RESEARCH ARTICLE

Effect of Inhaler Technique Health Education in Improving Symptoms and Lung Function in COPD Outpatient in a Private Hospital in Gresik, Indonesia: Pilot Studies

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ABSTRACT

Inhalers are the most effective therapy in the treatment of Chronic obstructive pulmonary disease (COPD). Research shows that a large number of COPD patients do not use inhalers properly. Incorrect inhaler use technique can reduce drug delivery and poor disease control. Education on how to use inhalers is an important part of COPD management. The study was conducted to determine the effect of education on symptom assessment, lung function assessment and inhaler use skill assessment in COPD patients. The research was in the form of a pre-experimental one-group pre-test post-test. The results showed that there was a significant difference in the effect of education on how to use the inhaler on the assessment of symptoms ($p = 0.000$), a significant difference in the assessment of lung function ($p = 0.001$) and a significant difference in the assessment of skills in using the inhaler ($p = 0.000$). Education on how to use inhalers has an influence on the assessment of symptoms, lung function and skills in using inhalers in COPD patients.

Keywords: COPD, inhaler, CAT, FEV1/FVC ratio.

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD), the frequently fatal pathology of the respiratory tract, accounts for half a billion cases globally. COPD is a major global health problem and has an impact on increasing health costs and decreasing productivity. COPD is the third leading cause of death worldwide, after ischemic heart disease and neoplasms.[1,2] In Indonesia, the prevalence in 2011 was 5.6% or around 9.2 million people.[3] COPD is defined as a common preventable and treatable disease characterized by persistent respiratory symptoms and airflow limitation caused by airway or alveolar abnormalities and caused by noxious particles or gases. Symptoms are characterized by tightness, coughing and/or phlegm.[4-7] The goal of COPD treatment is to reduce symptoms, reduce the frequency and severity of exacerbations, improve and prevent decreased lung function and improve the patient's quality of life.[8-10]

Inhalation therapy is the most effective therapy in the treatment of COPD. The advantage of this inhalation is that the drug is delivered directly into the breath, high local concentrations can be achieved and minimize the risk of systemic side effects.[11-13] However, the use of inhalers must have skills that are learned and maintained for the drugs administered to be effective. Various types of inhalers available on the market have different usage techniques which can result in the risk of errors in use. Research shows that as many as 50 to 80% of patients do not use inhalers properly.[14,15] Incorrect inhaler use technique is associated with reduced drug delivery and poor disease control.[16,17] In a study conducted by Gregoriano *et al*., 2018,[14] on 165 asthma and COPD patients in Switzerland. This study analyzes the technique of using inhalers, which is associated with the control of disease symptoms and lung function. The result was that COPD patients with the wrong inhaler technique resulted in a higher COPD assessment test (CAT) score ($p = 0.02$), more often suffered from coughing ($p = 0.03$) and experienced shortness of breath when walking uphill or climbing stairs ($p = 0.02$) and COPD patients with the correct inhaler technique had

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significantly better lung function values (FEV1%) ($p = 0.04$).[14]

Symptom assessment can use the COPD CAT questionnaire. The CAT score was developed to measure the impact of COPD on health-related quality of life and to aid patient and healthcare provider communication. The CAT score also correlates closely with health status as measured using the St. George's respiratory questionnaire (SGRQ) questionnaire and is reliable and responsive to treatment.[18-21] The most ideal pulmonary function examination is spirometry. Patients with COPD usually show a decrease in forced expiratory volume in 1-second (FEV1) and forced vital capacity (FVC). Extension of inflammation, fibrosis, and luminal exudate in the small airways is associated with a decrease in FEV1 and the FEV1/FVC ratio. It is possibly and related to an accelerated decline in the FEV1 characteristics of COPD.[22-24]

The level of knowledge and skills of COPD patients in using inhalers is a very important key to achieving therapeutic goals. Poor inhaler technique remains an important and multi-factorial problem that can stem from the device itself, the patient, the healthcare provider, technology, and policy.[25-27] Previous research by Yang *et al*.,[28] that incorrect inhalation technique often occurs in COPD patients. Up to 61.8% (55 of 89) of patients made at least one essential mistake in their inhalation technique. Also supported by another study by Çakmaklı *et al*.,[29] enrolled a total of 300 asthma/COPD patients, 70.2% used their inhaler drugs incorrectly. The most common mistake was 'failing to breath out before inhalation' for all types of devices (for MDI: 66.7%, and for DPI: 71.1–82.8%).

A low level of education is an important factor that influences the wrong technique of using inhalers. Inhaler use technique training resulted in a significant reduction in incorrect techniques for all inhaler devices.[30,31] Education is important in the long-term management of COPD.[32] Pharmacists in hospitals have the role of clinical pharmacy services, namely providing education to patients and/or their families. In this case, pharmacists have a role in providing education on correct inhaler technique skills.[33,34] Several studies have shown that educational interventions and reviews of inhaler use techniques have a positive impact on disease control. In a study by Hayoo *et al*.,[35] an evaluation was carried out of providing educational programs regarding how to use inhalers and COPD management in 127 patients in Korea. The result was that there was a significant improvement in the use of the inhaler after receiving education ($p < 0.05$) and the CAT scores were also significantly better (19.6 ± 12.5 *vs*. 15.1 ± 12.3). In a study conducted by Nguyen *et al*.,[36] on 211 COPD patients in Vietnam, an evaluation was carried out on training in the technique of using inhalers by pharmacists. The result was that there was a significant improvement in the technique of using inhalers after training compared to before training ($p = 0.05$). Education on how to use inhalers is an important part of the management of COPD patients so that they can improve better clinical outcomes.[37] Therefore, there was a need for research on providing education on how to use inhalers in COPD patients. This study aimed to analyze the effect of education on how to use inhalers in improving symptoms and lung function as well as technical skills in using inhalers in COPD patients. The education used an origami book on how to use inhalers by Lorensia *et al*.[34] with an educational method based on information-motivation-behavioral skills (IMB) to community pharmacists in conducting education on inhaler use techniques.

MATERIALS AND METHODS

Design Study

The design of this research is pre-experimental research in the form of a design of one group pre-post-test. This study was used to analyze the effect of education on how to use inhalers in improving symptoms and lung function as well as outpatient COPD inhaler use skills. The research was conducted at the pulmonary polyclinic at Hospital X in Gresik. Data collection was carried out from October 2019 to January 2020.

Research variable

The independent variable is the provision of education on how to use inhalers. The dependent variables were symptom assessment, pulmonary function assessment and inhaler use skills.

Population and Sample

The study population was patients with a diagnosis of COPD who used an inhaler at the pulmonary polyclinic at RS X in Gresik from October 2019 to January 2020. The study criteria included using an inhaler and being willing to be involved in the study. This sampling method was carried out using a purposive sampling method.

Method of Collecting and Analysis Data

The education referred to in this study is education on how to use inhalers. The educational material provided is using an educational smart book as an inhaler teaching aid (origami book) by Lorensia *et al*.[38] Provision of education was given in the early weeks of the study after the participants filled out an informed consent form and carried out a pre-test at the pulmonary polyclinic at Hospital X in Gresik. Providing this education takes ± 5 minutes.

Assessment of COPD symptoms

Symptom assessment is based on the CAT (COPD assessment test), namely, a measurement consisting of 8 questions to measure the decline in health status in COPD. The CAT has been used and translations have been validated around the world in multiple languages. CAT measurements were carried out during the pre-test (before education) and post-test (after education in the fourth week). Data analysis used the Wilcoxon signed ranks test with the data scale was ratio.

Lung function assessment

Pulmonary function measurements were carried out using spirometry during the pre-test and post-test. Data analysis used the Wilcoxon signed ranks test with the data scale ratio.

Inhaler use skills

Skills in the use of inhalers is the patient's ability to use inhalers. Measurements were made with a checklist form measuring tool during the pre-test and post-test. Each correct number gets a value of 1 and each wrong number gets a value of 0. The final result is the total score of the correct answers. Data analysis used the Friedman test with the data scale was a ratio.

RESULT

Characteristics of Research Participants

There were 42 COPD patients at the hospital. A total of 1 patient included exclusion criteria due to hearing limitations, and 3 patients included dropout criteria because the patient did not return to the hospital to continue the study. So that there were 38 patients who completed the study to the end. The basic characteristics of research participants can be seen in Table 1.

Effect of Education on Symptom Assessment

Assessment of symptoms in COPD patients was measured by the CAT before education (pre-test) and after four weeks of education (post-test). The CAT assessment consists of 8 questions with a score of 0 to 5 for each question (total scores range from 0–40). The total average value of the CAT at the pre-test was 17.26 ± 9.827 and after being given education (post-test), it was 10.82 ± 5.99. The pre-post CAT value decreased in symptoms in COPD patients by 6.44. The total CAT average value can be seen more clearly in Table 2.

The normality test with the Shapiro Wilk test using SPSS Statistics showed a pre-test (p = 0.150) and post-test (p = 0.009). Probability value <0.05 so it can be concluded that the data is not normally distributed. Comparative analysis of COPD patient symptom assessment using the Wilcoxon signed ranks test non-parametric test method obtained p = 0.000<0.05, so it can be concluded that there are differences in the symptom assessment of COPD patients before and after receiving education. The results of the CAT based on the incidence of acute exacerbations can be categorized into two groups, namely: mild (CAT value <10) and moderate-severe (CAT≥10 value).

Based on the results of the CAT, prior to education there were 28.95% of patients with mild symptoms and 71.05% of patients with moderate-severe symptoms. Meanwhile, after education, there were 36.8% of patients with mild symptoms and 63.2% of patients with moderate-severe symptoms (Table 3). The comparison test was carried out using the chi-square test and obtained p = 0.000 <0.05, so it can be concluded

Table 1: Basic characteristics of research participants

Characteristics		*Frequency (n = 38)*	*Percentage (%)*
Gender	Female	7	18.42
	Male	31	81.58
Age (year)	40–59	12	31.58
	60–74	22	57.89
	75–90	4	10.53
Level education	Elementary school	3	7.89
	Junior high school	5	13.16
	Senior high school	21	55.26
	Bachelor	9	23.68
Occupation	Employee civil servant	1	2.63
	Employee private	4	10.53
	Self-employed	10	26.32
	Other	23	60.53
GOLD criteria	GOLD 1 (mild) FEV1≥80% predicted	14	36.84
	GOLD 2 (moderate) 50%≤FEV1<80% predicted	9	23.68
	GOLD 3 (severe) 30%≤FEV1<50% predicted	9	23.68
	GOLD 4 (very severe) FEV1≤30% predicted	6	15.79
Smoking history	Yes	2	5.26
	No	16	42.11
	Ex-smoker	20	52.63
The type of inhaler used	Diskus® DPI	18	47.37
	Turbuhaler® DPI	20	52.63
Experience getting education on how to use inhalers	Yes	22	57.89
	No	16	42.11

Table 2: Changes in clinical symptoms, CAT values and lung function (FEV1/FVC ratio) with education

Variable	*Pre-test*		*Post-test*		Δ *(Pre-Post)*
	(Mean ± SD)	*Min-Max*	*(Mean ± SD)*	*Min-Max*	
CAT value	17.26 ± 9.827	2–37	10.82 ± 5.99	2–26	6.44
Symptom clinical					
Cough	2.45 ± 2.089	0–5	1.45 ± 1.446	0–4	1.00
Sputum	2.74 ± 2.226	0–5	1.29 ± 1.250	0–3	1.45
Chest tightness	2.00 ± 1.917	0–5	1.32 ± 1.338	0–4	0.68
Shortness of breath when climbing stairs	2.87 ± 1.877	0–5	1.79 ± 1.510	0–5	1.08
Limited activities at home	1.95 ± 1.627	0–5	1.18 ± 1.062	0–4	0.77
Worry about disease	1.39 ± 1.534	0–5	1.00 ± 0.986	0–4	0.39
Hard to sleep	2.08 ± 1.894	0–5	1.21 ± 1.379	0–4	0.87
Physical weakness	1.79 ± 1.119	0–4	1.32 ± 0.775	0–3	0.47
FEV1/FVC ratio (Liter)	1.28 ± 0.713	0.33–3.11	1.36 ± 0.722	0.35–3.14	0.08

Table 3: Categories of change in CAT scores with education

Category of CAT value	Pre-test		Post-test	
	Frequency (n = 38)	*Percentage (%)*	*Frequency (n = 38)*	*Percentage (%)*
CAT <10 (mild)	11	28.95	14	36.84
CAT ≥10 (moderate-severe)	27	71.05	24	63.16

Table 4: Average score comparison of Diskus® and Turbuhaler® Skills with education

Inhaler use skills	*Pre-test*	*Post-test*	
	(Mean ± SD)	*Post-test I (Mean ± SD)*	*Post-test II (Mean ± SD)*
Diskus®	6.89 ± 1.079	9.61 ± 0.502	9.72 ± 0.461
Turbuhaler®	5.25 ± 0.716	6.90 ± 0.308	6.85 ± 0.366

that there are differences in the assessment of symptoms of COPD patients before and after receiving education.

Effect of Education on Lung Function Assessment

Pulmonary function assessment in COPD patients using spirometry obtained forced expiratory volume in 1 second (FEV1) values measured before education (pre-test) and after four weeks of education (post-test). Based on Table 2 it showed that the FEV1 value tends to increase by 0.08 liters. The normality test with the Shapiro Wilk test using SPSS Statistics 20 shows ($p = 0.009$) for the pre-test and ($p = 0.008$) for the post-test. Probability value <0.05 so it can be concluded that the data is not normally distributed. Analysis to determine the effect of education on the FEV1 assessment before and after education was carried out using the Wilcoxon Signed Ranks non-parametric test. Based on the results of the Wilcoxon Signed Ranks non-parametric test, the value of $p = 0.001<0.05$, it can be concluded that there are differences in the assessment of lung function in COPD patients before and after receiving education.

The Influence of Education on Assessment of Inhaler Use Skills

Assessment of inhaler use skills using the Checklist form was measured before education (pre-test) and after education (post-test I) and four weeks after education (post-test II). The analysis was carried out on each type of inhaler used by the patient, namely Diskus® and Turbuhaler®.

Based on Table 4 shows that the average score for Diskus® skills had increased from pre-test to post-test I, which was 2.72 and from post-test I, it had also increased to post-test II, which was 0.11. The normality test with the Shapiro-Wilk test using SPSS Statistics showed a value of $p = 0.177$ (pre-test) and $p = 0.000$ (post-test I and post-test II). Probability $p <0.05$, so it can be concluded that the data is not normally distributed. The test was carried out to determine the effect of education on the assessment of Diskus® skills in the pre-test, post-test I and post-test II using the Friedman Test. It was found that the value of $p = 0.000 <0.05$. It can be concluded that there were differences in the effect of education on Diskus® skills

Table 5: Results of post-hoc analysis with the Wilcoxon test

Effect of education on inhaler use skills	*Pre-test* vs *Post-test I*	*Pre-test* vs *Post-test II*	*Post-test I* vs *Post-test II*
Diskus®	0.000	0.000	0.317
Turbuhaler®	0.000	0.000	0.655

in the pre-test, post-test I and post-test II. Then, proceed with the Wilcoxon post-hoc analysis to find out which groups are significantly different. Based on Table 4, it showed that the mean score for the skill of using Turbuhaler® had increased from pre-test to post-test I, which is 1.65. Meanwhile, from post-test I, it decreased to post-test II, which was 0.05, but from the pre-test to post-test II, values increased.

Based on Table 5, the results of the analysis test using the Wilcoxon test obtained $p = 0.000<0.05$, so it can be concluded that there was a difference in the effect of education during pre-test and post-test I. The results of the pre-test *vs* post-test II values are also obtained $p = 0.000 <0.05$, it can be concluded that there were differences in the effect of education on pre-test *vs* post-test II. Based on Table 5, the results of the analysis test using the Wilcoxon test obtained $p = 0.000 <0.05$ in the pre-test *vs* post-test I treatment. It can be concluded that there was a difference in the effect of education during pre-test and post-test I. The value of pre-test *vs* post-test II also obtained $p = 0.000<0.05$, so it can be concluded that there was a difference in the effect of education on pre-test *vs* post-test II.

Mistakes in Using Diskus® and Turbuhaler®

The results of the pre-test on the use of Diskus® showed that the correct way of using it in several steps could not be achieved. Of the ten steps for using Diskus®, the steps that often experience errors were number 4 (exhale as hard as you can), number 5 (inhale and exhale away from the Diskus® mouthpiece) and number 9 (exhale slowly) (Table 6).

The results of the pre-test using Turbuhaler® showed that the correct way of using it in several steps could not be achieved. Of the seven steps for using Turbuhaler®, the steps that often experience mistakes are number 4 (exhale as hard as you can, away from the Turbuhaler mouthpiece) and number 6 (hold your breath for about 10 seconds, then exhale slowly) (Table 7).

DISCUSSION

Effect of Education on Symptom Assessment

CAT is broader in scope of the impact of COPD on daily life.[18,20] The CAT score was developed to measure the impact of COPD on health-related quality of life and to aid patient and healthcare provider communication. The CAT score also correlates closely with health status as measured using the St. George's respiratory questionnaire (SGRQ) questionnaire and is reliable and responsive to treatment. CAT scores ≥10 have been shown to have a significant impact on the daily life of COPD patients and predict future exacerbations.[18,20,39] In assessing the patient's symptoms using the CAT questionnaire, it was found that the average value of the total CAT in the pre-test was 17.26 ± 9.827 and after being given education (post-test), it was 10.82 ± 5.99. The pre-post CAT value decreased symptoms in COPD patients by 6.44. This decrease in CAT is similar to the results of previous studies by Hayoo *et al*.,[35] was reported that there was a significant decrease in CAT scores (19.6 ± 12.5 *vs* 15.1 ± 12.3) after being given education (p <0.05). Comprehensive educational programs, including

Table 6: Assessment of accuracy in Diskus® Skills (n = 18)

No	*Diskus® use steps*	*Pre-test*		*Post-test I*		*Post-test II*	
		Frequency	*Percentage (%)*	*Frequency*	*Percentage (%)*	*Frequency*	*Percentage (%)*
1	Open the disc cover	18	100	18	100	18	100
2	Slide Lever to the right until you hear a click	18	100	18	100	18	100
3	Hold the Diskus® horizontally	18	100	18	100	18	100
4	Exhale as hard as you can	1	5.56	13	72.22	16	88.89
5	Inhale and exhale away from the mouthpiece	5	27.78	16	88.89	15	83.33
6	Place Diskus® in your mouth between your teeth and lips	17	94.44	18	100	18	100
7	Inhale steady and deep	18	100	18	100	18	100
8	Remove the mouthpiece from your mouth and hold a deep breath for 5 to 10 seconds	11	61.11	18	100	18	100
9	Exhale slowly	2	11.11	18	100	18	100
10	Close Diskus® by sliding the outer cover slide	17	94.44	18	100	18	100

Table 7: Assessment of accuracy in Turbuhaler® Skills (n = 20)

No	*Turbuhaler® use steps*	*Pre-test*		*Post-test I*		*Post-test II*	
		Frequency	*Percentage (%)*	*Frequency*	*Percentage (%)*	*Frequency*	*Percentage (%)*
1	Twist and remove the Turbuhaler® cover	20	100	20	100	20	100
2	Hold the Turbuhaler® in an upright position	20	100	20	100	20	100
3	Turn the lever (turning grip) at the bottom forward as far as it can go, then return it back until you hear a click.	16	80.00	20	100	20	100
4	Exhale as forcefully as possible (away from the turbuhaler mouthpiece)	1	5.00	19	95.00	17	85.00
5	Insert the mouthpiece into your mouth, between your teeth and cover your lips, then inhale as hard as you can through your mouth	19	95.00	20	100	20	100
6	Hold your breath for about 10 seconds, then exhale slowly	9	45.00	19	95.00	20	100
7	Hold Turbuhaler® cover	20	100	20	100	20	100

training on how to use inhalers and COPD management, can increase CAT scores and patient understanding of COPD management. Another research conducted by Jang *et al*.,[37] was, also reported that there was a decrease in the CAT score (2.61 ± 5.88 *vs* 2.41 ± 7.48, p =0.01).

Effect of Education on Lung Function Assessment

Peripheral airway obstruction progressively traps air during expiration, leading to hyperinflation. Hyperinflation reduces inspiratory capacity and causes an increase in residual capacity, especially during exercise (dynamic hyperinflation), causing increased dyspnea and limitation of exercise capacity.[40,41] Spirometry measurements were evaluated by comparison with values based on age, height, sex, and race.[42,43] Patients with COPD usually show decreased FEV1 and FEV1/FVC. Abnormal levels of spirometry usually indicate the severity of COPD. However, symptoms and spirometry must both be considered when developing and individualizing management strategies for each patient.[22,23] The FEV1 value is more precise when measured using a spirometer compared to a peak expiratory flow meter (PEF). Decreased FEV1 values can be found in patients with other lung diseases (or using the wrong spirometry technique), but a decrease in the FEV1/FVC ratio is an indication of airflow limitation.[22,23] Analytical tests were carried out using the Wilcoxon signed ranks non-parametric test. The results showed that there were significant differences in the assessment of lung function (FEV1) before and after education (p = 0.001). This decrease in lung function is similar to the results of previous studies by Aytac *et al*.,[44] was reported that there was an increase in lung function in COPD patients on FEV1 values (52.67 ± 23.51 *vs* 58.83 ± 25.48) after being given education. In another study by Maricoto *et al*.,[45] it was reported that there was an increase in lung function at FEV1 of 145.7 mL; 95% CI:11.7-279.8 : p = 0.035).

Influence of Education on Assessment of Inhaler Use Skills

Analysis with the Friedman test showed that there was a significant difference in the effect of education on inhaler skills in the pre-test, post-test I and post-test II (p = 0.000). Based on previous research by Ruud *et al*.,[46] it was found that education by pharmacists had an effect on how to use inhalers (regardless of the type of inhaler), the optimal technique for using inhalers was 8% in the pre-test (before education) and increased by 72% after being given education (p < 0.001) and at follow-up, 3 months after education decreased by 52% (p = 0.037). In the Diskus® inhaler type, it was found at pre-test *vs* follow-up 1 *vs* follow-up 2 (6 *vs* 81% *vs* 60%). Whereas in the type of Turbuhaler® inhaler, it was found at pre-test vs follow-up 1 *vs* follow-up 2 of (7 *vs* 75% *vs* 46%). Another study conducted by Nguyen *et al*.,[36] reported that education conducted by pharmacists had an increase in how to use Bodialer® after education (20.5 *vs* 61.9%) from pre-test to post-test (6 months), and from 6 months to 12 months decreased (61.9 *vs* 48.7%, p = 0.302).

Errors in using Diskus® which are often made before education, include three errors, namely step number 4 (exhale as hard as you can), step number 5 (inhale and exhale away from the Diskus® mouthpiece) and step number 9 (exhale slowly). In step number 4 only 5.6% is correct in using. This step was also common in previous studies.[29,47] Failure to perform step 4 (exhale as forcefully as possible) can reduce the patient's ability to take a full breath and affect the delivery of inhaled medication.[47] Furthermore, in step number 5 (inhale and exhale away from the mouthpiece) it was 27.7% correct in using. This step was also an obstacle that is often carried out in previous studies.[48] Do not exhale near the mouthpiece because it can cause the dose of medicine to be lost by being blown off and can cause moisture in the Diskus® so that the

powder clumps together and is difficult to inhale.[49] In step number 9 (exhale slowly), 11.1% was the right one to use. This step was also an obstacle in previous studies.[48,50] Failure to do step 9 can interfere with and expel drugs that were already stored in the lungs.[48]

There were 2 mistakes in using the Turbuhaler® that are often made, namely at step number 4 (exhale as hard as possible, away from the turbuhaler mouthpiece) and step number 6 (hold breath for about 10 seconds, then exhale slowly). In step number 4 (exhale as hard as you can, away from the turbuhaler mouthpiece) only 5% was correct in using. This step was also an obstacle that often occurs in previous studies.[36] Exhale away from the Turbuhaler® mouthpiece to prevent air from entering the turbuhaler.[49] A wrong step in number 4 can reduce the dose and the exhaled air will cause the powder in the Turbuhaler® to agglomerate because moisture will affect the next dose. The next dose will be reduced because the presence of clumping powder will hamper some of the powder when sucked.[49] Error in number 4 can cause failure in delivering the drug into the respiratory tract.[36] Next step in number 6 (hold breath for about 10 seconds, then exhale slowly) as much as 45% was correct in using. This step was also an obstacle that often occurred in previous studies.[50,51] Hold the breath for about 10 seconds to allow a longer contact time for the drug to settle in the bronchioles.[49]

CONCLUSION

There were significant differences in the effect of education on how to use inhalers on assessing patient symptoms (CAT values), lung function (FEV1/FVC ratio values), and skills on how to use inhalers in COPD patients.

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Inhalers are the most effective therapy in the treatment of Chronic obstructive pulmonary disease (COPD). Research shows that a large number of COPD patients do not use inhalers properly. Incorrect inhaler use technique can reduce drug delivery and poor disease control. Education on how to use inhalers is an important part of COPD management. The study was conducted to determine the effect of education on symptom assessment, lung function assessment and inhaler use skill assessment in COPD patients. The research was in the form of a pre-experimental one-group pre-test post-test. The results showed that there was a significant difference in the effect of education on how to use the inhaler on the assessment of symptoms (p = 0.000), a significant difference in the assessment of lung function (p = 0.001) and a significant difference in the assessment of skills in using the inhaler (p = 0.000). Education on how to use inhalers has an influence on the assessment of symptoms, lung function and skills in using inhalers in COPD patients.

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Effect Of Inhaler Technique Health Education In Improving Symptoms And Lung Function In Copd Outpatient In A Private Hospital In Gresik, Indonesia: Pilot Studies

by Amelia Lorensia

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RESEARCH ARTICLE

EFFECT OF INHALER TECHNIQUE HEALTH EDUCATION IN IMPROVING SYMPTOMS AND LUNG FUNCTION IN COPD OUTPATIENT IN A PRIVATE HOSPITAL IN GRESIK, INDONESIA: PILOT STUDIES

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ABSTRACT

Inhalers are the most effective therapy in the treatment of COPD. Research shows that a large number of COPD patients do not use inhalers properly. Incorrect inhaler use technique can reduce drug delivery and poor disease control. Education on how to use inhalers is an important part of COPD management. The study was conducted to determine the effect of education on symptom assessment, lung function assessment and inhaler use skill assessment in COPD patients. The research was in the form of a pre-experimental one group pre-test post-test. The results showed that there was a significant difference in the effect of education on how to use the inhaler on the assessment of symptoms (p=0.000), a significant difference in the assessment of lung function (p=0.001) and a significant difference in the assessment of skills in using the inhaler (p=0.000). Education on how to use inhalers has an influence on the assessment of symptoms, lung function and skills in using inhalers in COPD patients.
Keywords: COPD, inhaler, CAT, FEV1/FVC ratio

INTRODUCTION

Chronic obstructive pulmonary disease (COPD), the frequently fatal pathology of the respiratory tract, accounts for half a billion cases globally. COPD is a major global health problem and has an impact on increasing health costs and decreasing productivity. COPD is the third leading cause of death worldwide, after ischemic heart disease and neoplasms.[1,2] In Indonesia, the prevalence in 2011 was 5.6% or around 9.2 million people.[3] COPD is defined as a common preventable and treatable disease characterized by persistent respiratory symptoms and airflow limitation caused by airway or alveolar abnormalities and caused by noxious particles or gases. Symptoms are characterized by tightness, coughing and/or phlegm.[4,5,6,7] The goal of COPD treatment is to reduce symptoms, reduce the frequency and severity of exacerbations, improve and prevent decreased lung function and improve the patient's quality of life.[8,9,10]

Inhalation therapy is the most effective therapy in the treatment of COPD. The advantage of this inhalation is that the drug is delivered directly into the breath, high local concentrations can be achieved and minimize the risk of systemic side effects.[11,12,13] However, the use of inhalers must have skills that are learned and maintained for the drugs administered to be effective. Various types of inhalers available on the market have different usage techniques which can result in the risk of errors in use. Research shows that as many as 50-80% of patients do not use inhalers properly.[14,15] Incorrect inhaler use technique is associated with reduced drug delivery and poor disease control.[16,17] In a study conducted by Gregoriano *et al*., 2018,[14] on 165 asthma and COPD patients in Switzerland. This study analyzes the technique of using inhalers which is associated with the control of disease symptoms and lung function. The result was that COPD patients with the wrong inhaler technique resulted in a higher CAT (COPD Assessment Test) score (P=0.02), more often suffered from coughing (P=0.03) and experienced shortness of breath when walking uphill or climbing stairs (P=0.02) and COPD patients with the correct inhaler technique had significantly better lung function values (FEV1%) (P=0.04).[14]

Symptom assessment can use the COPD Assessment Test (CAT) questionnaire. The CAT score was developed to measure the impact of COPD on health-related quality of life and to aid patient and healthcare provider communication. The CAT score also correlates closely with health status as measured using the SGRQ (St. George's Respiratory Questionnaire) questionnaire and is reliable and responsive to treatment.[18,19,20,21] The most ideal pulmonary function examination is spirometry. Patients with COPD usually show a decrease in forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC). Extension of inflammation, fibrosis, and luminal exudate in the small airways is associated with a decrease in FEV1 and the FEV1/FVC ratio, and is possibly and related to an accelerated decline in the FEV1 characteristics of COPD.[22,23,24]

The level of knowledge and skills of COPD patients in using inhalers is a very important key in achieving therapeutic goals. Poor inhaler technique remains an important and multi-factorial problem that can stem from the device itself, the patient, the healthcare provider, technology, and policy.[25,26,27] Previous research by Yang et al.[28] that incorrect inhalation technique often occurs in COPD patients, up to 61.8% (55 of 89) of patients made at least one essential mistake in their inhalation technique. Also supported by another study by Çakmaklı et al.,[29] enrolled a total of 300 asthma/COPD patients, 70.2% used their inhaler drugs incorrectly. The most common mistake was 'failing to breath out before inhalation' for all types of devices (for MDI: 66.7%, and for DPI: 71.1–82.8%).

Low level of education is an important factor that influences the wrong technique of using inhalers. Inhaler use technique training resulted in a significant reduction in incorrect technique for all inhaler devices.[30,31] Education is important in the long-term management of COPD.[32] Pharmacists

in hospitals have the role of clinical pharmacy services, namely providing education to patients and/or their families. In this case, pharmacists have a role in providing education on correct inhaler technique skills.[33,34] Several studies have shown that educational interventions and reviews of inhaler use techniques have a positive impact on disease control. In a study by Hayoo et al.,[35] an evaluation was carried out of providing educational programs regarding how to use inhalers and COPD management in 127 patients in Korea. The result was that there was a significant improvement in the use of the inhaler after receiving education ($P<0.05$) and the CAT (COPD Assessment Test) scores were also significantly better (19.6±12.5 vs. 15.1±12.3). In a study conducted by Nguyen et al.,[36] on 211 COPD patients in Vietnam, an evaluation was carried out on training in the technique of using inhalers by pharmacists. The result was that there was a significant improvement in the technique of using inhalers after training compared to before training ($P=0.05$). Education on how to use inhalers is an important part of the management of COPD patients so that they can improve better clinical outcomes.[37] Therefore, there was a need for research on providing education on how to use inhalers in COPD patients. This study aimed to analyze the effect of education on how to use inhalers in improving symptoms and lung function as well as technical skills in using inhalers in COPD patients. The education used an origami book on how to use inhalers by Lorensia et al.[34] with an educational method based on information-motivation-behavioral skills (IMB) to community pharmacists in conducting education on inhaler use techniques.

METHOD

Design Study

The design of this research is pre-experimental research in the form of designone group pre-post-test. This study was used to analyze the effect of education on how to use inhalers in improving symptoms and lung function as well as outpatient COPD inhaler use skills. The research was conducted at the pulmonary polyclinic at Hospital X in Gresik, data collection was carried out from October 2019 to January 2020.

Research variable

The independent variable is the provision of education on how to use inhalers. The dependent variables were symptom assessment, pulmonary function assessment and inhaler use skills.

Population And Sample

The study population was patients with a diagnosis of chronic obstructive pulmonary disease (COPD) who used an inhaler at the pulmonary polyclinic at RS X in Gresik from October 2019 to January 2020. The study criteria included: using an inhaler and being willing to be involved in the study. This sampling method was carried out using purposive sampling method.

Method of collecting and analysis data

The education referred to in this study is education on how to use inhalers. The educational material provided is using an educational smart book as an inhaler teaching aid (origami book) by Lorensia et al.[38] Provision of education was given in the early weeks of the study after the participants filled out an informed consent form and carried out a pre-test at the pulmonary polyclinic at Hospital X in Gresik. Providing this education takes ±5 minutes.

a. **Assessment of COPD symptoms.** Symptom assessment is based on the CAT (COPD Assessment Test), namely, a measurement consisting of 8 questions to measure the decline in health status in COPD. The CAT has been used and translations have been validated around the world in multiple languages. CAT measurements were carried out during the pre-test (before education) and post-test (after education in the fourth week). Data analysis used the Wilcoxon signed ranks test with the data scale was ratio.
b. **Lung Function Assessment.** Pulmonary function measurements were carried out using spirometry during the pre-test and post-test. Data analysis used the Wilcoxon signed ranks test with the data scale was ratio.
c. **Inhaler Use Skills.** Skills in the use of inhalers is the patient's ability to use inhalers. Measurements were made with a checklist form measuring tool during the pre-test and post-test. Each correct number gets a value of 1 and each wrong number gets a value of 0. The final result is the total score of the correct answers. Data analysis used the Friedman test with the data scale was ratio.

RESULT

Characteristics of research participants

There were 42 COPD patients at the hospital. A total of 1 patient included exclusion criteria due to hearing limitations and 3 patients included drop out criteria because the patient did not return to the hospital to continue the study. So that there were 38 patients who completed the study to the end. The basic characteristics of research participants can be seen in **Table 1**.

Table 1. Basic Characteristics of Research Participants

Characteristics		Frequency (n=38)	Percentage (%)
Gender	Female	7	18.42
	Male	31	81.58
Age (year)	40-59	12	31.58
	60-74	22	57.89
	75-90	4	10.53
Level Education	Elementary school	3	7.89
	Junior high school	5	13.16

Characteristics		Frequency (n=38)	Percentage (%)
	Senior High School	21	55.26
	Bachelor	9	23.68
Occupation	Employee civil servant	1	2.63
	Employee Private	4	10.53
	Self-employed	10	26.32
	Other	23	60.53
GOLD criteria	GOLD 1 (mild) FEV1≥80% predicted	14	36.84
	GOLD 2 (moderate) 50%≤FEV1<80% predicted	9	23.68
	GOLD 3 (severe) 30%≤FEV1<50% predicted	9	23.68
	GOLD 4 (very severe) FEV1≤30% predicted	6	15.79
Smoking history	Yes	2	5.26
	No	16	42.11
	Ex-smoker	20	52.63
The type of inhaler used	Diskus® DPI	18	47.37
	Turbuhaler® DPI	20	52.63
Experience getting education on how to use inhalers	Yes	22	57.89
	No	16	42.11

The Effect of Education on Symptom Assessment

Assessment of symptoms in COPD patients was measured by the COPD Assessment Test (CAT) before education (pre-test) and after four weeks of education (post-test). The CAT assessment consists of 8 questions with a score of 0-5 for each question (total scores range from 0-40). The total average value of the COPD Assessment Test (CAT) at the pre-test was 17.26 ± 9.827 and after being given education (post-test) it was 10.82 ± 5.99. The pre-post CAT value decreased in symptoms in COPD patients by 6.44. The total CAT average value can be seen more clearly in **Table 2**.

Table 2. Changes in clinical symptoms, CAT values and lung function (FEV1/FVC ratio) with education

Variable	*Pre-test*		*Post-test*		Δ
	(Mean±SD)	Min-Max	(Mean±SD)	Min-Max	(Pre-Post)
CAT value	17.26 ± 9.827	2-37	10.82 ± 5.99	2-26	6.44
Symptom Clinical					
Cough	2.45 ± 2.089	0-5	1.45 ± 1.446	0-4	1.00
Sputum	2.74 ± 2.226	0-5	1.29 ± 1.250	0-3	1.45
Chest tightness	2.00 ± 1.917	0-5	1.32 ± 1.338	0-4	0.68
Shortness of breath when climbing stairs	2.87 ± 1.877	0-5	1.79 ± 1.510	0-5	1.08
Limited activities at home	1.95 ± 1.627	0-5	1.18 ± 1.062	0-4	0.77
Worry about disease	1.39 ± 1.534	0-5	1.00 ± 0.986	0-4	0.39
Hard to sleep	2.08 ± 1.894	0-5	1.21 ± 1.379	0-4	0.87
Physical Weakness	1.79 ± 1.119	0-4	1.32 ± 0.775	0-3	0.47
FEV1/FVC ratio (Liter)	1.28 ± 0.713	0.33-3.11	1.36±0.722	0.35-3.14	0.08

The normality test with the Shapiro Wilk test using SPSS Statistics showed a pre-test (p=0.150) and post-test (p=0.009). Probability value <0.05 so it can be concluded that the data is not normally distributed. Comparative analysis of COPD patient symptom assessment using the Wilcoxon Signed Ranks Test non-parametric test method obtained p=0.000<0.05, so it can be concluded that there are

differences in the symptom assessment of COPD patients before and after receiving education. The results of the COPD Assessment Test (CAT) based on the incidence of acute exacerbations can be categorized into two groups, namely: mild (CAT value <10) and moderate-severe (CAT≥10 value).

Table 3. Categories of Change in CAT Scores with Education

Category of CAT Value	*Pre-test*		*Post-test*	
	Frequency (n=38)	Percentage (%)	Frequency (n=38)	Percentage (%)
CAT <10 (mild)	11	28.95	14	36.84
CAT ≥10 (moderate-severe)	27	71.05	24	63.16

Based on the results of the COPD Assessment Test (CAT), prior to education there were 28.95% of patients with mild symptoms and 71.05% of patients with moderate-severe symptoms. Meanwhile, after education, there were 36.8% of patients with mild symptoms and 63.2% of patients with moderate-severe symptoms (**Table 3**). The comparison test was carried out using the chi-square test and obtained p = 0.000 <0.05, so it can be concluded that there are differences in the assessment of symptoms of COPD patients before and after receiving education.

The Effect of Education on Lung Function Assessment

Pulmonary function assessment in COPD patients using spirometry obtained Forced Expiratory Volume in 1 Second (FEV1) values measured before education (pre-test) and after four weeks of education (post-test). Based on **Table 2**, it showed that the FEV1 value tends to increase by 0.08 liters. The normality test with the Shapiro Wilk test using SPSS Statistics 20 shows (Pvalue=0.009) for the pre-test and (Pvalue=0.008) for the post-test. Probability value <0.05 so it can be concluded that the data is not normally distributed. Analysis to determine the effect of education on the FEV1 assessment before and after education was carried out using the Wilcoxon Signed Ranks nonparametric test. Based on the results of the Wilcoxon Signed Ranks non-parametric test, the value of Pvalue=0.001<0.05, it can be concluded that there are differences in the assessment of lung function in COPD patients before and after receiving education.

The Influence of Education on Assessment of Inhaler Use Skills

Assessment of inhaler use skills using the Checklist form was measured before education (pre-test) and after education (post-test I) and four weeks after education (post-test II). The analysis was carried out on each type of inhaler used by the patient, namely Diskus® and Turbuhaler®.

Table 4. Average Score Comparison of Diskus® and Turbuhaler® Skills with Education

Inhaler Use Skills	*Pre-test*	*Post-test*	
	(Mean±SD)	*Post-test* I (Mean±SD)	*Post-test* II (Mean±SD)

Diskus®	6.89 ± 1.079	9.61 ± 0.502	9.72 ± 0.461
Turbuhaler®	5.25 ± 0.716	6.90 ± 0.308	6.85 ± 0.366

Based on **Table 4**, it showed that the average score for Diskus® skills had increased from pre-test to post-test I, which was 2.72 and from post-test I, it had also increased to post-test II, which was 0.11. The normality test with the Shapiro Wilk test using SPSS Statistics showed a value of Pvalue=0.177 (pre-test) and Pvalue=0.000 (post-test I and post-test II). Probability Pvalue<0.05 so it can be concluded that the data is not normally distributed. The test was carried out to determine the effect of education on the assessment of Diskus® skills in the pre-test, post-test I and post-test II using the Friedman Test, was found that the value of Pvalue=0.000 <0.05, it can be concluded that there were differences in the effect of education on Diskus® skills in the pre-test, post-test I and post-test II. Then proceed with the Wilcoxon Post-Hoc analysis to find out which groups are significantly different. Based on **Table 4**, it showed that the mean score for the skill of using Turbuhaler® had increased from pre-test to post-test I, which is 1.65. Meanwhile, from post-test I it decreased to post-test II which was 0.05, but from the pre-test to post-test II values have increased.

Table 5. Results of Post-Hoc Analysis with the Wilcoxon Test

Effect of Education on Inhaler Use Skills	*Pre-test* vs *Post-test* I	*Pre-test* vs *Post-test* II	*Post-test* I vs *Post-test* II
Diskus®	0.000	0.000	0.317
Turbuhaler®	0.000	0.000	0.655

Based on **Table 5**, the results of the analysis test using the Wilcoxon test obtained Pvalue=0.000<0.05, so it can be concluded that there was a difference in the effect of education during pre-test and post-test I. The results of the pre-test vs post-test II values are also obtained Pvalue=0.000 <0.05, it can be concluded that there were differences in the effect of education on pre-test vs post-test II. Based on **Table 5**, the results of the analysis test using the Wilcoxon test obtained Pvalue=0.000<0.05 in the pre-test vs post-test I treatment. It can be concluded that there was difference in the effect of education during pre-test and post-test I. Results the value of pre-test vs post-test II also obtained Pvalue=0.000<0.05, so it can be concluded that there was a difference in the effect of education on pre-test vs post-test II.

Mistakes in Using Diskus® and Turbuhaler®

The results of the pre-test on the use of Diskus® showed that the correct way of using it in several steps could not be achieved. Of the 10 steps for using Diskus®, the steps that often experience errors were number 4 (exhale as hard as you can), number 5 (inhale and exhale away from the Diskus® mouthpiece) and number 9 (exhale slowly) (**Table 6**).

Table 6. Assessment of Accuracy in Diskus® Skills (n=18)

No	Diskus® Use Steps	*Pre-test*		*Post-test* I		*Post-test* II	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
1	Open the Disc Cover	18	100	18	100	18	100
2	Slide Lever to the right until you hear a click	18	100	18	100	18	100
3	Hold the Diskus® horizontally	18	100	18	100	18	100
4	Exhale as hard as you can	1	5.56	13	72.22	16	88.89
5	Inhale and exhale away from the mouthpiece	5	27.78	16	88.89	15	83.33
6	Place Diskus® in your mouth between your teeth and lips	17	94.44	18	100	18	100
7	Inhale steady and deep	18	100	18	100	18	100
8	Remove the mouthpiece from your mouth and hold a deep breath for 5-10 seconds	11	61.11	18	100	18	100
9	Exhale slowly	2	11.11	18	100	18	100
10	Close Diskus® by sliding the outer cover slide	17	94.44	18	100	18	100

The results of the pre-test using Turbuhaler® showed that the correct way of using it in several steps could not be achieved. Of the 7 steps for using Turbuhaler®, the steps that often experience mistakes are number 4 (exhale as hard as you can, away from the turbuhaler mouthpiece) and number 6 (hold your breath for about 10 seconds, then exhale slowly) (**Table 7**).

Table 7. Assessment of Accuracy in Turbuhaler® Skills (n=20)

No	Turbuhaler® Use Steps	*Pre-test*		*Post-test* I		*Post-test* II	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
1	Twist and remove the Turbuhaler® cover	20	100	20	100	20	100
2	Hold the Turbuhaler® in an upright position	20	100	20	100	20	100
3	Turn the lever (turning grip) at the bottom forward as far as it can go, then return it back until you hear a click.	16	80.00	20	100	20	100
4	Exhale as forcefully as possible (away from the turbuhaler mouthpiece)	1	5.00	19	95.00	17	85.00
5	Insert the mouthpiece into your mouth, between your teeth and cover your lips, then inhale as hard as you can through your mouth	19	95.00	20	100	20	100
6	Hold your breath for about 10 seconds, then exhale slowly	9	45.00	19	95.00	20	100
7	Hold Turbuhaler® cover	20	100	20	100	20	100

DISCUSSION

The Effect of Education on Symptom Assessment

CAT is broader in scope of the impact of COPD on daily life.[18,20] The CAT score was developed to measure the impact of COPD on health-related quality of life and to aid patient and healthcare provider communication. The CAT score also correlates closely with health status as measured using the SGRQ (St. George's Respiratory Questionnaire) questionnaire and is reliable and responsive to treatment. CAT scores≥10 have been shown to have a significant impact on the daily life of COPD patients and predict future exacerbations.[18,20,39] In assessing the patient's symptoms using the CAT questionnaire, it was found that the average value of the total CAT in the pre-test was 17.26±9.827 and after being given education (post-test) it was 10.82±5.99. The pre-post CAT value decreased symptoms in COPD patients by 6.44. This decrease in CAT is similar to the results of previous studies by Hayoo et *a*l.,[35] was reported that there was a significant decrease in CAT scores (19.6±12.5 vs 15.1±12.3) after being given education (Pvalue<0.05). Comprehensive educational programs including training on how to use inhalers and COPD management can increase CAT scores and patient understanding of COPD management. Another research conducted by Jang et al.[37] was also reported that there was a decrease in the CAT score (2.61±5.88 vs 2.41±7.48, Pvalue=0.01).

The Effect of Education on Lung Function Assessment

Peripheral airway obstruction progressively traps air during expiration, leading to hyperinflation. Hyperinflation reduces inspiratory capacity and causes an increase in residual capacity, especially during exercise (dynamic hyperinflation), causing increased dyspnea and limitation of exercise capacity.[40,41] Spirometry measurements were evaluated by comparison with values based on age, height, sex, and race.[42,43] Patients with COPD usually show decreased FEV1 and FEV1/FVC. Abnormal levels of spirometry usually indicate the severity of COPD. However, symptoms and spirometry must both be considered when developing and individualizing management strategies for each patient.[22,23] The FEV1 value is more precise when measured using a spirometer compared to a peak expiratory flow meter (PEF). Decreased FEV1 values can be found in patients with other lung diseases (or using the wrong spirometry technique), but a decrease in the FEV1/FVC ratio is an indication of airflow limitation.[22,23] Analytical tests were carried out using the Wilcoxon Signed Ranks nonparametric test. The results showed that there were significant differences in the assessment of lung function (FEV1) before and after education (Pvalue=0.001). This decrease in lung function is similar to the results of previous studies by Aytac et al.,[44] was reported that there was an increase in lung function in COPD patients on FEV1 values (52.67±23.51 vs 58.83±25.48) after being given education. Another study by Maricoto et al.,[45] it was reported that there was an increase in lung function at FEV1 of 145.7 ml; 95%CI:11.7-279.8 : Pvalue=0.035).

The Influence of Education on Assessment of Inhaler Use Skills

Analysis with the Friedman Test showed that there was a significant difference in the effect of education on inhaler skills in the pre-test, post-test I and post-test II (Pvalue=0.000). Based on

previous research by Ruud et al.,[46] it was found that education by pharmacists had an effect on how to use inhalers (regardless of the type of inhaler), the optimal technique for using inhalers was 8% in the pre-test (before education) and increased by 72% after being given education (Pvalue<0.001) and at follow-up 3 months after education decreased by 52% (Pvalue=0.037). In the Diskus® inhaler type, it was found at pre-test vs follow up 1 vs follow up 2 (6% vs 81% vs 60%). Whereas in the type of Turbuhaler® inhaler it was found at pre-test vs follow up 1 vs follow up 2 of (7% vs 75% vs 46%). Another study conducted by Nguyen et al.,[36] reported that education conducted by pharmacists had an increase in how to use Bodialer® after education (20.5% vs 61.9%) from pre-test to post-test (6 months), and from 6 months to 12 months decreased (61.9% vs 48.7%, Pvalue=0.302).

Errors in using Diskus® which are often made before education include 3 errors, namely step number 4 (exhale as hard as you can), step number 5 (inhale and exhale away from the Diskus® mouthpiece) and step number 9 (exhale slowly). In step number 4 only 5.6% is correct in using. This step was also common in previous studies.[29,47] Failure to perform step 4 (exhale as forcefully as possible) can reduced the patient's ability to take a full breath and affect the delivery of inhaled medication.[47] Furthermore, in step number 5 (inhale and exhale away from the mouthpiece) it was 27.7% correct in using. This step was also an obstacle that is often carried out in previous studies.[48] Do not exhale near the mouthpiece because it can cause the dose of medicine to be lost by being blown off and can cause moisture in the Diskus® so that the powder clumps together and is difficult to inhale.[49] In step number 9 (exhale slowly) 11.1% was the right one to use. This step was also an obstacle in previous studies.[48,50] Failure to do step 9 can interfere with and expel drugs that were already stored in the lungs.[48]

There were 2 mistakes in using the Turbuhaler® that are often made, namely at step number 4 (exhale as hard as possible, away from the turbuhaler mouthpiece) and step number 6 (hold breath for about 10 seconds, then exhale slowly). In step number 4 (exhale as hard as you can, away from the turbuhaler mouthpiece) only 5% was correct in using. This step was also an obstacle that often occurs in previous studies.[36] Exhale away from the Turbuhaler® mouthpiece to prevent air from entering the turbuhaler.[49] A wrong step in number 4 can reduce the dose and the exhaled air will cause the powder in the Turbuhaler® to agglomerate because moisture will affect the next dose. The next dose will be reduced because some of the powder when sucked will be hampered by the presence of clumping powder.[49] Error in number 4 can cause failure in delivering the drug into the respiratory tract.[36] Next step in number 6 (hold breath for about 10 seconds, then exhale slowly) as much as 45% was correct in using. This step was also an obstacle that often occurs in previous studies.[50,51] Hold the breath for about 10 seconds to allow a longer contact time for the drug to settle in the bronchioles.[49]

CONCLUSION

There were significant differences in the effect of education on how to use inhalers on assessing patient symptoms (CAT values), lung function (FEV1/FVC ratio values), skills on how to use inhalers in COPD patients.

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