World Journal of Nursing Sciences 5 (1): 41-52, 2019
ISSN 2222-1352

DOI: 10.5829/idosi.wjns.2019.41.52

Assessment of Current Technique of Metered-Dose Inhaler Usage among Mothers of Asthmatic Children in Port Said City

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Abstract: The management failure in asthmatic children may be due to the improper use of metered-dose inhalers "MDI" and they are not fully committed to it as well as lack of good knowledge and practice of how to use it. Therefore, the use of health services should be increased and these children and their mothers should be taught how to use MDI effectively to minimize and treat asthma complications. Aim of the study: is to assess the technique of metered dose inhalers among mothers of asthmatic children. Design: A descriptive design was applied in the current study. Sample: A convenience sample of 130 mothers with their asthmatic children who were using MDI or MDI with spacer were included in the study. Setting: The study was conducted at the Pediatric inpatient department in three governmental hospitals at Port Said City. Tools for data collection: Two tools were used: 1) structured interview questionnaire that contained two parts; Part I: Personal data & Medical history, Part II: Mother`s knowledge and reported practices regarding to asthma and MDI, 2) MDI checklist. Results: it was found that, 76.9% of the mothers had unsatisfactory knowledge and only 23.1% had satisfactory total knowledge scores. Regarding MDI practices, results revealed that, 42.3% of the mothers had poor practice scores, 45.4% had fair practice scores and only 12.3% had good practice scores. A statistically significant negative relation was found between children's age and hospitalization due to asthma and mother's total practice scores while a statistically positive relation was found between mother's education, crowding index and source of mother's information and mother's total practice scores. The study concluded that, there are lack of knowledge about asthma and MDI among mothers having asthmatic children which also affected their practices. The study recommended an educational training programs about how to use MDI for their asthmatic children should be held at hospitals for mothers, counselling session should be delivered by pediatric nurse to mothers having asthmatic children regarding MDI at the beginning of the diagnosis and be combined with every step of their asthma management.

Key words: Asthma · Children · Mothers · Technique of Metered-Dose Inhaler

INTRODUCTION

Asthma is the greatest common chronic illnesses among children and it considered a significant co-morbid disease [1]. Asthma considers a significant health problem throughout the world. So many changes happen for managing bronchial asthma. However, the number of hospital admission of asthmatic children has increased and also deaths. The prevalence and seriousness of asthma are rising throughout the world. The world health organization (WHO) has estimated that, asthma deaths accounted for 250, 000 worldwide and approximately 500, 000 annual hospitalizations are due to asthma. The burden of the uncontrolled asthma is high, which needs frequent emergency room visits and hospital admissions [1, 2].

Over the last three decades, asthma has been increased in developing and developed countries, where it was estimated that 8% of worldwide population are suffering from bronchial asthma [3 , 4]. Also, it was estimated that the number of individuals with asthma is expected to increase from 300 to 400 million by the year 2025 [2]. According to Zedan, *et al*. [2] 10% to 15% of

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children are affected by asthma worldwide and that childhood asthma prevalence ranged from 2.1% in developing to 32.2% in developed countries. The study done by Alruwaili *et al.* [1] in Saudi Arabia revealed high prevalence of bronchial asthma among Saudi children.

Educating asthmatic children and their mothers is the major role of a nurse because he\she is the most contact person with them. Teaching mothers of asthmatic children is a significant aspect of asthma management because mothers play pivotal role in the children adaptation to the illness, especially children who suffering from uncontrolled asthma [4]. It is apparent that no inhaled medications get its effectiveness unless it expanded through the lungs, as wrong inhaling technique may lead to more complications, so one of the most aspects of education should be about proper inhalation technique. Mother perform a vital role in control asthma for their children, particularly children who had experiences of distress and anxiety about difficulties to maintain wellness because errors in using the inhaler technique are prevalent and have been results in unsatisfied management in asthma control [1, 5].

Control of triggers and pharmacological treatment are the main components in managing asthma. As for medication, inhalation is the chosen method of asthma treatment as medications can be distributed directly into the bronchial airways, provided further fast onset of action, permit administering of minor dosages of medications and less systemic side effects [6, 7]. However, inhaled drugs have some disadvantages. One of the most common defects is that the correct inhalation method prescribed by the physician is necessary for each type of inhalers to achieve the desired result. However, many children incapable to use MDI appropriately. Also, spacer is additional maneuver designed to improve the effectiveness of inhaled medication and it is usually recommended for children who have difficulty in using MDI alone [8, 9].

Inhaled medications differ from other oral medications for the treatment of asthma, because inhaled medicines require lung deposition that needs certain learning skill [10, 11]. The goal of inhaled drugs is to maximize the regular amount of prescribed dose that spreads into the lungs and to reduce the missed drug in the air or mouth, leading to effectiveness and optimum ability to evaluate the dose effect. There is no way to inhalation the drug can provide 100% of the dose in the lung. However, adherence to the best medication administration is crucial for accomplishing the effectiveness of the medication [12]. In assessing whether children control asthma, the concept of inhaled drugs is properly transferred into the lungs is neglected and immediately decided that medications not effective and increase doses or prescribe additional to improve symptoms rather than assess the method of inhalation. The efficiency of inhalation techniques is a critical stage in the management of asthma. MDI is an unrivaled form of drug management and needs to gain awareness and skills [13 , 14].

Treatment of asthma by inhalation devices is in practice since many years. MDIs are often preferred inhalation devices. Combined with a spacer device it is more convenient especially in children and elderly people. The purpose of the spacer device is to act as an intermediary chamber into which the MDI can discharge the drug allowing to inhale over several breaths. A secondary advantage of using spacers with inhaled corticosteroid is the incidence of local side effects, such as oropharyngeal candidiasis and hoarseness, is reduced [15, 16].

Significance of the Study: In Egypt, it was reported that asthma prevalence was 4.8% in Egyptian infants and children aged less than 4 years, from five governorates, while prevalence in children was 7.7% in the Nile Delta region of Egypt. Current asthma prevalence is higher for children than for adults [12], a study done by Meatty *et al.* [12] in Dekerness District, Dakahlia Governorate, Egypt during a period of one-year children aged 2-17 years revealed that, 13.4% had bronchial asthma. Another two studies in Assuit and Quena, Egypt revealed that, the prevalence of asthma among children aged 3-15 years was estimated to be 8.2% -8.3% [13, 14].

It has been observed by the researchers that there were big number of cases admitted to pediatric inpatient unit with deteriorating asthma, although they were on MDI still a lot of them were fighting to take breathing and it was noticed that most mothers or children did not have enough knowledge about asthma and had a lot of errors during using of metered dose inhaler. Based upon these facts it is very important to assess the knowledge and practices of mothers and their asthmatic children for using MDI as it became critical to improve the health of children with asthma.

MATERIALS AND METHOD

Aim: The aim of the current study is to assess the technique of metered dose inhalers among mothers of asthmatic children.

Research Question: What are the mother's knowledge and practice regarding MDI for their asthmatic children?

Study Design: Descriptive research design was used in this study. It depends on observing the mothers of asthmatic children to collect the data in attempting to examine situations and construct what is the norms, i.e. what can be expected to occur another time with the same circumstances [18].

Sample: A convenience sample of 130 mothers with their asthmatic children who were using MDI or MDI with spacer. The study was carried out from May to November 2018.

Inclusion Criteria:

- Age: from 4-8 years.
- Admitted to pediatric inpatient.
- Both genders.
- Using MDI or MDI with spacer.
- Free from other chronic diseases that might affect their asthma condition.

Settings: The study was conducted at the Pediatric inpatient department in three governmental hospitals at Port Said City; Port Fouad Hospital, General Port Said Hospital and El Naser Hospital.

Tools for Data Collection:

- **Tool 1:** Structured interview questionnaire was prepared by the researchers which includes:
- Part I: A) Personal data: this tool was developed by researchers after reviewing the related literature. This part covered the children`s and their mothers demographic characteristics (gender, crowding index, family income & mothers' education). B) Medical history: it includes; duration of asthma, past hospitalization, length of hospitalization, sources of instructions giving to the mothers.
- Part II: mother`s knowledge and reported practices regarding to asthma and MDI (triggers and symptoms of asthma, definition of MDI, components and storage of MDI, …. etc) the tool's reliability was (r = 0.86) and its validity was done by consulting expertise in pediatric nursing.

Tool 2: The checklist was guided by [16 - 19] and was reviewed by researchers for its applicability for children's uses of MDI and MDI-spacer. The checklist contained 8 steps which were considered crucial steps to deliver medication into the child's airway. The inhalation technique was determined as satisfied if the essential 8 steps were correctly accomplished.

Scoring System:

- The mother`s answer and their children were checked compared to ideal answer, a score of (2) was given for satisfactory answers, (1) for unsatisfactory answers and (0) for don`t know. Therefore, their knowledge was categorized into as following: Satisfactory if the percent score was 60% or more and unsatisfactory if less than 60%.
- Regarding mother`s practices; the scores was converted to percentages, score of 30% or less was considered poor, more than 30% to less than 60% was considered fair and if the child achieves 60% or more it was considered good practices for MDI.
- The crowding index calculation it was according to Goodyear [20]: (0.5*number of children under 10) + (number of couples) + (all other people aged 10 and over) / (number of bedrooms available) and it was considered Sever >1.5 people per room, crowded >1.0 to <=1.5 people per room and not crowded: <= 1.0 person per room.

Procedure: A formal approval was taken from the directors of the three governmental hospitals in Port Said administrators and nursing directors to ensure their assistance. Data was collected during 6 months from May to October 2018, 2 days each week from 9.00 a.m. to 12.00 p.m. Demographic data for every child and his/her mother were collected. The mothers were asked to demonstrate the MDI or MDI with spacer in front of the researchers. The inhalation technique was evaluated by recording their performance on a standardized checklist then feedback was providing to mothers about what they did correct and which steps needs to be improved. If the mothers perform numerous mistakes, they were corrected on spot and trained on the correct technique of MDI.

Pilot Study: Pilot study was done on 10% of the children who fulfilled the inclusion criteria. Pilot study was done to determine the possibility as well as clarity of the tools in addition to estimation of the appropriate time for answering questions. Mothers and children included in the pilot study were excluded from the total sample.

Ethical Consideration: The researchers obtained the permission to conduct the study from managers of the three hospitals and the nurse directors. Privacy and confidentiality were secured through coding of the mothers and their children's information. Oral agreement was obtained from the mothers of children who fulfilled the inclusion criteria. Mothers were informed that they can withdraw their children during any stage of the study. A brief explanation of the purpose and importance of the study was clarified to the mothers and their children and assured them that obtained information will be confidential and used only for the purpose of the study.

Statistical Design: The collected data were organized, categorized, tabulated in tables and figures using numbers and percentage, mean percentage and standard deviation. Chi-square (x^2) test was used to test the associations among the qualitative variables, whereas for quantitative data T-test was used. The statistical package for social sciences (SPSS version 16) was used for statistical analysis.

RESULTS

In relation to demographic data, the current results revealed that, 59.2% of children were males, 53.8% of the children aged from 6 to 8 years with a mean age 6.54±1.17 year, on the other hand 45.4% of the children had crowded homes, 20% had a very crowded homes and 34.6% had uncrowded homes, 63.8% of the children had unsatisfactory family income. Regarding mother's education, 23.8% of them mothers were unable to read and write, 12.3% had primary school education, 36.9% had secondary school and 26.2% were university graduated. In relation to duration of asthma; only 13.1% of the children were asthmatic from less than 6 months, 24.6% had asthma from 6 months to one year, 31.5% of them had the diseases from one year to less than 2 years while 30.8% were asthmatic from more than 2 years. Regarding hospitalization due to asthma, it was found that, 70.8% of these children were admitted due to asthma attack and 35.4% of them were staying for 3 days in the hospital and 53.8% were staying from 1to 2 days. Results revealed that, 65.4% of the mothers did not have any instructions regarding their children's asthma and usage of MDI and only 34.6% had instructions regarding their asthma and MDI usage, 32.3% of them had their main asthma information from the media (internet), 13.8%, & 10% had their information from their peers and family members respectively, 15.4% & 18.5% had their information from the physician and the pharmacist respectively, while only 10% of the mothers got their information about MDI from the nurses.

Regarding mother's total knowledge scores about asthma as a disease and MDI, results revealed that, 76.9% had unsatisfactory knowledge and only 23.1% had satisfactory total knowledge scores (Figure 2). The results revealed that, 76.2% & 67.7% of mothers respectively mentioned that, asthma is not a disease that lasts many years and there are no stimuli or triggers can bring the asthma attack. As for the mother's knowledge about MDI, 30.1% of them did not know anything about MDI, 47.7% of them gave unsatisfactory answer about it. Also, 56.2% of mothers had unsatisfying knowledge about the importance of MDI and 35.4% of them did not know the component of the MDI, 60% of the mothers gave unsatisfactory answer about action and side effects of the medications used. Furthermore 62.3% of mothers for asthmatic children did not know that MDI should be with them wherever they go (Table 1).

Regarding total scores of MDI reported practices, results revealed that, 42.3% had poor practice scores, 45.4% had fair practice scores and only 12.3% had good practice scores (Figure 2). Results cleared that, 67.7% of mothers were helping their children for administering MDI, 60% of the children had errors during taking their doses, on the other hand 23.1% of mothers did not clean their children's MDI device after use, while 44.6% of them were incorrectly cleaning MDI after administration of medication. Furthermore, 69.2% of mothers were storing their children`s MDI in unsatisfactory way, on the other hand 47.7% of mothers did not knew how to check the expiry date for MDI medication, while 33.8% of mothers didn't know how to check if the inhaler is empty or nearly empty and 30.8% of them didn't check it at all (Table 2).

Results revealed that, 73.1% of mothers were not regularly following up their children's condition while 60.8% of mothers were not administering the children`s dose of MDI regularly (Figure 1). In relation to demonstration of MDI, Table (3) clears that, 46.2% were Shaking MDI and removing cap in unsatisfactory way and 30% never shake and remove MDI cap before giving MDI to their children, while 46.9% were connecting the MDI to spacer but in unsatisfactory way, 36.2% never hold the MDI upright, also, 33.1% never place mouthpiece between teeth and lips or place facemask over nose and mouth and form a seal while 51.5% were doing this step but in unsatisfactory way. As for activation of the MDI only once, 33.1% were not activating the MDI only once, as for taking 5-6 deep and slow breaths 40% of the mothers

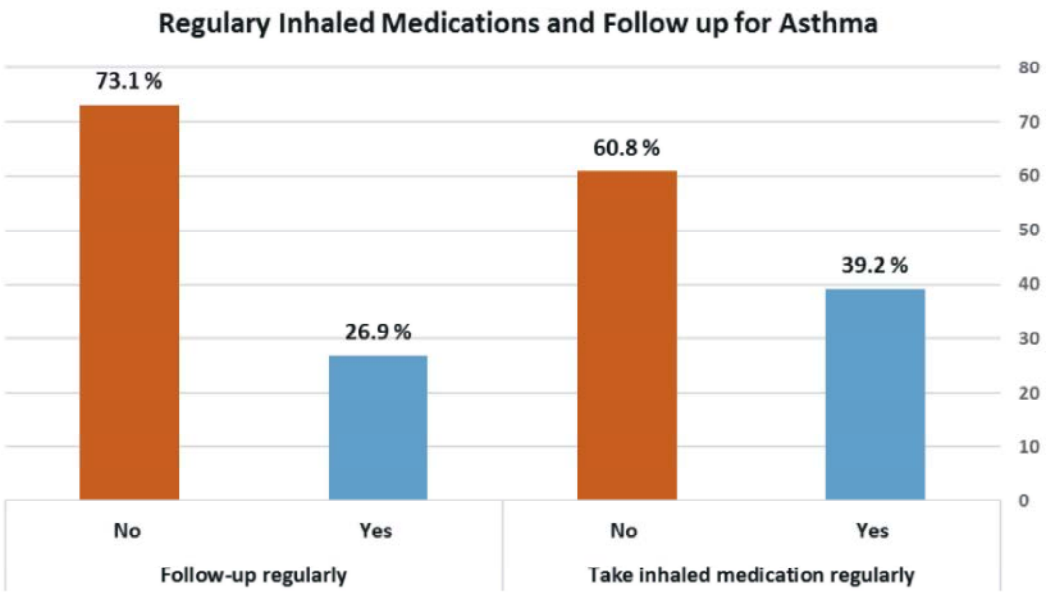

Fig. 1: Distribution of regularity of follow up & administration of inhaled medications:

Table 1: Frequency distribution of mother's knowledge regarding MDI/Spacer:

Knowledge	No	%
Asthma is an illness that lasts many years		
Yes	31	23.8
No	99	76.2
Different (stimuli or triggers) can bring asthma attack		
Yes	42	32.3
No	88	67.7
If yes Symptoms of asthma attach: n= 42		
Satisfactory	15	35.7
Unsatisfactory	27	64.3
Definition of MDI and Spacer		
Don`t know	43	33.1
Unsatisfactory	62	47.7
Satisfactory	25	19.2
Importance of MDI/spacer in asthma management:		
Satisfactory	57	43.8
Unsatisfactory	73	56.2
Components of MDI/spacer:		
Satisfactory	33	25.4
Unsatisfactory	51	39.2
Don`t know	46	35.4
Action and side effects of present asthma medications:		
Satisfactory	52	40.0
Unsatisfactory	78	60.0
MDI must be with the children wherever they go:		
Yes	49	37.7
No	81	62.3

Table 2: Frequency distribution of mother's reported practice regarding MDI/Spacer:

Practice regarding MDI	Frequency	%
Parents help in administer MDI		
Yes	88	67.7
No	42	32.3
Dose error (over or under dose):		
Yes	78	60.0
No	52	40.0
Cleaning the MDI\ Spacer:		
Did not cleaning it	30	23.1
Incorrect cleaning " washing and drying with towel or cleaning by dishwasher"	58	44.6
Correct cleaning " washing well in warm water and let it dry in air"	42	32.3
Storage of MDI\Spacer:		
Unsatisfactory done	90	69.2
Satisfactory done	40	30.8
Check expiry date of MDI/Spacer:		
Did not know how to check	62	47.7
Did not do it at all	38	29.2
Properly done	30	23.1
Check if inhaler is empty or nearly empty:		
Did not know how to check	44	33.8
Did not do it at all	40	30.8
Properly done	46	35.4

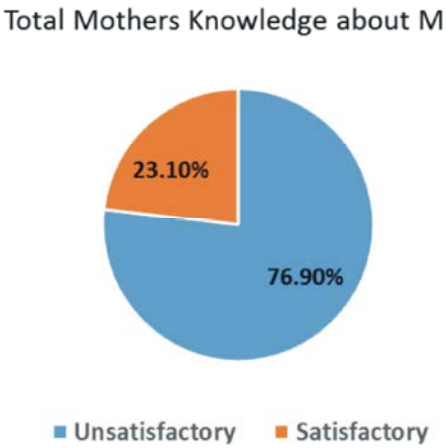

Fig. 2: Frequency distribution of total mother's knowledge scores:

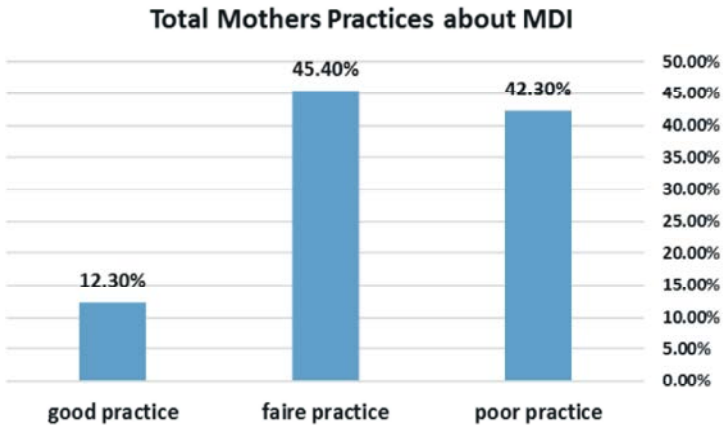

Fig. 3: Frequency distribution of total mothers practice scores regarding MDI:

Table 3: Frequency distribution of mother's demonstration of MDI for their asthmatic children

	Did not do step		Unsatisfactory done		Satisfactory done	
Mothers demonstration of MDI	No	%	No	%	No	%
Shaking MDI and removing cap	39	30.0	60	46.2	31	23.8
Connect MDI to spacer	37	28.5	61	46.9	32	24.6
Holding MDI upright	47	36.2	58	44.6	25	19.2
Place mouthpiece between teeth and lips or place facemask over nose and mouth and form a seal	43	33.1	67	51.5	20	15.4
Activation of the MDI only once	41	31.5	50	38.5	39	30.0
Take 5-6 deep and slow breaths	52	40.0	48	36.9	30	23.1
Wait for at least 30 seconds before next actuation	69	53.1	40	30.8	21	16.2
Rinse the mouth after the use of a steroid inhaler	45	34.6	66	50.8	19	14.6

Table 4: Correlation coefficient between total practice regarding MDI, demonstration of MDI, children gender & age, family income and duration of illness.

	Total practice score	
Items	R	P
Age	-0.297	0.001**
Mother Education	0.279	0.001**
Crowding index	0.203	0.021*
Hospitalization due to asthma	-0.226	0.000**
Source of information about MDI	0.233	0.008**

**Correlation is significant at the 0.05

never did this step and only 36.9 were doing this step but in unsatisfactory way. It was found that, 53.1% of the mothers never Waited for at least 30 seconds before giving their children the next actuation. As for the last step of demonstration of MDI, 34.6% of the mothers were not rinsing the children`s mouth after MDI and 50.8% of the mothers were rinsing the children's mouth but in unsatisfactory manner.

A statistically significant negative relation was found between children's age and hospitalization due to asthma and mother's total practice scores of MDI (p=0.001, p=0.000) respectively while a statistically positive relation was found between mother's education, crowding index and source of mother's information and mother's total practice scores of MDI (p=0.001, p=0.021, p=0.008) respectively (Table 4).

DISCUSSION

Inhaled medications are the backbone of asthma treatment and metered dose inhaler is commonly used to administer asthma drugs so knowledge and practices about MDI for mothers of children with asthma are still the most important aspects to control asthma among their children, it is a technique that needs high skills Costello *et al*. [21].

Results of the current study revealed that, slightly more than half of the children were males. A lower percentage was found by Haroon *et al*. [22] who made a study to assess the frequency of correct use of inhaler technique among 82 asthmatic children aged from 5-13 years in Islamabad, Pakistan where 40.2% of the patients were male. A higher percentage was found by Ranaut *et al.* [23] who studied the effect of intervention on the use of Metered Dose Inhaler among asthmatic children and their caregivers in India and found that around three fourth (73%) subjects were male. This result is the same as American Academy of Allergy Asthma and Immunology [24] and Tantawi *et al*. [17] who identified that, boys are frequently reported to have more asthma attacks than girls and that bronchial asthma is more common in boys than girls due to the smaller airway diameters in boys. From the researchers' point of view, Egyptian male children tend to play outdoor than females who obey commands from their mothers than males and this exposes them to outdoor triggers of asthma.

Results of the study revealed that the mean age of the children is 6.54±1.17 years. The same results were found by Ranaut *et al.* [23] in India where the mean age of the subjects was 7.7 ± 0.6 years. This results might be attributed to the fact that there is high prevalence of asthma among Egyptian children less than 4 years [12].

Results revealed that, two third of the mothers did not have any instructions regarding their children's asthma and usage of MDI and that one third of them had their information from the media (internet) while only ten percent of the mothers got their information about MDI from the nurses. These finding is in congruent with a study conducted by Al-Jahdali *et al.* [25] in Saudi Arabia about improper inhaler technique associated with poor asthma control and frequent emergency department visits showed that, 40 percent of the patients did not receive any formal education by any health care. In contrast to the study results was the study done by Mbchb, [26]

in South Africa about the use of MDI and revealed that, 70% identified that nurses were the frequent educators on the use of MDI, followed by doctors (42%), only 4% were taught by pharmacists on the use of MDI. Another study done by Gelaw & Gelaw [27] in Ethiopia revealed that, 93.4% asthmatic children got instructions from general practitioners. From the researcher's point of view, mothers play a vital role in the management of their child's asthma and health care providers cannot force asthma treatment on these children, so their mother's decision is usually based on their own understanding of the illness and medication. This can high light the importance of the nurse's role in educating the asthmatic children and their mothers.

Regarding mother's total knowledge scores about asthma as a disease and MDI, results revealed that, three quarter of the mothers had unsatisfactory knowledge and only about one quarter had satisfactory total knowledge scores (Figure 2). This result was supported by the National Heart, Lung and Blood Institute/National Asthma Education and Prevention Program, who stated that educating caregivers of asthmatic children is the key element in treating and managing the disease because children are dependent on their caregivers' knowledge. Great attention must be paid on giving parents all the required knowledge from the beginning, because incorrect asthma treatment can lower the quality of the children's life and can be life threatening as well [10]. According to the study done by Cabelloa *et al.* [29] the scores of the general knowledge on asthma was; 80.2% of the respondents knew the prevalence of childhood asthma, 60% stated that asthma was not harmful to the heart, only 21.5% could enumerate the three main symptoms of an asthma attack. When it came to an acute asthma attack, only 4.4% could identify the three main triggers of such an attack (colds, allergens and exercise), but up to 29.6% of the respondents named at least two of these triggers. As for the management of asthma, only 39.2% answered correctly about the medications that are used in an acute attack.

Almost the same results were found by Amin *et al.* [30] who studied 70 mothers of children diagnosed with bronchial asthma in Pediatric Hospital, Cairo University and identified that, 85.7% of mothers had fair knowledge and only 14.3% had very good knowledge about medication devices. In relation to asthma triggers, 88.6% of the mothers had poor knowledge and 11.4% had fair knowledge. As for asthma definition, 95.7% of the mothers had poor knowledge and 4.3% of them had fair knowledge, 61.4% had fair knowledge about asthma medication. In relation to asthma triggers, 88.6% of the mothers had poor knowledge and 11.4% had fair knowledge. In relation to prevention of asthma attack, 87.2% of mothers had poor knowledge and 12.8% had fair knowledge. In contrast with the study results of Handelman *et al*. [31] who conducted a study about "understanding pediatric inner-city asthma and found that most mothers knew more than one of their children's medication. The researchers' point of view that insufficient knowledge of mothers about any aspect of asthma particularly inhaler using is one of the major obstacles to control asthma for their children. From the researchers point of view, lack of knowledge among mothers can be attributed to lack of constructed educational training program about asthma as a disease and how it can be controlled and this is reflected in the results as this mothers had obtained their knowledge from the internet which cannot be a trusted sources as the health care team.

Regarding total scores of MDI reported practices, results revealed that, slightly less than half of the mothers had poor practice scores, forty five percent of them had fair practice scores and only few of them had good practice scores (Figure 3). The study done by Lenney *et al.* [32] in asthmatic children in Siri Lanka revealed that, the technique was very good in 17%, satisfactory in 50% and poor in 33% and recommended that, at each contact, healthcare professionals should work with patients and their families on inhaler technique. From the researcher's point of view, if continuous education and training is provided to asthmatic children and their mothers this will help in improving the knowledge and skill and thus improving the child's condition.

Regarding to MDI practices, the finding cleared that more than two thirds of the children were having help from their parents for administering MDI and slightly less than sixty percent of them had errors during taking their doses, on the other hand about one quarter of mothers did not clean the children`s MDI device after use it while slightly less than half of them were cleaning MDI after administration of medication but incorrectly. Furthermore, only one third of mothers store MDI by satisfactory way, on the other hand about half of them knew how to check the expiry date for MDI medication in addition to almost one third knew how to check if inhaler is empty or nearly empty but they did not (Table 3). About three quarter of children neither follow up nor take

their dose of MDI regularly (Figure 1). The study done in India by Ranaut *et al.* [23] was in the same line with the current results, where it was clarified that, although the children were using inhalers since years, yet none of them or their parents could achieve good or excellent scores in using their MDI. Another study done by Haroon *et al*. [22] to assess the frequency of correct use of inhaler technique among 82 asthmatic children aged from 5-13 years of age who had been using MDI inhalers for one year in Islamabad, Pakistan revealed that, 18.3% performed all 10 steps correctly while 81.7% had an incorrect technique and that although the correct use of an inhaler looks simply, it was shown that a large proportion of children do not use these devices correctly.

In relation to demonstration of MDI, Table (3) clears that, slightly less than half of the mothers were Shaking MDI and removing cap in unsatisfactory way and about one third never shake and remove MDI cap before giving MDI to their children, while less than half were connecting the MDI to spacer but in unsatisfactory way, about one third never hold the MDI upright, also, one third never place mouthpiece between teeth and lips or place facemask over nose and mouth and form a seal while half of them were doing this step but in unsatisfactory way. As for activation of the MDI only once, one third of mothers were not activating the MDI only once, as for taking 5-6 deep and slow breaths, more than one third of the mothers never did this step and only one third of them were doing this step but in unsatisfactory way. It was found that, half of the mothers never waited for at least 30 seconds before giving their children the next actuation. As for the last step of demonstration of MDI, about one third of the mothers were not rinsing the children`s mouth after MDI and half of the mothers were rinsing the children's mouth but in unsatisfactory manner. This finding agrees with the study done by Haroon *et al*. [22] to assess the frequency of correct use of inhaler technique among 82 asthmatic children aged from 5-13 years who had been using MDI inhalers for one year in Islamabad, Pakistan and found that, only 18.3% performed all 10 steps correctly while 81.7% had an incorrect technique and that although the correct use of an inhaler looks simply, it was shown that a large proportion of children do not use these devices correctly. The most common error found was to breathe out all the way before pumping in inhaler. Also, they found that, many children did not shake their inhaler and many children did not know that it is recommended to activate the inhaler for every dose. The study explained that, one of the reasons of poor MDI practice was the poor coordination abilities in young children and the reduced strength and expertise of their fingers to actuate the aerosol and their mother were not interested to follow up and learn how to practice it or teach their asthmatic children unless during the attack.

A slightly higher percentage was found by Gelaw & Gelaw [27] where the most frequently noticed errors during inhalation of medications were: not rinsing the mouth after inhaling (86.9%), not cleaning the plastic bottle at all (72.1%), the rate of breathing through the inhaler was slow (65.6%), no shaking before use (37.7%), not rinsing the mouth after inhaling (86.9%), not cleaning the plastic bottle (72.1%), slow rate of breathing through the inhaler (65.6%), not shaking before use (37.7%), activate the inhaler (MDI) twice before starting to inhale through the spacer (43%) and not shaking before use (20%) were the most frequently noticed mistakes. in general and how to use medications correctly. Another study done by Uijen *et al*. [33] to evaluates the knowledge among Dutch children and their parents regarding asthma inhaler therapy and appropriateness of its use revealed that, the most frequently made mistake was; not shaking the inhaler before use (20%), activate MDI twice before starting to inhale through spacer was the most frequently noted incorrect answer (43%). From the researcher's point of view all these mistakes were related to lack of mother's knowledge and practice and this can be corrected by proper educational program provided at the beginning of the disease to increase their awareness about the disease

The results of the current study illustrated that, there are a statistically significant positive relation between mother`s practice regarding MDI and mother's education and crowding index. These results was supported by the study done by Mbchb [26] in South Africa revealed a significant association between the level of education of participants and the use of MDI, where the higher levels of participant education the better performed MDI than those with lower levels of education, since the participant level of education was generally low and hence the poor performance of this technique. In agreement with the study findings Capanoglu *et al.* [34] who applied research to assess the compliance to MDI in Turkey and revealed that, children with mothers who had low level of education had high recurrence of improper usage of inhaler devices. These results contrasted the study that done by Idriss [35] in Khartoum, Sudan found non-significant relation between mothers' education and

mothers' practice. From the researcher's point of view, educational level can affect greatly on MDI technique as poor reading skills can affect the mother's ability to realize the importance of using an inhaler properly, so the higher the educational level of the mother the better MDI practices. On the same line the study done by Gelaw & Gelaw [27] on asthmatic children in Ethiopia revealed that, 52.5% of asthmatic children live in a family member of 1-5, 45.9% live in a family member of 5-10 and only 1.6% lives in a family member of > 10 and these results in the same line with Al-Zahrani *et al.* [36] and Topal *et al.* [37]. From the researcher's point of view, crowded homes with poor ventilation can increase asthma attacks as large number of children in crowded place can make organisms transmission very easily from child to another and this might affect the health of asthmatic children.

CONCLUSION

The study concluded that, there are lack of knowledge about asthma and MDI among mothers having asthmatic children which also affected their practices

Recommendations: Based on the study results, the following recommendations were proposed:

- An educational training programs about how to use MDI for their asthmatic children should be held at hospitals for mothers.
- Counselling session should be delivered by pediatric nurse to mothers having asthmatic children regarding MDI at the beginning of the diagnosis and be combined with every step of their asthma management.
- Replicate the study on larger group of mothers' having asthmatic children.

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