

Effect of interventional health educational program on clinical improvement in a sample of Egyptian school-age asthmatic children

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Background/aim

Asthma is one of the most widespread chronic disorders. To achieve better control over the disease, health intervention education programs could be applied to manage asthma and its consequences effectively to have a better quality of life. This study aimed to evaluate the impact of interventional health education programs on asthma symptoms and the quality of life of Egyptian asthmatic children.

Patients and methods

This study was conducted as an interventional study on asthmatic children and patients aged 6–16 years. Potential asthmatics according to GINA guidelines were enrolled in the study. Pulmonary function tests were applied including forced expiratory volume in the first second (FEV1), forced vital capacity (FVC) and FEV1/FVC ratio. 97 asthmatic cases were evaluated by asthma scoring, asthma control, and pediatric asthma quality of life questionnaire. All the study procedures were conducted at the start of the study and after applying the educational intervention program.

Results

The present results reported marked significant improvement ($P<0.05$) in the respiratory symptoms after the application of the intervention education program including cough, night symptoms, dyspnea, and chest pain. In addition significant improvement ($P<0.05$) occurred in the posteducational pulmonary function tests, including FEV1, prebronchodilator and postbronchodilators while there is no significant difference pre and postbronchodilator, FVC compared with the pre-educational pulmonary function tests.

Conclusion

The interventional health education program has been useful for the improvement of clinical symptoms, pulmonary function, and quality of life of Egyptian school-age asthmatic patients and the performance of their families.

Keywords:

asthma, children, health education, intervention, pulmonary function tests

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Introduction

Asthma is a troublesome childhood chronic disease. Although the effort done by the Global Initiative for Asthma to improve awareness about asthma burden and educate families about efficient management, asthma control is still suboptimal in several countries [1].

Asthmatic children typically describe a history of subsequent episodes of wheezing and/or cough initiated by upper respiratory infection, physical activity, or weather changes. Wheezing and coughing during physical activity or during laughing or crying, and episodes triggered in the absence of infection indicate asthma [2]. Most asthmatic children have constant disease, and only a few children face exacerbations requiring hospital or emergency room admission [3].

Poor asthma control is significantly associated with limitation of physical activity, school absence, emergency unit stay in, and hospital admissions [4]. Then, inappropriate asthma management adversely influences the quality of life of children with asthma and induce parental stress [5].

Studies have stated that poor asthma control may contribute to many factors as half of patients with chronic condition either do not take their medication probably or do not understand their condition satisfactory [2] leading to inadequate

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treatment compliance [6]. Asthma therapy main aim is to preserve children 'symptom free' by preventing chronic symptoms, preserving lung function, and permitting for daily normal activities [2].

Asthma children besides their caregivers need education programs to know more about their condition, the management plan, triggers of asthma, and home symptoms management. It is essential to improve public awareness, to decrease the myths and stigma related to asthma in some locations [7].

Asthma guidelines outline including national and international, suggested actions for children suffering from persistent asthma to enhance protective treatment and ensure optimum control of asthma [8]. These measures need committed engagement of a parents to distinguish relevant symptoms, reach and communicate with health care a provider to achieve an asthma action plan [9].

The present study aimed to evaluate the impact of interventional health education programs on the outcomes of treatment of asthma including clinical condition, pulmonary function and quality of life of Egyptian asthmatic school age patients and their caregivers.

Patients and methods

Patients

An interventional study included 97 asthmatic school age patients 6–16 years old, selected from primary and preparatory schools in Giza Governorate, Egypt, during the second part of the project titled 'Effectiveness of health education program on pulmonary functions and quality of life in Egyptian asthmatic children' and supported by the National Research Centre, Cairo, Egypt, from 2020 to 2021, in which 128 potential asthmatic cases were enrolled in the project.

All participants were interviewed and given appointments to be checked. Known asthmatic and probable cases (with positive family history of atopy, history of allergy and recurrent attack of respiratory tract infections and fulfilled the diagnostic criteria of bronchial asthma) were selected from medical records of schools with the assistance of medical staff schools (school doctors and nurses) and were included in the study. All the following cases were excluded: Child with an acute illness including upper and/or lower respiratory tract infections or child have congenital heart disease, known immunodeficiency,

rheumatologic disease, cystic fibrosis, renal disease or congenital anomaly, history of receiving systemic steroids for disorder other than asthma and children with mental disability.

Study design

A quasi experimental design was applied for this study (pre and post-test). In medical informatics, the quasi-experimental design, is often described as nonrandomized, pre and postintervention research, which often used to evaluate the influences of certain interventions. The increasing health care organizations capacity to obtain routine clinical data has led to the growing use of quasi experimental study designs in the field of medical informatics as well as in other medical disciplines [10].

Ethical approval

The current study was conducted along with the Code of Ethics of the World Medical Association, agreeing to the principles expressed in the Declaration of Helsinki. The current study has been approved by the local Ethics Committee of National Research Centre, Cairo, Egypt with approval number 16/381. The caregiver or legal guardian of each participating child provided written informed consent before their inclusion in the study.

Study population

All the 128 subjects enrolled in the project were invited to the health education program. Only 97 patients and their families approved to complete the second part of the study. Eligible subjects who gave approval were telephoned to verify eligibility and schedule the first date of the sessions. The program was held on subsequent six sessions in which the asthmatic children and their caregivers were invited to active participation.

Educational program

Sessions were held in the Medical Research Centre of Excellency as an interactive workshops at baseline and 2nd, 3rd 4th, and 5th months by a collaborative team, Expert professors from Child Health Department gave the theoretical lecture and the team of pediatric researchers helped as facilitators to cover the applied part and make sure of the communication between all the participations.

During the session, the following topics were discussed with the asthmatic children and their caregiver (asthma facts, how to prevent asthma episodes, controlling the asthma symptoms and triggers, using medical devices and inhalers, common mistakes and pitfalls in asthma home management including common myths and diet

appropriate to asthma patients) the scientific source of these topics were collected and prepared by the project team in a simple Arabic language as a power point and handouts for the participants.

Asthma and quality of life

All the asthmatic children were subjected to asthma scoring, Pediatric asthma quality of life questionnaire (PAQLQ) and The Pediatric Asthma Caregiver's Quality of Life (PACQLQ) pre and post educational program [11,12] were done for all caregivers.

The primary target was Asthma control as the studied cases answered the seven-asthma control questionnaire (ACQ) concerning symptoms, activity limitation, bronchodilator use and airway caliber by spirometer, each question was scored and then the total score was calculated according to the manual [13].

The score greater than or equal to 1.15 was considered positive=poor asthma control and the score less than 1.15 was considered negative=well asthma control.

Caregiver reports all the hospital visits and compliance to treatment over the 6 months to assess the quality of life of the children [12].

Caregiver health-related quality of life was evaluated using the Pediatric Asthma Caregiver's Quality of Life (PACQLQ). The 13 questions evaluate the difficulties with limitation of physical activity, emotional behaving, and a total score faced by parents of children with asthma, with better scores suggesting a better parental health-related quality [11].

Pulmonary functions test

Pulmonary function test was applied to the entire participant pre-educational as a part of the base line enrollment to prove the asthma and asses the degree of severity according to GINA guidelines 2017. Then Pulmonary function tests were applied to all the 97 children and adolescents who completed the study. This was held in the pediatric pulmonary function unit in the Medical Centre of Excellency in The National Research Centre using the MS Pediatric unit (Erich Jaeger GmbH-Hochberg, Germany). Flow-volume curves were performed according to American Thoracic Society standards and Impulse Sociometry (IOS) for the sociometric determination of respiratory impedance.

Sample size

The sample size was calculated using Sample power 3. It was based on the mean and differences in FEV1 and

FEV1% pre and post intervention 10. With 80% power (beta error=0.2) and an alfa level set at 0.05, a minimum of 40 participants are required [10].

Statistical analysis

The collected data were coded, tabulated and statistically analyzed using IBM SPSS statistics (Statistical Package for Social Sciences) software version 28.0, IBM Corp., Chicago, USA, 2021. Quantitative data was tested for normality using Shapiro-Wilk test, then described as mean±SD, and then compared using independent *t*-test (two independent groups) and paired *t*-test (paired data). Qualitative data were illustrated as number and percentage and was compared using χ^2 test. The level of statistical significance for all tests was set at *P* less than 0.05, otherwise the tests were considered insignificant.

Results

Descriptive data are illustrated in (Table 1). Among the studied group 54 (55.7) were female and 43 (44.3) were males. A percentage of (45.4%) had positive history of allergy and regarding the potential exposure to smoking, it was showed that 79 (81.4%) cases reported positive exposure, which are significantly difference ($P<0.001$) than nonexposure to smoking (18.6%). Concerning the severity of asthma, the enrolled children gave history to mild (28.9%) and moderate persistent asthma 71.1%. Among all the participant children 44 (45%) were controlled.

The frequency of respiratory symptoms in the studied cases pre and post intervention education program

Table 1 Characteristic data of asthmatic cases under study

Age in years [#]	10.4±3.5		
No (%)	χ^2	<i>P</i> value	
Sex			
Male	43 (44.3)	0.83	0.83
Female	54 (55.7)		
History of allergy			
Yes	44 (45.4)	0.51	0.475
No	53 (54.6)		
Potential exposures to smoke			
Yes	79 (81.4)	38.36	< 0.001*
No	18 (18.6)		
Severity of asthma			
Mild persistent	28 (28.9)	15.68	< 0.001*
Moderate persistent	69 (71.1)		
Control of asthma			
Controlled	44 (45.4)	0.51	0.475
Not controlled	53 (54.6)		

[#]. Data presented as Mean±SD (*n*=97 cases). ** Correspondence to : Significant difference at *P* value less than 0.05, using χ^2 test).

Table 2 Frequency of respiratory symptoms in the studied cases pre and postintervention education program application

Respiratory symptoms	Pre educational No (%)	Post educational. No (%)	χ^2	P value
Cough				
1 dry	55 (56.7)	30 (30.9)	13.087	0.001*
2 productive	50 (51.5)	27 (27.8)	11.392	0.001*
Timing				
1 morning	5 (5.2)	4 (4.1)	0.116	0.733
2 nights	78 (80.4)	28 (28.9)	51.994	0.001*
3 all day	43 (44.3)	22 (22.7)	10.203	0.001*
Respiratory difficulty				
1 tachypnea	17 (17.5)	8 (8.2)	3.719	0.054
2 dyspnea	70 (72.2)	34 (35.1)	26.862	0.001*
3 grunting	10 (10.3)	4 (4.1)	2.771	0.096
Wheezing	65 (67.0)	51 (52.6)	4.203	0.040*
Hoarseness of Voice and/or Stridor	44 (45.4)	23 (23.7)	10.055	0.002*
Chest pain	44 (54.4)	20 (20.6)	13.431	0.001*
Chocking	15 (15.5)	7 (7.2)	3.281	0.070
Cyanosis	19 (19.6)	6 (6.2)	7.76	0.005*

*: Significant difference at P value less than 0.05, using Chi square test (χ^2).

application was reported in (Table 2). Marked statistically significant improvement in the respiratory symptoms had occurred after application of the intervention education program. 55 (56.7%) were complaining of dry cough after intervention percentage decreased to 30 (30.9%) with significant P value=0.001 night symptoms improved it was 78 (80.4) and became 28 (28.9) chest pain was improved at P value=0.001.

The data represented in (Table 3) showed, Pre and post education intervention program quality of life scores of

asthmatic children and their care givers. It was found that a significant improvement ($P<0.05$) in post education quality of life scores of the children that including the activity limitation, symptoms, emotional function and mean total child score, compared with their pre-educational scores. Moreover a significant improvement ($P<0.05$) in their care givers quality of life scores with P value=0.001, using Paired sample t -test.

The data represented in (Table 4) showed, Pre and posteducation intervention program pulmonary

Table 3 Pre and post education intervention program quality of life scores of asthmatic children and their caregivers

Quality of life scores	Pre educational	Post educational	t	P value
Child quality of life scores:				
Activity limitation score	4.51±1.23	5.82±1.03	6.918	0.001*
Symptoms score.	4.51±1.14	5.35±1.12		
Emotional function score	4.51±1.32	5.93±1.37		
Mean total child score	4.51±1.35	5.71±1.31		
Caregivers quality of life scores:				
Activity limitation score	5.14±1.65	6.17±1.32	6.701	0.001*
Emotional effect score	4.76±1.42	5.92±1.46		
Mean total care giver score	4.92±1.54	5.81±1.38		

*: Significant difference at P value less than 0.05, using Paired sample t -test.

Table 4 Pre and post education intervention program pulmonary functions scores of asthmatic children

Pulmonary functions	Pre educational	Post educational	t-test	P value
Pre bronchodilator FVC	90.70±9.078	92.61±7.082	1.801	0.085
Pre bronchodilator FEV ₁	83.70±11.534	88.70±5.363	-3.501	0.004*
Pre bronchodilator FEV ₁ /FVC%	91.78±8.801	94.74±4.454	-2.915	0.0097*
Post bronchodilator FVC	92.65±5.556	93.04±5.740	0.349	0.730
post bronchodilator FEV ₁	85.83±8.569	90.35±8.348	-5.589	0.0025*
post bronchodilator FEV ₁ /FVC%	92.04±7.252	97.13±6.174	-6.124	0.0018*

FEV₁, forced expiratory volume in the first second; FVC, forced vital capacity. *: Significant difference at P value less than 0.05, using independent t -test.

functions scores of asthmatic children. A significant improvement ($P < 0.05$) was reported only in FEV1, pre bronchodilator and FEV1 postbronchodilators while there is no significant difference in pre and post bronchodilator FVC.

Discussion

Asthmatic children education in self-management of asthma has appeared as one of the therapeutic intervention to improve children to understand and control asthma, and positively to become active, self-efficacious asthma care participants [14]. Children usually depend on their caregiver for management of asthma. Therefore, asthma education should focus on whole family. This interventional evaluated the effectiveness of health education programs on the quality of life of asthmatic children and their caregivers.

By comparing respiratory symptoms frequency as before and after implementation of the educational program, there is significant improvement of symptoms was detected in asthmatic patients including cough, night symptoms, dyspnea and chest pain. This agreed with many previous studies [15–18]. Although these studies used different tools or variant sample size, but all the studies gave a positive change in asthma control after health education including less exacerbations, infrequent symptoms.

Asthma is often worse at night, however, asthma night symptoms as shortness of breath, wheezing, and cough be associated with sleep disorder are common which in turn lead to day somnolence, school absences, and poor quality of life. Few studies investigate the correlation between nocturnal asthma symptoms and quality of life [19,20]. In our study, there was a significant decrease in night cough after health education P less than 0.01.

Recurrent exacerbation, chest pain and cyanosis are considered an emergency condition which often needs an emergency department visit or even hospitalization. This led to more emotional and financial burden on the family [21,22].

In our study there was a significant difference in comparing pre and post education as regards these symptoms. This is in agreement with an Egyptian study reported less ER visits after health education program for asthmatic patients [23]. Similarly, a study conducted in Saudi Arabia on asthmatic children, found statistically significant decrease in ED visits, hospitalizations, and ICU admissions in the post-education groups [24]. Also, another study proposed

that asthma education was accompanied by 54% lower hospitalization risk and 31% lower emergency department visit risk than usual care. Sensitivity analysis found that the group that received health education had experienced a decrease clinic visit risk. This may be explained by the fact that asthma was better controlled after an educational intervention [25].

In our study there was a significant difference in comparing pre and post education as regard these symptoms. This can be contributed to many factors first; early warning signs can be identified by the patient or the care giver after proper health education and a correct performance in case of acute exacerbation. Second is the fact that many patients may not have the proper knowledge and skills of using different lines of treatment, especially spacer or inhalers which may need training from the health care provider. In our study we noticed that most of the children did not know the appropriate way to use inhalers. Moreover, many children did not know the importance of using spacer [26,27] and finally, as any chronic disease the compliance and adherence to the treatment affect the severity of the disease [28].

To sum up, all these findings support the theory that health education will lead to better asthma control and in turn better quality of life for both the patient and caregiver. In the current study significant improvement in quality of life scores of the children and their care givers was detected comparing pre and post educational scores. Many studies showed an improvement of quality of life after health education [23,29].

However, some studies showed that group education targeted to asthmatic children improved morbidity and understanding of the disease but not quality of life [30,31].

This can be explained by the applying different approach in health education. We used a face-to-face interactive approach which have more learning impact over the remote way either by web based or online ways which overcome the traditional education system [32,33].

Clinical evaluation of asthmatic children and their follow up mainly depend on reliable information of lung function [34] therefore, In asthmatic children regular evaluation of pulmonary function is necessary to adjust management and ensure that management objectives are fulfilled [35].

Many studies have described the evaluation of lung function in asthmatic patients, as defined by monitoring forced expiratory volume in the first second FEV₁, FVC, the FEV₁/FVC ratio, and forced expiratory flow between 25 and 75% of the vital capacity (FEF_{25–75%}), [34,36–38]. Some authors found an early decrease in lung function in 52% of the patients in asthmatic children suffering from moderate asthma [38].

By comparing the pulmonary function in asthmatic children in our study, a significant improvement was reported only in EFV₁, pre bronchodilator and post bronchodilators while there is no significant difference post bronchodilator FVC. This was in agreement with Nunes C *et al.* [7] who observed that self-management education of asthmatic children enhances pulmonary function [39].

Other study conducted on children aged 8–12 years, stating that there was no statistically significant difference between pulmonary function regarding studied children within the data collection [31].

Although, Maximal expiratory flow volume curves are red the gold standard for the evaluation of pulmonary function in asthmatic children. In patient with poor asthma control symptoms, FEF_{25–75%} can present airway obstruction better than can FEV₁ and the FEV₁/FVC ratio, both of which are often normal in children with asthma [34]. All children in our study were under treatment and more or less controlled. Even though pulmonary function test is an optimum way to monitor the asthmatic children, but it needs more periodic visits on more long-time scale. Periodic evaluation of pre and post bronchodilator FEV₁ may be used to classify children at risk for developing a continuing decline in airflow. Epidemiologic research have reliably presented a tracing of FEV₁ and FEV₁/FVC ratio from childhood to adulthood [40].

In our study, we found a significant improvement of pre and postbronchodilator FEV₁ after educational program but there was no significant difference in pre and post bronchodilator FVC, while the present study reported significant improvement in post bronchodilator FEV₁/FVC%. In young children, FEV₁ may not be accurate and may have a different physiological significance as compared with older children. Moreover, on a shorter period, FEV₁ has been presented to be an independent predictor of asthma attacks exacerbations: asthmatic children with a baseline FEV₁ less than 60% predicted have a doubled asthma attacks risk in the following year as

compared with children with an FEV₁ greater than 80% predicted [35] FEV₁ is essential in asthma severity scoring [41]. Though, most of school children have an FEV₁ greater than 80% predicted, consequently within the known normal range independent of asthma severity when defined on symptoms base. Generally, both FEV₁ and the FEV₁/FVC ratio relate weakly with symptom-based severity in children.

Asthmatic children who have poor awareness of bronchial obstruction may be at higher risk of severe asthma attacks and diminished pulmonary function which may lead to poor asthma outcomes [41] Thus, periodic evaluation of pulmonary function appears reasonable in observing of asthmatic children. Though, only 20–40% of primary health care providers suggest lung function assessment in asymptomatic children with asthma and up to 59% of clinician never recommend pulmonary function [42,43]. Spirometry is greatly recommended as part of the diagnostic work up of asthmatic children aged between 5 and 16 years old [44].

Conclusion

In conclusion, quality of life of both asthmatic children and their families are affected significantly by asthma severity and its degree of control. Health educational programs should be conducted to Egyptian asthmatic children, their parents, and their caregivers because caregivers of asthmatic children suffer from many challenges and can be strongly affected by their child's disease, so the preventive measures, early diagnosis and the appropriate management of asthma should be well known for the asthmatic child caregiver.

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Author's contributions: H.G.E.N. was responsible for conceptualization, data curation, methodology, project administration, supervision, and review and editing, A.S.E.R., D.A.S. and H.A. were participated in the data curation, clinical management, investigation, visualization and writing the original draft, D.E.E., R.M.S. and D.M.E.M. were participated in data curation, formal analysis. All authors have read and approved the final manuscript.

Conflicts of interest

There are no conflicts of interest.

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