

## Original Research Article



## Comparative study between MDI vs DPI and its limitation: Bangladesh Perspective

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**Abstract: Background:** Effective use of inhaler devices is critical for asthma and COPD management. However, improper usage can hinder treatment efficacy and patient outcomes. **Objective:** This study aims to compare the efficacy, safety, and limitations of metered-dose inhalers (MDI) and dry powder inhalers (DPI) in adult patients with moderate-to-severe asthma. **Method:** A randomized, open-label, parallel-designed trial was conducted at a tertiary medical hospital from January 2021 to January 2022. Two hundred adult patients were divided into MDI (n=100) and DPI (n=100) groups. Patient demographics, inhaler technique, asthma control, and adverse events were recorded and analyzed. **Results:** The majority of patients (65%) were aged 26–33 years, and 50% had asthma. In the DPI group, 40% exhaled before taking a dose, 86% tilted their head during use, 100% loaded the dose, 21% held their breath after inhalation, 98% exhaled correctly, 51% waited 1 minute between doses, and 47% gargled after corticosteroid inhalation. For the MDI group, 30% exhaled before dosing, 81% tilted their head, none loaded a dose, 50% held their breath, 92% exhaled correctly, 49% waited 1 minute, and 53% gargled. Asthma exacerbations requiring hospitalization or emergency visits were 3% in the MDI group and 4% in the DPI group. Adverse events included nasopharyngitis (MDI: 9%, DPI: 6.2%), bronchitis (MDI: 6%, DPI: 6.3%), and headaches (MDI: 3%, DPI: 6%). **Conclusion:** Patients using DPIs demonstrated better administration techniques and outcomes, but many lacked adequate device education. Improving education on proper inhaler use is essential for optimizing asthma management.

**Keywords:** Asthma, Metered-dose inhalers (MDI), Dry Powder Inhalers Are Now Available For ICS-LABA Combo Treatment (DPI).

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## Introduction

Although the prevalence of asthma in older persons ranges from 6% to 10%, it is typically more difficult for them to obtain asthma control than for younger asthmatics. With an aging population, adequate care of elderly asthmatics has emerged as a growing problem. At the age of 40, aging is related with a decrease in small airway widths, which

contributes to a drop in expiratory flow rate.<sup>1-3</sup> Age-related structural changes in the respiratory system increase closure volume, increasing the likelihood of small airway dysfunction.<sup>4-5</sup> Aging and asthma duration have been shown to be risk factors for poorly managed asthma, contributing to alterations in small airways in older asthma patients.

Metered-dose inhalers (MDI) and dry powder inhalers are now available for ICS-LABA combo treatment (DPI). MDI needs inhalation and device activation to be coordinated, DPI depends only on the subject's quick and forced inhaling. DPI is acceptable for people who can create adequate inspiratory airflow to activate the drug; however, this inhaler is not good for elderly patients or those with significant airflow restriction. Because tiny airways are significant sites of inflammation, the ideal aerosol size and spray impact force of p-MDI lead to increases in total lung deposition and peripheral airway penetration, which would be useful for older patients with longer durations of asthma.<sup>6-8</sup> In this study our main goal is to compare the efficacy of MDI vs DPI and its limitation. To compare the efficacy of MDI vs DPI and its limitation.

### Methodology

This randomized, open-label, parallel-designed trial was carried out at tertiary medical hospital from January 2021 to January 2022. Where a total of 200 adult patients with moderate-to-severe asthma, and compared the efficacy and safety for asthma control between the 2 groups (MDI, n=100, DPI, n=100) Subgroup analyses on disease duration and air trapping were performed. Clinical parameters, including changes in lung function parameters, inhaler technique and adherence, were compared with monitoring adverse reactions between the 2 groups. All collected data were coding and input in SPSS-25 for further analysis. Both descriptive and inferential statistics done. Descriptive statistics included frequency distribution, percent, mean, standard deviation; graph, tables, figures and inferential statistics.

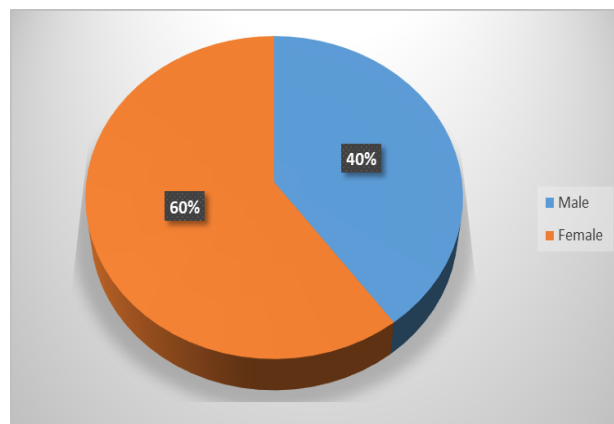
### Results

In table-1 shows age distribution of the study group where majority were belonging to 26-33 years age group, 65%. Followed by 25% belong to 18-25 years group and 10% belong to 34-39 years age group. The following table is given below in detail:

**Table 1: Age distribution of the patients**

Age group	%
18-25 years	25%
26-33 years	65%
34-39 years	10%

In figure 1 shows gender distribution where 60% were female and 40% were male. The following figure is given below in detail:



**Figure 1: Gender Distribution of the study group**

In table 2 shows clinical status of the study group where majority had asthma, 50%. Followed by 35% had diagnosis of pulmonary diseases by the age of 1-5 years and 50% cases had moderate level of pulmonary conditions. The following table is given below in detail:

**Table 2: Clinical status of the study group**

Clinical status	%
<b>Primary pulmonary diagnosis:</b>	
Asthma	45%
Chronic obstructive pulmonary disease	50%
Other pulmonary diseases	5%
<b>Time of diagnosis</b>	
< 1 month	10%
month to 1 years	26%
1-5 years	35%
6-10 years	20%
>6 years	9%
<b>Patient-perceived severity of pulmonary disease</b>	
Mild	30%
Moderate	50%
Severe	20%

In table-3 shows distribution of the study group according to administration techniques where in DPIs group 40% exhaling before taking the dose, followed by 86% cases were tilting the head while using the inhaler, all cases loading the dose, 21% cases holding breath after taking the dose, 98%

cases were type of exhaling after inhaling the dose, 51% cases waiting around 1 minute between two consecutive inhalations, 47% cases were gargling after taking a corticosteroid inhalation. Whereas in MDIs groups 30% exhaling before taking the dose, followed by 81% cases were tilting the head while using the inhaler, no cases loading the dose, 50% cases holding breath after taking the dose, 92% cases were type of exhaling after inhaling the dose, 49% cases waiting around 1 minute between two consecutive inhalations, 53% cases were gargling after taking a corticosteroid inhalation. The following table is given below in detail:

**Table-3: Distribution of the study group according to administration techniques**

Administration techniques	DPI, %	MDI, %	P value
Priming the inhaler	0	20%	-
shaking the inhaler	0	25%	-
exhaling before taking the dose	40%	30%	0.06
tilting the head while using the inhaler	86%	81%	0.5
loading the dose	100%	0%	
holding breath after taking the dose	21%	50%	0.01
type of exhaling after inhaling the dose	98%	92%	0.1
waiting around 1 minute between two consecutive inhalations	51%	49%	0.08
gargling after taking a corticosteroid inhalation	47%	53%	0.2

In table 4 shows distribution of the study group according to CT score and asthma exacerbation where during the study period, there were no significant differences in mean ACT scores between the p-MDI and DPI groups (20.3 vs. 21.4 in week 4, 20.0 vs. 21.4 in week 8, and 20.7 vs. 22.0 in week 12, respectively). Whereas in MDIs group proportion of patients without asthma exacerbations was 62% and asthma exacerbations in hospitalization or an emergency department visit during the 12-week

3%. Whereas in DPIs group proportion of patients without asthma exacerbations was 80% and asthma exacerbations in hospitalization or an emergency department visit during the 12-week 4%. The following table is given below in detail:

**Table 4: Distribution of the study group according to CT score and asthma exacerbation**

Variable	MDI	DPI	P value
ACT score	20.6 ± 2.7	25.2 ± 2.3	0.34
proportion of patients without asthma exacerbations	62%	80%	0.12
asthma exacerbations in hospitalization or an emergency department visit during the 12-week	3%	4%	0.54

In table-5 shows side effects of treatments where in MDIs group 9% had Nasopharyngitis followed by 6% had bronchitis, 3% had headache where as in DPIs group 6.2% had Nasopharyngitis followed by 6.3% had bronchitis, 2% had rhinitis, 6% had headache. The following table is given below in detail:

**Table-5: Side effects of treatments**

Patients with at least on adverse events	MDI, %	DPI, %
Nasopharyngitis	9	6.2
Bronchitis	6	6.3
Rhinitis	0	2
Headache	3	6

### Discussion

In our case, majority had asthma, 50%. Followed by 35% had diagnosis of pulmonary diseases by the age of 1-5 years and 50% cases had moderate level of pulmonary conditions. Which was similar to other study where majority had asthma, 60%? Followed by 25% had diagnosis of pulmonary diseases by the age of 1-5 years and 15% cases had moderate level of pulmonary conditions.<sup>9</sup> In one study A higher percentage of DPI users (87.3%) found the devices easy to use compared to 56.7% of the MDI users group who said their devices are easy to use (p = 0.001, RR: 2.031, 95% CI: 1.187–3.453). The majority of DPI users (94.8%) found it

easy to inhale the dose vs. 53.6% of MDI users ( $p = 0.001$ , RR: 2.321, 95% CI: 1.075–3.835). Most of MDI users (81.4%) found difficulty in coordinating between pressing the canister and inhaling, whereas 15.8 and 23.7% of DPI users, respectively, considered loading the dose or loading the capsule inside the device (for DPIs) and holding the breath after taking the dose as the most difficult steps. Out of 246 patients of both groups, 109 patients (44.31%) mentioned that they did not receive the required education or counseling from the healthcare professionals (pharmacists or physicians) about the devices. When asked how comfortable would you feel using an inhaler without counseling, 48.47% of DPI users and 41.51% of MDI users, respectively, answered as relatively comfortable.<sup>10</sup> Which was similar to other studies too.<sup>11-13</sup>

Besides that, it was quite similar to our study where in DPIs group 40% exhaling before taking the dose, followed by 86% cases were tilting the head while using the inhaler, all cases loading the dose, 21% cases holding breath after taking the dose, 98% cases were type of exhaling after inhaling the dose, 51% cases waiting around 1 minute between two consecutive inhalations, 47% cases were gargling after taking a corticosteroid inhalation. Whereas in MDIs groups 30% exhaling before taking the dose, followed by 81% cases were tilting the head while using the inhaler, no cases loading the dose, 50% cases holding breath after taking the dose, 92% cases were type of exhaling after inhaling the dose, 49% cases waiting around 1 minute between two consecutive inhalations, 53% cases were gargling after taking a corticosteroid inhalation. In one study MDIs group 10% had Nasopharyngitis followed by 5% had bronchitis, 10% had headache where as in DPIs group 7% had Nasopharyngitis followed by 4% had bronchitis, 3% had rhinitis, 6% had headache.<sup>14</sup> which was supported by our study where MDIs group 9% had Nasopharyngitis followed by 6% had bronchitis, 3% had headache where as in DPIs group 6.2% had Nasopharyngitis followed by 6.3% had bronchitis, 2% had rhinitis, 6% had headache.

## Conclusion

In this study found that a large proportion of adult patients with COPD/asthma in the Lebanese population do not take MDIs/DPIs effectively. However, patients who used DPIs had

considerably better administration method. It also revealed that a substantial number of patients were not obtaining the necessary device education. As a result, it is critical for healthcare practitioners to properly teach their patients in order to reap the most advantages from the devices and avoid exacerbations and worsening of symptoms.

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