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Effect of Buteyko Breathing Exercise on Pulmonary Functions Tests and Quality of Life in Asthmatic Elderly Patients

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Abstract: Background: Asthma in the elderly is not a rare disorder; health related quality of life is negatively impacted by poorly managed asthma and pulmonary function tests. Buteyko breathing exercise can improve lung function or alter bronchial responsiveness, alleviate symptoms of an attack and reduce the need for a bronchodilator. ***Aim:*** Measure the effect of buteyko breathing exercise on pulmonary functions tests and quality of life in asthmatic elderly patients. ***Design:*** A quasi-experimental research design (study-control) was used in this study. ***Setting:*** This study was took place at chest diseases department affiliated to Mansoura University Hospital, Egypt .***Subjects:*** A purposeful selection of 80 elderly patients who were present in the previously described setting who met the inclusion criteria. ***Tools:*** Four tools were used in this study; Demographic and Health related Data Structured Interview Schedule, Pulmonary Functions Tests, Asthma Quality of Life Questionnaire and Buteyko Breathing Technique Observational Checklist. ***Results:*** There were statistically significant differences between the two groups 3 months after the training program (post 1) regarding FEV1, FCV and FEV1/FCV score (P= 0.004, P= 0.003 & P= 0.005) respectively and 6 months after the training program (post 2) regarding FEV1, FCV and FEV1/FCV score (P= 0.001, P= 0.001 & P= 0.001) respectively. The differences between the two groups were statistically significant at both 3and 6 months after the training for all dimensions of asthma quality of life. There was a significant positive correlation between total practice score and FEV1/FVC and quality of life. ***Conclusion:*** Buteyko breathing exercise can be used safely for elderly patients with asthma. The buteyko breathing exercise implementation had positive effects in improving pulmonary function tests and quality of life among asthmatic elderly patients. ***Recommendation:*** Development of different educational programs focusing on integration of buteyko breathing exercise in asthma treatment as a complementary therapy.

Key words: Asthma, Buteyko Breathing Exercise, Elderly patients, Pulmonary function tests, Quality of life.

INTRODUCTION

An ongoing treatment regimen is necessary for the chronic respiratory condition known as asthma. Over 1.6 million visits to emergency departments (EDs) were made in 2017 due to asthma and 183,000 hospital admissions in the US **[1].** According to estimates, 5–10% of people with asthma worldwide and 8–11% of asthmatic elderly in Japan suffer from severe asthma **[2]**. According to **[3]**asthma is ranked the nineteenth in terms of disability-adjusted life years (DALYs) and twenty-sixth in terms of mortality in the Kingdom of Saudi Arabia (KSA).

An inflammatory respiratory condition known as chronic asthma narrows the airways. Coughing, tightness in the chest, wheezing, and dyspnea are frequently associated with it, particularly in the early morning or at night. Numerous triggers can this illness, including allergens like pollen, pet dander, dust mites, and mold, as well as respiratory infections, air pollution, smoke, exercise, and stress. Additionally, genetics play a role **[4].**

Numerous aging- related changes to lung shape and physiology take place, which probably have an effect on asthma. Weakness in the respiratory muscles, stiffness in the chest wall, and a noticeable decrease in elastic recoil are all linked to aging **[5].**An essential tool for the examination and follow-up of older individuals with respiratory pathology is the pulmonary function test (PFTS). They offer crucial details about the pulmonary parenchyma, size, the big and small airways and the pulmonary capillary bed integrity. They enhance diagnosis, help evaluate progress to treatment and can influence decisions on further treatment and management **[6].**

If the diagnosis and course of treatment are not accurately performed, despite only affecting a small percentage of patients, severe asthma is a significant socioeconomic burden because it requires the majority of the financial resources allocated to treating asthmatic subjects. Severe asthma (SA) is characterized by frequent exacerbations, additional visits, and hospitalizations, which can lead to a poor quality of life **[7].**

Use of non-pharmacological management is one method of treating asthma. A non-medical therapy called Buteyko breathing (BB) suggests using particular breathing exercises to treat respiratory conditions like asthma. Konstantin Buteyko, a Ukrainian physiologist, invented Buteyko breathing in the 1950s because he thought that a lot of

diseases were brought on by hyperventilation or a persistently elevated respiration rate **[8].** Buteyko breathing can help elderly patients with bronchial asthma better control their disease, improve their level of function, and maintain their independence by lowering the severity of asthma-related symptoms and the frequency of asthma episodes **[9].**

In asthmatic elderly patients the gerontological nurse plays a major role in buteyko's breathing exercise. There are certain important roles for nurses that follow such as teach buteyko's breathing steps, nose breathing during the night and exercise regularly **[10].**

Therefore it was important to study the effect of buteyko breathing exercise on pulmonary functions and quality of life in asthmatic elderly patients.

Significance of the study:

Among the non-communicable diseases (NCDs) that are most common is asthma. Approximately 339 million individuals worldwide are impacted by it, including both younger and older generations. Asthma ranks among the top twenty causes contributing to years lived disabled and accounts for a high global burden of death and disability—roughly one thousand people die from it every day. The prevalence of asthma is rising in developing nations. Due to hospitalization and the highest cost of medications, the prevalence of asthma is rising and severely straining socioeconomic conditions **[9].**

Poorly-controlled asthma can have negative effects including lethargy or weariness, inadequate sleep, failing to exercise, deteriorated mental health, pneumonia, and respiratory failure. The long-term consequences of asthma can impact lung functions, general health, and quality of life **[11].** Elderly patients seem to benefit from practicing buteyko breathing by increase lung function or alter bronchial responsiveness, lessen the intensity of an attack's symptoms and the requirement for bronchodilators **[8].**

Aim of the study was to:

Measure the effect of buteyko breathing exercise on pulmonary functions tests and quality of life in asthmatic elderly patients**.**

Research hypothesis:

1- Asthmatic elderly patients who practice buteyko breathing exercise will have an improvement in their pulmonary functions tests than those who don't.
2- Asthmatic elderly patients who practice buteyko breathing exercise will have an improvement in their quality of life than those who don't.

SUBJECTS & METHOD

Study Design:

A quasi-experimental research design (study-control) was used in this study.

Setting:

This study was carried out at chest diseases department affiliated to Mansoura University Hospital, Egypt. It consists of one floor which contains three rooms each room contains 10 beds and three intensive care units each unit contains 6 beds. It also contains one unit to measure pulmonary function tests and other unit for sleep disorders.

Subjects:

A purposeful selection of 80 elderly patients attending the previous mentioned setting and selected according to the following criteria:-

- ***Inclusion criteria:***

1. 60 years of age or older.
2. Diagnosed with asthma for more than one year.
3. Be able to speak and consent to taking part in the study.

- ***Exclusion criteria:***

1. Elderly patients with cardiac, renal and hepatic diseases.
2. Elderly patients with bronchiectasis, interstitial lung diseases, tuberculosis, and chest infection.
3. Elderly patients with nose disorders or surgeries.
4. Elderly patients with psychiatric disorders such as depression.

Tool of data collection:

To collect the necessary data four tools were used:
Tool I: Demographic and Health related Data Structured Interview Schedule: This two-parts tool was created by the researcher to gather baseline data from the study participants based on a review of literature: ***Part 1: Demographic information:*** including age, educational attainment, gender, marital status, employment before to retirement, and income source. ***Part 2: Medical health history:*** such as past history of chronic diseases and current medications used.

Tool II: Pulmonary Functions Tests: These tests including Forced Expiratory Volume in first second (FEV_1), Forced Vital Capacity (FVC) and the ratio between Forced Expiratory Volume in first second and Forced Vital Capacity (FEV1/ FVC) and were be measured by spirometry.

Tool III: Asthma Quality of Life Questionnaire (AQLQ)*:* It was developed by **Juniper et al. (1992) [12].** It is a disease-specific tool for measuring health-related quality of life that records the psychological and physical effects of illness. The thirty-two items on this measure are broken down into four domains: emotional function (five items), symptoms (twelve items), activity limitation (eleven items), and environmental exposure (four items). Using seven- point likert scale from 1 to 7, where 7= not limited at all and 1=severely impaired), with higher scores indicating better quality of life, with higher scores indicating better quality of life.

Tool IV: Buteyko Breathing Technique Observational Checklist: The researcher created this tool following an intensive review of recent literature **[13, 14].** To assess the elderly performance of buteyko breathing technique. A three-point Likert scale was used to assess each item on the checklist: 0 represents "not done," 1 represents "done partially," and 2 represents "done completely." The total scores on the checklist are the sum of the scores for each group of items. The following categories applied to the total scores:

- Good practice: more than or equal 75%.
- Fair practice: 60% to less than 75%.
- Poor practice: less than 60%.

Sample size calculation:

With a power of 80% and a level of significance of 5% based on data from the literature **[15],** the sample size can be computed using the following formula:
$n = [(Z_{\alpha/2} + Z_{\beta})^2 \times \{2(SD)^2\}]/$ (mean difference between the two groups)^2 where SD = standard deviation
$Z_{\alpha/2}$: for 5% this is 1.96, depending on level of significance.
Z_{β}: depends on power, for 80% this is 0.84
Therefore, $n= [(1.96 + 0.84)^2 \times \{2(0.41)^2\}]/ (0.27)^2=36.2$
Based on the above formula, the sample size of 37 was calculated and added 5% because of defaulter to become 40 in each group, one buteyko and one comparison group.

METHOD

Phase I: Preparatory phase:

1. ***Administrative stage:***

- The Mansoura University Faculty of Nursing officially granted authorization to conduct the study and interview the senior patients in the designated government hospital.
- After outlining the goal of the study and the timeline for data collection, the director of the Mansoura University Hospital approved the formal letter.

Ethical considerations:

- Ethical approval was granted by the Mansoura University Faculty of Nursing's Research Ethics Committee (Ref. No. 0482).
- The researcher informed the study participants of its aim before obtaining their verbal consent to take part in the study.
- The confidentiality of the data gathered was preserved, and the subjects' privacy was guaranteed.
- The study participants were advised of their freedom to leave the study at any moment and without consequence.

2. ***Preparatory stage:***

Following extensive review of the literature, data collection instruments were created and implemented, and teaching materials for the study were created as a booklet and audiovisual content.

- Tool I (Demographic and Health related Data Structured Interview Schedule) and tool IV (Buteyko Breathing Technique Observational Checklist) were designed after review of related literature by the researcher.
- Tool III (Asthma Quality of Life Questionnaire) was translated into Arabic and put through a test-retest assessment process to determine its reliability.
- The researcher developed the suggested program using basic Arabic and added images to it, which includes two parts (educational and practical):
  - Educational part including: asthma disease process, causes, risk factors, symptoms, complications and management.
  - Practical part including: buteyko breathing exercise technique.

Validity of the study tools:

- To ensure the translation's accuracy, the researcher translated study tools into Arabic. An English language specialist from the Faculty of Education then confirmed the translation's accuracy.
- The data collection tools' content validity was checked by five specialists in the field, and any necessary modifications were performed.

Reliability of the study tools:

The internal consistency for study tool was done using test-retest on two occasions of the pilot of the instrument on the same participants. Test-retest reliability phase was considered by Pearson's correlation coefficient as follow: tool III (r=0.856) and tool IV (r=0.820) which refers to be reliable.

Pilot study:

Prior to beginning data collecting, a pilot study with 10% (8) of the study sample was conducted to determine the clarity, feasibility, relevance, applicability and time needed to collect data. The required adjustments were made accordingly. A pilot study revealing that the seven point likert scale of QOL was difficult for the elderly as they couldn't differentiate between Extremely affected/ Very affected, Moderate effect/ Some limitation so five point likert scale was used (Totally affected, Very affected, Moderately limited, A little limitation and Not at all limitation). The study sample did not include the elderly patients who were part of the pilot study.

Phase II: Implementation phase:

- The researcher began by introducing herself and briefly outlining the goal of the study to the elderly patient.
- Individual interviews were conducted with every elderly patient in the comparison group and the buteyko group at the beginning of the proposed program in order to baseline data collection using tool I (Demographic and Health related Data Structured Interview Schedule), tool II (Pulmonary Functions Tests), tool III (Asthma Quality of Life Questionnaire) and tool IV (Buteyko Breathing Technique Observational Checklist). Filling up the study tools took between thirty and forty minutes. To maintain constant communication, the researcher obtained the study participants' phone numbers.
- To encourage elderly patients to relax, set up a peaceful, distraction-free setting that includes a chair with back support.
- For each elderly patient, the weight was obtained using a bathroom type scale. The scale was checked to make sure its efficiency and returned to zero after taking the weight of each patient. The weight was obtained by asking the elderly patient to stand on the scale without moving or touching anything, then the reading was recorded into the nearest kilogram.
- For the height, it was measured using a measuring tape which numbered from 1 to 150 cm. The elderly patient was instructed to stand erect, barefoot, with their heels together, and their back against the wall while their

height was measured against the wall. To the closest centimeter, a measurement was taken.

- The pulmonary function tests were done by a pulmonary function lab technician, chest disease department, at Main Mansoura university hospital by using MIR spirolab II apparatus.
- The height, weight, sex, and age of the old patient were noted in order to calculate reference values for body mass index and FEV1.
- Before, during, and after the test, elderly patients were asked to maintain as much relaxation as possible and to adhere to instructions.
- A patient had their nose snipped to ensure that their breath would only come from their mouth.
- For infection control purposes, each elderly patient was given a cartoon mouthpiece that was modified to fit the mouthpiece of the spirometer and was used to violently expire after taking a full breath.
- The training program was conducted on individualized basis, the program was covered in 8 sessions, which divided into 4 sessions for provision of knowledge and 4 sessions for practicing buteyko breathing exercise. The program was done on 2 sessions weekly for 4 weeks. The time for each session takes 30 to 45 minutes approximately, considering the attention span of the elderly patients.
- The researcher used concise, uncomplicated, and unambiguous wards during the training sessions. The buteyko group's understanding and practice for each subject were made clear through the usage of an illustrated booklet. Additional instructional strategies included lectures, roundtable discussions, laptop power point presentations, films, in-person demonstrations, and re-demonstration. The researcher highlighted the key aspects in a brief summary that was delivered at the conclusion of each session. Prior to the beginning of subsequent sessions, the researcher would pose inquiries concerning the subjects covered in the preceding session; any aspects that were overlooked or ambiguous were reiterated by the researcher.
- The buteyko group participants were given the educational booklet in order to focus their attention, encourage them, and enable at-home review and practice
- After discharge, the sessions have been completed in chest out patients' clinic. The telephone follow up for the buteyko group was carried out weekly to encourage and ensure adherence of elderly patients with buteyko breathing exercise.
- The time frame for gathering the data was 10 months started from the first of April 2023till the end of January 2024. The days of the data collection schedule are from 9 a.m. to 2 p.m

Phase III: Evaluation phase:

- Immediately after training program implementation, assessment of asthmatic elderly patients' practice of buteyko breathing exercise using tool IV (Buteyko Breathing Technique Observational Checklist) to determine the ability of elderly patients to practice breathing exercise.
- After 3 months and then 6 months reassessment of the elderly patients in both groups by using tool II (Pulmonary Function Tests), tool III (Asthma Quality of Life Questionnaire) and tool IV (Buteyko Breathing Technique Observational Checklist).

Limitation of the study:

- There was only one apparatus to perform pulmonary function test at Mansoura university hospital and there was long time on waiting list

Statistical analysis:

Version 20 of the statistical package for social science (SPSS) was used to examine the data. For data visualization, Microsoft Excel was used to create graphs. To display the quantitative data numbers and percentages were used. The one-way analysis of variance (ANOVA) f test and the independent sample t test were used to compare the groups. Pearson's correlation coefficient (r) is used to assess variables correlation. At $p < 0.05$, the difference was deemed significant.

RESULTS

Table (1): Demographic data of the asthmatic elderly patients in the buteyko and comparison groups. In terms of age, the table indicates that the elderly patients with asthma ranged in age from 60 to 80 years, with a mean age of 70.97±7.37 years for those in the buteyko group and 69.22±6.318 years for those in the comparison group. In terms of sex, females made up 65% of the elderly patients with asthma in the buteyko group and 72.5% in the comparison group.

As for marital status, 62.5% in the buteyko group and 75.0%in the comparison group respectively are married. Asthmatic elderly patients who read and write are prevailing among 67.5% and 75% of the elderly in the buteyko and comparison groups respectively.

Concerning current work, 87.5% of the buteyko group and 77.5% of the comparison group are not work. As for income, 72.5% of the buteyko group and 62.5%of the comparison group have not enough income. Regarding place of residence, 52.5% of the buteyko groups compared to 55% of the comparison group are residing in rural areas and the differences are not statistically significant between the two groups in all items of demographic data.

Table (1): Demographic data of the asthmatic elderly patients in the buteyko and comparison groups

Demographic data	Buteyko group		Comparison group		Test of significance
	No (40)	(%)	No (40)	(%)	
Age					
60-70	25	62.5	21	52.5	$\chi 2 = 0.818$ (0.366)
71-80	15	37.5	19	47.5	
Mean ± SD Range	70.97± 7.37 (61-80)		69.22± 6.318 (60-79)		
Sex					
Female	26	65.0	29	72.5	$\chi 2$ =0.524 (0.469)
Male	14	35.0	11	27.5	
Marital status					
Married	25	62.5	30	75.0	MC = 3.636 (0.162)
Single	12	30.0	10	25.0.	
Widow	3	7.5	0	0.0	
Educational level					
Illiterate	3	7.5	0	0.0	MC =5.484 (0.241)
Read and write	27	67.5	30	75	
Secondary	5	12.5	6	15.0	
University	5	12.5	4	10.0	
Current work					
No	35	87.5	31	77.5	$\chi 2 = 1.385$ (0.239)
Yes	5	12.5	9	22.5	
Income					
Not Enough	29	72.5	25	62.5	$\chi 2 = 0.912$ (0.340)
Enough	11	27.5	15	37.5	
Residence					
Rural	21	52.5	22	55.0	$\chi 2 = 0.450$ (0.502)
Urban	19	47.5	18	45.0	

(*) At p ≤0.05, statistically significant, Monte Carlo test: MC, χ^2 = chi square, Fisher Exact test: FE

Table (2): Medical history of the asthmatic elderly patients in the buteyko and comparison groups. It can be observed from the table that, 62.5% and 50% of the buteyko and comparison groups respectively are suffering from asthma from 1 to 3 years ago. Regarding previous hospitalization 65% and 70% of the buteyko and comparison groups respectively have history of previous hospitalization.

Regarding the medication taken for asthma, it was observed that, all elderly patients 100% in both groups take corticosteroids and bronchodilators. Concerning compliance with medications, 60% of the buteyko group and 57.5% of comparison group are compliance. Also, 75% and 65% of the buteyko and comparison groups respectively are suffering from other chronic diseases. Hypertension is the most common chronic disease reported by 80% and 76.9% of the buteyko and comparison groups respectively and the differences are not statistically significant between the two groups in all items of medical history.

Table (2): Medical history of the asthmatic elderly patients in the buteyko and comparison groups

Medical history	Buteyko group		Comparison group		Sig. Test
	N (40)	(%)	N (40)	(%)	
Duration of disease					
from 1 < 3 years	25	62.5	20	50.0	MC =3.175 (0.204)
From 3 < 5 years	4	10.0	10	25.0	
5 years and more	11	27.5	10	25.0	
Previous hospitalization					
Yes	26	65.0	28	70.0	$\chi2$ = 0.228 (0.633)
No	14	35.0	12	30.0	
Asthma medication taken					
Corticosteroids	40	100.0	40	100.0	----
Bronchodilator	40	100.0	40	100.0	----
Antibiotic	38	95.0	39	97.5	$\chi2$ =0.346 (0.556)
Mucolytic	16	40.0	21	52.5	$\chi2$ =1.257 (0.262)
Anticholinergics	15	37.5	11	27.5	$\chi2$ =0.912 (0.340)
Compliance with medication					
Yes	24	60.0	23	57.5	$\chi2$ = 0.052 (0.820)
No	16	40.0	17	42.5	
Suffering from other disease					
Yes	30	75.0	26	65.0	$\chi2$ = 0.952 (0.329)
No	10	25.0	14	35.0	
Type of chronic disease[#] N=30			N=26		
Hypertension	24	80.0	20	76.9	$\chi2$ = 0.078 (0.780)
Diabetes Mellitus	18	60.0	17	65.4	$\chi2$ = 0.172 (0.678)
Osteoarthritis	15	50.0	14	53.8	$\chi2$ = 0.083 (0.774)
Osteoporosis	9	30.0	10	38.5	$\chi2$ = 0.445 (0.505)
Eye disease	6	20.0	4	15.4	FE = 0.202 (0.653)

([#]) More than one answer

Table (3): Effect of training program on pulmonary function tests score in the buteyko and comparison groups. It reveals that, no statistically significant differences were detected between two groups before the training program regarding FEV1, FCV and FEV1/FCV score (P= 0.403, P= 0.529 & P= 0.437) respectively. Moreover, the differences between the two groups 3 months following the training program (post 1) regarding FEV1, FCV and FEV1/FCV score (P= 0.004, P= 0.003 & P= 0.005) respectively and 6 months after the training program (post 2) regarding FEV1, FCV and FEV1/FCV score (P= 0.001, P= 0.001 & P= 0.001) respectively were statistically significant.

The total FEV1 score of the buteyko group improved significantly 3 and 6 months after training program (Post 1 & post 2) (P =0.001 & P =0.001). Moreover, the FEV1 score of the comparison group was increased after 3 months (Post 1) and the variations were statistically significant (P=0.046).

Regarding FCV score of the buteyko group improved significantly 3 and 6 months after training program (Post 1 & post 2) (P =0.001 & P =0.001). Moreover, the FCV score of the control group was improved moderately after 3 months (Post 1) and the differences were statistically significant (P=0.025).

In relation to FEV1/FCV scores of the study group improved significantly 3 and 6 months after the training program (Post 1, P =0.001) (post 2, P =0.001). Compared to the FEV1/FCV scores of the comparison group no noticeable statistically significant differences 3 and 6 months after training program (Post 1 & post 2) (P =0.414 & P =0.655) respectively.

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Table (3): Effect of training program on pulmonary function tests score in the buteyko and comparison groups

Pulmonary function test	Buteyko group						Comparison group						Sig. test		
	Before		After 1		After 2		Before		After 1		After 2		$(p)^1$	$(p)^2$	$(p)^3$
	N	%	N	%	N	%	N	%	N	%	N	%			
FEV1															
Normal	8	20.0	11	27.5	18	45.0	5	12.5	5	12.5	6	15.0	2.927 (0.403)	8.731 (0.004)**	15.524 (0.001)**
Mild 70-79%	5	12.5	17	42.5	13	32.5	8	20.0	10	25.0	8	20.0			
Moderate 60-69%	18	45.0	11	27.5	8	20.0	22	55.0	22	55.0	24	60.0			
Severe < 60%	9	22.5	1	2.5	1	2.5	5	12.5	3	7.5	2	5.0			
$(p)^a$	4.459 (<0.001)**						2.000 (0.46)*								
$(p)^b$	4.727 (<0.001)**						1.890 (0.59)								
FCV															
Normal	8	20.0	14	35.0	14	35.0	5	12.5	6	15.0	6	15.0	2.217 (0.529)	9.276 (0.003)**	19.620 (<0.001)**
Mild 70-79%	8	20.0	18	45.0	23	57.5	12	30.0	14	35.0	13	32.5			
Moderate 60-69%	15	37.5	7	17.5	2	5.0	17	42.5	15	37.5	17	42.5			
Severe < 60%	9	22.5	1	2.5	1	2.5	6	15.0	5	12.5	4	10.0			
$(p)^a$	5.000 (<0.001)**						2.236 (0.025)*								
$(p)^b$	5.470 (<0.001)**						1.667 (0.096)								
FEV1/FVC															
Normal	12	30.0	12	30.0	25	62.5	9	22.5	8	20.0	7	17.5	2.719 (0.437)	8.339 (0.005)**	24.019 (<0.001)**
Mild 60-69%	6	15.0	21	52.5	13	32.5	12	30.0	13	32.5	14	35.0			
Moderate 50-59%	13	32.5	6	15.0	1	2.5	12	30.0	15	37.5	13	32.5			
Severe <50%	9	22.5	1	2.5	1	2.5	7	17.5	4	10.0	6	15.0			
$(p)^a$	4.004(<0.001)**						0.816 (0.414)								
$(p)^b$	4.396(<0.001)**						0.447 (0.655)								

Table (4): Effect of training program on quality of life in the buteyko and comparison groups. According to the table, there were no statistically significant differences in any of the asthma quality of life dimensions between the buteyko and comparison groups prior to the training program implementation. However, all of the asthma quality of life dimensions showed statistically significant differences between the two groups at the 3 and 6 month after the training.

When compared to elderly patients in the comparison group, there were no statistically significant differences in the mean scores of all asthma quality of life dimensions, including symptom frequency, activity limitation, emotional function, and environmental exposure, while improved significantly in the buteyko group at 3 months after training program (post 1) and the improvement maintained at 6 months(post 2) (P= 0.00

Table (4): Effect of training program on quality of life in the buteyko and comparison groups

AQLQ domains	Buteyko group (40)			Comparison group (40)			t-test		
	Before	After 1	After 2	Before	After 1	After 2	P1	P2	P3
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD			
Symptom frequency	2.93±0.99	3.65±0.71	3.97±0.57	2.98±0.92	3.00±0.89	2.95±0.85	1.249 (0.215)	2.123 (0.041) *	5.408 (<0.001)**
(p)[a]	8.364 (<0.001)**			1.708 (0.096)					
(p)[b]	9.682 (<0.001)**			1.026 (0.311)					
Activity limitation	2.62±1.16	3.37±0.72	3.61±0.67	2.84±0.91	2.85±0.96	2.89±0.99	1.124 (0.265)	2.731 (0.008) *	4.320 (<0.001)**
(p)[a]	8.734 (<0.001)**			1.508 (0.140)					
(p)[b]	8.762 (<0.001)**			1.898 (0.065)					
Emotional function	2.77±0.94	3.35±0.71	3.65±0.61	2.94±0.86	2.96±0.86	2.96±0.85	0.871 (0.386)	2.178 (0.032) *	4.175 (<0.001)**
(p)[a]	5.313 (<0.001)**			1.941 (0.071)					
(p)[b]	6.542 (<0.001)**			1.706 (0.096)					
Environmental exposure	2.68±1.01	3.45±0.71	3.81±0.65	2.96±1.12	2.95±1.12	2.93±1.1	1.155 (0.251)	2.394 (0.019) *	4.360 (<0.001)**
(p)[a]	10.164 (<0.001)**			1.138 (0.262)					
(p)[b]	8.510 (<0.001)**			1.837 (0.074)					
Total mean score	2.75±0.9	3.46±0.61	3.76±0.5	2.94±0.84	2.93±0.83	2.92±0.78	0.976 (0.332)	3.179 (0.002) **	5.726 (<0.001)**
(p)[a]	10.738 (<0.001)**			0.059 (0.953)					
(p)[b]	10.208 (<0.001)**			1.126 (0.267)					

Figure (1): Performance of buteyko breathing exercises of the buteyko group pre and post training program implementation. The buteyko group's overall practices score improved significantly after training (P=0.001), but this improvement was only slightly maintained in the study group's mean practice score after three and six months (Posts 1 and 2), and it continued to differ significantly from the pre-training sessions (P=0.001).

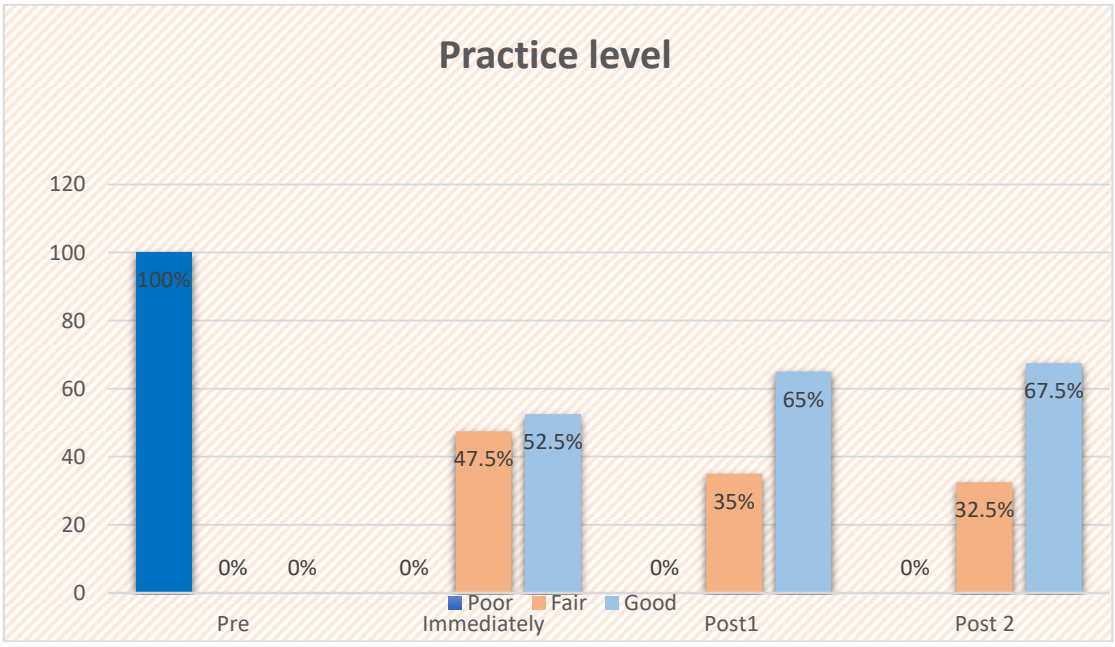

Figure (1): Performance of buteyko breathing exercises of the buteyko group before and after implementation of training program.

Table (5): Correlation between the study variables in the buteyko group before and after training program

implementation. The table shows that all of the study variables, including FEV1/FVC and quality of life, had a positive and significant relation to the total practice score.
As total practice score increased the FEV1/FVC and quality of life improved.

Table (5): Correlation between the study variables in the buteyko group before and after the pre and post training program implementation (n=40)

Item		Total Practice	
		Post 1	Post 2
FEV1/FVC	r	0.364	0.321
	p	0.021*	0.044*
Quality of life	r	0.564	0.553
	p	(<0.001)**	(<0.001)**

DISCUSSION

One factor that is thought to contribute to worsening asthma control is aging. If asthma is not properly treated in older adults, it can lead to major health issues **[16].** According to this study, the majority of elderly patients with asthma were under 70 years old, with mean ages of 70.97±7.37 and 69.22±6.318 for the buteyko and comparison groups, respectively. This could be connected to the anatomical, physiological, and immunological changes that aging brings about in the respiratory system. As a result, asthma gets worse and more elderly persons are admitted to hospitals.

In the same line a study took place in Turkey by Gemicioglu et al., (2019) **[17]**, the average age of asthmatic patients was 69.4±3.6 years. Similarly, a study conducted in Egypt by Abd El-fatah et al., (2020)**[18]** found that the majority of older asthmatic patients were between the ages of 60 and 69, with an average age of 67.4 ±6.3 years. However, a Michigan study by Ross et al., (2013) **[19]** found that over half of the participants with asthma were between the ages of 66 and 92.

In the study, there were more women than men. This could be because female sex hormones affect a person's entire life and are linked to inadequate asthma control **[20]**. The same results were found in additional studies performed in Egypt by **Abd El-Rahman et al., (2015) [21]** and Turkey by **Gemicioglu et al., (2019) [17]**, where over half of the asthmatic patients evaluated were female. In contrast, a study conducted in Egypt by El-fadl & Sheta (2019) **[22]** and Abd El-fatah et al., (2020) **[18]** revealed that less than two thirds of study participants were men.

Concerning marital status; the current study conveyed that about two thirds of elderly in the buteyko group and more than two thirds of the elderly in the comparison group were married. The same results were reported in a study carried out in Egypt by Abd El-fatah et al., (2020) **[18]** who reported that the majority of studied subjects were married.

Regarding levels of education, almost two thirds of the studied elderly in both the buteyko and comparison groups were illiterate. This result could be explained by the fact that most of the patients were from rural areas where there is a lower emphasis on education and a lower degree of health awareness. This result is similar to study conducted in Egypt by El-fadl & Sheta (2019) **[22]** who found that the majority of patients were illiterate, and in Turkey by Gemicioglu et al., (2019)**[17],** who found that almost half of the participants in their study were illiterate. However, a study conducted in Poland by Uchmanowicz et al., (2016) **[23]**showed that most of the sample had completed high school.

As for occupation of the studied subject, more than half of them were not work. This finding in contrast with study done in Egypt by Abd El-fatah et al., (2020)**[18]** reported that more than half of the subjects were working.

According to this study, approximately two thirds of the elderly participants in both the buteyko and comparison groups do not have enough money. These results may be attributed to Egypt's high cost of living and low retirement incomes, as well as the lack of additional income sources that would otherwise negatively impact the quality of life and financial burden of the elderly population. This is consistent with research conducted in Egypt by Abd El-fatah et al., (2020) **[18]**, which found that three quarters of study participants felt their monthly income was insufficient. However, a study conducted in Egypt by Abd El-Rahman et al., **(2015) [21]** found that over half of the participants had a sufficient income.

This study found that over half of the elderly in the buteyko and comparison groups were residing rural areas. In line with previous studies conducted in Egypt by Abd El-fatah et al., (2020) **[18]** who reported that two thirds of studied participants lived in rural areas and by El-fadl & Sheta (2019) **[22]** who reported that the majority of the sample lived in rural areas, in contrast, a study conducted in Turkey by Gemicioglu et al., (2019)**[17]**revealed that around half of the participants were urban dwellers.

Concerning medical history for asthma about two thirds of the elderly in the buteyko and half of comparison groups suffering from asthma from one to three years ago. This may be due to lack of awareness among the elderly of the seriousness of the disease and not seeking medical attention or diagnosis until the disease has worsened. Also, the disease starting in young age and have chronic effect. This finding is dissimilar to a study done in Egypt by Abd El-fatah et al., (2020) **[18]** who reported that less than two-thirds of the sample has asthma since 6 – 10 years and other study done in Romania by Marincu et al., (2015) **[24]** who found that elderly people were readmitted to hospital complaining of asthma from five to ten years. In Egypt Abd El-Rahman et al., (2015) **[21]** found that approximately two thirds of the elderly people were diagnosed by bronchial asthma for more than ten years. Also, in Turkey Ozturk et al., (2015) **[25]** found that the asthma mean duration in elderly people was13.7±15.4 years.

As regard to the medication taken for asthma, it was observed that, all elderly patients 100% in both groups take corticosteroids and bronchodilators. These findings may be justified by, asthma medications are essential for the condition of elderly patients and they may have fear of their status deterioration that can interfere with their activities of daily living. The same findings in a study conducted in Turkey by Gemicioglu et al., (2019) **[17]**

who reported that, long-acting beta 2-adrenergic agonists and inhaled corticosteroids were the most commonly recommended drugs for both categories.

This current study demonstrated that more than two thirds of the study participants had previous hospitalization from 1 to 5 times. This may be due to the chronicity of the disease, noncompliance with their medications and not follow the safety precautions to decrease asthma attacks. This is similar to a study done in Egypt by Abd El-Rahman et al., (2015) **[21]** who found that, two thirds of the studied participants had previous hospitalization from one time and more. In contrast, a study done in Egypt by Nafie et al., (2017) **[26]** reported that more than three quarters of patients with bronchial asthma were not hospitalized in the previous year.

In relation to compliance with medications, the current study reported that more than half of the studied participants in the buteyko and comparison groups were compliance with medication. In this regard, a study done in Egypt by Nafie et al., (2017)**[26]**who reported that, more than three quarters of bronchial asthmatic patients were compliance with medication.

This study demonstrated that about three quarters of the asthmatic elderly patients were suffering from hypertension. This may be attributed to aging and the age related changes in arterial stiffness, decreased its elasticity and other physiological changes can increase the risk of developing hypertension. This is supported by a study carried out in Turkey by Gemicioglu et al., (2019) **[17]**who revealed that hypertension was the most comorbidities frequently observed in the elderly group. Dissimilarly, a study carried out in Japan by Adachi et al., (2019) **[27]**who reported that allergic rhinitis/pollinosis was the most common comorbidity.

According to pulmonary function tests score in the buteyko and comparison groups, no statistically significant variations were detected between two groups before the training program regarding Forced Expiratory Volume in first second (FEV1), Forced Vital Capacity (FVC) and the ratio between Forced Expiratory Volume in first second and Forced Vital Capacity (FEV1/ FVC) score. This is in accordance with a study done in Kuwait by Refaat & Gawish (2015)**[28]**who reported that no significant variations in both patient groups before training program regarding FEV1, FCV and FEV1/FCV scores.

Regarding FCV score of the study group improved significantly 3 and 6 months after training program (Post 1 & post 2) (P =0.001 & P =0.001). Moreover, the total FCV score of the control group was increased after 3 months (Post 1) and the variations were statistically significant (P=0.025). In this respect, a Kuwaiti study by Refaat & Gawish (2015)**[28]**, there was a significant difference in FVC values between the training group's pre- and post-training values (2.63 ± 0.57 and 2.95 ± 0.41, respectively, $p < 0.05$) as well as between the training group's post-training values and those of the comparison group (2.95 ± 0.41 and 2.81 ± 0.41, respectively, $p < 0.05$).

Following the training program, there was a statistically significant variation between the buteyko and comparison groups three and six months following the program. Approximately half of the buteyko group reported a moderate to severe degree of improvement in their overall FEV1 score when compared to the comparison group. This may have to do with the reduction of airway obstruction during training, which could be attained by exerting more inspiratory power as a result of the diaphragm's mechanical advantage. Similarly, a study donein Kuwait by Refaat & Gawish (2015) **[28]** who reported that for FEV_1, at pre-training levels, there was no discernible difference between the two patient groups. The training group's FEV1 values showed significant changes from pre- to post-training (2.42 ± 0.53 to 2.78 ± 0.42 respectively, $p < 0.05$), as did the training group's post-training values when compared to the comparison group (2.78 ± 0.42 to 2.51 ± 0.40 respectively, $p < 0.05$).

A study conducted in Egypt by Abd Elmawla et al., (2023)**[29]**revealed that there was a significant change in pulmonary functions by an increase in Spirometry values of FVC, FEV1, FEV1/FVC%, after 4 weeks of the intervention. The purpose of buteyko exercise is to decrease minutes of ventilation and readjust the breathing center to greater CO2 values. A control pause increases CO2 concentration, which penetrates the blood brain barrier. This penetration resets the respiratory center into the medulla **[30].**Also in agreement with the study finding another study done in India by Kumar et al., (2023)**[31]**reported a significance improvement (P=<0.001) in FVC, FEV1 and ratio of FEV1/FVC within buteyko group.

According to the current study, prior to the implementation of the training program, there were no statistically significant differences between the buteyko and comparison groups on any of the categories of asthma quality of life (AQL). Similarly, a study carried out in Kuwait by Refaat & Gawish (2015) **[28]** showed that pre-training values of all AQLQ domains showed no significant variation between the two groups ($p > 0.05$).

The present study reported that the asthma quality of life mean scores of all dimensions of such symptom frequency, activity limitation, environmental exposure and emotional function were significantly improved in the buteyko group at 3 months after training program (post 1) and the improvement maintained at 6 months (post 2) (P= 0.000), compared to elderly patients in the comparison group had no statistically significant differences at 3 and 6 months after training program. This is consistent with a Kuwaiti study by Refaat & Gawish (2015)**[28]**, which showed that individuals with moderate to severe bronchial asthma can benefit from physical exercise in terms of HRQOL. As compared to the comparison group, the training group had significant improvements in all baseline AQLQ scores immediately following the training intervention ($p < 0.05$), with the exception of the environmental exposure domain. Significant improvements were observed in the physical limits, frequency of symptoms, emotional domains, and overall score; the level of improvement above the minimum clinically meaningful change criteria (≲0.5 points per item). Three months after training, the same three domains showed

continued improvements that were noticeably bigger than any changes seen in the comparison group.

A study done in India by Prem et al. (2013) **[15]**found that the buteyko group improved more than the pranayama group in terms of trends of improvement (mean (95% confidence interval), P-value) in the total AQLQ score after the intervention (0.47 (–0.008–0.95), P = 0.056). Similarly, Abouelala et al., (2017)**[32]**found that the quality of life of asthmatic patients was relatively low prior to implementing BBT, with a statistically significant variation in the distribution of the study group's total score levels of quality of life (p value at 0.008*). The mean and standard deviation improved from 49.2 ± 8.4 to 60.4 ± 12.9 after BBT.

The present study demonstrated that, following the training program, the buteyko group's overall practices score increased significantly. However, the mean practice score in the buteyko group decreased slightly after three and six months (Post 1 & Post 2), and it continued to differ significantly from before the training sessions. This finding is supported by a study conducted in Egypt by Labieb et al., (2020)**[33]**, which found that the study group's progress in practical level was statistically significantly different from that of the control group (pre, month 2 and month 6).

The findings of this study conveyed that there was inadequate practice prior to the training program's implementation. While the study group shown a statistically significant improvement in total score practice following the training program, the majority of elderly patients demonstrated fair and good practices at the program's immediate, three, and six-months. These results were similar to those of Labieb et al., (2020) **[33]**, who found that prior to the training program's implementation; there was a low degree of practice. Following the intervention, the study group shown a statistically significant improvement in total score practice, with most patients exhibiting satisfactory and satisfied practices at the program's immediate, two, and six-month marks. Additionally, Amer et al., (2018) **[34]** revealed that regular practice of breathing exercises and coughing exercises improves the performance of the elderly by improving their ability to control their breathing and expel sputum. Through continual training sessions, step-by-step demonstrations of each practical component, and demonstrations of each step, the researcher conducted an immediate posttest to make sure the elderly had learnt in an appropriate manner.

The present study demonstrated that a positive significant correlation was found between total practice score and the study variables including FEV1/FVC, and quality of life. As total practice score improved FEV1/FVC and quality of life improved. This attributed to the elderly patients in the study group followed the buteyko breathing exercise training and associated instructions help to improve hypoventilation and increase their control on asthma symptoms thus help to improve their quality of life.

CONCLUSION

The buteyko breathing exercise had a notable beneficial impact on improving pulmonary function tests and quality of life of asthmatic elderly patients. There were a positive significant relation between total practice score of buteyko breathing exercise and FEV1/FVCand quality of life. Therefore, buteyko breathing exercise must be taken into account as a complementary treatment modality plus pharmacological therapy in improving health status and achieving holistic benefits to elderly patients suffering from asthma.

RECOMMENDATIONS

- Periodically implementing an ongoing education programs for patients with asthma can enhance their knowledge, skills, and respiratory function.
- Provide a clear, thorough booklet with illustrations that explains asthma and how to manage it to older persons who have asthma. This will help them better control and manage their asthmatic behaviors.
- Development of different educational programs focusing on integration of buteyko breathing exercise in asthma treatment as a complementary therapy, focused on high risk elderly patients as who have previous hospitalization in different health care settings.

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