The impact of different counseling techniques on children asthma control

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Abstract

Background: Children asthma control complex due to the chronic nature of asthma and its interference with children's quality of life, patient counseling about asthma nature and inhaler use are considered the cornerstone in asthma control. We evaluated various patient counseling techniques for optimizing the use of pressurized metered dose inhalers (pMDIs) to enhance asthma medication delivery and asthmatic state.

Methods: A random cohort of nonsmoking children with asthma aged 11-19 years was collected from an outpatient clinic; all diagnosed using Global Initiative for Asthma (GINA) diagnosis guidelines. The patient's asthma status and pMDI use were assessed during the initial structured interview, and three groups were randomly divided for different counseling techniques, as the following, traditional verbal counseling only was applied to Group 1, while Group 2 received advanced counseling just via two smartphone applications without verbal corrections for inhaler use errors and Group 3 received the advanced counseling using two smartphone applications alongside with verbal correction of the inhaler use mistakes. We monitored the three groups for two consecutive months using the forced expiratory volume in the one second to the forced vital capacity of the lungs ratio (FEV1/FVC) ratio, Asthma Control Test (ACT), Asthma Control Questionnaire (ACQ), and GINA control assessment Questionnaire.

Results: A total of 102 children with asthma n=102 were divided in to three counseling groups, each group is consisted of 34 patients, n=34. We found that, in term of FEV1/FVC 2nd month interview, the advanced verbal counseling group was superior to the advanced alone counseling group p=0.016. In term of ACT 2nd month interview, the advanced verbal counseling group was superior to the verbal only counseling group p=0.023. In term of ACQ 8th week interview the advanced alone counseling group was superior to the verbal alone counseling group p=0.018. From the 2-month follow-up course using FEV1/FVC ratio, ACT, ACQ, and GINA control assessment questionnaires, the three counseling techniques significantly improved asthma control for all groups p<0.001.

Conclusion: The combination of smartphone applications based advanced counseling alongside with the verbal correction of the inhaler use errors resulted in a better children asthma control than using a single counseling approach.

Keywords: Children asthma counseling; Asthma control test; Asthma Control Questionnaires; Advanced counseling; Pressurized Metered Dose Inhalers

Introduction

The physical and psychological changes that children with asthma go through have an effect on their health and well-being. Childhood asthma is a significant global public health issue. Children who have asthma are typically at higher risk for asthma-related complications.[1] Children and their caregivers who experience higher rates of anxiety might fail to adhere to their treatment plans, which results in poor symptom control.[2] Therefore, child asthma counseling is crucial and must be taken into account

to improve asthma control, decrease the number of times a child needs to attend the emergency room or urgent care, and improve school attendance.[2]

Most asthma medications are administered using inhalation devices.[3] In order to ensure successful medication administration, physicians and other healthcare professionals ought to constantly educate children on how to use their inhalation devices and correct mistakes when they occur. The majority of children misuse their inhalers.[3] In the treatment of asthma, inhaled medications are crucial. To obtain the desired therapeutic benefits of the medicine, the correct use of an appropriate device is required.[4] The inhaled drugs should meet the patient's needs, be cost-effective, easy to use, minimize oropharyngeal deposition, and have minimal systemic side effects.[4]

The Asthma Control Questionnaire (ACQ) is frequently used by clinicians and researchers to evaluate the effectiveness of treatment for childhood asthma. The extent to which a patient's asthma interferes with their ability to operate on a variety of levels, including social, emotional, and physical functioning, is thought to be indicated by quality of life measurements.[5] As a result, it is used to determine if asthma treatment is effective in helping patients function better and cope with their chronic illnesses. Healthcare professionals who manage children's asthma use these outcome measurements to develop a plan for the treatment approach and administration of asthma medications. However, there is little correlation between the severity of children's asthma and their quality of life (QOL), while other research has reported such associations. Numerous studies have shown that assessments of children's QOL are not always correlated with symptoms of poorly controlled asthma, such as wheezes and night awakenings that interfere with daytime activities. The association between asthma severity and child QOL (such as symptoms, activity limitation, night waking, and pulmonary function tests) may be affected by inconsistencies in how asthma severity is evaluated.[6] The severity of asthma is frequently evaluated by the patient and/or caregiver or by the physician's evaluation in accordance with published recommendations for asthma management.[5]

Medication-containing pressurized metered-dose inhalers (pMDIs) are considered the standard asthma treatment. [7] That is because of their local quick action, minimal side effects as compared to oral alternatives in the same class, and minimal cost per dosage.[4] They are widely used in the treatment of asthma because of their precise consistency in dose and ease of administration.[7, 8] One of the main drawbacks of pMDIs is the inadequate inhaling technique, even though it is one of the most frequently recommended techniques for managing asthma. According to several studies, the majority of patients make mistakes in more than 20% of the steps, and between 80 and 90 percent of patients make at least one mistake.[7, 8] Failure to maintain steady inhalation while using the device is one of the most frequent mistakes made with this device.[8] The main reason for the incorrect handling of pMDIs is inadequate patient education and counseling by the healthcare team before pMDI use.[9] Continuous patient education improves asthma management, aerosol drug delivery to the lungs, and clinical outcomes.[9]

Tests of lung function and the Asthma Control Test (ACT) could be used to monitor the effects.[7] The patient's impressions about the advantages and motivation to continue using the inhaler, which enhances the inhaled drug's lung deposition, are influenced by the ideal inhaler use. Inhaler technique education is the primary factor that the medical staff can modify, although the benefits are debatable.[10] Combining verbal instruction with practical demonstration is the most effective way to teach inhaler technique. [11]

Composite asthma-control measure questionnaires have become more common for patients and physicians who use them to assess the level of control. [12] These questionnaires collect answers from patients about symptoms, activity level and restriction, and inhaler use. Symptom frequency and usage of bronchodilators are crucial predictors of asthma control, case impairment, and future of asthma prognosis. [12, 13]

pMDI is the most common and economical device for inhaled medications in the treatment of asthma. In these devices, the medication is kept in a pressurized liquefied gas (propellant) solution or as micronized particles suspended in a solution in an aluminum canister attached to a plastic actuator. Once the device has released the dose, the patients should take a slow, deep breath in and hold it for 10 seconds, or for as long as feels comfortable. The necessity of actuation-inhalation synchronization, which is particularly challenging in children, is one of the main drawbacks of pMDI.[14]

The study aims to improve handling, use, and adherence to inhaled medication for asthmatic children, using a variety of patient counseling techniques about the most effective way to use their inhalers to improve the delivery of asthma-inhaled medications and, consequently, improve the patient's asthmatic state.

Methods

The study has received ethical approval with a serial number: REC-H-PhBSU-23002 in accordance with The

Declaration of Helsinki, from Beni-Suef University Faculty of Pharmacy's ethical approval committee

Study design and sample size

A total of 119 asthmatic children between the ages of 11 and 18 years attended the outpatient clinic; all of them were using pMDI. Only 102 of the patients completed the study, while 17 were out of the study because it was impossible to contact them after the first interview in order to continue the counseling strategy.

Study population

A cohort of non-smoking children previously diagnosed with asthma was included in the study's population.

Sampling procedures

A cohort of children with asthma, all nonsmokers aged between 11 and 19, was assembled for our study. The participants displayed diverse asthma histories from a few months to several years. Random sampling was conducted at the outpatient clinic to gather this patient group. The classification of asthma severity was based on the forced expiratory volume to forced vital capacity ratio (FEV1/FVC) and the guidelines outlined by GINA.

Baseline assessments

During the initial interview at the beginning of the study, the asthmatic status of all patients was appraised through the measurement of FEV1/FVC ratio. Furthermore, their asthma symptoms were evaluated using three asthma follow-up questionnaires—ACT, ACQ, and GINA asthma symptoms control assessment. The utilization of patients' pMDI devices was also assessed during this phase.

Procedures

During the initial interview, patients were categorized into three groups through random assignment, each assigned to a distinct approach for asthma counseling. This random assignment posed that Group 1 exclusively received verbal counseling, with Group 2 undergoing advanced counseling utilizing the "Asthma software" and "asthma Doddge app" smartphone applications without verbal correction for pMDI usage errors. However, Group 3 received a combination of advanced counseling via the "Asthma software" and "asthma Doddge app" smartphone application with verbal counseling addressing pMDI administration and error correction.

Counseling groups

FEV1/FVC ratio and Global Initiative for Asthma (GINA) standards were used to evaluate the severity of their asthma, and their asthma histories ranging from a few months to years. All the patients were using pMDI. During the first interview patients were allocated into three groups, and each group received a different approach to counseling for asthma. Group 1 received verbal counseling only, group 2 received advanced counseling alone using two smartphone applications which were "Asthma software" and "asthma Dodge app" without any verbal correction of the patient pMDI using errors, and Group 3 received a combination of advanced counseling using two smartphone applications which were "Asthma software" and "asthma Dodge app" with verbal counseling on pMDI administration and error correction**.** Verbal counseling group consisted of 34 patients received verbal counseling only. Advanced counseling group consisted of 34 patients received advanced counseling alone using two smartphone applications which were "Asthma software" and "asthma Dodge app" without any verbal correction of the patient pMDI using errors. Advanced verbal counseling group consisted of 34 patients received a combination of advanced counseling using two smartphone applications which were "Asthma software" and "asthma Dodge app" with verbal counseling on pMDI administration and errors correction**.**

Asthma smartphone application

"Asthma "called "AsthmaSALEEMORIOD version 1.0.0 Franco Dos Sntos (University of Jordan, Amman, Jordon) [15] which is a video record for pMDI's ideal use, provides the asthmatic patients with a full description of asthma symptoms.

"Dodge" Martin Rees" which is a free educational and entertaining game which teach the child about asthma and its triggers, find out how asthma works, explore different asthma triggers and when and how to use pMDI. The application was made by a collaboration of School–based asthma project and Centre of the cell at Queen Mary University of London, UK, which was more suitable for younger patients. The advanced and advanced verbal groups were trained using these two applications which assisted them to use pMDI shown in Table 1.

Each patient attended 8 structured interviews for 2 consecutive months each interview was separated by one week.

On each interview

pMDI technique errors for the verbal counseling alone group and the advanced verbal counseling group were detected and fixed, while for the advanced only counseling group there was no any verbal intervention or correction

of the pMDI mistakes, the counseling in this group is solely based on the smart phone applications and then the outcomes of each interview were compared. FEV1/FVC ratio pre and post-bronchodilator was measured for the three counseling groups. A weekly ACQ and monthly ACT and GINA control assessment Questionnaire were completed by the three groups of counseling. The three counseling groups were followed up using 3 asthma control questionnaires as shown in Table 2 and Figure 1.

Table1: Steps of pMDI use.

- Open the plastic cap
- Shake the pMDI twice
- Exhale as much as you can
- Seal the pMDI mouthpiece with the lips after inserting it between the teeth.
- keep your tongue away from the mouthpiece opening
- Press the inhaler down to release the dose before inhaling.
- Continue to inhale slowly until the lungs are full
- Take the pMDI out of your mouth and hold your breath for five to ten seconds.
- If you take multiple doses at once, wait 30 seconds between each dose.
- Following inhalation, rinse your mouth and, and wash your teeth.
- Replace the pMDI's cap.

Table 2. Different types of Asthma Control questionnaires.

	ACQ-5,6,7 (Five, six, or seven-item Asthma Control Questionnaire)	**ACT** (Asthma Control Test)	**GINA** (Global Initiative for Asthma)
appropriate age range	Above 11	Above 12	Above 6
Number of items	5, 6, or 6 + spirometry	5	4
Questionnaire items	Nighttime awakenings The activity restrictions Day time symptoms Shortness of breath Wheezing using a reliever (ACQ-6,7) Spirometry (ACQ-7)	Activity restriction Shortness of breath Nighttime awakening Reliever use Self-assessed control	Daytime symptoms Night time symptoms Using a reliever Activity restriction
Duration of the questionnaire	Prior week	Prior 4 weeks	Prior 4 weeks
Scoring system	> 1.5 Poorly controlled 0.75-1.5 ‘Grey zone’ 0-0.75 Well controlled	5-15 Very poorly controlled 16-19 Not well controlled 20-25Well controlled	3-4 Uncontrolled 1-2 Partly controlled 0 Well controlled

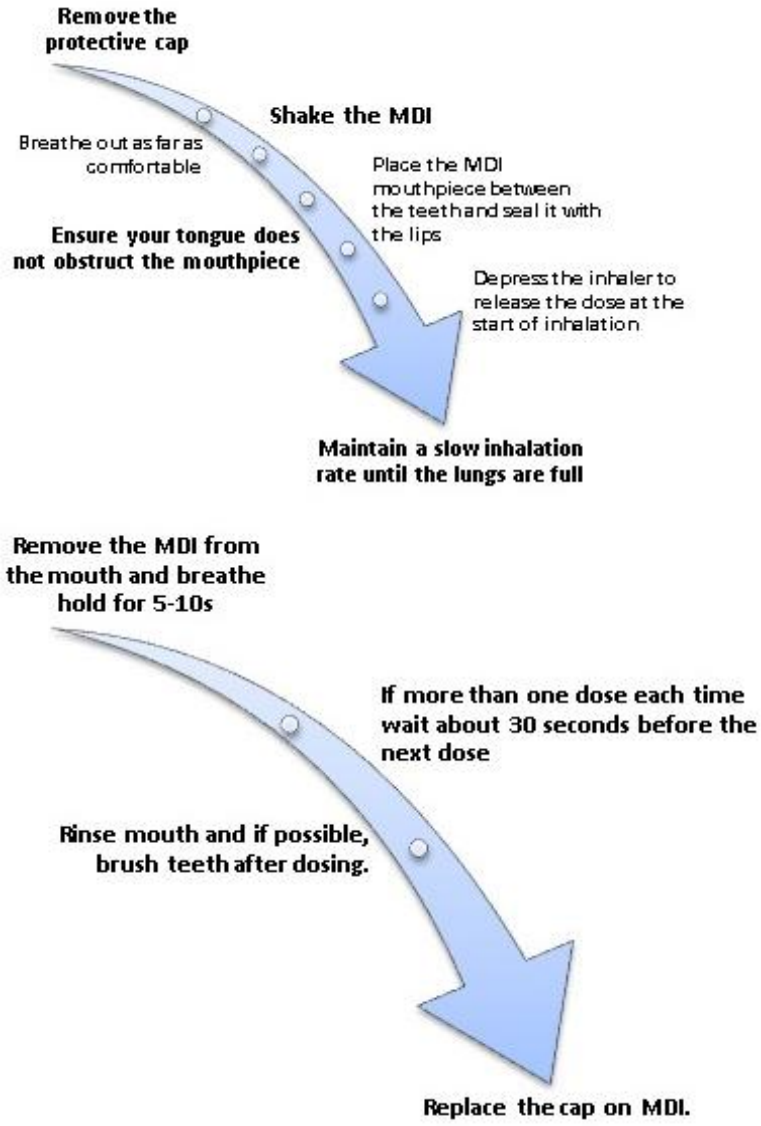

Figure 1. Steps of pressurized metered dose (p MDI) use

Inclusion criteria: Children who have been previously diagnosed with asthma based on GINA criteria and pulmonary function, aged 11 to 18 years old, nonsmokers, using pMDI, and capable of performing the pulmonary function test correctly.

Exclusion criteria: Ages more than 18 or lower than 11, smokers who are either active or passive, neurological conditions that can interfere with learning, medical instability, other chronic lung disorders, hypersensitivity to any ingredients, or the inability to correctly carry out the pulmonary function tests after training.

Statistical analysis

All data were expressed as a mean SD. Statistical analysis was carried out using the statistical package for social sciences (SPSS) computer software (version 22), IBM software, USA, to analyze the effects of various counseling strategies via the follow-up program using monthly ACT, GINA control assessment Questionnaire, and FEV1/FVC ratio, as well as weekly ACQ. The comparison of counseling results among the three groups was conducted using Multivariate Analysis of Variance (MANOVA) post-hoc tests, with differences considered statistically significant,

For the intercept effect, $F(18,79)= 2475.781$, Wilk's $\Lambda =.002$, partial $\eta^2 =0.998$, $P<0.0005$, patient.name effect $=F(54,236) = 3.505$, Wilk's $\Lambda = 0.173$ partial $\eta^2 =0.502$, $P<0.0005$.

Results

A total of 119 asthmatic children between the ages of 11 and 18 years attended the outpatient clinic; all of them

were using pMDI. Only 102 of the patients completed the study, while 17 were out of the study because it was impossible to contact them after the first interview in order to continue the counseling strategy. Regarding FEV1/FVC ratio, ACT, and GINA control assessment Questionnaire for the 3 counseling groups, and the significance appeared from the 1st month and last for the 2nd month of follow up p<0.001. (As showed in Table 3 and Figure 2).

Table 3. mean ± SD of the monthly ACT, FEV1/FVC ratio, ACQ, and GINA control assessment Questionnaire for the three counseling groups.

	Verbal counseling	Advanced Counseling	Advanced verbal counseling
FEV1/FVC ratio			
Baseline	0.81±0.1	0.78±0.11	0.78±0.093219834
1st month	0.83±0.09	0.83±0.11	0.84±0.095273
2nd month	0.9±0.07	0.87±.09	0.92±0.073491
ACT			
baseline	15.53±6.47	13.4±6.51	12.6±6.491533
1st month	16.33±6.26	16.17±6.43	17.1±6.402343
2nd month	19.23±4.71	19.17±5.48	20.8±4.749737
ACQ			
W baseline	1.06±0.54	1.19±0.49	1.12±0.48949
1st wk	0.99±0.51	0.97±0.57	0.84±0.547542
2nd wk	0.94±0.54	0.96±0.57	0.89±0.575565
3rd wk	0.88±0.53	0.9±0.59	0.87±0.59615
4th wk	0.85±0.53	0.85±0.58	0.83±0.605894
5th wk	0.74±0.51	0.8±0.57	0.74±0.606134
6th wk	0.59±0.47	0.71±0.55	0.63±0.605587
7th wk	0.47±0.46	0.62±0.55	0.51±0.50989
8th wk	0.36±0.02	0.6±0.55	0.43±0.218893
GINA control assessment questionnaire			
Baseline	2.69±1.53	3.13±1.50	2.78±1.350694
1st month	2.67±1.47	2.53±1.50	2.03±1.635352
2nd month	1.67±1.16	1.63±1.43	1.23±1.20451

*FEV1/FVC ratio of the forced expiratory volume in the first one second to the forced vital capacity of the lungs. *ACT (Asthma Control Test) *ACQ (Asthma Control Questionnaire), *wk :week,* GINA control assessment Questionnaire.

As shown in Figure 3, for ACQ, it was found that for verbal-only counseling, the significance began to appear from the first week of counseling p=0.02, then this difference became non-significant again between the third week to the fourth week of counseling p=0.153, then difference become significant again between the fourth week to the eighth week of counseling p<0.001, the difference was significant between eighth week, the first week of counseling and baseline point p=0.03 and p<0.001 respectively, for advanced counseling group, the difference between the first and second week of counseling was insignificant p=0.184, the difference started to be significant beginning from the second week of counseling to the seventh week of counseling as follow (baseline and 1st week, 2nd week and the 3rd week, 3rd week and the 4th week, 4th week and the 5th week, 5thand the 6th week, 6th and the 7th week, and the baseline and the 8th-week, the p-values were as the follow (p<0.001, p=0.037, p=0.009, p=0.01, p=0.002, p=0.01, and p<0.001, respectively).

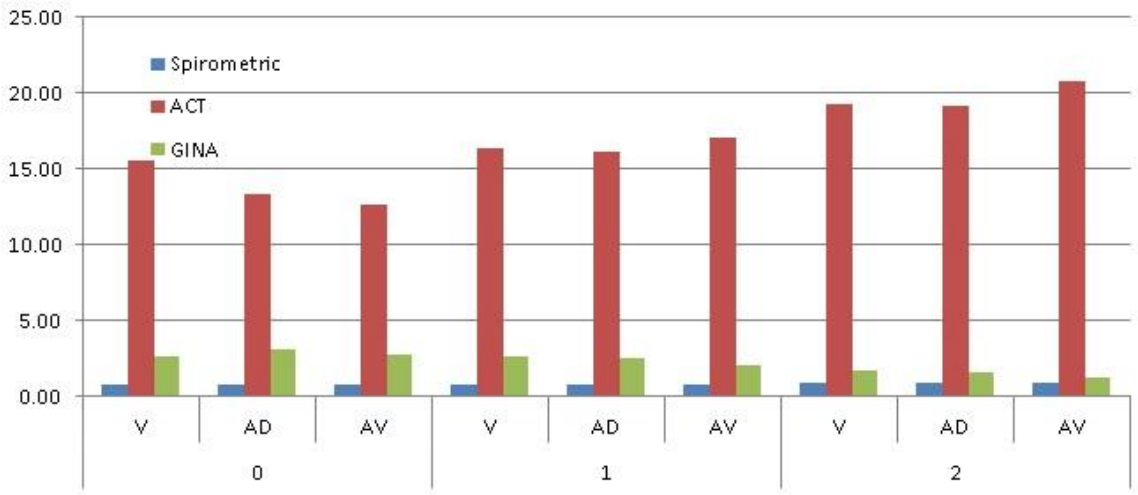

Figure 2. Schematic design for the monthly ACT, FEV1 and GINA questionnaire for Verbal, Advanced and Verbal advanced counseling groups

Figure 3. Schematic design for the weekly ACQ questionnaire for Verbal, Advanced and Verbal advanced counseling groups

The difference became non-significant again by the seventh week and lasted until the eighth week of counseling p=0.418, for the advanced verbal counseling group it was found that the difference began to be significant starting from the first week of counseling and lasted until the second week of counseling p=0.006, the difference started to be insignificant between the second and third week of counseling p=0.106, then the difference began to be significant again from the third week and lasted to the eighth week of counseling with p-values as the following (p=0.027, p=0.009, and p<0.001, respectively), the difference was significant between eighth week, the first week and baseline point p<0.001 as shown in Table 3.

In the comparison between the three counseling groups, it was found that the advanced verbal counseling group caused significant pulmonary function improvement FEV1/FVC ratio in the 2nd the month compared to that caused by the advanced alone counseling group p=0.016. Compared to the verbal-only counseling group, the advanced verbal resulted in significant higher ACT p=0.023, for ACQ 8th week, compared to the verbal only counseling group, the advanced counseling group resulted in a significantly better asthma control p=0.018 as shown in Table 3.

Discussion

With 102 asthmatic children using pMDI, three asthma counseling techniques were employed in the current study to improve the symptoms of their asthma. They visited the outpatient clinic at the University Hospital of Beni-Suef for their regular follow-up and asthma monitoring. As stated above in the methodology section, 102 patients were divided into three groups. All patients were monitored using monthly FEV1/FVC ratio, ACT, GINA control

assessment Questionnaire, and weekly ACQ for two consecutive months.

Results showed the vital role of asthma patient counseling, illustrating how all patient counseling approaches significantly enhanced the outcomes for all asthma severity levels across all groups from the baseline point, particularly for young children who, according to by Mathew et al., are known at this age for their poor adherence to asthma treatment and consequently poor asthma management.[1]

For FEV1/FVC ratio a second month, advanced verbal counseling was superior to the advanced counseling alone (p=0.016), which can be explained by the fact that verbal counseling added to advanced counseling improved the patient's skills, which leads to better application of the advanced counseling rather than to the advanced counseling alone without any verbal correction or counseling of the pMDI using errors. The advantage of adding verbal counseling has been made clear, and this is in according to Elgendy et al., who thought that regular pMDI counseling was required to maintain the optimal pMDI inhalation technique and enhance patients' pulmonary function test results.[16] According to the current study's findings, advanced counseling is superior to verbal counseling alone, from ACQ, and this difference first appeared in the eighth week of follow-up p=0.03. This difference can be attributed to the significant benefits of employing a smartphone application. This finding agrees with Sinthia Z., et al.'s hypothesis that the physical demonstration in addition to written and verbal instructions will improve pMDI use.[17, 18]

Additionally, from FEV1/FVC ration which measures the extent of the improvement in the pulmonary function, it was found that the advanced verbal counseling resulted in a greater improvement in the pulmonary functions of the asthmatic children compared to the traditional verbal counseling alone which agrees with Tony et al. who claimed that the asthmatic children who used smartphone application based counseling rather than using the traditional conventional verbal counseling alone showed a significant improvement in their FEV1/FVC ratio results and consequently significant improvement in their pulmonary functions. [18]

The present study showed that the advanced verbal counseling was superior to the advanced alone counseling which may be explained by the fact that the combination of the traditional verbal counseling and correction of the pMDI using errors greatly enhanced the children asthmatic patient's skills to apply such instruction in their using the smartphone applications which resulted in a better understanding of the pMDI using technique and handling resulted in a better asthma clinical outcomes and better asthma symptoms control which is consistent with Elgendy et.al who explained the vital role of the verbal counseling especially for the children asthma, that the regular and continuous follow up the pediatric asthmatic status using the verbal counseling leads to a better understanding and better administration technique with reduced number of mistakes and consequently a better asthma control and lung functions.[19]

The results of the current study show a significant difference between the advanced verbal group and verbal alone in ACT second month, p=0.023, and ACQ score, which supports the finding that advanced verbal counseling is superior to traditional verbal counseling alone, also the current study agrees with, Sobh et.al., who stated that using modern counseling techniques, such as training devices with smartphone apps, enhance patients' skills, and resulted in greater outcome for asthmatic patients than traditional counseling. [7] Also agree with Abdelrahman. et.al who made it clear how crucial it is to combine continuous verbal counseling with additional counseling techniques to improve asthma control outcomes. [11] The present study findings also agrees with Tony et,al. who supposed that the asthmatic children who received advanced verbal counseling resulted in a better asthma clinical outcomes with reduced pMDI using mistakes compared to those who received the traditional verbal counseling only. [20]

In our study, using of Asthma software" version 1.0.0 Franco Dos Sntos Androidmobil application, which was a video record for pMDI's resulted in a significant improvement of asthma control because it added the benefit of being a video record based counseling, with high degree of flexibility and repeatability, which assist the patient regularly about the ideal use of his inhaler device even in the absence of health care provider as a tool for the patient self-education which agrees with Al-Kharouf et al who said that Video-based treatment was beneficial in enhancing QOL, medication adherence, and illness control over time, as well as the inhaler technique.[21]

Our current findings demonstrated the great role of using smartphone applications in asthma counseling. Several studies talked about the significant improvement in the overall asthmatic status of the patients with asthma as a result of introducing the smartphone applications alongside with the traditional counseling approaches. [21-32]

The current study's findings agree with Schatz et al.'s claim that the ACT is accurate, reliable, and responsive to changes in asthma control over time in patients newly diagnosed as asthmatic by specialists. [33] The current

research supports Liu, Andrew H. et al.'s assertion who claimed that the Child-ACT (C-ACT) is a validated instrument for assessing asthma control for children with poorly managed asthma. [34, 35]

The current study demonstrated the great sensitivity of ACQ for the assessment of childhood asthma for all severity levels, supporting Juniper, E. Fet. al's claim that ACQ is a powerful assessment method and is appropriate for application in children. [36]

Conclusion

Children are known for having high skills using, interacting with, and applying smartphone applications. Advanced only and advanced verbal counseling has a greater influence than verbal counseling alone. The use of smartphone apps in children asthma counseling significantly improves asthma management. All counseling techniques dramatically improved asthma control, but advanced verbal counseling resulted in the best asthma clinical outcomes, therefore, the advanced verbal counseling is considered the best approach to managing children asthma and asthma symptoms control.

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