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Effects of Buteyko-Inspired Hypoventilation Therapy on Patients with Bronchial Asthma

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Abstract

Background: Bronchial asthma is one of the important chronic diseases and a leading public health concern. The demand for complementary therapies amongst chronic disease patients has gained significant momentum over recent years especially Buteyko-Inspired Hypoventilation Therapy. **Aim:** This study aimed at evaluate the effect of Buteyko-Inspired Hypoventilation Therapy on patients with bronchial asthma. **Design**: A quazi–experimental design was used. **Setting**: The study was conducted at the Chest Diseases Clinic in Ain Shams University Hospital. **Sample**: It included a purposive sample of 50 adult patients, randomly allocated to two equal groups (study & control). **The tools** for data collection: Demographic and Clinical Data assessment questionnaire, Breathlessness, Cough, and Sputum Scale, Fatigue Severity Scale, Pulmonary Function Tests (FEV1 & FEV1/FVC) scales also Respiratory rate and O2 saturation sheet, and Lung Collapse Index. All tools' measurements were made at baseline, after 2, 4 and 6 weeks of the study, except for Socio-demographic and Clinical data Sheet that was collected once; and lung collapse index at baseline, and after 6 weeks of the study. **Results**: revealed statistically significant lower-level severity of common respiratory problems for breathlessness, cough, sputum after 4 and 6 weeks among patients of the study group compared to control group. **Conclusion** Buteyko-Inspired Hypoventilation Therapy demonstrates significant lower-level severity of common respiratory problems for breathlessness, cough, sputum, fatigue and significant improvement **Recommendations**: is recommended to use Buteyko-Inspired Hypoventilation Therapy through conducting comprehensive health education programs for patients with bronchial asthma in outpatients' clinics in the early course of the disease.

Keywords: *Buteyko Breathing Exercises technique, Bronchial asthma, Breathlessness, Cough, Fatigue, lung Collapse, Sputum.*

Introduction

Bronchial asthma is a prevalent chronic respiratory disease characterized by airway inflammation, hyperresponsiveness, and reversible airflow obstruction (GINA, 2024). Despite advances in pharmacotherapy (e.g., inhaled corticosteroids, biologics), a subset of patients continues to experience symptoms and exacerbations, highlighting the need for adjunctive therapies (Papi et al., 2021). Among non-pharmacological interventions, breathing retraining techniques, particularly Buteyko-inspired hypoventilation therapy, have gained attention for their potential to improve asthma control by targeting dysfunctional breathing patterns **(Santino et al., 2020).**

The Buteyko-Inspired Hypoventilation Therapy (BBT), developed by Russian physician Konstantin Buteyko in the 1950s, is based on the premise that chronic hyperventilation (excessive breathing) reduces arterial carbon dioxide (CO_2) levels, leading to bronchoconstriction and worsened asthma symptoms (Courtney, 2020). By teaching patients to reduce breathing volume and adopt

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shallow, nasal breathing, BBT aims to normalize CO_2 levels, thereby reducing airway resistance and decreasing reliance on rescue medications **(Borges et al., 2022).**

Recent clinical studies suggest that Buteyko breathing may improve asthma symptoms, quality of life, and reduce bronchodilator use. A 2023 randomized controlled trial (RCT) demonstrated that asthma patients practicing BBT for 12 weeks had a 30% reduction in β2-agonist use compared to controls **(Liang et al., 2023).** Another 2024 meta-analysis found moderate evidence supporting BBT for improving Asthma Control Test (ACT) scores, though further high-quality trials are needed **(Lee et al., 2024).**

However, the mechanisms behind Buteyko's efficacy remain debated. While some researchers attribute benefits to CO_2-mediated bronchodilation **(Alkhalil et al., 2021),** others propose that improved respiratory biomechanics and reduced inspiratory airflow turbulence play key roles (Hsu et al., 2025). Additionally, BBT's emphasis on nasal breathing may filter allergens, humidify air, and reduce exercise-induced bronchoconstriction (**Breslin et al., 2024).**

The technique offers a complementary method of reliving respiratory symptoms based on the voluntary control of breathing, be able to manage any intermittent symptom of breathlessness by teaching the patients to use short period of voluntary hypoventilation, breaths –holding exercises and relaxation techniques during the period of onset **(Prasanna et al.,2016).** Thus, the purpose of the current study was to examine the effect of Buteyko-Inspired Hypoventilation Therapy on severity of common respiratory symptoms (breathlessness, cough, sputum & fatigue), pulmonary function and lung collapse among patients with bronchial asthma.

Significance of the study:

Despite advancements in pharmacological treatments (e.g., biologics, inhaled corticosteroids), many asthma patients continue to experience poor symptom control, frequent exacerbations, and medication dependence (Papi et al., 2021). This study evaluates Buteyko breathing as a cost-effective, non-pharmacological adjunct therapy, potentially reducing reliance on rescue medications. It is important to remember that bronchial asthma is potentially controllable and that every effort should be made to keep the patient free of symptoms. Buteyko-Inspired Hypoventilation Therapy aimed to reduce chronic hyperventilation **(Papi et al.,2021).** Current guidelines **(GINA, 2024)** emphasize individualized treatment. This study identifies which asthma phenotypes (e.g., hyperventilators, exercise-induced asthma) benefit most from Buteyko therapy. Moreover, Buteyko-Inspired Hypoventilation Therapy is safe, noninvasive, pain free, easily carried out by the patient and enhances a patients' sense of control over their condition. Hence, it is an innovative idea to involve patients in their own plan of care to play a major role in relieving their distressing symptoms by using own hands.

Aim of the study

The aim of the study was to evaluate the effect of Buteyko-Inspired Hypoventilation Therapy (BBT) on severity of common respiratory symptoms (breathlessness, cough, sputum and fatigue), pulmonary function and lung collapse among patients with bronchial asthma.

Research Hypothesis:

In order to accomplish the aim of this research, the following hypothesis were suggested:

Hypothesis1: The study group that receives Buteyko-Inspired Hypoventilation Therapy (BBT) plus traditional management will have a lower severity level of breathlessness, cough, sputum and fatigue than control group who receive traditional management only.

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Hypothesis2: The level of pulmonary function test scores will be significantly improved among study group who will receive Buteyko-Inspired Hypoventilation Therapy (BBT) plus traditional management than control group who will receive traditional management only.

Hypothesis3: The lung collapse index scores will be significantly lower among study group who will receive Buteyko-Inspired Hypoventilation Therapy (BBT) plus traditional management than control group who will receive traditional management only.

Subjects and Methods

Research Design

A quazi – experimental design was utilized to conduct the study.

Setting

The study was conducted at the chest diseases clinic at Ain Shams University Hospital.

Subjects

A purposeful sample of 50 adult patients of both sex, diagnosed as bronchial asthma with stage II(Moderate) and stage III(Severe) and clinically stable were included in this study. The diagnosis of bronchial asthma was made based on Global Initiative for Asthma (GINA), (2024). Patients who had other causes of airflow limitation such as pulmonary tuberculosis, bronchial asthma, bronchiectasis or heart failure were excluded from the enrolled patients by reviewing their medical histories as well as, patients who are seriously ill, with cognitive impairments and patients who previously had instruction in the Buteyko method.

Sample size

The sample size of the study group was calculated according to the following Slovin's equation:

$n=N/1+N(e)^2$

n = sample size.

N=total population.

e = Margin of errors (0.05) confidence level=95%.

n=50, N = 75.

After application of the inclusion and exclusion criteria, the consecutive 50 patients were randomly allocated to two equal groups (study& control), 25 subjects each. The study group received Buteyko-Inspired Hypoventilation Therapy (BBT) plus traditional management while, the control group received traditional management only (O2 & drugs: bronchodilators; expectorant; antibiotics if needed).

Tools

The tools used for data collection included the following:

Tool I: Demographic and Clinical Data assessment questionnaire: The sheet was designed by the researchers to gather information related to patient's Socio-demographic characteristics as age, sex, level of education, occupation and smoking history. It also covered data related to duration of illness, severity of the disease and repeated hospitalization. It was filled in once by the researchers.

This tool was revised by a group of three experts in medical surgical nursing and two experts in community health nursing at faculty of nursing, at Ain Shams University for the content validity. No modifications were needed.

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Tool II: **Breathlessness, Cough, and Sputum Scale (BCSS)**: According to Huidrom et al.,(2016), BCSS is used to predict patient exacerbations by evaluating common symptoms identified in the COPD population. The scale was developed to provide a quick and easy method of evaluating the severity of respiratory symptoms common in COPD patients. It was adopted from Carlin,(2009). The BCSS is based on a three –item questionnaire (How much difficulty did you have breathing?; How was your cough?; How much trouble was your sputum?), patient-reported outcome in which each of the three symptoms (breathlessness, cough, and sputum)by the measure is represented by a single item.

-For breathlessness, it is classified into 5 point Likert-type scale according to breathlessness severity as follows:0= (None): unaware of any difficulty, 1= (Mild): noticeable during strenuous activity(e.g., running),2=(Moderate): noticeable during light activity (e.g., bed making), 3= (Marked) : noticeable when washing or dressing, 4= (Severe): almost constant and present even when resting.

- For cough, it is classified into 5-point Likert-type scale according to cough severity as follows:0= (None): unaware of coughing, 1= (Rare): cough now and then, 2=(Occasional): less than hourly, 3= (Frequent): one or more times an hour, 4= (Almost constant): never free of cough or need to cough.

- For sputum, it is classified into 5-point Likert-type scale according to sputum severity as follows:0= (None): unaware of any difficulty, 1= (Mild): rarely caused problem, 2=(Moderate): noticeable as a problem, 3= (Marked): caused a great deal of inconvenience, 4= (Severe): an almost constant problem.

The three subscale scores of the tool are summed to obtain an overall assessment score that ranging from 0 to 12. The total assessment score was categorized as follows:

-If an overall assessment score is 0 = highly effective.

-If an overall assessment score is 1 ≤ 3= Moderately effective.

- If an overall assessment score ranges from 4 ≤ 6= Mildly effective.

- If an overall assessment score ranges from 7 ≤ 9= Not effective.

- If an overall assessment score ranges from 10 ≤ 12= Made worse.

Tool III: **Fatigue severity scale (FSS):**

According to Prasanna et al. (2015), FSS is a method of evaluating the impact of fatigue on life. The scale is designed for measurement the severity of fatigue. It was adopted from wong et al. (2010). The FSS includes 9 questions with visual diagram scaled from 0 (lack of fatigue) to 4(severe fatigue). Fatigue levels for the patients were rated to lack of fatigue (0 ≤ 9), Mild (10 ≤ 18), Moderate (19 ≤ 27) and Severe (28 ≤ 36). Modification was performed and content validity was done by four panels of experts from medical surgical faculty staff members.

Regarding **BCSS** and **FSS** scales, the patient is instructed to read each statement and circle a number based on how accurately it reflects the extent to which the patient measures the symptom that the statement applies to him.

Tool IV: **Pulmonary Function Test Scale (PFTS):** According to Liang et al., (2023) pulmonary function tests used to identify the pattern, progression and severity of signs & symptoms of lung diseases and monitor the effectiveness of therapy. It was adopted from Al-Ashkar et al., (2008). The scale designed to grade the severity of the lung abnormality based on the [Forced Expiratory Volume in 1 second (FEV1 percentage of predicted), Forced Vital Capacity (FVC) and FEV1/FVC]. It classified the forced expiratory volume in one second into 3 categories according to percentage of prediction: (≥ 70%) = Mild, (69% - 39%) = Moderate, (≤ 38%) = Severe. Also, the scale classified (FEV1/FVC) into 2 categories: ≥70% (which indicates Mild Severity of COPD) and <70"% (which indicates Moderate Severity of COPD).

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Tool V: **Respiratory rate and O2 saturation sheet:** it was developed by the researchers to record the respiratory rate, in addition, a pulse oximetry was used to measure the O_2 saturation in a finger.

Tool VI: **Lung Collapse Index (LCI):** It was designed to evaluate the degree of lung collapse based on changes in routine chest X-ray. It was adopted from Nishimura et al., (2011). Based on LCI, the degree of lung collapse was classified using a 4-point scale as follows: 0= Normal lung expansion, 1= Single lobe collapsed, 2= Two Lobes collapsed, and 3= Multiple lobes collapsed.

Content validity and reliability:

To ensure methodological rigor, the research instrument underwent thorough validation through the following process:

Expert Panel Review: A panel of three specialists in medical-surgical nursing and internal medicine evaluated the study instrument. Their feedback led to significant improvements in the measurement tool, boosting its content validity.

Content Validity Evaluation: Each questionnaire item was carefully examined to assess: - Conceptual relevance to the study objectives - Appropriate phrasing and clarity - Measurement accuracy for target outcomes

Reliability Analysis: Internal consistency reliability was measured using Cronbach's alpha coefficient.

Ethical consideration

An official permission was obtained to conduct the study from the director of Ain Shams University hospitals and heads of each selected setting which with the assigned ethical approval code No: 426-6-2020. Prior to conducting the study, each potential subject was fully informed with the purpose and nature of the study, and then oral informed consent was taken from the participants. In addition, the researcher emphasized to each subject that participation in the study is entirely voluntary; anonymity and confidentiality were assured through coding of data, yet, withdrawal from the study is permitted as it is one of their rights. Each subject was assured that the intervention used in this study (BBT) is safe, noninvasive, can be self-administered and has no harmful effect on patients. In order to apply the principle of fairness in management, the patients in control group were received a session about the Breathing Exercises technique and how to apply it at the end of the data collection time.

Pilot study

A pilot study was conducted on five patients (10%) of the study subjects at the chest department. These patients were excluded from the study sample. The objectives of the pilot study were: to evaluate the content of the tools, to ensure clarity, relevancy, objectivity and feasibility. Almost all items were clearly understood and the responses were found appropriate. Modifications were done in the final form of the tools. The result of the pilot study confirmed that the study is feasible.

Procedures

The study started from June to November 2020. An exploratory visit was done to chest diseases clinic in order to estimate the rate of admission and suitable time for collecting data. Patients who meeting the inclusion criteria were recruited in the current study. They were randomly and equally assigned to the study and control group. The study group consisted of 25 patients who received the traditional management and the designed BBT for 6 weeks while the control group consisted of 25 patients received the traditional management only and did not participate in any physical therapy program during the time of the study.

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Socio-demographic and Clinical data Sheet; Breathlessness, Cough, and Sputum Scale (BCSS); Fatigue severity scale (FSS); Pulmonary Function Test Scale (PFTS); Respiratory rate & O_2 saturation sheet and Lung Collapse Index (LCI) were filled out in order to determine the baseline information for both groups in the 1st interview. By establishing baseline of findings before treatment, the therapist can assess for changes that occur during, or that result for treatment. Patients in the study & control groups were followed up for 6 weeks based on the plan for data collection.

No	Tools	Study group				Control group			
		Baseline	After 2 weeks	After 4 weeks	After 6 weeks	Baseline	After 2 weeks	After 4 weeks	After 6 weeks
1-	Socio-demographic and Clinical data Sheet	√				√			
2-	Breathlessness, Cough, and Sputum Scale(BCSS)	√	√	√	√	√	√	√	√
3-	Fatigue severity scale (FSS)	√	√	√	√	√	√	√	√
4-	Pulmonary Function Test Scale(PFTS%)	√	√	√	√	√	√	√	√
5-	Respiratory rate & O_2 saturation sheet	√	√	√	√	√	√	√	√
6-	Lung Collapse Index(LCI)	√			√	√			√

The plan for data collection:

For the study group, each patient was trained by the Buteyko Breathing Exercises program which continued for 6 weeks and each session was about (30 minutes). In the first week, each patient of this group was trained by BBT intensively for 3 sessions, then the following 5 weeks were 2 sessions per week. The time of the session was in the morning for at least two hours after breakfast meal. Each patient performed the technique also by him/herself at home twice daily in the morning and in the evening, at least 2 hours after meals; during the time of the study.

Patients in the study group were taught how to apply the BBT technique. In addition to the teaching sessions, each patient was provided by brochure that is included (What will BBT do?, How does BBT work?, How effective is BBT?, and tips for successful). In order to apply the principle of fairness in management, the control group received a session about the BBT and demonstration was done by the end of the data collection time, brochure is also available for them.

Buteyko-Inspired Hypoventilation Therapy

*Step1: The ‘‘Control pauses’’ breathing (CP):

The patient is asked to sit in an upright chair and adopt a good posture. Relax shoulders and rest lower back against the back of the chair. Do not change breathing before taking CP. Take a small breath in (2s) and a small breath out (3s). Hold nose on the ‘‘out’’ breath, with empty lungs but not too empty. Holding nose is necessary to prevent air entering into the airways (Courtney, 2008). Count how many seconds can comfortably last before the need to breathe in again. Hold breath until the patient

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feels the first need to breathe in. Release nose and breathe in through it. The first intake of breath after the CP should be no greater than his breath prior to taking measurement; he should not hold his breath for too long as this may cause him to take a big breath after measuring the CP (Patrick,2009).

**Step 2: Shallow breathing

The patient is asked to sit up straight. Monitor the amount of air flowing through his nostrils by placing finger under the patient's nose in a horizontal position. The finger should lie just above top lip and close enough to his nostrils so that he can feel the airflow, but not so close that the air-flow is blocked. Now, breathe air slightly into the tip of his nostrils. For example, just take enough air to fill his nostrils and no more. Breathe in a flicker of air (may be 1 cm) with each breath. As the patient exhales, pretend that finger is a feather. Breathe out gently onto his finger so that the feather

does not move. When breathe out, the warmer air feels, the bigger he is breathing. Concentrate on calming the patient's breath to reduce the amount of warm air that feel on his finger. As the patient reduces the amount of warm air onto finger, he will begin to feel a need or want for air.

*** Step 3: Putting it together

Take Control pause (PC). Reduced breathing for 4 min. Wait 2 min and repeat this technique for 3 times (Freitas et al.,2013, and Patrick,2009).

The patients of control group received their traditional management only (O2 & drugs: bronchodilators; expectorant; antibiotics if needed) and they did not participate in any Breathing exercises program during the time of the study. The tool measurements were made according to the plan for data collection.

Special Procedures

For Pulmonary Function Test Scale :

Pulmonary function (FEV1 and FVC) was measured for each patient using computerized electronic spirometer (ZAN-GP12.00, made in Germany) while the patient was seated with back erect and supported. The patient is asked to take the deepest breath they can (forced inspiratory part) will come before the forced exhalation, and then exhale into the sensor (tidal volume) as hard as possible, for as long as possible, preferably at least 6 seconds. During the test, soft nose clips may be used to prevent air escaping through the nose. Filter mouthpieces may be used to prevent the spread of microorganisms. The best of at least three technically acceptable values for FEV1 and FVC were selected. Data were expressed as a percentage of the predicted values into the test scale.

For Respiratory rate & O2 Saturation Sheet: For respiratory rate measurement, patients in both groups are asked to be at rest and involves counting the number of breaths for one minute by counting how many times the chest rises. Each patient had oxygen saturation monitored. Measurements were done with a pulse oximeter attached to a fingertip probe.

For Lung Collapse Index: Chest X-ray was done and based on the changes in the results, the degree of lung collapse in each patient in the study and control groups was determined.

The FEV1, FEV1/FVC, Respiratory rate & O2 Saturation and Chest X-ray were applied according to the plan for data collection.

Statistical analysis:

Upon completion of data collection, each answer sheet was coded and scored manually. Data was summarized using descriptive statistics as well as inferential statistics. The descriptive statistics included frequency & percentage distribution, means & standard deviation. Inferential statistics included t-test & chi –square. Data was revised, coded, analyzed and tabulated by the researcher using

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the statistical package for social studies (SPSS) version 16. The level of significance was fixed at the 5 % level ($P < 0.05$).

Results

Table 1. Frequency and Percentage distributions of Demographic and Clinical Data assessment Characteristics in the Study and Control Groups (n=50)

Socio-demographic and Clinical Data Characteristics	Groups				X^2	P-Value
	Study(n=25)		Control(n=25)			
	No.	%	No.	%		
Age:						
40+	3	12.0%	1	4.0%	1.11	0.57
50+	17	68.0%	19	76.0%		
60+	5	20.0%	5	20.0%		
Sex:						
Male	13	52.0%	15	60.0%	0.32	0.56
Female	12	48.0%	10	40.0%		
Level of Education:						
Read and Write	6	24.0%	4	16.0%	1.48	0.68
Basic Education	10	40.0%	12	48.0%		
Middle Education	5	20.0%	3	12.0%		
Higher Education	4	16.0%	6	24.0%		
Occupation:						
White Collar	4	16.0%	3	12.0%	0.41	0.93
Blue Collar	5	20.0%	5	20.0%		
Exposed to Irritant	9	36.0%	11	44.0%		
Retired or house wife	7	28.0%	6	24.0%		
Smoking:						
Yes	21	84.0%	19	76.0%	0.50	0.47
No	4	16.0%	6	24.0%		
Duration of Illness:						
≤ 2 Years	8	32.0%	10	40.0%	0.34	0.55
> 2 Years	17	68.0%	15	60.0%		
Disease Severity:						
Stage II (Moderate)	16	64.0%	20	80.0%	1.58	0.20
Stage III (Severe)	9	36.0%	5	20.0%		
Repeated Hospitalization:						
None	16	64.0%	18	72.0%	1.45	0.69

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Once Time	**6**	**24.0%**	**6**	**24.0%**		
Twice Times	**2**	**8.0%**	**1**	**4.0%**		
Three Times and more	**1**	**4.0%**	**0**	**0.0%**		

(*) Statistically significant at p<0.05

Table (1) illustrated Socio-demographic and clinical data characteristics of the study and control groups. More than half of the study and control groups were 50 years age or older (68% & 76%, respectively), while (52%) of patients in the study and (60%) in the control groups were males. In addition, (40% & 48%) of the study and control groups had basic level of education, while (36% & 44%) of patients were exposed to irritant in the study and control groups respectively. Moreover (84% & 76%) of the patients in the study and control groups respectively reported that they are smokers. A regard the duration of illness and disease severity, it was showed that more than half of the patients (68% & 60%) were diagnosed as bronchial asthma for more than 2 years and (64% & 80%) had bronchial asthma stage II (moderate severity of the disease). Meanwhile, (64% & 72%) of patients in the study and control groups respectively were not hospitalized before. The studied sample was homogenous in relation to socio-demographic and clinical data characteristics and no statistically significant differences were noted between the two groups (P > 0.05).

Table 2. Comparison of Breathlessness Severity as a common respiratory symptom among patients with bronchial asthma in the Study and Control Groups Throughout Study Period.

Observational periods	**Groups**				**X^2**	**P-Value**
	Study(n=25)		**Control(n=25)**			
	No.	**%**	**No.**	**%**		
Breathlessness Severity						
***At Baseline:**						
- Mild (BCSS=1)	**2**	**8.0%**	**3**	**12.0%**	**0.87**	**0.83**
- Moderate(BCSS=2)	**3**	**12.0%**	**2**	**8.0%**		
- Marked(BCSS=3)	**15**	**60.0%**	**13**	**52.0%**		
- Severe(BCSS=4)	**5**	**20.0%**	**7**	**28.0%**		
Breathlessness Severity						
***After 2 Weeks:**						
- Mild (BCSS=1)	**2**	**8.0%**	**3**	**12.0%**	**2.15**	**0.54**
- Moderate(BCSS=2)	**3**	**12.0%**	**1**	**4.0%**		
- Marked(BCSS=3)	**16**	**64.0%**	**14**	**56.0%**		
- Severe(BCSS=4)	**4**	**16.0%**	**7**	**28.0%**		
Breathlessness Severity						
*** After 4 Weeks:**						
- Mild (BCSS=1)	**6**	**24.0%**	**1**	**4.0%**	**8.51**	**0.03***
	6	**24.0%**	**2**	**8.0%**		

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- Moderate(BCSS=2)	10	40.0%	14	56.0%		
- Marked(BCSS=3)	3	12.0%	8	32.0%		
- Severe(BCSS=4)						
Breathlessness Severity						
*** After 6 Weeks:**						
- Mild (BCSS=1)	8	32.0%	1	4.0%	20.2	0.002*
- Moderate(BCSS=2)	9	36.0%	1	4.0%		
- Marked(BCSS=3)	7	28.0%	15	60.0%		
- Severe(BCSS=4)	1	4.0%	8	32.0%		

(*) Statistically significant at p<0.05

Table (2) compared breathlessness severity as common respiratory symptoms among patients in the study and control groups. As the table shows that the two groups were similar at baseline and after 2 weeks of the study with no differences of statistically significance, P >0.05. However, after 4 weeks (24%) of patients in the study group had mild breathlessness which increased to (32%) after 6 weeks of the study compared to only (4%) in the control group after 4 and 6 weeks with statistically significant differences between the two groups, (P= 0.03 and P= 0.002, respectively).

Table 3. Comparison of Cough Severity as a common respiratory symptom among patients with bronchial asthma in the Study and Control Groups Throughout Study Period.

Observational periods	Groups				X^2	P-Value
	Study(n=25)		Control(n=25)			
	No.	%	No.	%		
Cough Severity						
***At Baseline:**						
- Rare (BCSS=1)	0	0.0%	0	0.0%	0.51	0.77
- Occasional(BCSS=2)	3	12.0%	2	8.0%		
- Frequent(BCSS=3)	6	24.0%	8	32.0%		
-Almost Constant(BCSS=4)	16	64.0%	15	60.0%		
Cough Severity						
***After 2 Weeks:**						
- Rare (BCSS=1)	1	4.0%	0	0.0%	2.35	0.50
- Occasional(BCSS=2)	4	16.0%	2	8.0%		
- Frequent(BCSS=3)	5	20.0%	8	32.0%		
-Almost Constant(BCSS=4)	15	60.0%	15	60.0%		
Cough Severity						

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*** After 4 Weeks:**						
- Rare (BCSS=1)	**2**	**8.0%**	**0**	**0.0%**	**10.41**	**0.01***
- Occasional(BCSS=2)	**8**	**32.0%**	**1**	**4.0%**		
- Frequent(BCSS=3)	**8**	**32.0%**	**9**	**36.0%**		
-Almost Constant(BCSS=4)	**7**	**28.0%**	**15**	**60.0%**		
Cough Severity						
*** After 6 Weeks:**						
- Rare (BCSS=1)	**6**	**24.0%**	**1**	**4.0%**	**23.97**	**0.001***
- Occasional(BCSS=2)	**13**	**52.0%**	**1**	**4.0%**		
- Frequent(BCSS=3)	**3**	**12.0%**	**9**	**36.0%**		
-Almost Constant(BCSS=4)	**3**	**12.0%**	**14**	**56.0%**		

(*) Statistically significant at p<0.05

Table (3) displayed a comparison of cough severity as common respiratory symptoms among patients in the two groups. It can be noticed that the two groups were similar at baseline and after 2 weeks of the study with no differences of statistically significance, P >0.05. The table shows that (8%) of the patients in the study group had rare cough compared to no one of patients in the control group, this difference was statistically significant, (P= 0.01).

Table 4. Comparison of Sputum Severity as a common respiratory symptom among patients with bronchial asthma in the Study and Control Groups Throughout Study Period.

Observational periods	**Groups**				**X^2**	**P-Value**
	Study(n=25)		**Control(n=25)**			
	No.	**%**	**No.**	**%**		
Sputum Severity						
***At Baseline:**						
- Mild (BCSS=1)	**0**	**0.0%**	**1**	**4.0%**	**2.98**	**0.39**
- Moderate(BCSS=2)	**4**	**16.0%**	**1**	**4.0%**		
- Marked(BCSS=3)	**10**	**40.0%**	**12**	**48.0%**		
- Severe(BCSS=4)	**11**	**44.0%**	**11**	**44.0%**		
Sputum Severity						
***After 2 Weeks:**						
- Mild (BCSS=1)	**2**	**8.0%**	**1**	**4.0%**	**2.01**	**0.56**
- Moderate(BCSS=2)	**5**	**20.0%**	**2**	**8.0%**		
- Marked(BCSS=3)	**9**	**36.0%**	**11**	**44.0%**		
- Severe(BCSS=4)	**9**	**36.0%**	**11**	**44.0%**		

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Sputum Severity						
*** After 4 Weeks:**						
- Mild (BCSS=1)	**6**	**24.0%**	**1**	**4.0%**	**8.10**	**0.04***
- Moderate(BCSS=2)	**6**	**24.0%**	**2**	**8.0%**		
- Marked(BCSS=3)	**6**	**24.0%**	**12**	**48.0%**		
- Severe(BCSS=4)	**7**	**28.0%**	**10**	**40.0%**		
Sputum Severity						
*** After 6 Weeks:**						
- Mild (BCSS=1)	**10**	**40.0%**	**2**	**8.0%**	**10.82**	**0.01***
- Moderate(BCSS=2)	**7**	**28.0%**	**4**	**16.0%**		
- Marked(BCSS=3)	**3**	**12.0%**	**9**	**36.0%**		
- Severe(BCSS=4)	**5**	**20.0%**	**10**	**40.0%**		

(*) Statistically significant at p<0.05

Table (4) showed a comparison of sputum severity as common respiratory symptoms among patients in the two study groups is illustrated in Table (4). As the table shows, no statistically significant differences were revealed among the two groups at baseline and after 2 weeks of the study, P >0.05. However, after 4 weeks, (28%) of patients in the study group had severe sputum severity compared to (40%) in the control group, this difference was statistically significant, (P= 0.04). After 6 weeks of the study, (40%) of patients in the study group had mild sputum severity compared with (8%) of patients in the control group with statistically significant differences between them (P= 0.01).

Table 5. Comparison of Fatigue Severity as a common respiratory symptom among patients with bronchial asthma in the Study and Control Groups Throughout Study Period.

Observational periods	**Groups**				**X^2**	**P-Value**
	Study(n=25)		**Control(n=25)**			
	No.	**%**	**No.**	**%**		
Fatigue Severity						
***At Baseline:**						
- Lack of Fatigue(0 ≤ 9)	**1**	**4.0%**	**0**	**0.0%**	**1.78**	**0.61**
- Mild(10 ≤ 18)	**1**	**4.0%**	**2**	**8.0%**		
- Moderate(19 ≤ 27)	**7**	**28.0%**	**5**	**20.0%**		
- Severe(28 ≤ 36)	**16**	**64.0%**	**18**	**72.0%**		
Fatigue Severity						
***After 2 Weeks:**						
- Lack of Fatigue(0 ≤ 9)	**1**	**4.0%**	**0**	**0.0%**	**1.22**	**0.74**
- Mild(10 ≤ 18)	**2**	**8.0%**	**2**	**8.0%**		
- Moderate(19 ≤ 27)	**5**	**20.0%**	**4**	**16.0%**		

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- Severe(28 ≤ 36	**17**	**68.0%**	**19**	**76.0%**		
Fatigue Severity						
*** After 4 Weeks:**						
- Lack of Fatigue(0 ≤ 9)	**3**	**12.0%**	**1**	**4.0%**	**1.43**	**0.69**
- Mild(10 ≤ 18)	**3**	**12.0%**	**2**	**8.0%**		
- Moderate(19 ≤ 27)	**4**	**16.0%**	**5**	**20.0%**		
- Severe(28 ≤ 36	**15**	**60.0%**	**17**	**68.0%**		
Fatigue Severity						
*** After 6 Weeks:**						
- Lack of Fatigue(0 ≤ 9)	**9**	**36.0%**	**1**	**4.0%**	**13.31**	**0.004***
- Mild(10 ≤ 18)	**5**	**20.0%**	**1**	**4.0%**		
- Moderate(19 ≤ 27)	**3**	**12.0%**	**6**	**24.0%**		
- Severe(28 ≤ 36	**8**	**32.0%**	**17**	**68.0%**		

(*) Statistically significant at p<0.05

Table (5) compared fatigue severity as common respiratory symptoms among patients in the study and control groups. It can be noticed that the two groups were similar at baseline, after 2 and 4 weeks of the study with no differences of statistically significance, P >0.05. However, after 6 weeks, (36%) of patients in the study group had lack of fatigue compared to only (4%) of patients in the control group and the difference was statistically significant, (P= 0.004).

Table 6. Comparison of pulmonary function test score's Level among patients with bronchial asthma in the Study and Control Groups Throughout Study Period.

Observational periods	**Groups**				**X^2**	**P-Value**
	Study(n=25)		**Control(n=25)**			
	No.	**%**	**No.**	**%**		
(FEV1) Level:						
***At Baseline:**						
-Mild(≥ 70%)	**1**	**4.0%**	**1**	**4.0%**	**0.50**	**0.77**
-Moderate(69% - 39%)	**6**	**24.0%**	**4**	**16.0%**		
-Severe(≤ 38%)	**18**	**72.0%**	**20**	**80.0%**		
*** After 2 Weeks:**						
-Mild(≥ 70%)	**2**	**8.0%**	**0**	**0.0%**	**2.82**	**0.24**
-Moderate(69% - 39%)	**6**	**24.0%**	**4**	**16.0%**		
-Severe(≤ 38%)	**17**	**68.0%**	**21**	**84.0%**		
*** After 4 Weeks:**						
Mild(≥ 70%)	**5**	**20.0%**	**0**	**0.0%**	**6.82**	**0.03***
-Moderate(69% - 39%)	**5**	**20.0%**	**3**	**12.0%**		

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-Severe(≤ 38%)	15	60.0%	22	88.0%		
* After 6 Weeks:						
Mild(≥ 70%)	8	32.0%	1	4.0%	8.45	0.01*
-Moderate(69% - 39%)	6	24.0%	4	16.0%		
-Severe(≤ 38%)	11	44.0%	20	80.0%		
(FEV1/FVC) Level:						
*At Baseline:						
-Mild Severity(≥70%)	2	8.0%	1	4.0%	0.35	0.55
-ModerateSeverity (<70%)	23	92.0%	24	96.0%		
* After 2 Weeks:						
-Mild Severity(≥70%)	3	12.0%	1	4.0%	1.08	0.29
-Moderate Severity (<70%)	22	88.0%	24	96.0%		
* After 4 Weeks:						
-Mild Severity(≥70%)	8	32.0%	1	4.0%	6.64	0.01*
-Moderate Severity (<70%)	17	68.0%	24	96.0%		
* After 6 Weeks:						
-Mild Severity(≥70%)	12	48.0%	2	8.0%	9.92	0.001*
-Moderate Severity (<70%)	13	52.0%	23	92.0%		

(*) Statistically significant at p<0.05

Table (6) illustrated comparison between the patients in study and control groups regarding pulmonary function test score level throughout study period. It was noticed that the FEV1 at baseline and after 2 weeks of the study was ≤ 38% (which indicates severe stage of COPD) among the majority of the whole patients, it represents (72% versus 80%) at baseline and (68% versus 84%) after 2 weeks among the study and control groups, respectively and the difference between the two groups was not statistically significant P >0.05. On the other hand, after 4 weeks FEV1 was ≥70% (which indicates mild severity of COPD) among (20%) of patients in the study group compared to no one of patients in the control group and the difference between the two groups was statistically significant (P= 0.03). After 6 weeks, (32%) of patients in the study group had mild severity of COPD compared to only (4%) of patients in the control group with statistically significant difference between the groups (P= 0.01).

Moreover, the findings of the present study revealed that the FEV1/ FVC at baseline and after 2 weeks of the study was < 70% (which indicates moderate severity of COPD) among (92% versus 96%) at baseline and (88% versus 96%) after 2 weeks among the patients in study and control groups, respectively, while after 4 weeks, FEV1/FVC was ≥70% (which indicates mild severity of COPD) among (32% versus 4%) and (48% versus 8 %) after 6 weeks in the study and control groups, respectively and the differences were statistically significant after 4 and 6 weeks (P= 0.01 and P=0.001), respectively.

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Table 7. Comparison of Mean Scores between the patients in Study and Control Groups of the Respiratory Rate and Oxygen Saturation Throughout Study Period.

Observational periods	Groups (Mean ± SD)		t-test	P-Value
	Study(n=25)	Control(n=25)		
***Respiratory Rate:**				
-At Baseline	24.6±2.5	24.9±2.1	0.45	0.64
-After 2 Weeks	23.1±2.3	24.7±1.9	2.68	0.01*
-After 4 Weeks	22.6±1.2	23.7±1.3	3.11	0.003*
-After 6 Weeks	21.5±0.41	23.2±1.1	7.24	0.001*
***Oxygen Saturation:**				
-At Baseline	89.1±0.4	88.9±1.1	0.85	0.39
-After 2 Weeks	90.5±1.6	88.9±1.9	3.22	0.02*
-After 4 Weeks	93.8±2.1	89.6±2.3	6.74	0.01*
-After 6 Weeks	95.4±2.6	89.8±2.5	7.76	0.001*

(*) Statistically significant at p<0.05

Table (7) demonstrated comparison of mean scores between the patients in study and control groups of the respiratory rate and O_2 saturation throughout the study period. It can be noticed that both groups had higher mean scores in respiratory rate at baseline (24.6 ± 2.5 versus 24.9 ± 2.1) with no differences of statistical differences, P >0.05. It was evident that respiratory rate was decline after 2, 4 and 6 weeks in the study group compared to control group. It was (23.1± 2.3 versus 24.7 ± 1.9) after 2 weeks; (22.6 ± 1.2 versus 23.7 ± 1.3) after 4 weeks and (21.5 ± 0.41 versus 23.2 ± 1.1) after 6 weeks with statistically significant difference between the study and control groups after 2, 4 and 6 weeks, (P= 0.01; P= 0.003 and P= 0.001) respectively. In addition, the table shows that both groups had lower mean scores in O_2 saturation at baseline of the study whereas, regarding to O_2 saturation, the mean scores for the study group were increased after 2, 4 and 6 weeks compared to control group. It was (90.5 ± 1.6 versus 88.9 ± 1.9) after 2 weeks; (93.8 ± 2.1 versus 89.6 ± 2.3) after 4 weeks and (95.4 ± 2.6 versus 89.8 ± 2.5) after 6 weeks and the differences were statistically significant between the two groups after 2, 4 and 6 weeks, (P= 0.02; P= 0.01 and P= 0.001), respectively.

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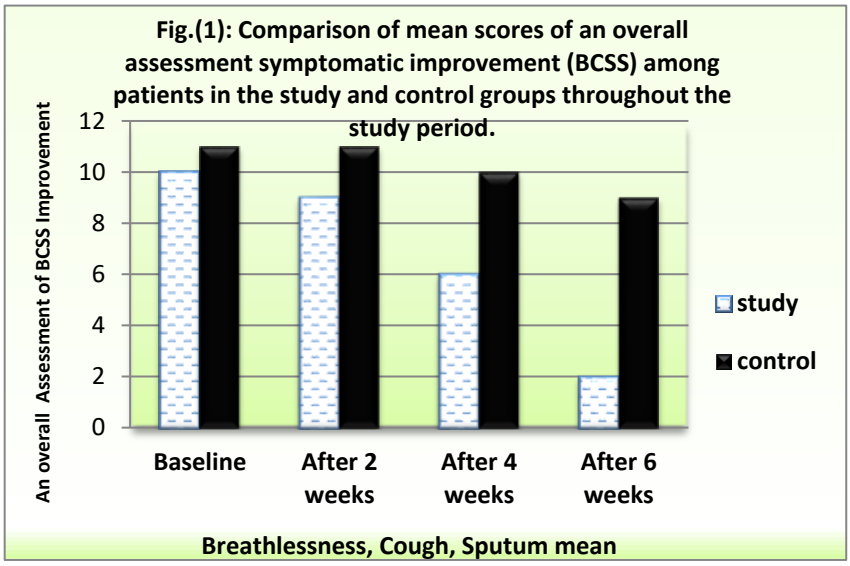
Table 8. Comparison of Lung Collapse Index Score among the patients with bronchial asthma in Study and Control Groups at Baseline and after 6 Weeks of the study.

Observational periods	Groups				X^2	P-Value
	Study(n=25)		Control(n=25)			
	No.	%	No.	%		
Lung Collapse Index Score:						
*At Baseline:					1.60	0.65
-Normal Expansion	5	20.0%	6	24.0%		
-Single Lobe Collapsed	11	44.0%	9	36.0%		
-2 Lobes Collapsed	4	16.0%	7	28.0%		
-MultipleLobes Collapsed	5	20.0%	3	12.0%		
* After 6 Weeks:					11.22	0.01*
-Normal Expansion	9	36.0%	6	24.0%		
-Single Lobe Collapsed	12	48.0%	4	16.0%		
-2 Lobes Collapsed	2	8.0%	10	40.0%		
-Multiple Lobes Collapsed	2	8.0%	5	20.0%		

(*) Statistically significant at p<0.05

Concerning lung collapse Index score, Table (8) shows the changes in level of lung collapse in the two groups. At baseline, it was found that (20%) of the patients in the study group had normal lung expansion compared to (24%) of the patients in the control group with no statistically significant difference between the two groups, P >0.05. The difference reached statistically significant after 6 weeks of the study (P= 0.01). It is evident that (36%) of patients in the study group had normal lung expansion with no change of patients in the control group (24%).



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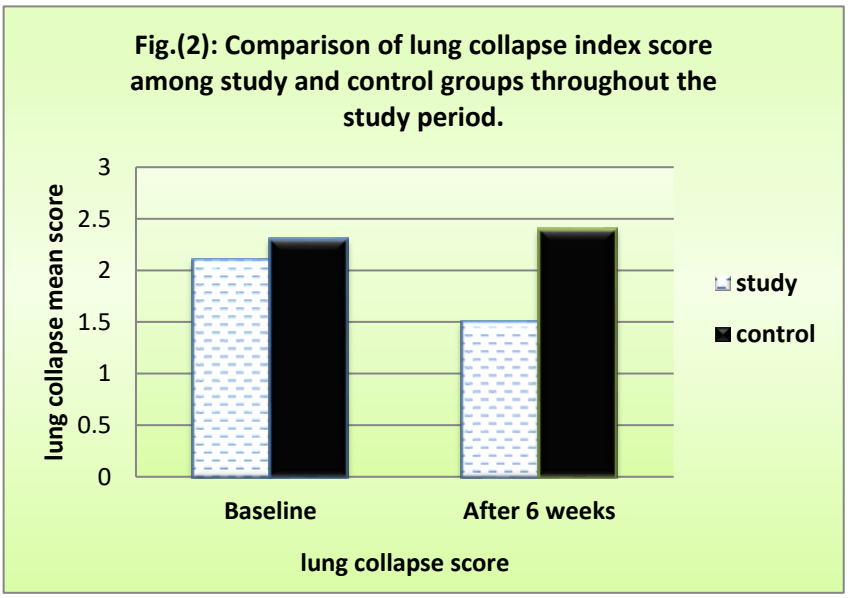

Figure (1) and (2) summarize the changes in mean scores of an overall assessment symptomatic improvement (BCSS) and lung collapse Index scores among study and control groups. Figure (1) shows that at baseline, the mean scores of (BCSS) was worse for both patients in study and control groups. Moreover, after 2 weeks, it was no effect in the study group and still worse for the control group. Meanwhile, it was mildly affected after 4 weeks and moderate effect after 6 weeks which reflect continuous BCSS improvement in the study group while no similar improvement could be revealed in the control group. Figure (2) points to decrease in the mean scores of lung collapse in the study group from baseline and after 6 weeks of the study which means also improvement. Conversely, control group had no change.

Discussion

Chronic obstructive pulmonary disease is a preventable and treatable disease with some significant extra pulmonary effects that may contribute to the severity in individual patient **Alkhalil et al. (2021)**. It is now recognized to be a condition of global importance in terms of its impact on the morbidity and risk of premature death of millions of people **Borges et al.(2022)**. The demand for complementary therapies amongst chronic disease patients has gained significant momentum over recent years especially BBT because it is safe effective method of treatment, with no side effect profile, which in part adds to its popularity amongst patients **Breslin et al.(2024)**.

Therefore, the current study was conducted to examine the effect of BBT on severity of common respiratory symptoms (breathlessness, cough, sputum and fatigue), pulmonary function and lung collapse among patients with bronchial asthma. It has been hypothesized that the study group who receive BBT plus traditional management will have a lower level of breathlessness, cough, sputum, fatigue and improved pulmonary function tests scores with lower LCI scores than control group who will receive traditional management only.

Regarding demographic characteristics of the patients in the study and control groups under study, it was found that more than half of the study sample had 50 years or older. Most of the study sample was male; this finding is congruent with **Courtney, (2020)** who found that, all of the study sample were male. But it is incongruence with **Hsu et al. (2025)** who reported in their study that most patients were females. Nearly two fifth of the study sample was exposed to irritant, this finding may be

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due to the high prevalence of bronchial asthma between individuals who exposed to irritants at their work place which are inhaled into their lungs causing serious lung damage. It was found that the majority of the studied subjects were smoking. This result is in the same line with **Lee et al., and Liang et al. (2024)**, who found that bronchial asthma most often occurs in people with a history of smoking (either current or former smokers). Also, as many as one out of six people with bronchial asthma never smoked. A study done by his result was similar to **Papi et al. (2021)** who stated that, hospitalization rates in the patients with bronchial asthma are increasing especially with aging. Also, similar to **Santino et al.(2020)** who illustrated that, high fatigue score and score of the daily activities affected by fatigue were presented by those who had the bronchial asthma for ≥ 12 years.

According to the present study findings, BCSS comparison as a common respiratory symptom has demonstrated among patients in the study and control groups throughout study period. Concerning breathlessness severity, the current study has revealed that slightly less than one quarter of the patients in the study group had mild breathlessness after 4 weeks of the study compared to less than one tenth in patients of the control group. This was statistically significantly higher than control group and after 6 weeks of the study, it was more than one quarter for the study group with no change with patients in the control group. These findings are in agreement with **Papi et al. (2021)**, who observed that the improvement in daily dyspnea symptom to be statistically significant in the interventional of BBT when compared to the control groups. On the same line, **Huidrom et al. (2016)** explained that in bronchial asthma, hyperventilation lies partially in the mechanics of breathing and the elastic recoil of the chest wall resist hyperinflation of the lungs causing breathlessness. **Prasanna et al. (2015)** confirm that chronic hyperventilation causes a loss of CO2 in the lungs and in the blood. A deficit of CO2 disturbs the body's acid-alkaline balance, causing bronchoconstriction, constriction of blood vessels and smooth muscle, and poor tissue oxygenation. Also, **El-Metwaly and M. E. H. (2019)** added that BBT reducing volume and using breath holding techniques, raised CO2 levels and reversed bronchoconstriction. In addition, **Mendonca et al. (2017)** found that those practicing BBT reduced hyperventilation which induced dyspnea and their use of beta2-agonist. A trend toward reduced inhaled steroid use and better QoL was observed in these patients without change in objective measures of airway caliber.

Concerning cough severity, the present study has revealed that slightly less than one tenth of the patients in the study group had rare cough after 4 weeks of the study compared to no one in patients of the control group. Meanwhile, after 6 weeks of the study, it was increased to become slightly less than one quarter for the study group compared to only less than one tenth with statistically significant differences between both groups after 4 and 6 weeks. This result is in line with **Hepworth et al. (2019)** who mentioned that Buteyko Method is an effective technique in improving cough severity and QoL. Their study showed that subjects instructed with Buteyko Method reduced their use of inhaled corticosteroids and inhaled beta-agonist medications significantly better than the control group. In the same vein, **Courtney and Cohen (2019)** in his study approved that BBT as a part of respiratory rehabilitation exercises training reduced dyspnea, cough severity and increased excises tolerance.

Concerning sputum severity, the present study revealed that slightly less than one quarter of the patients in the study group had mild sputum severity after 4 weeks of the study compared to less than one tenth in patients of the control group. Meanwhile, after 6 weeks of the study, it was increased to become less than half for the study group compared to only slightly less than one tenth with statistically significant differences between both groups after 4 and 6 weeks. This finding is congruence with foregoing present study finding, **Prasanna et al., (2016)** found out that BBT reduced the hyperventilation, then cough and sputum production severity among study sample. **El-Nahas and El-Tantawy, (2019)** have highlighted that excess mucus accumulation was the main factor driving cough in bronchial asthma. In the same line, **McKeown (2017)** who have reported that the patients in the

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control group may have had a higher suitability to sputum which was related to impairment of lung function and chronic lung inflammation. The present study is congruent with the results of the recent study carried out by **Hsu et al. (2025)** that showed a reduction in the fatigue intensity among bronchial asthma patients performing BBT.

The present study reveals that at baseline and after 2 weeks, the majority of patients in the study and control groups had low FEV1/ FVC < 70% (which indicates moderate severity of bronchial asthma), while after 4 and 6 weeks the (FEV1/ FVC) improved to ≥70% (which indicates mild severity of bronchial asthma) on both groups but the level of improvement in patients of the study group was greater than those in the control group with statistically significant differences between the two groups after 4 and 6 weeks of the study. These results are in agreement with the findings of **Bernardi et al. (2015)** they reported that the pre-intervention of BBT, EFV1 was low percent and post intervention, FEV1 was little high percent of the patients and had an improvement in pulmonary function of at least twenty percent following intervention.

Also, the study compares the mean scores between the patients in study and control groups of the respiratory rate and O_2 saturation throughout the study period. Concerning respiratory rate, the study results shows that there was a statistically significant difference between the study and control groups after 2, 4, and 6 weeks of the study with lower mean rate in the study group than control group. The study result was supported by a study done by **Alkhalil et al. (2021)** on bronchial asthma patients, it was found that 30 minutes of daily BBT for 30 days improved respiratory rate, dyspnea, anxiety , blood pressure and heart rate when compared with a placebo group.

Concerning O_2 saturation, the results revealed that there was a statistically significant difference between study and control group after 2, 4, and 6 weeks with higher mean scores in the study group than control group. This indicates that study group had better O_2 saturation than control group. The possible explanation of O2 saturation improvement may be contributed by the dyspnea improvement and other possible suggestion that relaxation of respiratory muscles may improve the respiration process as respiratory muscle tensions may hinder the of rib cage movement through BBT. A study done by **McKeown (2017)** come into the same vein and supported the study results which found that BBT was effective in improving pulmonary function and O_2 saturation when compared with a placebo group that received BBT at an inappropriate location in patients with bronchial asthma.

According to LCI scores, the present study has revealed that less than half of the study subjects were having normal lung expansion after 6 weeks of the study compared to slightly less than one quarter of the control group, with statistically significant difference between both groups. This finding is in agreement with **Borges et al. (2022)**, who found that BBT is able to reduce lung collapse among bronchial asthma patients as the condition continuous to improve with BBT performing up to one month.

When an overall assessment of symptomatic (BCSS) improvement was compared at baseline, after2, 4 and 6 weeks of the study, the mean scores were found to be decreasing gradually which means continuous improvement of BCSS in patients of study group throughout period of the study starting from (worse to moderately effect) of BBT. No similar improvement could be noticed in the control group which starting from (worse to no effect). This result is in congruent with **Papi et al. (2021)**, the BCSS has reliably demonstrated significant results correlating changes in COPD of 1,426 patients. The analysis of the BCSS clarified improvement of symptoms over the program of BBT.

Also, the current study noticed that there is apparent decrease in LCI score among patients in the study group than in control group after 6 weeks of the study. In this respect, **Bernardi et al. (2015)** explained that the patient is considered to be responding positively to BBT with improved dyspnea,

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cough, sputum, vital signs, lung collapse and increased oxygen saturation in the blood as measured by ABGs values.

Conclusion

In view of the study results, it is concluded that Buteyko Breathing Exercises technique (BBT) demonstrates significant lower-level severity of common respiratory problems for breathlessness, cough, sputum, fatigue and significant improvement level of pulmonary function test scores (FEV1 & FEV1/FVC) with significant lower scores of lungs collapse among patients in the bronchial asthma. Therefore, the study findings support all the study hypothesis.

Recommendation

As result of the current research, the following recommendations were proposed:

- Conducting comprehensive health education programs for patients with bronchial asthma in outpatients' clinics in the early course of the disease in order to restore energy using simplified printed guidelines through leaflets, brochures or booklets explaining the importance of BBT and how to perform it.
- - Prospective study should be designed to determine the effect of BBT as an adjuvant to control dyspnea for patients with bronchial asthma on long run.
- Replicate the study in other fields and for other patients' population with different diagnosis who also suffer from breathlessness, cough, sputum or have abnormality of pulmonary function tests or high risk for developed lung collapse such as asthmatic patients, and those with lung cancer to evaluate the effectiveness of BBT.

Further research:

1. This study provides nurses with research findings to support decisions to implement nursing education for BBT.
2. Nurses should continue to use the clinical judgment in selecting the type of breathing exercises that they believed to be the most appropriate for bronchial asthma patients.

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