

Impact of pharmacist education program to improve inhalation technique in asthmatic patients at Thi-Qar governorate

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Abstract

Background: Incorrect inhaler use is very common and this subsequently leads to poor asthma control. Pharmacist can have a positive impact on patient's education about proper inhaler technique that can lead to a significant improvement of asthma management.

Aim: The objective of this study was to determine the effectiveness of pharmacist education program on inhaler technique of asthmatic patients.

Patients and Methods: the present study is prospective cohort study of 51 patients with asthma, divided into two groups, study (intervention) group include 26 patients that faced to pharmacist intervention and control group include 25 patients. Patients who using metered dose inhaler or turbuhaler collected from 5 community pharmacies located in diverse areas of Thi-Qar governorate [Nasiriya, Suq Al-Shoyokh and Al Eslah cities]. The inhaler technique was evaluated using standardized checklists of the proper administration of metered dose inhaler MDIs and turbuhaler. Patients within a study group were face to education about inhaler technique by demonstration and re demonstration education. After baseline session for both groups, inhaler technique was reassessed after 4 weeks (Post).

Results: a total of 51 (35 on turbuhaler and 16 on MDI) patients were involved in this study. At baseline session of assessment for both groups (study and control), a high rate of incorrect performance of inhalation technique was recorded. After intervention for study group, the median value for correct inhaler use was increased significantly (of 3.5 (basic) to 7 (Post), $p > 0.05$, for MDI and of 4 (basic) to 7 (Post), $p > 0.05$, for turbuhaler) while no significant change for control group. The average counseling time was 15 minutes for education session.

Conclusion: Asthmatic patients in Thi-Qar governorate area have poor inhalation technique of MDI and turbuhaler. The present study showed that a pharmacist education program led to improve inhalation technique significantly. Our model of pharmacist education program should be considered as effective choice for asthmatic patient's management and best utilization of human resources in health care system, especially in country like Iraq.



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Introduction:

Asthma is defined as a chronic inflammatory disease of the airways, the inflammatory process characterized by the including of several cells and cellular fragments as mast cells, neutrophils, T lymphocytes, eosinophils, epithelial cells [1], [2]. This inflammation causing recurring episodes of wheezing, dyspnea, chest tightness, and coughing in sensitive individuals, usually at night and wake up morning [3]. Asthma was estimated to affect 262 million individuals of all ages, and it is recorded in all countries of the world [4]. Asthma therapy seeks to produce maximal symptomatic control and, as a result, greatest quality of life [5]. Around the world, asthma is uncontrolled majorly. Uncontrolled asthma frequency in developed nations may reach up to 51%, which lowers life quality and cause of higher costs from medical and non-medical sources [6]. The Global Initiative for Asthma (GINA) have described control as the effective management of the disease's clinical features, such as symptoms, nocturnal awakening, reliever utilize, activity limitation, and lung function [2]. Inhalers consider as a major device for drug delivery in asthma treatment, as most of drugs used in asthma treatment are administrated by inhalers through inhalation [3]. Because the airways are the primary site of action for obstructive disorders like asthma, an inhaled medication consider as the best to reach the target, so inhalation method enables for a smaller dose to have a quicker onset of action and generating less side effects [7].

Deposition of inhaled medications at target site is affected by various factors either related to device such as particle size of drug or related to patient such as inhalation flow or technique [8]. Incorrect inhalation technique and improper use of inhalers are often observed in clinical settings and are associated with increased inhaler usage, decreased bronchodilator efficacy, lower patient adherence to treatment plans, and worse disease management [9]. Various designs of metered dose inhalers (MDI) and dry powder inhalers are now available in the market, however, the improper inhalation technique are widely demonstrated by health care providers and their patients [10]. MDIs are utilized most commonly due to their popularity, affordability, and requirements for low flow rates of inspiration for optimal drug deposition in the patient's lung [11]. Recently, dry powder inhaler including turbuhaler (TH), becoming more popular than MDI due to overcoming the coordination difficulty that associated with MDI [12].

To use MDIs and turbuhaler correctly and deposit the drug deeply into the lungs, patients must get training and acquire certain skills about inhaler technique. Patient education about inhaler technique can be provided through a variety of modes, including written materials, podcast, videos, Slide shows, posters, graphs, group classes, and teaching staffs who have received specialized training. There are advantages and downsides to each resource. Each person's reaction is unique, therefore using a mix of different methods is often the best option [13]. Aerosol device

performance and proper usage should be familiar to respiratory doctors, respiratory therapists (RTs), nurses, and pharmacists who taking care of patients with respiratory disorders. The time and resources that doctors have to devote effective advising and educating their asthmatic patients is frequently limited [14]. It is therefore better to outsource the counseling and instruction to another health care practitioner. Patients with asthma can benefit from the information and training provided by pharmacists, who are member of a healthcare team and who is serve as the first and most accessible point of contact [15], [16]. Because of their knowledge about medications and the frequency with which they come into contact with the patients on prescription refill, pharmacist can share a basic role in patient education. Pharmacists have been shown to have a positive impact on improving inhalation technique in patients with asthma in many researches [13], [17]–[19]. It is surprising that only a small number of studies have specifically examined the role of pharmacists in treating patients with asthma especially in underdeveloped nations [20]. Iraq is best example of these countries that in which health care resources are very limited, and the duty of pharmacists is primarily limited to dispensing in hospitals and pharmacies.

This study aimed to evaluate the inhaler technique of patients with asthma living in Thi-Qar governorate. Secondly, it aimed to determine the effect of pharmacist education program that applied to patients to improve inhalation technique.

Materials and methods:

Study design:

A prospective cohort study was performed using pre-post-testing approach for two groups (study and control) to evaluate the effectiveness of pharmacist's education program to improve inhaler technique of patients with asthma. The study conducted over four month's period from November 2021 until March 2022. There are two scheduled visits of participants to pharmacy as follows:

- 1- At start of run of study [basic session or Pre].
- 2- After four weeks [session 2 or Post].

Study Setting and source of data:

Data extracted from known patients with asthma at Thi-Qar governorate, Iraq. In order to get valid and comprehensive data, the study conducted at community pharmacies distributed in Thi-Qar governorate [Nasiriya, Suq Al-Shoyokh and Al Eslah cities].

Sample of study:

A non-probability sample of 51 patients was selected. Populations of the current study were patients with asthma who were coming to get usual care of their treatments at community pharmacies in the study place. The patients were recruited consecutively in 5 pharmacies located in diverse area of Thi-Qar governorate.

Criteria of the Sample:

The sample of participants was selected according to the following criteria:

1. Adult patients [18 years old and older].
2. Both male and female patients.

3. All participants were medically diagnosed as asthma and using at least one inhaler medication including pressurized metered-dose inhalers or turbuhaler (TH) [AstraZeneca plc, London, UK] for at least 1 month or more.
4. Patients who agree to participate in the study and able to communicate in the Arabic language.
5. Those whose score less than 80% [depend on pre or basic assessment of inhaler technique steps] for notify the improvement that expected to be.
6. Conscious patient with good intellectual reactivity.

Implementation of the education Program:

The education program applied to study (intervention) group participants was conducted over four phases: assessment phase, planning phase, implementation phase & evaluation phase, while the control group was not faced to that and just involved in evaluation.

1-Assessment phase: The first interview carried out by the researcher for each participant of both groups for collecting baseline data about sociodemographic, medical data and inhaler performance. The researcher utilized the tool (observational checklist or questionnaire) and placebo devices similar to their own devices to assess each participant of both groups for their performance of inhaler use.

2-Planning phase:

Planning Phase Based on assessment phase and extensive literature review, as educational needs identified for each individual patient of study group. A colored written pocket sized booklet in Arabic language is prepared and distributed to each participant putting into consideration the outcomes criteria, it includes the follow information:-

Procedure of correct technique of inhaler according to the inhaler manufacture including images to illustrate the steps of inhaler use, and it include general guide and advices about asthma such as causes, triggering factors for exacerbation and common myths about it.

3-Implementation phase:

The researcher conducted face to face training session for each participant of study [intervention] group. Each session conducted using demonstration, re-demonstration and visual presentation by researcher, as patients asked to use placebo inhalers same as prescribed in the way they were told according to the checklist. Improper applications were corrected by repeating until the patients use the inhalers correctly.

4-Evaluation phase:

After the completion of the educational program at implementation phase for study group and also after assessment for patient in control group, the reevaluation were conducted; patients were reassessed in next 4 weeks of basic [Post session]. Evaluation sessions conducted either in the pharmacy or in patients' homes according to patient's preference.

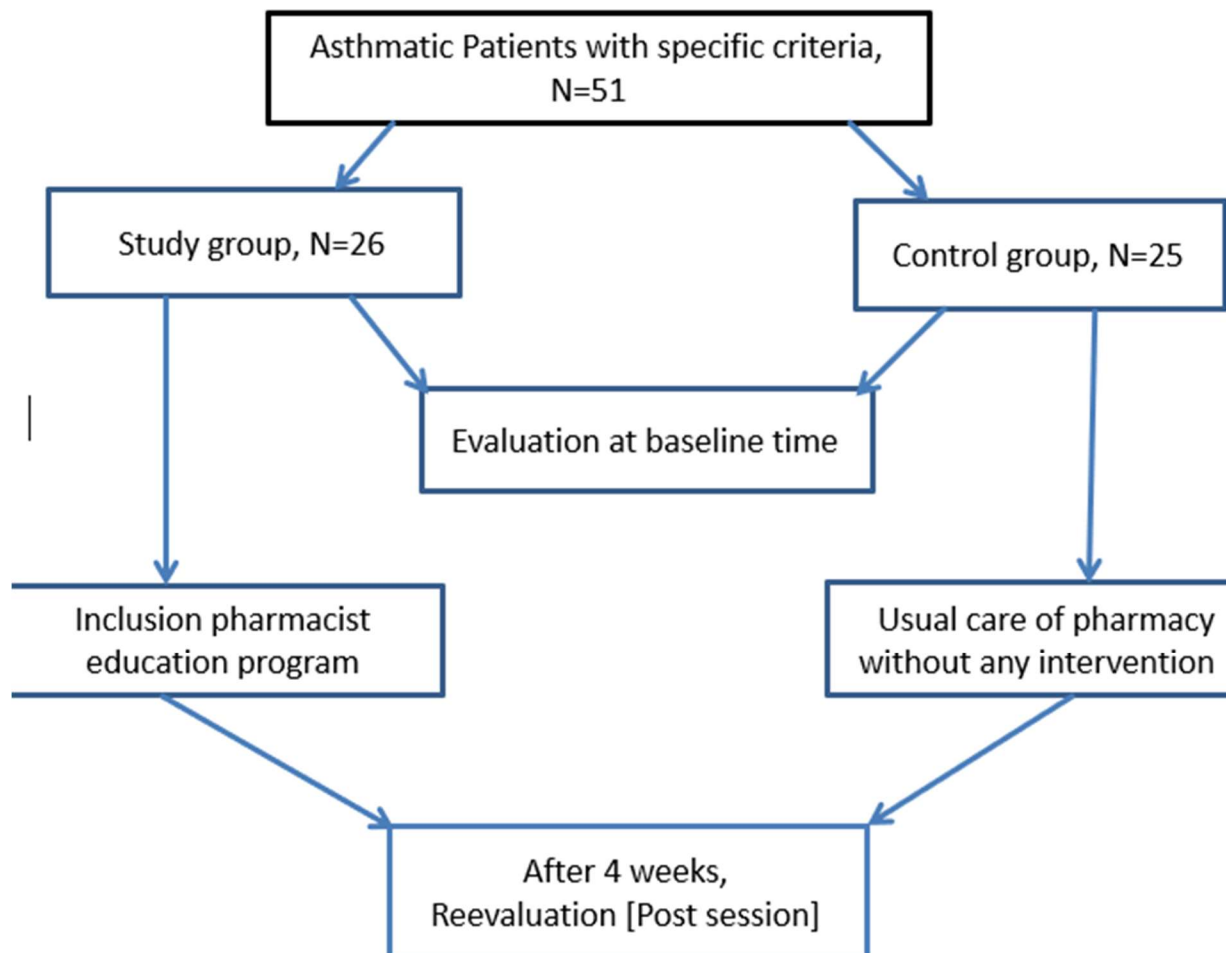


Figure 1 Study flow chrt.

Study Instrument:

Knowledge format questionnaires in English language adapted from previously conducted studies and customized to fit with current study.

The questionnaire consists of four parts for collect the data that required for the study by direct asking the patient, include the following:

Part 1: The demographic and socio- demographic characteristics of the patients with asthma: This part is concerned with the collection of data such as [age, gender, level of education, marital status, occupation and economic status].

Part 2: Clinical characteristic of patients with asthma: This part is concerned with the collection of clinical characteristic such as (duration of disease, instructions given by whom and smoking history).

Part 3: Characteristics related to use of inhalers: it concerned with the collection of characteristics related to inhalers that used by patient such as {type of inhaler [MDI or turbuhaler TH], duration of inhaler use, number of different inhaler used and education about technique}.

Part 4: Patients' practice regarding inhalation technique which includes:

1-Inhalation technique of metered dose inhaler [MDI], this part comprised of (8) sub-domains [21] with two possible answers [correct or in-correct].

Inhaler shaking before use, cap removing, exhale away of device, slightly tilt your head backward, inhaler's mouthpiece inserted in mouth with closed lips around it, as you start to inhale, press down on the inhaler to release the drug, full breathing [3 to 5 seconds] and hold your breath for at least 10 seconds or as you possible before you take next breath.

2- Inhalation technique of turbohaler TH, this part of the questionnaire is comprised of (7) sub-domains [21] with two possible answers [correct or in-correct].

Inhaler mouthpiece opening, rotate the grip counter clockwise and then back until a “click” is heard, exhale away of device, mouthpiece insertion into the mouth, inhalation of quick, steady breath, hold your breath for at least 10 seconds or as you can and exhale away of device.

Data Collection:

The data was collected using a specially designed questionnaire that had been evaluated for validity and reliability, by a structured interviewing approach with individuals who were each questioned separately.

Conducting Pilot Study: To determine if the study materials and instructional program are reliable, a sample of (10) patients were selected of patients with asthma who had been on inhaler for one month at least, the sample participants faced to educational program and reevaluated after 4 weeks (Post session). It was conducted at one pharmacy in Nassiriya city in interval 1st of October to 29 th of the same month, 2021. The present study does not include the pilot study sample.

Validity:

Validity of the education program and the study instruments are committed by four experts [2 PhD degree pharmacists and 2 respiratory specialist doctors] in order to assess the difficulty, clarity, applicability, and comprehensiveness of questionnaire items and to provide comments about general design of the study.

Reliability:

The reliability of questionnaire was assessed using a test-and-retest methodology on (10) patients of pilot study. The principal components about the responses to the questionnaire's items exhibited extremely high levels of stability and consistency.

Statistical analysis:

The study's data are analyzed using the statistical package (SPSS) version (22). Median and interquartile ranges are used to describe continuous variables (IQR 25–75). Percentages and frequencies are used to represent categorical variables. The data was arranged in tables and figures.

Ethical Consideration:

Ethics approval was obtained from Iraqi ministry of health _Thi-Qar health department. The purpose of study was clearly explained to each participants of study and oral consent was obtained before the commencement of the study.

Results:

A total of 73 patients with asthma who meet a criteria were enrolled in the study and were divided as study and control groups. Only 51 of them complete until the end of study [others withdraw of complete all sessions of study]. 26 participants were involved in study (intervention) group while 25 in control one.

Baseline characteristics of study population:

The demographic details of the patients are summarized in **table 1**.

Most of the study participants were in age range of 40-49 years of total participants as representing as (30.8%) for study group and (40%) in control one. Majority of intervention (study) group participants were female (73%) while male in control group (64%). Most of the participants were domicile in urban area as (80%) and (52%) for study and control groups respectively. Most of participants were in married status for both groups. The majority of participants of both groups were in monthly income range [300.000 to 600.000 IQD] which indicates poor economic status. The proportion of smokers participants were (20%) and (7.7%) in intervention and control groups respectively, as shown in **figure 2**. Most of patients were have asthma for 1-5 years ago (44%) of control group while for 6-10 years ago (32%) in study group. The response for question [Did you receive any health education regarding asthma?] was with answer “YES” in percent more than (64%) in both groups and the source for that education was physician in (100%) as shown in **table 2**.

The majority of participants were used turbuhaler TH inhaler, **table 3**. Also the majority of participants were on one inhaler device in both groups. The answer for question [Did you receive information about proper use of inhaler?] was “YES” in percent more than 92% for both group, as the information was delivered majorly by physicians [17 (68.0%), 19 (82.6%) in study and control groups respectively], while was just 3 (12.0%) by pharmacist in study group and no one received information about inhaler in control group by pharmacist, **table 3**.

Table 1 : Demographics characteristics of the study patients.

Variables	Category	Study group n=26	Control group n= 25	P value
Age, years, n,(%)	Less than 20 years	3 (11.5)	0 (0.0)	0.246
	20 to 29 years	2 (7.7)	4 (16.0)	
	30 to 39 years	3 (11.5)	6 (24.0)	
	40 to 49 years	8 (30.8)	10 (40.0)	
	50 to 59 years	7 (26.9)	3 (12.0)	
	More than 60 years	3 (11.5)	2 (8.0)	
Gender n,(%)	Male	7 (26.9)	16 (64.0)	*0.008
	Female	19 (73.0)	9 (36.0)	
Residential area n,(%)	Rural	5 (20.0)	12 (48.0)	*0.037
	Urban	20 (80.0)	13 (52.0)	
	Illiterate	7 (26.9)	1 (4.0)	

Level of education n, (%)	Read & write	1 (3.8)	3 (12.0)	0.185
	Primary school graduate	5 (19.2)	3 (12.0)	
	Intermediate school graduate	5 (19.2)	5 (20.0)	
	High Institute graduate	4 (15.4)	7 (28.0)	
	University graduate	3 (11.5)	6 (24.0)	
	Higher education (post graduate)	1 (3.8)	0 (0.0)	
Marital status n, (%)	Single	5 (19.2)	4 (16.0)	0.334
	Married	19 (73.0)	21 (84.0)	
	Widowed	2 (7.7)	0 (0.0)	
Occupation	Unemployed	1 (3.8)	0 (0.0)	0.393
	Government employee	7 (26.9)	12 (48.0)	
	private work	0 (0.0)	1 (4.0)	
	house Wife	11 (42.3)	7 (28.0)	
	Retired	4 (15.4)	4 (16.0)	
	Student	3 (11.5)	1 (4.0)	
Monthly income in IQD	less than 300.000 IQD	5 (19.2)	4 (16.0)	0.292
	300.000-600.000 IQD	13 (50.0)	10 (40.0)	
	600.000- 900.000 IQD	3 (11.5)	0 (0.0)	
	900.000 -1.200.000 IQD	4 (15.4)	8 (32.0)	
	1.200.000- 1.500.000 IQD	1 (3.8)	2 (8.0)	
	1.500.000 or more	0 (0.0)	1 (4.0)	
Note: Data are expressed as n (%) percentages and frequencies for the categorical variables. Values of * =P < 0.05 were considered as significant. Abbreviations: IQD =Iraqi dinnar.				

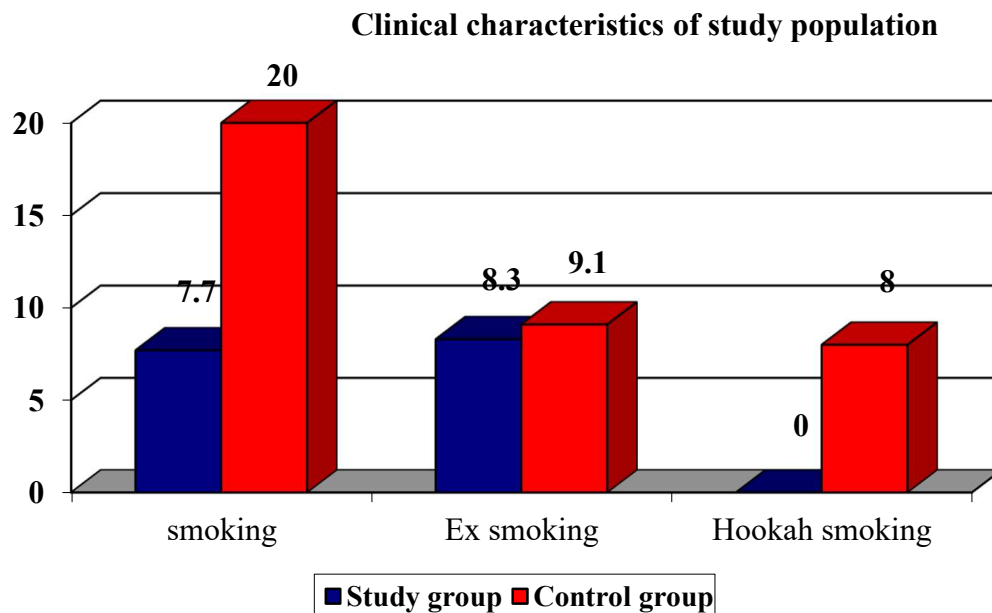


Figure 2 Smoking characteristics of study population representative as percentage.

Table 2 : Clinical characteristics of the study patients.

Variables	Category	Study group n=26	Control group n= 25	P value
Duration of asthma n, (%)	Less than one year ago	5 (19.2)	2 (8.0)	0.554
	1-5 years	7 (26.9)	11 (44.0)	
	6-10 years	6 (32.1)	5 (20.0)	
	16-20 years	4 (15.4)	5 (20.0)	
	21 years and above	4 (15.4)	2 (8.0)	
Did you receive any health education regarding asthma?	Yes	17 (65.4)	16 (64.0)	0.918
	No	9 (34.6)	9 (36.0)	
If the answer is yes. What is the source of information?	Physician	17 (100)	16 (100)	0

Note: Data are expressed as n (%) percentages and frequencies for the categorical variables. Data are expressed as median and (inter quarter)for continus variable. Values of * =P < 0.05 were considered as significant.

Table 3: Characteristics related to use of inhalers.

Variables	Category	Study group n=26	Control group n= 25	P value
Type of inhaler use n, (%)	MDI	8 (30.8)	8 (32.0)	0.925
	TH	18 (69.2)	17 (68.0)	
Duration of inhalation therapy in years?	Less than 1years ago	10 (38.5)	6 (24.0)	0.855
	1-5 years	12 (46.2)	14 (56.0)	
	6-10 years	2 (7.7)	3 (12.0)	
	11-15 years	1 (3.8)	1 (4.0)	
	16 years and above	1 (3.8)	1 (4.0)	
Number of different inhaled medications	One	19 (73.1)	21 (84.0)	0.343
	Two	7 (26.9)	4 (16.0)	
Did you receive information about proper use of inhaler?	Yes	25 (96.2)	23 (92.0)	0.592
	No	1 (3.8)	2 (8.0)	
If the answer is yes. What is the source of information?	Physician	17 (68.0)	19 (82.6)	0.258
	Pharmacist	3 (12.0)	0 (0.0)	
	Nurse	1 (4.0)	2 (8.7)	
	Other sources	4 (16.0)	2 (8.7)	

Note: Data are expressed as n (%) percentages and frequencies for the categorical variables. Values of * =P < 0.05 were considered as significant. Abbreviations :MDI=metered dose inhaler.

Quality of MDI inhalation technique:

Assessment of MDI inhalation technique at baseline session showed high percentage of mistakes in performing most of technique steps, **Table 4**. The low technique performance was showed and confirmed by low median score value for total MDI score (out of 8 correct score, for study was 3.5 and 5 for control group), **Table 5**. Regarding the specific steps, as shown in **Table 4**, no mistake was observed for step 2 for all patients; however, the most common mistakes for both groups were occurred in step 2, step 3, step 6, step 7 and step 8. Higher mistake percent was in step 6 [Press down on the inhaler to release medication as you start to breathe in slowly].

Table 4: Percentage of patients performing each step of MDI correctly at Pre and Post sessions.

Steps	Study group n (8)		Control group n (8)	
	Pre-test	Post -test	Pre-test	Post -test
	n (%)	n (%)	n (%)	n (%)
1. Inhaler shaking before use.	2 (25)	8 (100)	5 (62.5)	6 (75)
2. Cap removing.	8 (100)	8 (100)	8 (100)	8 (100)
3. Exhale away of device.	2 (25)	5 (62.5)	1 (12.5)	2 (25)
4. Slightly tilt your head backward.	6 (75)	8 (100)	5 (62.5)	6 (75)
5. Inhaler's mouthpiece inserted in mouth with closed lips around it.	6 (75)	8 (100)	8 (100)	8 (100)
6. As you start to inhale, press down on the inhaler to release the drug.	1 (12.5)	4 (50)	2 (25)	2 (25)
7. Full breathing [3 to 5 seconds].	0 (0.0)	5 (62.5)	3 (37.5)	2 (25)
8. If you can, hold your breath for at least 10 seconds or as you possible before you take next breath.	0 (0.0)	7 (87.5)	4 (50)	4 (50)

Note: Data are expressed as n (%) percentages and frequencies for the categorical variables.

All the patients in study group had low inhalation technique performance which got improved after intervention. As shown in **Table 4** and **Table 5**, there was a significant improvement in steps performance at Post session for intervention group. Step 1 session performance increased from (25%) to (100%) correct percent. Also, there was improvement in other steps like step 3 (of 25% to 62%), step 6 (of 12.5% to 50%) and step 8 (of zero percent to 87.5%). Also the improvement was showed by significant increase in median value for total MDI score of Post session from basic session ($p=0.010$), **Table 5**. From review the results; there was no significant difference between

basic and Post session for control group, as this was expected due to study design. For pairwise comparisons of each group, the Wilcoxon test was used to show the significance.

Quality of turbuhaler TH inhalation technique:

Table 5: Median score of MDI inhalation technique pre and Post -test.

Performance of MDI			
Groups	Pre-test	Post –test	<i>P</i> value ^a
Study group	3.5 (2.0-4.0)	7.0 (5.5-7.0)	0.010 ^a
Control group	5.0 (3.2-5.0)	5.0 (4.2-5.0)	0.157 ^a

^a *P* value for differences between pre and post-test in each groups. Statistically significant ($P < 0.05$). Abbreviations: MDI = metered dose inhaler.

Out of 51 patients in study, 35 of them used TH. 18 were in study group and the rest 17 in control group. Assessment of TH inhalation technique which involves 7 steps at basic session [Pre] showed high percent of mistakes in performing most of steps of technique, **table 6**.

Regarding the specific steps, no mistake was observed for step 4 for all patients. The most common mistakes for both groups were occurring in step 3, step 5, step 6 and step 7. Higher incorrect performance was in step 3 [Exhale away from the inhaler], **table 6**.

All the patients in study group had low knowledge in the inhalation technique performance which got improved after intervention like that of MDI, as shown in **table 6** and **7**. There was significant improvement in the performance at Post session for study group, as step 3 performance increased from zero correct percent to (94.4%) which is the most responded step for intervention. Also, there were improvements in other steps like step 5 (of 44.4% to 100%), step 6 (of 27.8% to 88.9%), and step 7 (of 11.1% to 94%). The same improvement was seen on median value of TH score after intervention, as median value increase of 4 to 7 ($p=0.000$), **table 7**. The assessment results for patients with TH in control group in all session of the study were without significant difference as that of MDI, **table 6** and **7**.

Table 6: Percentage of patients performing each step of TH correctly at Pre and Post.

Steps	Study group n (18)		Control group n (17)	
	Pre-test	Post -test	Pre-test	Post -test
	n (%)	n (%)	n (%)	n (%)
1. Inhaler mouthpiece opening.	17 (94.4)	18 (100)	17 (100)	17 (100)
2. Rotate the grip counter clockwise and then back until a “click” is heard.	17 (94.4)	18 (100)	16 (94.1)	16 (94.1)
3. Exhale away of device.	0 (0.0)	18 (100)	1 (5.9)	2 (11.8)
4. Mouthpiece insertion into the mouth.	18 (100)	18 (100)	17 (100)	17 (100)
5. Inhalation of quick, steady breath.	8 (44.4)	18 (100)	14 (82.4)	13 (76.5)
6. Hold your breath for at least 10 seconds or as you can.	5 (27.8)	16 (88.9)	10 (58.8)	13 (76.5)
7. Exhale away of device.	2 (11.1)	17 (94.4)	1 (5.9)	1 (5.9)

n indicates the number of patients.

Table 7: Median score of turbuhaler inhalation technique pre and post -test.

Groups	Performance of TH		
	Pre-test	Post –test	<i>P</i> value ^a
Study group	4.0 (3.0-4.2)	7.0 (7.0-7.0)	0.000 ^a
Control group	5.0 (4.0-5.0)	5.0 (4.0-5.0)	0.257 ^a

^a *P* value for differences between pre and post-test in each groups. Statistically significant ($P < 0.05$).

From data analysis, the evaluation of quality of inhalation technique for both MDI and TH founded no significant dependences on sociodemographic characteristics like age, gender, occupation of patients and also nor on other clinical characteristics variable like time of disease diagnosis.

Discussion:

In this study, a total of 51 patients (26 in study and 25 in control group) have completed the study. Demographic details, like age, education, Occupation and monthly income were without significant difference between control and intervention groups. Our results showed that most of patients received their education about disease or inhaler use by physicians while there was very limit or no role for pharmacist in patient's education. This could be the reason behind patients receiving education about inhaler technique only when they first start using their inhalers. Most of participants in our study were on turbuhaler TH (35 out of total 51) rather than metered dose inhaler MDI, a possible explanation might be related to higher distribution and prescribing of TH among patients by physicians in study area, due to less complex administration (no coordination need) and also may be due to its dispensing free in visits hospitals. The assessment of inhalation technique in this study was performed using a quantitative scoring in order to simplify the assessment process and ensure consistency. The researcher just needed to check steps performing by scoring 1 point for each correct step and zero for each incorrect one and a total score just obtained by summing the points. There are many studies in which the same scoring system has also been used [17], [22]. While there are another studies used another scoring system in which unequal score giving to each step depending on important of step in drug delivery to the lung, the more important steps give high points score more than another steps [12], [23]. However, the multiple checklists employed in the assessment of inhaler technique in published researches reveal no apparent consensus on the relevance of each step [24]. A review by Basheti et al [12] analyzed 24 checklists for DPI usage found a wide range variations in the number of steps (ranging of 3 to 14 steps) and also different in identified critical steps in 10 of checklists. Focusing on crucial steps may also result in a loss of attention to "less important" steps that might have a substantial impact on medication delivery [24]. Since the inhalation steps employed in our investigation were scored equally, this approach appears to be more suited for clinical usage because of its simplicity and consistency. Assessment of MDI and TH inhalation technique at basic session for all study population showed high percent of mistakes in performing most of technique steps. For MDI, the most common mistakes for both groups of the study were occur in step 1 (Inhaler shaking before use), step 3 (Exhale away of device), step 6 (As you start to inhale, press down on the inhaler to release the drug), step 7 (Full breathing [3 to 5 seconds]) and step 8 (If you can, hold your breath for at least 10 seconds or as you possible), and this were similar to findings in studies previously

published in Iraq [23], [25], [26]. While for turbuhaler (TH), the most commonly mistakes for both groups were occurring in step 3 (Exhale away of device.), step 5 (Inhalation of quick, steady breath), step 6 (Hold your breath for at least 10 seconds or as you can.) and step 7 (Exhale away of device), the results were similar to findings of study conducted at Lebanon [27] especially in step 3 (Exhale away), step 5 (Inhalation of quick breath), and step 6 (Hold your breath) results. The most frequent errors that seen in MDI users were in step 6 (coordination between actuation and inhalation) and step 7 (slow inhalation), as these two steps consider as important in drug delivery to targeted airways. The failure of patients to perform step 6 (coordination) can be explained by: most of patients lack to skills and previous training that required to perform it correctly, this issue related to most of MDI users [9]. The majority of MDI users inhale with fast rate (step 7). For getting maximal effects of drug, peripheral sedimentation in airways better than central impaction and this result by slow inhalation rate [28]. For TH, exhale away (breathing out) gently to residual volume of air in lung is an important step and was the most frequent incorrect step, as without adequate exhalation, patients may don't able to inhale forcefully and deeply enough through the inhaler in order to ensure deposition of drug particles into the lungs. Unlike MDI, TH need forcefully and rapid rate of inhalation to ensure that a drug reached to targeted airways and the results showed a high percent of patients performing this step correctly. Also there is no need to coordination step as in MDI therefore, correctly using of TH is relatively easier than MDI.

Our results for study (intervention) group showed that patient's inhaler technique in both steps and scores improved significantly after training receiving from pharmacists. As there was statistically significant improvement in MDI technique (median score increased from 3.5 to 7, $p=0.010$) and turbuhaler technique (median score increased from 4 to 7, $p=0.000$) after intervention, this was similar to results of studies by Basheti et al [29], Anita et al [30], which showed that pharmacist training on inhalation technique is important to enhance patient's knowledge in correct use of inhaler device. This result was in agreement with many other studies which showed the same positive correlation between inhalation techniques with counselling that given to patients [18], [31].

For control group, there was no significant difference between basic and follow up session for both MDI and TH users and this was expected due to study design.

For ethical reason, patients in control group received the required education at final session of study.

Conclusion:

In conclusion, we conducted this study at community pharmacies to assess the effectiveness of pharmacist education program applied to patients with asthma. Asthmatic patients in Thi-Qar governorate area have poor inhalation technique in both MDI and TH. Pharmacists have a minimal role in management the patients with asthma. The present study showed that a pharmacist education program led to improve inhalation technique significantly in intervention group compared with the control group. Our model of pharmacist education program should be

considered as effective choice for asthmatic patient's management and best utilization of human resources in health care system, especially in country like Iraq. This study should be encouraging community pharmacist to involve in asthma care, to ensure effective use of treatments in patients with asthma.

Limitations:

There were some limitations in our study can be summarized by:

1-One of limitations for such type of study design what is known as Hawthorne effect, which occurs when patients are aware that their inhaler technique is being evaluated and consequently adjust their behavior in a way that may deviate from the approach that they typically follow at home [32], however, this effect is probably negligible compared to size of effect found.

2-Short duration of study, as based on the results of our study, it is difficult to say if the beneficial effects of an inhalation method intervention will last for a longer time, so it would probably be essential to repeat such an intervention frequently on regular basis or doing a study for a longer duration.

3- A selection bias of sample of participants cannot be fully excluded due to such offers for participation in such type of study are usually more accepted by motivated participants rather than by unmotivated one.

4- A sample size may be one of limitations in this study, although the study showed that it was possible to deliver effective inhaler technique education within the limits of a community pharmacy setting and has confirmed the improved effectiveness resulted by using physical demonstration of inhaler.

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