCP) guidelines by the International Council for Harmonization (ICH), and local regulatory requirements. Following approval from the Institutional Ethics Committees of all participating centers and after obtaining written informed consent from each patient, the study was conducted over the period from August 2023 to July 2024.

Study Patients

The study included adult patients aged 18–65 years, of either gender, with mild to moderate asthma. Mild asthma was characterized by a predicted forced expiratory volume in 1 second (FEV_1) of 80% or greater, with a normal FEV_1 to forced vital capacity (FEV_1/FVC) ratio, whereas moderate asthma was defined as a predicted FEV_1 between 60% and less than 80%, with a possible reduction in the FEV_1/FVC ratio of up to 5%. Furthermore, eligible patients had not received any regular controller medication in the last 12 weeks and demonstrated bronchodilator reversibility, defined as an increase in FEV_1 of at least 12% and 200 mL following salbutamol inhalation, along with a prebronchodilator FEV_1 between 60 and 85% of the predicted normal value at screening. Additionally, patients were also needed to have an asthma control test (ACT) score of 15 or less at screening and to provide informed consent in writing, agreeing to adhere to all study protocol requirements.

Patients were excluded if they had known hypersensitivity to any β2-agonist, sympathomimetic drug, or corticosteroid (inhaled, intranasal, or systemic), a history of life-threatening asthma in the past 5 years, or an asthma exacerbation requiring systemic corticosteroids or hospitalization within 6 months prior to screening. Those diagnosed with COVID-19 within 3 months or a bacterial or viral respiratory tract infection within 4 weeks before screening were also excluded. The exclusion criteria further included patients with any chronic respiratory disease other than asthma, clinical evidence of oropharyngeal candidiasis, clinically significant uncontrolled systemic diseases, hepatic or renal dysfunction, current or recent smokers, alcohol or drug abuse history, or participation in another clinical trial within 3 months before screening. Women who were pregnant, breastfeeding, or not willing to use reliable contraceptive methods were excluded from the study.

Medication Regimen and Administration

Patients enrolled in the study received a fixed-dose combination (FDC) therapy comprising formoterol fumarate (6 µg) and fluticasone propionate (250 µg), delivered either via a DPI as Formoflo 250 transcaps or through an MDI as Formoflo 250 transhaler. The appropriate formulation was determined by the investigator, considering the preferences of the patient, compatibility, and their ability to effectively use either a DPI or MDI. Patients prescribed Formoflo 250 transcaps (DPI) were instructed to inhale one transcap twice daily (morning and evening) using the Lupihaler device. Those using Formoflo 250 transhaler (MDI) were directed to administer one puff twice daily (morning and evening) via an MDI with transpacer V, according to the approved package insert. All patients were provided with detailed instructions on the proper technique for using both DPI and MDI formulations to ensure correct administration of the medication. Administration of the medication was to be performed immediately after recording the FEV_1 reading.

Data Collection

In this prospective study, patients were followed up with three scheduled visits conducted across a 6-month period to systematically collect data. At visit 1 (day 0), patients provided informed consent and were screened for eligibility based on inclusion and exclusion criteria, with demographic data, medical history, vital signs, and clinical examination results recorded. Female patients of childbearing potential underwent a urine pregnancy test, and a blood sample was collected for laboratory investigations. Spirometry was conducted to confirm bronchodilator reversibility (an increase in FEV_1 of at least 12% and 200 mL postsalbutamol inhalation), along with ACT and asthma quality of life questionnaire (AQLQ) scores were documented. Eligible patients were enrolled and prescribed formoterol fumarate and fluticasone propionate FDC via DPI or MDI in doses as mentioned above, along with rescue medication (salbutamol MDI), based on the investigator's discretion.

At visit 2 (month 3 ± 14 days), reassessments included vital signs, clinical examination, recording of any adverse events (AEs), asthma exacerbations, along with updates to ACT and AQLQ scores. The global impression of change (GIC) in the disease condition was recorded by patients. At visit 3 (month 6 ± 14 days), final evaluations encompassed all previous assessments, including spirometry, laboratory tests, and recording of AEs or asthma exacerbations, along with final patient-reported and investigator-assessed global evaluations of the disease and treatment efficacy. Unscheduled visits were allowed throughout the study for managing AEs or other clinical conditions, and any protocol deviations, such as visits outside the permitted window, missed or incomplete procedures, or evaluations, were recorded as they occurred.

Efficacy Assessment

The primary efficacy endpoint of the study was the evaluation of the change in predose (trough) FEV_1 from baseline to week 24 (visit 3). Trough FEV_1 was measured using spirometry before the administration of the study drugs' morning dose, with baseline values (visit 1) compared to those obtained at the end of week 24 (visit 3). Secondary endpoints assessed changes from baseline in trough FVC at the end of week 24, as well as changes in the ACT score and the AQLQ score at the end of week 12 and week 24. Trough FVC was measured similarly to trough FEV_1. ACT scores, which have been validated in numerous studies for evaluating asthma control, were calculated at baseline and at each subsequent visit, using a five-item questionnaire that scored responses from 5 to 25 (higher scores indicating better control).[26–28] AQLQ scores, widely used in clinical studies to assess asthma-related quality of life, were also evaluated at baseline and each follow-up visit, with patients responding to 32 questions across four domains, scored on a 7-point scale (higher scores indicating less impairment).[29,30] Additionally, global assessments included the GIC in disease condition, recorded by patients at week 12 and week 24, on a 7-point scale. Furthermore, global assessment of efficacy was conducted by the investigator at week 24, based on the ACT score, using a 4-point scale to categorize efficacy as "Excellent" (ACT score > 20), "Good" (ACT score 16–20), "Fair" (improvement from baseline with ACT score ≤ 15), or "Poor" (no improvement or a decrease in ACT score compared to baseline).

Safety Assessment

The safety of the study drugs was evaluated by monitoring all AEs and serious adverse events (SAEs) reported throughout the clinical study. Hematological and biochemical laboratory investigations were performed at screening and at the end of treatment to detect any clinically significant abnormalities, which were recorded as AEs if observed. All abnormalities identified during physical examinations, including vital signs, and any AEs observed or volunteered by the patients, regardless of their suspected causal relationship to the study drug, were documented. Asthma exacerbations, defined as acute or subacute worsening episodes with a progressive increase in symptoms and a decline in expiratory flow, were closely monitored throughout the study. These exacerbations were categorized as nonsevere, severe, or life-threatening, based on clinical presentation and the required level of care, as specified in the clinical study protocol. All exacerbations occurring after the administration of the study medication were documented to ensure a comprehensive safety assessment.

Statistical Analysis

All data from the study were accurately managed using an EDC platform. The data collected was then used to perform statistical analyses. Efficacy parameters were analyzed for the modified intention-to-treat (mITT) population, which included all enrolled patients who completed the specified postenrollment visits (visit 2 or visit 3), regardless of major protocol deviations. The per-protocol (PP) analysis, excluding patients with significant protocol deviations, yielded conclusions consistent with those observed in the mITT analysis, indicating no substantial impact on overall study outcomes. Therefore, the mITT analysis results, which more closely reflect real-world scenarios, are presented in this manuscript. In contrast, safety parameters were evaluated for all patients who gave informed consent in writing and received a minimum of one dose of the investigational drug.

Descriptive statistics were employed to summarize baseline demographic and clinical characteristics. This includes such information as age, gender, height, weight, body mass index, asthma severity, the percentage of patients who demonstrate reversibility, the percentage of patients who are prescribed medication, the type of medication prescribed, and any coexisting medical conditions that may be present. Continuous variables were expressed as mean ± standard deviation (SD) along with their corresponding 95% confidence intervals (CIs). Categorical variables were described using frequencies and proportions (*n*, %) with associated 95% CIs, unless otherwise specified.

To assess efficacy, the paired *t*-test was utilized to determine the mean differences in trough FEV_1 and FVC values between baseline and follow-up visits, given that the data followed a normal distribution. Additionally, mean changes in the ACT and AQLQ scores from baseline to subsequent visits were assessed using Dunnett's multiple comparisons test, while the overall mean change across different time points was determined using a mixed-model Analysis of Variance (ANOVA). The GIC in disease condition, as reported by patients at week 12 and at the end of the study (week 24), and the global assessment of efficacy by the investigator at the end of the study (week 24) were analyzed using descriptive statistics.

Safety assessments were conducted through descriptive statistics, including frequency and percentage distributions, to provide a thorough evaluation of safety parameters. Statistical analyses were carried out using GraphPad Prism software (version 8.4.3) along with a licensed version of Microsoft Excel 2010.

Results

Patient Demographics

A total of 503 patients were enrolled in the study, with eight patients lost to follow-up after visit 2. The remaining patients completed the study as per protocol. Fifteen major protocol deviations were identified, leading to the inclusion of 480 patients in the PP analysis, 495 patients in the mITT efficacy analysis, along with all 503 patients in the safety analysis. For this manuscript, the mITT population was considered for efficacy analysis, as it provides comprehensive assessment of the study outcomes (Fig. 1).

Out of the 503 patients enrolled in the study, 236 (46.9%) were within the age group of 18–40 years, 217 (43.1%) were aged between 40–60 years, and 50 (9.9%) were above 60 years. A total of 272 patients (54.1%) were prescribed Formoflo DPI, while 231 patients (45.9%) received Formoflo MDI. Among the participants, 43.1% were female and 56.9% were male. The detailed distribution of patients receiving Formoflo via DPI or MDI is provided in Table 1. The enrolled patients had a mean height of 165.3 ± 8.2 cm, a mean weight of 64.8 ± 12.4 kg, and a mean BMI of 23.7 ± 4.4 kg/m^2. Asthma severity was categorized as mild in 41.0% patients, moderate in 58.8% and severe in 0.2%. Reversibility after bronchodilator administration was observed in 97.6% of patients, with a slightly higher rate in the Formoflo MDI group (99.1%) compared to the Formoflo DPI group (96.3%). Table 1 presents

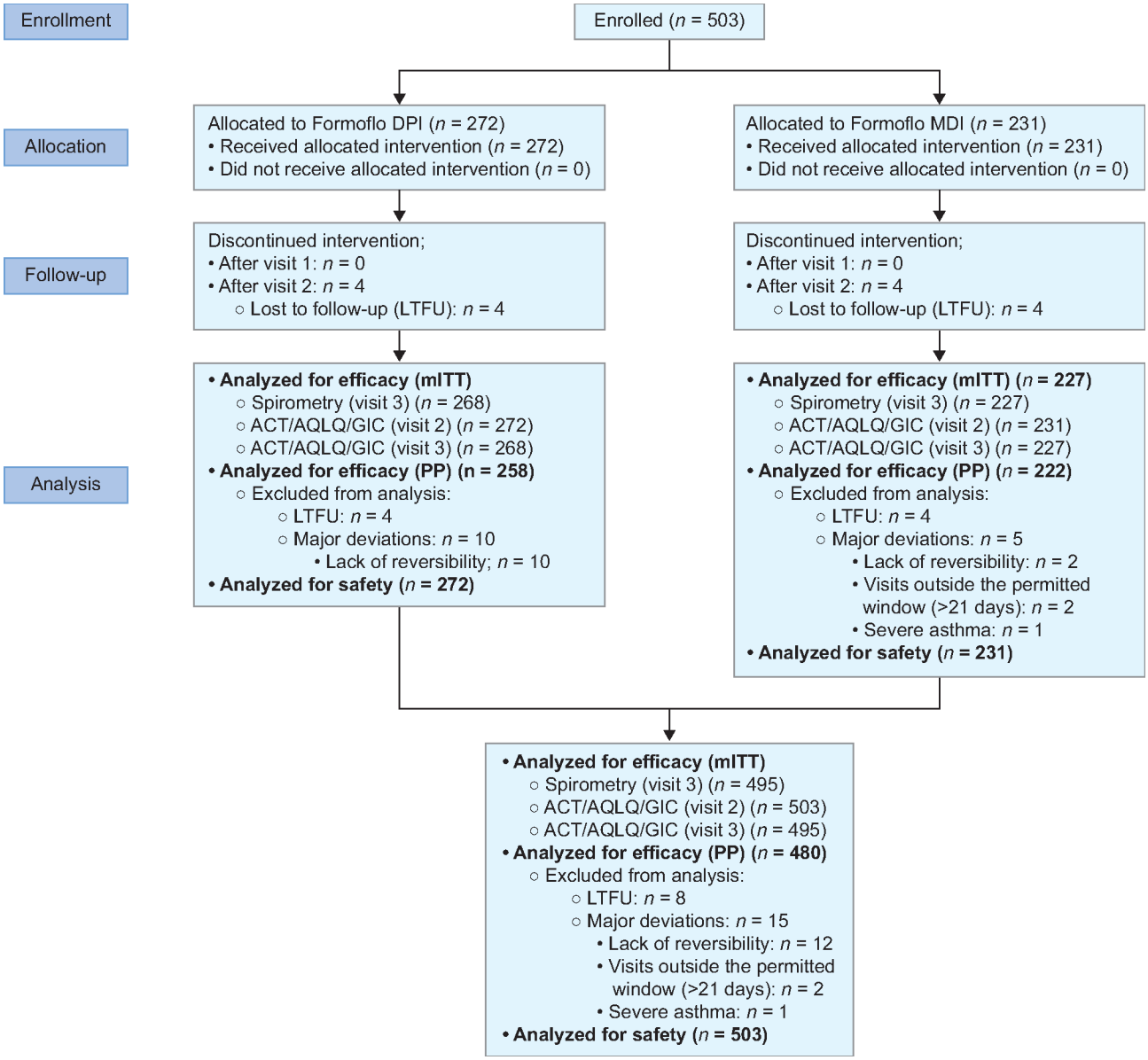


Fig. 1: Patient enrollment and progression through the study

the demographic profile and baseline clinical characteristics of the enrolled patients.

Primary Efficacy Endpoint

Trough FEV1

The primary endpoint was defined as the change from baseline in trough FEV_1 at week 24. The mean difference in trough FEV_1 at week 24 for the study participants (n = 495) was 312.2 ± 121.1 mL (95% CI: 301.5, 322.9) from baseline, demonstrating statistical significance ($p < 0.0001$). Similarly, the mean change in trough FEV1 at week 24 was 326.2 ± 135.3 mL (95% CI: 310.0, 342.5) for patients receiving Formoflo DPI and 295.7 ± 99.6 mL (95% CI: 282.7, 308.7) for those receiving Formoflo MDI, both demonstrating statistically significant improvements ($p < 0.0001$). These findings indicate consistent and significant lung function improvements with both Formoflo DPI and MDI, as outlined in Table 2.

Secondary Efficacy Endpoints

Trough FVC

One of the key secondary endpoints was the change in trough FVC at week 24 from baseline. The mean change in trough FVC for study patients (N = 495) at week 24 was 279.3 ± 147.3 mL (95% CI: 266.3, 292.3), which was statistically significant compared to baseline ($p < 0.0001$). In subgroup analyses, patients receiving Formoflo DPI had a mean change of 288.1 ± 160.8 mL (95% CI: 268.8, 307.5), while those receiving Formoflo MDI showed a mean change of 268.9 ± 129.2 mL (95% CI: 252.0, 285.8), both achieving statistically significant lung function improvements ($p < 0.0001$), as shown in Table 3.

ACT Score

The results of the change from baseline in ACT score at week 12 and at the end of the study (week 24) are presented in Table 4. The mean change in ACT score at week 12 was 8.5 ± 5.3 (95% CI: 8.0, 9.0), and at week 24, it was 11.6 ± 3.7 (95% CI: 11.2, 11.9), both of which were statistically significant ($p < 0.0001$), as compared to baseline. In patients receiving Formoflo DPI, the mean difference in ACT score from baseline to week 12 was 9.4 ± 4.8 (95% CI: 8.9, 10.0), and to week 24, it was 12.2 ± 3.8 (95% CI: 11.7, 12.7). For those receiving Formoflo MDI, the mean change was 7.4 ± 5.7 (95% CI: 6.6, 8.1) at week 12 and 10.8 ± 3.5 (95% CI: 10.4, 11.3) at week 24, both showing statistically significant improvements ($p < 0.0001$). Baseline data showed that an ACT score ≤15 was observed in 100% of patients,

Table 1: Demographic and baseline characteristics of the study population

Parameters		*Total (N = 503)*	*Formoflo DPI (N = 272)*	*Formoflo MDI (N = 231)*
Age (years)#	18–40	236 (46.9%)	151 (55.5%)	85 (36.8%)
	40–60	217 (43.1%)	97 (35.7%)	120 (51.9%)
	>60	50 (9.9%)	24 (8.8%)	26 (11.3%)
Gender#	Male	286 (56.9%)	145 (53.3%)	141 (61.0%)
	Female	217 (43.1%)	127 (46.7%)	90 (39.0%)
Height (cm)*		165.3 ± 8.2 (164.6–166)	165.3 ± 6.6 (164.5–166.1)	165.2 ± 9.8 (163.9–166.5)
Weight (kg)*		64.8 ± 12.4 (63.7–65.8)	62.5 ± 10.9 (61.2–63.8)	67.4 ± 13.4 (65.7–69.2)
Body mass index (kg/m^2)*		23.7 ± 4.4 (23.4–24.1)	22.9 ± 4.0 (22.4–23.4)	24.8 ± 4.7 (24.1–25.4)
Severity of asthma#	Mild	206 (41.0%)	89 (32.7%)	117 (50.6%)
	Moderate	296 (58.8%)	183 (67.3%)	113 (48.9%)
	Severe	1 (0.2%)	0 (0%)	1 (0.4%)
Patients showing reversibility#	Yes	491 (97.6%)	262 (96.3%)	229 (99.1%)
	No	12 (2.4%)	10 (3.7%)	2 (0.9%)
Comorbidities# (*N* = 227)	Gastroesophageal reflux disease (GERD)	106 (21.1%)	55 (20.2%)	51 (22.1%)
	Allergic rhinitis	40 (8.0%)	26 (9.6%)	14 (6.1%)
	Sinusitis	36 (7.2%)	19 (7.0%)	17 (7.4%)
	Ischemic heart disease (IHD)	15 (3.0%)	14 (5.1%)	1 (0.4%)
	Others [hypertension, diabetes mellitus (DM), deviated nasal septum (DNS)]	30 (6.0%)	12 (4.4%)	18 (7.8%)
Concomitant medications# (*N* = 227)	Respiratory medications (antiallergic and mucolytic agents)	135 (26.8%)	79 (29.0%)	56 (24.2%)
	Gastroprotective agents [proton pump inhibitors (PPI)]	48 (9.5%)	22 (8.1%)	26 (11.3%)
	Cardiovascular agents (antihypertensive, antiplatelet, and statins)	31 (6.2%)	20 (7.4%)	11 (4.8%)
	Antidiabetic medications (hypoglycemic agents)	13 (2.6%)	5 (1.8%)	8 (3.5%)

*Data presented as mean ± SD (95% CI); #Data presented as *n* (%)

Table 2: Mean change in trough FEV_1 from baseline to the end of week 24

Population	*Parameter*	*Values (mL)*	*Change as compared to baseline (mL)*	*p-value#*
Total (*N* = 495)	Trough FEV_1* (baseline)	1993.0 ± 423.6 (1955.6–2030.4)	NA	< 0.0001
	Trough FEV_1* (week 24)	2305.2 ± 441.3 (2266.2–2344.2)	312.2 ± 121.1 (301.5–322.9)	
Formoflo DPI (*N* = 268)	Trough FEV_1* (baseline)	2027.6 ± 393.2 (1980.3–2074.9)	NA	< 0.0001
	Trough FEV_1* (week 24)	2353.8 ± 416.0 (2303.8–2403.9)	326.2 ± 135.3 (310.0–342.5)	
Formoflo MDI (*N* = 227)	Trough FEV_1* (baseline)	1952.2 ± 454.3 (1892.7–2011.6)	NA	< 0.0001
	Trough FEV_1* (week 24)	2247.8 ± 463.9 (2187.1–2308.5)	295.7 ± 99.6 (282.7–308.7)	

*Data presented as mean ± SD (95% CI); #*p*—as compared to baseline (based on paired *t*-test)

reflecting poor asthma control in both the DPI and MDI groups. Week 12 results indicated significant improvements, with an ACT score ≥20 achieved by 55.2% of DPI patients and 43.2% of MDI patients. An ACT score of 16–19 was recorded in 15.7% of DPI patients and 17.6% of MDI patients, while an ACT score ≤15 was observed in 29.1% of DPI patients and 39.2% of MDI patients. Further improvements were reported at week 24, with an ACT score ≥20 achieved by 80.2% of DPI patients and 86.3% of MDI patients. An ACT score of 16–19 was recorded in 13.8% of DPI patients and 8.4% of MDI patients, while an ACT score ≤15 was observed in 6.0% of DPI patients and 5.3% of MDI patients, demonstrating significant asthma control in both groups.

AQLQ Score

At week 12, the mean increase in AQLQ score was 1.6 ± 1.2 (95% CI: 1.5, 1.7), which further improved to 2.5 ± 1.2 (95% CI: 2.4, 2.6) by week 24, both demonstrating statistical significance compared to baseline ($p < 0.0001$). In patients receiving Formoflo DPI, the mean AQLQ score improvement was 1.8 ± 1.2(95% CI: 1.6, 1.9) at week 12 and 2.6 ± 1.2 (95% CI: 2.5, 2.8) at week 24, both of which were statistically significant. Similarly, for patients treated with Formoflo MDI, the mean changes were 1.5 ± 1.1 (95% CI: 1.3, 1.6) at week 12 and 2.3 ± 1.2 (95% CI: 2.2, 2.5) at week 24, also demonstrating statistical significance ($p < 0.0001$). The results for these changes in AQLQ score are provided in Table 5.

Table 3: Mean change in trough FVC from baseline to the end of week 24

Population	*Parameter*	*Values*	*Change as compared to baseline*	*p-value#*
Total (*N* = 495)	Trough FVC* (baseline)	2495.6 ± 531.4 (2448.7–2542.5)	NA	< 0.0001
	Trough FVC* (week 24)	2774.9 ± 533.4 (2727.8–2822.0)	279.3 ± 147.3 (266.3–292.3)	
Formoflo DPI (*N* = 268)	Trough FVC* (baseline)	2469.2 ± 504.5 (2408.5–2529.9)	NA	< 0.0001
	Trough FVC* (week 24)	2757.3 ± 521.3 (2694.6–2820.0)	288.1 ± 160.8 (268.8–307.5)	
Formoflo MDI (*N* = 227)	Trough FVC* (baseline)	2531.2 ± 558.4 (2458.1–2604.2)	NA	< 0.0001
	Trough FVC* (week 24)	2800.1 ± 543.2 (2729.1–2871.1)	268.9 ± 129.2 (252.0–285.8)	

*Data presented as mean ± SD (95% CI); #*p*–as compared to baseline (based on paired *t*-test)

Table 4: Mean change from baseline in ACT score at week 12 and at the end of week 24

Populations	*Parameter*	*Values*	*Change as compared to baseline*	*p-value**
Total	ACT score (baseline) (*N* = 503)	10.3 ± 2.5 (10.1–10.6)	NA	NA
	ACT score (week 12) (*N* = 503)	18.8 ± 4.7 (18.4–19.2)	8.5 ± 5.3 (8.0–9.0)	< 0.0001
	ACT score (week 24) (*N* = 495)	21.9 ± 3.2 (21.6–22.2)	11.6 ± 3.7 (11.2–11.9)	< 0.0001
	p-value (ANOVA)^	< 0.0001	NA	NA
Formoflo DPI	ACT score (baseline) (*N* = 272)	9.8 ± 2.3 (9.6–10.1)	NA	NA
	ACT score (week 12) (*N* = 272)	19.3 ± 4.7 (18.7–19.8)	9.4 ± 4.8 (8.9–10.0)	< 0.0001
	ACT score (week 24) (*N* = 268)	22.0 ± 3.6 (21.6–22.4)	12.2 ± 3.8 (11.7–12.7)	< 0.0001
	p-value (ANOVA)^	< 0.0001	NA	NA
Formoflo MDI	ACT score (baseline) (*N* = 231)	10.9 ± 2.6 (10.6–11.2)	NA	NA
	ACT score (week 12) (*N* = 231)	18.3 ± 4.5 (17.7–18.9)	7.4 ± 5.7 (6.6–8.1)	< 0.0001
	ACT score (week 24) (*N* = 227)	21.8 ± 2.7 (21.4–22.1)	10.8 ± 3.5 (10.4–11.3)	< 0.0001
	p-value (ANOVA)^	< 0.0001	NA	NA

^*p*-value based on mixed model ANOVA; **p*—as compared to baseline (based on Dunnett's multiple comparisons test)

Table 5: Mean change from baseline in AQLQ score at week 12 and at the end of week 24

Populations	*Parameter*	*Values*	*Change as compared to baseline*	*p-value**
Total	AQLQ score (baseline) (*N* = 503)	3.5 ± 1.0 (3.4–3.6)	NA	NA
	AQLQ score (week 12) (*N* = 503)	5.1 ± 1.2 (5.0–5.2)	1.6 ± 1.2 (1.5–1.7)	< 0.0001
	AQLQ score (week 24) (*N* = 495)	5.9 ± 1.0 (5.8–6.0)	2.5 ± 1.2 (2.4–2.6)	< 0.0001
	p-value (ANOVA)^	< 0.0001	NA	NA
Formoflo DPI	AQLQ score (baseline) (*N* = 272)	3.5 ± 0.9 (3.4–3.6)	NA	NA
	AQLQ score (week 12) (*N* = 272)	5.2 ± 1.5 (5.1–5.4)	1.8 ± 1.2 (1.6–1.9)	< 0.0001
	AQLQ score (week 24) (*N* = 268)	6.1 ± 1.2 (5.9–6.2)	2.6 ± 1.2 (2.5–2.8)	< 0.0001
	p-value (ANOVA)^	< 0.0001	NA	NA
Formoflo MDI	AQLQ score (baseline) (*N* = 231)	3.5 ± 1.0 (3.3–3.6)	NA	NA
	AQLQ score (week 12) (*N* = 231)	4.9 ± 0.8 (4.8–5.0)	1.5 ± 1.1 (1.3–1.6)	< 0.0001
	AQLQ score (week 24) (*N* = 227)	5.8 ± 0.8 (5.7–5.9)	2.3 ± 1.2 (2.2–2.5)	< 0.0001
	p-value (ANOVA)^	< 0.0001	NA	NA

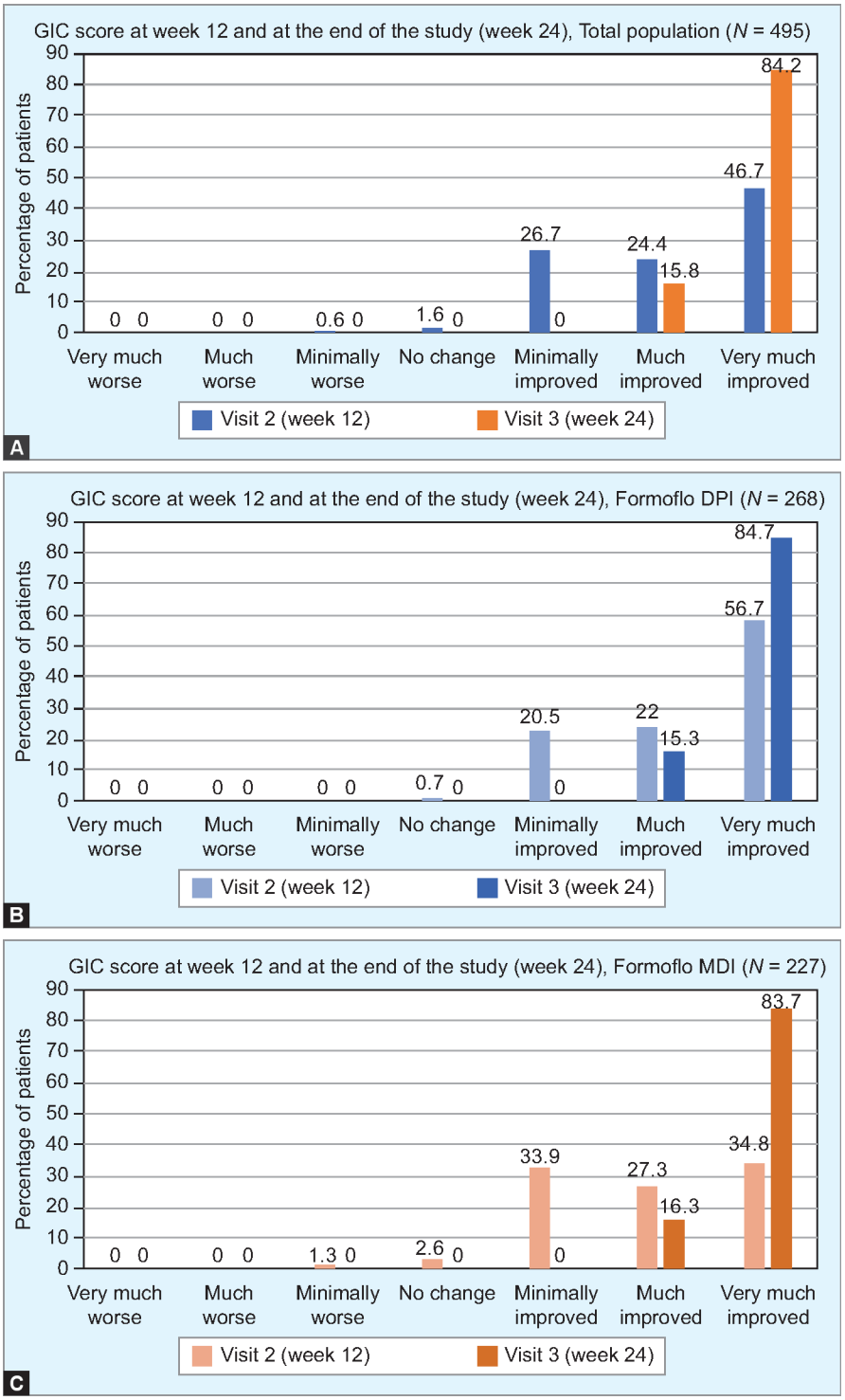
^*p*-value based on mixed model ANOVA; **p*—as compared to baseline (based on Dunnett's multiple comparisons test)

GIC Score Reported by Patients

The GIC score at week 12 and at the end of the study (week 24) from baseline is depicted in Figure 2A. The GIC scores from the total population of 495 patients indicated that at the end of week 12, 0.6% of patients reported "minimal worsening", 1.6% reported "no change", 26.7% reported "minimal improvement", 24.4% reported "much improvement", and 46.7% reported "very much improvement". At the end of week 24, 15.8% of patients reported "much improvement", and 84.2% reported "very much improvement".

The results for patients receiving Formoflo DPI, as depicted in Figure 2B, showed that 0.7% of patients reported "no change", 20.5% experienced "minimal improvement", 22.0% were "much improved", and 56.7% were "very much improved" by the end of week 12. At the end of week 24, 15.3% reported being "much improved", and 84.7% reported being "very much improved". Similarly, for patients receiving Formoflo MDI (Fig. 2C), 1.3% reported "minimal worsening", 2.6% reported "no change", 33.9% experienced "minimal improvement", 27.3% were "much improved", and 34.8% were "very much improved" at week 12, while at the end of week 24, 16.3% reported being "much improved", and 83.7% reported being "very much improved". The GIC analysis indicates that both Formoflo DPI and Formoflo MDI resulted in marked improvement at the end of week 24, with the majority of patients reporting being "very much improved".

At the end of the study (week 24), the physician's global assessment of efficacy showed that, out of 495 patients (Fig. 3A), 388 (78.4%) were rated as having "excellent" control (ACT score > 20), 79 (16.0%) as "good" (ACT score 16–20), and 28 (5.7%) as "fair" (improvement with an ACT score ≤ 15), with no patients rated as "poor" (0%). For the Formoflo DPI group (n = 268; Fig. 3B), physicians rated 203 patients (75.7%) as "excellent," 49 (18.3%) as "good," and 16 (6.0%) as "fair." In the Formoflo MDI group (n = 227; Fig. 3C), 185 patients (81.5%) were rated as "excellent," 30 (13.2%) as "good," and 12 (5.3%) as "fair." Both groups showed high efficacy, with a nearly equivalent proportion of "excellent" control reported between the Formoflo MDI and DPI groups.



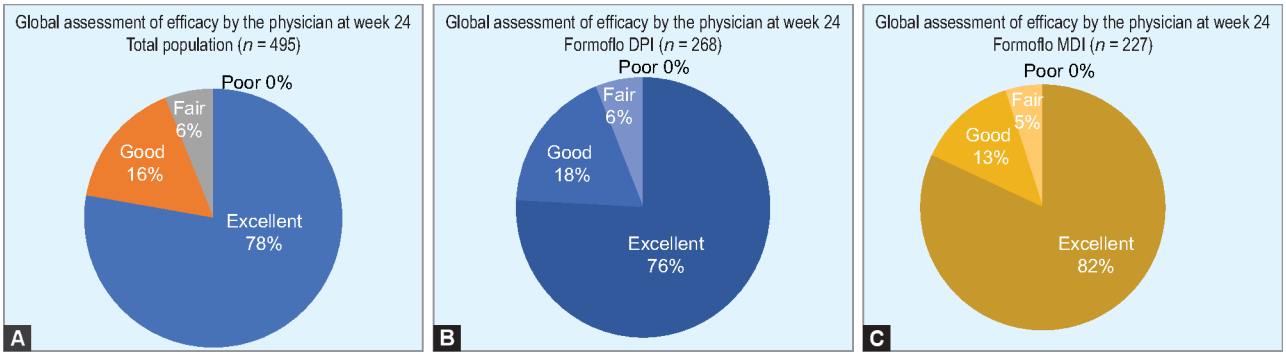
Figs 2A to C: (A) GIC score at week 12 and 24 (end of study)—total population (N = 495); (B) GIC score at week 12 and 24 (end of study)—Formoflo DPI (N = 268); (C) GIC score at week 12 and 24 (end of study)—Formoflo MDI (N = 227)

Safety Evaluation

Figure 4 provides a listing of all AEs reported during the study. A total of 35 AEs were recorded in 35 patients (7.0% of the study population). Of these, 33 were mild (grade I) in severity, while two were of moderate severity. Additionally, two nonsevere exacerbations were observed in patients of the Formoflo MDI group, both of which were determined to be unrelated to the study drug and resolved completely. All other AEs resolved completely, with or without the need for treatment. There were no fatalities during the study, and no patients exhibited any clinically significant alterations in vital signs, systemic examinations, or laboratory parameters throughout the entire study. Furthermore, no pneumonia cases or SAEs were reported during the study period.

Discussion

Asthma contributes to 27.9% of DALYs within the Indian population, with an associated mortality rate of 13.2 per thousand deaths



Figs 3A to C: (A) Global assessment of efficacy by the physician at week 24 (total population, *N* = 495); (B) global assessment of efficacy by the physician at week 24 (Formoflo DPI, *N* = 268); (C) global assessment of efficacy by the physician at week 24 (Formoflo MDI, *N* = 227)

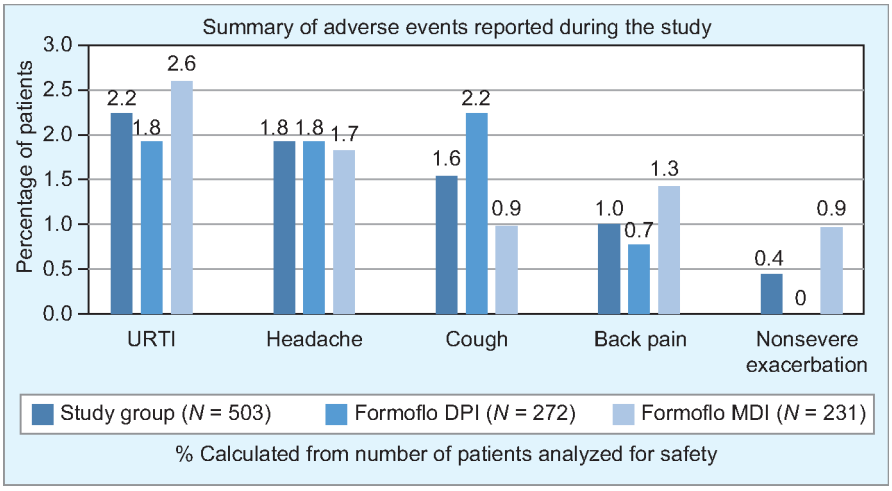


Fig. 4: Summary of adverse events reported during the study

in the country.[4,31] The SWORD survey further highlights suboptimal asthma management in India, with only 53.8% of patients using inhalers, while the rest of the patients relied on oral medications or remained untreated. Among inhaler users, 41.7% received ICS. Although treatment guidelines are available, only 41.3% of patients with poorly controlled asthma and 52.9% of those with a history of hospitalization receive appropriate therapy, highlighting a persistent gap in asthma management.[6] These highlight the need for modification and optimization of asthma treatment strategies in India to improve patient outcomes. While various international studies have examined formoterol fumarate and fluticasone propionate combination, comprehensive data on its use as a first-line therapy in Indian asthma patients remains limited. This real-world evidence study, AFFIRM, evaluated the effectiveness and safety of formoterol fumarate (6 µg) and fluticasone propionate (250 µg) combination, administered through DPI or MDI, in patients with asthma.

The 2024 GINA guidelines (Global Initiative for Asthma) represent a significant advancement in asthma management, emphasizing the need for control-based treatment strategies across various levels of disease severity. The recommendation to use a combination of ICS and LABA, reflects a strategy aimed at addressing both symptom control and long-term risk mitigation across all severity levels of asthma. In asthma management across all treatment steps, the use of ICS-formoterol as both maintenance and reliever therapy is recommended due to its proven efficacy in lowering hospitalization rates and improving patients' quality of life. Given the persistently high burden of asthma-related morbidity and mortality in India, the incorporation of evidence-based, guideline-recommended therapies is crucial for enhancing clinical outcomes in affected patients.[7,13] A recent study by Salvi et al. revealed that India utilizes less than 10% of the required ICS for its estimated 34.2 million asthma patients, contributing to high asthma mortality rates, and emphasized that improving ICS usage could reduce asthma-related deaths by 50%.[32] Thus, implementing the ICS-LABA combination (fluticasone and formoterol) could significantly improve asthma management in India by enhancing symptom control, reducing exacerbations, and potentially lowering asthma-related mortality.

Numerous studies have demonstrated improved lung function with the utilization of the formoterol/fluticasone combination in asthma management.[33–35] Rattu et al. conducted a randomized, open-label, prospective, parallel-group study to assess the effectiveness of two inhalation therapies in 80 bronchial asthma patients over 8 weeks. Group A was treated with formoterol and fluticasone (6/125 µg) twice daily, while group B received salmeterol and fluticasone (50/125 µg) twice daily. In group A, a significant increase in FEV_1 was observed, from 1.34 ± 0.11 to 1.50 ± 0.12 L ($p < 0.001$), along with an improvement in FVC from 2.39 ± 0.15 to 2.48 ± 0.19 L ($p < 0.001$). Similarly, group B demonstrated a significant rise in FEV_1 from 1.36 ± 0.12 to 1.48 ± 0.13 L ($p < 0.001$) and FVC from 2.40 ± 0.15 to 2.49 ± 0.16 L ($p < 0.001$).[36] The current study results align with these findings, further supporting the effectiveness of the formoterol fumarate and fluticasone propionate combination in enhancing lung function in asthma patients.

The combination of formoterol fumarate and fluticasone propionate has been evaluated in several other studies, demonstrating significant enhancement in asthma control and improving the quality of life of asthma patients.[37,38] Ghoshal et al. conducted an observational clinical study of 24-week in persistent asthma patients showed a mean ACT™ score improvement from 14.9 ± 3.26 at baseline to 21.6 ± 2.75, with 80.7% of patients achieving ACT™ score ≥20 by the end of the clinical study (week 24). The findings of the current study are consistent with these results, further supporting the effectiveness of formoterol fumarate and fluticasone propionate combination in enhancing asthma control. This study also highlighted a favorable safety profile for fluticasone/formoterol, reporting AEs in 6.7% of patients, none fatal, and a single nondrug-related SAE. The current study

results align with these findings, confirming a better safety profile with 7.0% mild, fully resolved AEs, no SAEs or fatalities, and no clinical significant changes in laboratory parameters or vital signs, which further support the tolerability of the combination of formoterol fumarate and fluticasone propionate.[39] Further supporting these findings, a 12-month observational study by Backer et al. conducted an evaluation of asthma outpatients who were treated with the fluticasone/formoterol combination therapy as per approved clinical indications. Among the 2116 patients, 83.3% maintained a stable dosage, with 4.8% on a low dose (50/5 µg, two puffs BD), 48.0% on a medium dose (125/5 µg, two puffs BD), and 30.6% on a high dose (250/10 µg, two puffs BD). The mean ACT™ score, which assesses asthma control, increased from 16.3 (4.8) at baseline to 20.4 (4.3) by the end of the study. The percentage of patients attaining well-controlled asthma, defined as an ACT™ score of ≥ 20, rose from 29.4 to 67.4%. Improvements in lung function were noted as well, with the mean FEV_1 increasing from 2.58 to 2.72 L and the mean FVC from 3.32 to 3.43L. The mean AQLQ score improved from 4.7 (1.2) to 5.6 (1.1).[35] The current study further supports the efficacy of the formoterol fumarate and fluticasone propionate combination in improving asthma control and pulmonary function, aligning with previously reported findings.

The findings of the current study demonstrate a strong alignment between patient-reported GIC, with 84.2% of patients reporting "very much improved", and the physician's global assessment of efficacy, with 78.4% of patients achieving "excellent" control, highlighting the significant clinical effectiveness of the treatment at the end of the study (week 24). In addition, DPIs were identified as a preferred alternative to MDIs, possibly due to their ease of use, eliminating the need for inhalation-actuation coordination, and their lack of chlorofluorocarbon propellants, along with potential cost-effectiveness advantages.[40–42] The study further demonstrated that the DPI formulation produced a marginally greater improvement in efficacy outcomes compared to MDI; however, both formulations were equally effective and safe, aligning with findings from previous studies in real-world settings. Formoterol fluticasone combination has been evaluated with other ICS/LABA combinations in asthma in systematic reviews and reviews, which have placed the combination of formoterol fluticasone as an upfront option.[43,44] This combination has also been shown to have a very low tuberculosis risk.[45]

The study's multicentric, real-world design provided useful insights into the effectiveness and safety of the FDC of formoterol fumarate and fluticasone propionate in a diverse cohort of Indian asthma patients, demonstrating significant improvements in pulmonary function, asthma control, and quality of patients' life over a 24-week period while adhering to stringent ethical standards. It offers crucial real-world evidence for Indian pulmonologists, addressing longstanding data gaps in asthma management specific to Indian patients. By bridging these gaps with region-specific findings, the study supports evidence-based, guideline-aligned therapies to optimize asthma outcomes and reduce the disease burden in India. However, the open-label study design may introduce potential bias in patient behavior and adherence due to the lack of blinding between DPI and MDI treatment types, despite the use of spirometry measures to minimize such bias. Additionally, the exclusion of severe asthma patients limits the applicability of these findings to populations with more severe disease, especially in the context of management of chronic asthma. Therefore, further studies including severe asthma patients are necessary to fully evaluate the long-term effectiveness and safety of the FDC of formoterol fumarate and fluticasone propionate, especially under more severe clinical conditions.

Conclusion

The AFFIRM study is the first real-world Indian study to evaluate change in trough FEV1 (from baseline) as a primary endpoint in asthmatics with FDC therapy of formoterol fumarate and fluticasone propionate. The findings of this study indicate that the FDC of formoterol fumarate and fluticasone propionate, administered via DPI or MDI, significantly improves lung functions, asthma control, and health-related quality of life in Indian patients with asthma, demonstrating a safety profile consistent with existing international literature. The findings are in favor of using formoterol fluticasone combinations as an effective first-line therapy in Indian asthma patients.

Orcid

Shital Patil https://orcid.org/0000-0003-0502-5904
Ronak Panwala https://orcid.org/0009-0003-0297-0975
Kundan Nivangune https://orcid.org/0000-0001-8360-9900
Kamlesh Patel https://orcid.org/0009-0003-3084-6306

References

1. Goldin J, Hashmi MF, Cataletto ME. Asthma. Treasure Island (FL): StatPearls Publishing; 2024.
2. World Health Organization. (2024). Asthma. [online] Available from: https://www.who.int/news-room/fact-sheets/detail/asthma. [Last accessed October, 2025]
3. GBD 2019 Diseases and Injuries Collaborators Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet 2020;396(10258):1204–1222.
4. Singh S, Salvi S, Mangal DK, et al. Prevalence, time trends and treatment practices of asthma in India: the Global Asthma Network study. ERJ Open Res 2022;8(2):528–2021.
5. Salvi S. Letter from India. Respirology 2018;23(11):1074–1075.
6. Singh S, Sharma BB, Sharma AK, et al. Assessment of obstructive airway disease in the multicenter SWORD survey in India. Lung India 2024;41(5):335–344.
7. Swarnakar R, Dhar R. Call to action: addressing asthma diagnosis and treatment gaps in India. Lung India 2024;41(3):209–216.
8. McCracken JL, Veeranki SP, Ameredes BT, et al. Diagnosis and management of asthma in adults: a review. JAMA 2017;318(3):279–290.
9. National Heart, Lung, and Blood Institute. Global initiative for asthma: global strategy for asthma management and prevention. NHLBI/WHO Workshop Report. NHLBI Publication; 1995.
10. Aalbers R, Vogelmeier C, Kuna P. Achieving asthma control with ICS/LABA: a review of strategies for asthma management and prevention. Respir Med 2016;111:1–7.
11. Beasley RW, Donohue JF, Mehta R, et al. Effect of once-daily indacaterol maleate/mometasone furoate on exacerbation risk in adolescent and adult asthma: a double-blind randomised controlled trial. BMJ Open 2015;5(2):e006131.
12. Rajesh V, Augustine J, Divya R, et al. Inhaled formoterol-fluticasone single inhaler therapy in asthma: real-world efficacy, budget impact, and potential to improve adherence. Can Respir J 2020;2020:8631316.
13. Global Initiative for Asthma. (2024). 2024 GINA Main Report. [online] Available from: https://ginasthma.org/2024-report/ [Last accessed October, 2025]
14. Staresinic AG, Sorkness CA. Fluticasone propionate: a potent inhaled corticosteroid for the treatment of asthma. Expert Opin Pharmacother 2000;1(6):1227–1244.
15. Kelly HW. Establishing a therapeutic index for the inhaled corticosteroids: part I. Pharmacokinetic/pharmacodynamic comparison of the inhaled corticosteroids. J Allergy Clin Immunol 1998;102(4 Pt 2):S36–S51.
16. Remien K, Patel P, Bowman A. Fluticasone. Treasure Island (FL): StatPearls Publishing; 2024.
17. Adams NP, Bestall JC, Lasserson TJ, et al. Fluticasone versus placebo for chronic asthma in adults and children. Cochrane Database Syst Rev 2008;(4):CD003135.
18. Palmqvist M, Arvidsson P, Beckman O, et al. Onset of bronchodilation of budesonide/formoterol vs salmeterol/fluticasone in single inhalers. Pulm Pharmacol Ther 2001;14(1):29–34.
19. Politiek MJ, Boorsma M, Aalbers R. Comparison of formoterol, salbutamol and salmeterol in methacholine-induced severe bronchoconstriction. Eur Respir J 1999;13(5):988–992.
20. Lötvall J, Ankerst J. Long duration of airway but not systemic effects of inhaled formoterol in asthmatic patients. Respir Med 2008;102(3):449–456.
21. Berger WE. The use of inhaled formoterol in the treatment of asthma. Ann Allergy Asthma Immunol 2006;97(1):24–33.
22. Papi A, Qasuri M, Chung E, et al. Fixed-dose combination fluticasone/formoterol for asthma treatment in a real-world setting: meta-analysis of

exacerbation rates and asthma control. Eur Clin Respir J 2023;10(1):2174642.
23. Bodzenta-Lukaszyk A, Dymek A, McAulay K, et al. Fluticasone/formoterol combination therapy is as effective as fluticasone/salmeterol in the treatment of asthma, but has a more rapid onset of action: an open-label, randomized study. BMC Pulm Med 2011;11:28.
24. Nathan RA, D'Urzo A, Blazhko V, et al. Safety and efficacy of fluticasone/formoterol combination therapy in adolescent and adult patients with mild-to-moderate asthma: a randomised controlled trial. BMC Pulm Med 2012;12:67.
25. Tanninen TH, Pelkonen AS, Malmberg LP, et al. Effect of fluticasone propionate/formoterol and fluticasone furoate/vilanterol on adolescents with chronic bronchial obstruction. J Allergy Clin Immunol Glob 2024;3(3):100268.
26. Gurková E, Popelková P. Validity of asthma control test in assessing asthma control in Czech outpatient setting. Cent Eur J Public Health 2015;23(4):286–291.
27. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention 2025. Available from: https://ginasthma.org/.
28. Nathan RA, Sorkness CA, Kosinski M, et al. Development of the asthma control test: a survey for assessing asthma control. J Allergy Clin Immunol 2004;113(1):59–65.
29. Juniper EF, Guyatt GH, Epstein RS, et al. Evaluation of impairment of health related quality of life in asthma: development of a questionnaire for use in clinical trials. Thorax 1992;47(2):76–83.
30. Juniper EF, Guyatt GH, Willan A, et al. Determining a minimal important change in a disease-specific quality of life questionnaire. J Clin Epidemiol 1994;47(1):81–87.
31. Institute for Health Metrics and Evaluation. (2021). GBD Compare. [online] Available from: http://vizhub.healthdata.org/gbd-compare. [Last accessed October, 2025]
32. Salvi S, Madas S, Ghorpade D, et al. Is underuse of inhaled corticosteroids for asthma in India contributing to 42% of global asthma deaths? Lung India 2022;39(4):331–336.
33. Płoszczuk A, Bosheva M, Spooner K, et al. Efficacy and safety of fluticasone propionate/formoterol fumarate in pediatric asthma patients: a randomized controlled trial. Ther Adv Respir Dis 2018;12:1753466618777924.
34. Pertseva T, Dissanayake S, Kaiser K. Superiority of fluticasone propionate/formoterol fumarate versus fluticasone propionate alone in patients with moderate-to-severe asthma: a randomised controlled trial. Curr Med Res Opin 2013;29(10):1357–1369.
35. Backer V, Ellery A, Borzova S, et al. Non-interventional study of the safety and effectiveness of fluticasone propionate/formoterol fumarate in real-world asthma management. Ther Adv Respir Dis 2018;12:1753466618796987.
36. Rattu A, Kaur I, Goel A, et al. The comparison of clinical efficacy of formoterol and fluticasone versus salmeterol and fluticasone in patients of bronchial asthma. Int J Basic Clin Pharmacol 2018;7(5):947–951.
37. Bodzenta-Lukaszyk A, van Noord J, Schröder-Babo W, et al. Efficacy and safety profile of fluticasone/formoterol combination therapy compared to its individual components administered concurrently in asthma: a randomised controlled trial. Curr Med Res Opin 2013;29(5):579–588.
38. Bodzenta-Lukaszyk A, Pulka G, Dymek A, et al. Efficacy and safety of fluticasone and formoterol in a single pressurized metered dose inhaler. Respir Med 2011;105(5):674–682.
39. Ghoshal A, Waghray P, Dsouza G, et al. Real-world evaluation of the clinical safety and efficacy of fluticasone/formoterol FDC via the Revolizer® in patients with persistent asthma in India. Pulm Pharmacol Ther 2020;60:101869.
40. Liljas B, Ståhl E, Pauwels RA. Cost-effectiveness analysis of a dry powder inhaler (Turbuhaler) versus a pressurised metered dose inhaler in patients with asthma. Pharmacoeconomics 1997;12(2):267–277.
41. Atkins PJ. Dry powder inhalers: an overview. Respir Care 2005;50(10):1304–1312.
42. Selroos O. Dry-powder inhalers in acute asthma. Ther Deliv 2014;5(1):69–81.
43. Venkitakrishnan R, Thomas PK, Bansal A, et al. Fluticasone/formoterol compared with other ICS/LABAs in asthma: a systematic review. J Asthma 2022;59(6):1221–1230.
44. Venkitakrishnan R, Augustine J. Inhaled steroid—long acting beta two agonist (ICS-LABA) combinations in asthma: are all formulations the same? Indian J Tuberc 2022;69(2):125–127.
45. Venkitakrishnan R, Ramachandran D, Augustine J, et al. Inhaled corticosteroids and risk of tuberculosis—how bad is the risk? Indian J Tuberc 2022;69(2):128–130.