SRYAHWA PUBLICATIONS

Open Access Journal of Internal Medicine
ISSN: 2638-5279 | Volume 6, Issue 1, 2024
https://doi.org/10.22259/2638-5279.0601003

RESEARCH ARTICLE

Effect of Supervised Breathing Exercise on Patients with Bronchial Asthma

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Received: 16 April 2024 Accepted: 30 April 2024 Published: 16 May 2024

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Abstract

Background: Bronchial asthma is the most common form of lung disease, accounting for about 20% of general physician visits. Anti-asthmatic drugs like salbutamol, steroid inhalers, and aminophylline have been used for decades in clinical practice to relieve and control local inflammation and breathlessness in asthma.

Aim of the study: In the present study, combined therapy of anti-asthmatic drugs and breathing exercises for bronchial asthma is given to determine the patient's functional improvement and clinical outcome.

Methods: It was a Prospective Interventional randomized clinical study conducted in the Department of Physical Medicine and Rehabilitation, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka, from February 2012 to July 2012. Fifty-four patients between 19 to 70 years without consideration of gender with a history of persistent asthma symptoms having more than 20% diurnal variation on three or more days in a week for two weeks or FEV1>15% decrease after six minutes of exercise. Then, they were divided randomly into Groups A and Group B. Group A will receive → anti-asthmatic drugs with a supervised exercise program, and Group B will receive → unsupervised exercise program and anti-asthmatic drugs. Study parameters are used to assess the disease activity and functional capability of the patients: (1) spirometry and (2) ACQ (asthma control questionnaire). The study group then follows up after the 6th and 12th week.

Result: The mean (±SD) age 33.96(±8.91) was in Group A and 39.96(±8.73) were in Group B. Most age groups, 10(37.04%), were 20-30 years old; in Group A, they were 31-40. 15(55.56%) were in Group B, followed by 41-50 yrs. 09(33.33%) were Group A and 06(22.22%) were Group B. Most of the females, 19(70.37%), were in Group A and 20(74.07%) were in Group B. Out of All patients, 09(33.33%) were housewife in Group A and 05(18.52%) were in Group B, 11(40.74%) service holder were in Group A and 20(74.07%) were in Group

Citation: Dr. Md. Shakil Younus, Dr. Shams Ibne Maksud, Dr. Sharmin Kabir, *etal.* TEffect of Supervised Breathing Exercise on Patients with Bronchial Asthma. Annals of Ecology and Environmental Science. 2024;6(1): 14-21.

B, 05(18.52%) student was Group A and 02(7.41%) student were Group B. All of the majority, 25(92.59%), come from middle-class socio-economic status, in Group A and 22(81.48%) in Group B. spirometry analysis of lung function, pre-treatment mean (FEV1/FVC %) 69.43(±3.15) were in Group A and 67.83(±3.64) were in Group B (p >0.05) that different was not statistically significant. ACQ (Asthma control questionnaire) score and pre-treatment mean score of 1.66(±0.40) were in Group A, and 1.91(±0.69) were in Group B (p >0.05). That difference was not statistically significant. After giving Group A a supervised rehab program, there was a significant improvement in spirometry analysis and ACQ score between the two groups.

Conclusion: Although the study was conducted with a small sample size in a single Centre in Dhaka city, which may not be representative of the whole country, it was found that there was a statistically significant difference in spirometry analysis and ACQ score between the groups.

Keywords: Supervised, Breathing Exercise and Bronchial Asthma.

1. Introduction

Asthma is characterized as a syndrome rather than a disease. Currently asthma defined as it is a complex chronic inflammatory disorder of airway in susceptible individual due to certain stimuli resulting variable airflow limitation and presenting as wheezing, breathlessness, chest tightness and cough [1]. Pulmonary rehabilitation is an integral part of the clinical management and health maintenance of patients with chronic respiratory disease who remain symptomatic or continue to have decreased function despite standard medical treatment. Consequences of respiratory diseases are peripheral muscle dysfunction, respiratory muscle dysfunction, nutritional abnormalities, cardiac impairment, skeletal disease, sensory deficits, and psychological dysfunction. The benefits of pulmonary rehabilitation are seen even in irreversible pulmonary disorders, since much of the disability and handicap results not from the respiratory disorder per se but from secondary morbidities that often are treatable if recognized. Although the degree of airway obstruction or hyperinflation of chronic obstructive pulmonary disease (COPD) does not change appreciably with pulmonary rehabilitation, reversal of muscle deconditioning and better pacing enables patients to walk farther with less dyspnea [2]. Rehabilitation programs include prevention; early recognition and treatment of morbidities; and inpatient, outpatient, and extended care of patients with chronic respiratory illness. The choice of setting often depends on the physical, functional, and psychological status of the patient; the variability and distance to the program; insurance payer coverage; and patient preference. Inpatient rehabilitation generally is recommended for patients affected to the greatest degree because of intensive rehabilitation services and specialized training for the patient and/or family. Outpatient rehabilitation, which can be hospital-based or community-based, requires a certain level of functional ability and has the potential to benefit most patients. Although outcomes have not been studied well, home-based pulmonary rehabilitation is convenient for the patient and family members and may provide sustained motivation for continued exercise training. Chronic obstructive pulmonary disease (asthma) is characterized by progressive airflow obstruction and lung hyperinflation due to loss of elastic recoil and air trapping. These physiological changes are associated with an altered pattern of ventilator muscle recruitment. The musculature of the rib cage makes an increased contribution to chest wall movement and there is increased activity of the accessory muscles of ventilation [3,4]. In the event of inspiratory muscle fatigue, there may be asynchrony between rib cage and abdominal movement with paradoxical abdominal in drawing during inspiration [5]. Breathing retraining aims to alter respiratory muscle recruitment to reduce dyspnea, lessen hyperinflation, improve respiratory muscle performance, and optimize thoracoabdominal motion [6]. Several breathing retraining techniques have been used in asthma, including diaphragmatic breathing (also known as breathing control or abdominal breathing), pursed lip breathing, active expiration, ventilation pacing, and ventilation feedback training. These techniques may result in acute improvements in gas exchange and ventilation, however, effects on important clinical outcomes such as dyspnea, exercise capacity, and quality of life have not consistently been identified [7-11]. Some breathing retraining techniques may increase dyspnea and reduce the mechanical efficiency of breathing [8,12]. The clinical utility of breathing retraining in asthma is therefore unclear. The impact of breathing retraining in patients with asthma may vary according to underlying physiology, the technique employed, and the conditions of training. Some authors have

reported that breathing retraining reduces dyspnea in patients who are severely obstructed and hyperinflated, whilst others have found no physiological predictors of response [10,13]. Diaphragmatic breathing, which involves active abdominal muscle recruitment, may have different effects compared to pursed lip breathing which focuses on passive, prolonged expiration. Some breathing retraining techniques may increase dyspnea and reduce the mechanical efficiency of breathing [8,12]. The clinical utility of breathing retraining in asthma is therefore unclear. The impact of breathing retraining in patients with asthma may vary according to underlying physiology, the technique employed, and the conditions of training. Some authors have reported that breathing retraining reduces dyspnea in patients who are severely obstructed and hyperinflated [10], whilst others have found no physiological predictors of response [13]. Diaphragmatic breathing, which involves active abdominal muscle recruitment, may have different effects compared to pursed lip breathing which focuses on passive, prolonged expiration. Breathing retraining performed during exercise may have different clinical benefits compared to training performed only at rest [9]. The study aims to find out the effectiveness of supervised breathing exercises in patients with bronchial asthma.

2. Methodology and Materials

It was a prospective interventional randomized clinical study. This study was conducted in the Department of Physical Medicine and Rehabilitation, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbagh, Dhaka, Bangladesh. A total of 54 patients were enrolled in this study for one year, from February 2012 to July 2012. The study population was outdoor referral patients, irrespective of sex, between 19 and 70 years of age, who had asthma and attended the Department of Physical Medicine and Rehabilitation, BSMMU. The patient was informed about the nature of the study. Written consent was obtained from the patient, and ethical approval was obtained from the institution's ethics committee.

2.1 Inclusion Criteria

- Patients of the age group between 19 to 70 years.
- Patients have more than 20% diurnal variation more than three days a week on the PEF diary for two weeks.
- Patients have FEV1 more than 15% decrease after 6 minutes of exercise.

2.2 Exclusion Criteria

- Criteria include conditions interfering with the rehabilitation process or involving risk of exercise, e.g., cognitive dysfunction, severe pulmonary hypertension, unstable angina, and recent myocardial infarction.
- Radiological evidence of TB, malignancy, osteoarthritis, fracture, or calcification.
- Patients who need to comply with follow-up.

2.3 Study Procedure

The primary purpose of this study was to assess the effect of breathing exercises in addition to anti-asthmatic drugs in asthmatic patients. Fifty-four patients between 18 to 70 years without consideration of gender with a history of persistent asthma symptoms having more than 20% diurnal variation on three or more days in a week for two weeks or FEV1>15% decrease after six minutes of exercise. Then, they will be divided randomly into groups A and B.

Group A: Will receive anti-asthmatic drugs with a supervised exercise program.

Group B: Will receive an unsupervised exercise program and anti-asthmatic drugs.

Study parameters are used to assess the disease activity functional capability of the patients - spirometry and ACQ (asthma control questionnaire)

2.4 Operational Definition

Forced Expiratory Volume in 1 sec (FEV1): The average value for FEV1 in healthy people depends mainly on sex and age. Values between 80% and 120% of the average value are considered normal. Predicted typical values for FEV1 can be calculated online and depend on age, sex, height, weight, ethnicity, and the research study on which they are based. For diagnosing asthma, FEV1>15% increase following administration of a Broncho dilator or trial of corticosteroid plus either/or FEV1>15% decrease after six minutes of exercise.

2.5 The Procedure of Data Interpretation

SPSS analyzed data for the Windows 16.00 version. Descriptive statistics cross tables with observed data were analyzed to calculate the row, column, and total percentage. Pearson-chi square association test was applied to establish the objectives and answer the research questions. The frequency, percentage, mean, and standard deviation were included in descriptive statistics. Necessary tables were prepared based on the findings relevant to the study.

3. Results

Total number of patients was 54. Table 1 shows the demographic characteristics of the study population: mean(±SD) age 33.96(±8.91) was in Group A, and 39.96(±8.73) was in group B. Most age groups, 10(37.04%), were 20-30, and most were in Groups A and 31-40. 15(55.56%) were Group B, followed by 41-50 yrs. 9(33.33%) were Group A and 6(22.22%) were Group B. Most of the females, 19(70.37%), were in group A, and 20(74.07%) were in Group B. Out of All patients, 9(33.33%) were housewife in Group A and 5(18.52%) were in Group B, 11(40.74%) service holder were in Group A and 20(74.07%) were in Group B, 5(18.52%) students were Group A and 2(7.41%) student were Group B. All of the majority, 25(92.59%), come from middle-class socio-economic status in Group A and 22(81.48%) in Group B. Table 2 shows that mean height was 161.77(±4.77) in Group A and 166.06(±5.30) in group B. Mean weight 59.11(±5.45) in Group A and 61.0(±5.64) were in Group B. Table 3 shows mean duration of breath 1.19(±0.55) were in Group A and 1.25(±0.55) were in Group B, the duration of cough 1.19(±0.55) were in Group A and 1.25(±0.55) were in Group B, Wheeze 1.19(±0.55) were in Group A and 1.17(±0.61) were in Group B. Table 4 shows an analysis of breathlessness's significant difference between group A and group B in the onset of breathless p value <0.05, with no significant difference between the Precipitation factor and disability p-value being >0.05. Table 5 shows the treatment history of the study population: 7(25.93%) Salbutamol was given to group A, and 8(29.63%) was given to Group B. 20(74.07%) Steriod+Salbutamal given in Group A and 16(59.26%) in Group B. Aminophylin+Salbutamal 3(11.11%) was given to group B. Table 6 shows that in the general examination, healthy-looking 12(44.4%) were in group A, and 17(62.96%) were in group B. ill-looking 6(22.22%) were in Group A and 5(18.52%) were in Group B. 9(33.33%) depressed in Group A and 5(18.52%) were in Group B. Table 7 shows respiratory system findings reparatory rate, chest expansion, vocal fremitus, breath sound, and added sound was significant between study groups (p <0.05). The chest and vocal resonance movement were less significant in this study (P >0.05). Table 8 shows spirometry analysis of lung function, pre-treatment mean (FEV1/FVC %) 69.43(±3.15) were in Group A and 67.83(±3.64) were in Group B (p >0.05) that different was not statistically significant. Follow-up in 1st-week mean (FEV1/FVC%) 72.77(±0.55) were in Group A, and 68.26(±2.38) were in Group B (p<0.05). That difference was statistically significant. Follow-up in the 6th-week mean (FEV1/FVC%) 73.23(±3.55) were in Group A, and 68.59(±2.27) were in Group B (p<0.05). That difference was statistically significant. Follow-up in the 12th-week mean (FEV1/FVC%) 73.80(±3.08) were in Group A, and 69.05(±2.45) were in Group B (p<0.05). That difference was statistically significant. Table 9 shows the ACQ (Asthma control questionnaire) score and pre-treatment mean score of 1.66(±0.40) in group A and 1.91(±0.69) in group B (p>0.05), and the difference was not statistically significant. Follow-up in 1st-week mean scores 0.99(±0.25) were in group A and 1.58(±0.60) were in group B (p<0.05). That difference was statistically significant. Follow-up in the 6th-week mean score of 0.83(±0.22) was in Group A, and 1.81(±1.74) was in Group B (p<0.05). That difference was statistically significant. Follow-up in the 12th-week mean scores of 0.73(±0.25) were in group A, and 1.36(±0.56) were in group B (p <0.05). That difference was statistically significant.

Table 1. *Demographic characteristics of the study population.*

Variables	Group A		Group B		Total
	n	%	n	%	
20-30	10	37.04	2	7.41	12
31-40	8	29.63	15	55.56	23
41-50	9	33.33	6	22.22	15
>50	0	0	4	14.81	4
Mean (±SD)	33.96(±8.91)		39.96(±8.73)		
Sex					
Male	8	29.63	20	74.07	28
Female	19	70.37	7	25.93	26
Occupation					
House wife	9	33.33	5	18.52	14

Service	11	40.74	20	74.07	31
Student	5	18.52	2	7.41	7
Business	2	7.41	0	0	2
Socio-economic condition					
Poor	0	0	3	11.11	3
Middle	25	92.59	22	81.48	47
Rich	2	7.41	2	7.41	4

Table 2. *Mean difference between study group with height and weight.*

Variables	Group A	Group B	P Value
	Mean (±SD)	Mean (±SD)	
Height	161.77(±4.77)	166.06(±5.30)	0.003
Weight	59.11(±5.45)	61.0(±5.64)	0.21

Table 3. *Mean duration of breath, cough and wheeze according to study population.*

Variables	Group A	Group B	P Value
	Mean (±SD)	Mean (±SD)	
Breath	1.19(±0.55)	1.25(±0.55)	0.66
Cough	1.19(±0.55)	1.25(±0.55)	0.66
Wheeze	1.19(±0.55)	1.17(±0.61)	0.89

Table 4. *Analysis of breathlessness according to study population.*

Variables	Group A		Group B		Total	P Value
	n	%	n	%		
Onset						
Acute	2	7.41	11	40.74	13	0.01
insidious	12	44.4	5	18.52	17	
episodic	13	48.15	11	40.74	24	
Precipitation factor						
Cold	13	48.15	14	51.85	27	0.46
Dust	9	33.33	11	40.74	20	
Food and exceptional	5	18.52	2	7.41	7	
Disability						
Problem in maintaining ADL	14	51.85	13	48.15	27	1
performing job related task	13	48.15	14	51.85	27	

Table 5. *Distribution of treatment history according to study groups.*

Variables	Group A		Group B		Total	P value
	n	%	n	%		
Salbutamol	7	25.93	8	29.63	15	0.17
Steriod+Salbutamal	20	74.07	16	59.26	36	
Aminophylin+Salbutamal	0	0	3	11.11	3	
Total	27	100	27	100	54	

Table 6. *Appearance of study population.*

Variables	Group A		Group B		Total	P value
	n	%	n	%		
Healthy	12	44.4	17	62.96	29	0.17
Ill looking	6	22.22	5	18.52	11	
Depressed	9	33.33	5	18.52	14	
Total	27	100	27	100	54	

Table 7. *Respiratory system findings of study population.*

Variables	Group A		Group B		Total	P value
	n	%	n	%		
Movement of chest						
Normal	24	88.89	21	77.78	45	0.46
Reduced	3	11.11	6	22.22	9	
Reparatory rate						
Normal	9	33.33	2	7.41	11	0.03
Reduced	18	66.67	25	92.59	43	
Chest expansion						
Normal	15	55.56	7	25.93	20	0.02
Reduced	12	44.44	20	74.47	34	
Vocal fremitus						
Normal	8	29.63	20	74.07	28	0.001
Reduced	19	70.37	7	25.93	26	
Breath sound						
Vesicular	18	66.67	3	11.11	21	<0.001
Bronchial	9	33.33	24	88.89	33	
Vocal resonance						
Normal	20	74.07	15	55.56	35	0.15
Reduced	7	25.93	12	44.44	19	
Added sound						
Present	2	7.41	14	51.85	16	0.001
Absent	25	92.59	13	48.15	38	

Table 8: *Spirometry analysis of lung function (FEV1/FVC %) between two groups in pre-treatment and follow up in 1st, 6th and 12th weeks.*

Variables	Group A	Group B	P value
	Mean (±SD)	Mean (±SD)	
Pre-treatment	69.43(±3.15)	67.83(±3.64)	0.09
Follow up in 1st week	72.77(±0.55)	68.26(±2.38)	<0.001
Follow up in 6th week	73.23(±3.55)	68.59(±2.27)	<0.001
Follow up in 12th week	73.80(±3.08)	69.05(±2.45)	<0.001

Table 9: *ACQ (Asthma control questionnaire) score between two groups in pre-treatment and follow up in 1st, 6th and 12th weeks.*

Variables	Group A	Group B	P value
	Mean (±SD)	Mean (±SD)	
Pre-treatment	1.66(±0.40)	1.91(±0.69)	0.12
Follow up in 1st week	0.99(±0.25)	1.58(±0.60)	<0.001
Follow up in 6th week	0.83(±0.22)	1.81(±1.74)	<0.001
Follow up in 12th week	0.73(±0.25)	1.36(±0.56)	<0.001

4. Discussion

The primary purpose of this study is to assess the effect of supervised breathing exercises in patients with bronchial asthma. Fifty-four patients between 19 to 70 years of age group without consideration of gender with a history of persistent asthma symptoms having more than 20% diurnal variation on 3 or more days in a week for 2 weeks or FEV1>15% decrease after 6 mints of exercise. Mean(±SD) age 33.96(±8.91) was in group A and 39.96(±8.73) were in group B, most of the age groups were 20-30 yrs. 10(37.04%) in group A and 31-40 yrs. 15(55.56%) were Group B. followed by 41-50 yrs. 09(33.33%) were Group A and 06(22.22%) were Group B. Female 19(70.37%) were in Group A and 20(74.07%) were in Group B. Out of All patient 09(33.33%) house wife in Group A and 05(18.52%) were Group B, 11(40.74%) service holder were in Group A and 20(74.07%) were in Group B, 05(18.52%) student were Group A and 02(7.41%) student were Group B.

All of the majority 25(92.59%) come from middle-class socio-economic status, in Group A and 22(81.48%) in group B. This study is compared with Vemppati et al. (2009) study reported that, the male to female ratio was 1:1 in each group, the mean age was 30 years for yoga and 31 for the control group and most of them were farmers [14]. In this study mean heights were 161.77(±4.77) in group A and 166.06(±5.30) in group B. Mean weight 59.11(±5.45) in Group A and 61.0(±5.64) were in Group B. El-Helaly and Aboel-magd study mean height was 130.05±12.31 Group A and 130.85±30.05 were in group B, mean weight in kg 28.65±8.40 were in group A and 30.05±7.36 in Group B that is nearly similar to our study [15]. Vemppati et al study reported that,88 there was a significant decrement in the number of asthma attacks (day and night) and use of drugs especially to the use of puff (p=0.044) in the yoga group during and after the 4-week exercise. Eight (66.7%) of the yoga group reduced use of salbutamol puff. In the control group the reduction was in the use of puff was only in 16.6%. In this series general examination healthy looking 12(44.4%) were in Group A and 17(62.96%) were in Group B. ill looking 06(22.22%) were in Group A and 5(18.52%) were in Group B. 9(33.33%) depressed in Group A and 05(18.52%) were in Group B. In this series respiratory system findings reparatory rate, chest expansion, vocal fremitus, breath sound, and added sound were significant between study groups ($p < 0.05$). Movement of the chest and vocal resonance were less significant in this study ($P > 0.05$). Vemppati et al study reported that the mean change in the PEFR was 10 in the yoga group whereas 2 in the control group which was statistically significant ($p < 0.0001$). A similar pattern was also observed in the mean change of pulse rate, respiratory rate and wheezing among the two groups ($P < 0.001$) in this series spirometry analysis of lung function, pre-treatment mean (FEV1/FVC %) 69.43(±3.15) were in Group A and 67.83(±3.64) were in Group B ($p > 0.05$) that different was not statistically significant [14]. Follow up in 1st-week mean (FEV1/FVC %) 72.77(±0.55) were in Group A and 68.26(±2.38) were in Group B ($p < 0.05$) that difference was statistically significant. Follow-up in the 6th-week mean (FEV1/FVC %) 73.23(±3.55) were in Group A and 68.59(±2.27) were in Group B ($p < 0.05$) that difference was statistically significant. Follow-up in the 12th-week mean (FEV1/FVC %) 73.80(±3.08) were in Group A and 69.05(±2.45) were in Group B ($p < 0.05$) that difference was statistically significant. The results of a study on 30 healthy individuals in the age range 15-30 years, divided into 2 sub-groups of equal number (yoga and physical exercise group), the yoga group practicing deep breathing exercises 15 minutes daily, six days a week for one month & physical exercise group practicing running 15 minutes daily, six days a week for one month showed that there was a significant increase in FVC, FEV1, MVV and PEFR in yoga group as compared to physical exercise group [16]. In another study conducted on 50 asthma patients, divided into two groups of equal size, Group A and Group B, with group A patients practicing deep breathing 20 minutes twice daily for a period of 12 weeks & Group B patients practicing meditation 20 minutes twice daily for a period of 12 weeks, showed that there was significant increase in FEV1 and PEFR in group A as compared to Group B [17]. In this series ACQ (Asthma control questionnaire) score, the pre-treatment mean score of 1.66(±0.40) was in Group A and 1.91(±0.69) was in Group B ($p > 0.05$) that difference was not statistically significant. Follow up in 1st-week mean scores 0.99(±0.25) were in Group A and 1.58(±0.60) were in Group B ($p < 0.05$) that difference was statistically significant. Follow-up in the 6th week mean score of 0.83(±0.22) was in Group A and 1.81(±1.74) was in Group B ($p < 0.05$) that difference was statistically significant. Follow-up in the 12th week mean scores of 0.73(±0.25) were in Group A and 1.36(±0.56) were in Group B ($p < 0.05$) that difference was statistically significant. Abd El-Kader et al study reported that the mean values of FVC, FEV1, and FEF75-85% were significantly higher, whereas the mean values of the number of asthmatic attacks per week were significantly lower in both groups after treatments. There were significant differences between mean levels of the investigated parameters in group (A) and group (B) after treatment, which is supported by our study [15].

Limitations of the Study

The present study has some limitations. The study was conducted in a single center in Dhaka, which may only be representative of some of the country. The small sample size is also a limitation of the study. Due to time constraints, patients were observed for six weeks only.

5. Conclusion and Recommendations

Although the study was conducted with a small sample size in a single center in Dhaka, which may not be representative of the whole country, there was a statistically significant difference between the groups in spirometry analysis and ACQ score.

Funding: No funding sources.

Conflict of Interest: None declared.

Ethical Approval: The study was approved by the Institutional Ethics Committee.

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