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Buteyko Breathing Exercises: Effectiveness Of Technique On The Severity Of Respiratory Symptoms Among Patients With Chronic Obstructive Pulmonary Disease

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Abstract:
Background*: Chronic obstructive pulmonary disease 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 breathing technique.*
Aim: *This study aimed at examining the effect of Buteyko Breathing Exercises technique on severity of common respiratory symptoms (breathlessness, cough, sputum & fatigue), pulmonary function and lung collapse among patients with chronic obstructive pulmonary diseases.*
Materials & Methods*: A quazi–experimental design was used. The study was conducted at the Chest Diseases Clinic in Ain Shams University Hospital. The sample included 50 adult patients, randomly allocated to two equal groups (study & control). The tools for data collection: Socio-demographic and Clinical data Sheet, 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 tool 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. FEV1 and FEV1/FVC were statistically significant increased ≥ 70% after 4 and 6 weeks among patients of the study group compared to control group. After 6 weeks of the study 36% of the study subjects were having normal lung expansion compared to 24% of the control group, with statistically significant difference between both groups.*
Conclusion*: Buteyko Breathing Exercises technique demonstrates significant lower-level severity of common respiratory problems for breathlessness, cough, sputum, fatigue and significant improvement in the level of pulmonary function test scores (FEV1 & FEV1/FVC) with significant lower scores of lung collapse. It is recommended to use Buteyko Breathing Exercises technique through conducting comprehensive health education programs for patients with chronic obstructive pulmonary disease in outpatients' clinics in the early course of the disease in order to restore energy of the patient.*
Keywords*: Buteyko Breathing Exercises technique, Chronic Obstructive Pulmonary Disease, Breathlessness, Cough, Sputum, Fatigue, FEV1, FEV1/FVC, Lung Collapse*

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I. Introduction

Chronic obstructive pulmonary disease (COPD) is one of the important chronic diseases and a leading public health concern with one of the most important causes of morbidity and mortality worldwide[1]. Despite efforts of reducing, the prevalence of COPD remains high. More than 52 million individuals suffer from COPD all over the world[2]. The COPD is an international health problem with a worldwide prevalence of at least 9.34/1000 in men and 7.33/1000 in women. According to World Health Organization, (WHO,2011), for 2030, COPD will probably shift to third rank common factor for death in the world and it will be the fourth leading cause of lost disability adjusted life years[3]. According to Statistics by Country for COPD, (2013) the prevalence rate of undiagnosed COPD in Egypt is 4,197,651 and the diagnosed prevalence rate in Egypt is 3,777,886. It was estimated that 80 million people worldwide have moderate to severe COPD. The COPD symptoms and exacerbation are responsible for considerable healthcare consumption, with high levels of physician consultation and hospitalization[4].

The COPD is defined as a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the

lungs to noxious particles and gases. It results from the airway narrowing, bronchoconstriction and loss of elastic recoil that result from these pathologic processes. (The Global Initiative for Chronic Obstructive Lung Disease [GOLD], 2005). The main cause of bronchoconstriction is Carbon dioxide (CO_2) deficiency in alveolar air, resulting from hyperventilation and low metabolic activity[5]. With COPD, hyperventilation has 4 primary effects:1) CO_2 levels decrease which can cause the smooth muscle around the bronchioles (tubes that carry air into and out of the lungs) to spasm, resulting in chest tightness and difficulty in exhaling.2) Oxygen(O_2) is released from the blood more slowly, causing breathlessness. 3) Mast cells, immune-system components found in connective tissue, become overly sensitive to perceived allergens and release large amounts of histamine, which causes inflammation to produce cough and 4) Airways dry out and become inflamed, encouraging mucus formation[6].

Hyperventilation in COPD usually accompanied with symptoms such as exertion dyspnea, chronic cough, sputum expectoration, fatigue and exercises intolerance. The COPD is a significant disease which affects the individual physically, emotionally, and socially and leads to loss of productivity, disability and interfere with quality of life with increasing in the social support needs of the patients[7]. The primary cause of COPD is tobacco smoke (including secondhand or passive exposure). Other risk factors include: indoor air pollution (such as solid fuel used for cooking and heating); outdoor air pollution; occupational dusts and chemicals (vapors, irritants, and fumes); frequent lower respiratory system infections during childhood[8].

Dyspnea is the most common symptom experienced by patients with COPD. It is identified as a perception or observation of abnormal and disturbing sensation of breathing. It also called breathlessness or shortness of breath, in which the patients experience labored, uncomfortable breathing, and may produce secondary physiological, emotional, cognitive, and behavioral responses[9]. Dyspnea is the most common cause of patients with COPD seeking medical help, but only 39 % obtained relief using prescribed treatment[10]. Additionally, quality of life (QOL) of these patients diminish most often as a result of dyspnea, as ninety-five percent of patients reported that breathlessness was their most significant debilitating symptom[11].

Another accompanying important symptom to dyspnea in COPD is a chronic cough which is the earliest symptom. The cough initially intermittent and later is present every day, but is seldom present during the night. There are ranges in the amount of sputum produced. The COPD face excessive production of mucus, impaired mucociliary clearance and a very high risk of lung collapse because they cannot cough effectively[12]. Lung collapse, if not treated, may progress to respiratory failure or acute respiratory distress syndrome, which would lead to intubation on ventilator use and increase mortality to 33% to 71%[13].

Fatigue considered the second symptom in importance for patients with COPD after dyspnea[14]. Fatigue is a subjective, the multidimensional sensation of tiredness that the individual experiences when perceiving the reduced capacity to function normally"[15]. Fatigue is "almost always" experienced by 43%–58% of persons with COPD[16]. It is strongly associated with depression [17], decline in daily functional activity, and substantial impairment in QoL[18]. In addition, COPD patients with fatigue have been shown to be less physically active and more exercise intolerant[19].

According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines (2011), It classified severity of COPD; GOLD stage0 (patient at risk) is diagnosed when patients report chronic cough and sputum production whilst their lung function is still normal. In GOLD I, Mild COPD, there may be mild airflow limitation but patient may be unaware that lung function has started to decline. patient may not yet have any COPD symptoms, or may have symptoms of chronic cough and excessive mucus. During GOLD II, Moderate COPD, airflow limitation worsens and patient may start to notice symptoms, particularly shortness of breath upon exertion along with cough and sputum production. Once the disease has advanced to GOLD III, Severe COPD, limitation of airflow significantly worsens, shortness of breath becomes more evident and COPD exacerbation is common. In this stage, patient may notice a decrease in activity tolerance and an increase in fatigability with high risk for developing lung collapse. By the time a COPD patient reaches GOLD IV, Very Severe COPD, their QoL is greatly impaired and COPD exacerbations are life threatening. Airflow limitation is severe and chronic respiratory failure is often present at this stage, and may lead to complications with heart, such as cor-pulmonale and/or eventually, death[20].

Although pharmacologic management of COPD is of proven benefit, but it does not help all patients[21]. In addition, the side effects of pharmacotherapy may actually exacerbate respiratory effort and increase respiratory muscle weakness. As well as, the very costly of management in terms of time, space, staff, and equipment[22]. Therefore, it is recommended to examine other modalities for effective management of symptoms such as dyspnea, cough and fatigue to improve individual QoL and reduce health care costs[23].

There are several breathing exercises therapies that aim to correct hyperventilation and restore normal CO_2 tension. Buteyko breathing technique(BBT) is a system of breathing exercises that focuses on breathing through the nose, hypo-ventilating and avoiding deep breaths. It is based on the theory that slowing the rate of breathing will raise levels of CO_2, a natural bronchodilator, and will therefore result in bronchodilatation and symptomatic improvement. 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[24]. Thus, the purpose of the current study was to examine the effect of Buteyko Breathing Exercises technique on Severity of Respiratory Symptoms among Patients with Chronic Obstructive Pulmonary Disease (COPD).

II. Significance of the study:

The patient with COPD develops an increased respiratory rate with prolonged expiration to compensate for the obstruction to airflow resulting in dyspnea. In addition, the accessory muscles of breathing in the neck and upper part of the chest are used excessively to promote chest wall movement during cough. These muscles are not designed for long-term use, and as a result the patient experiences increased fatigue especially during clearance of secretions from the tracheobronchial system[25]. Breathing exercises may assist the patient during rest and activity (e.g., lifting, walking, stair climbing) by decreasing dyspnea, improving oxygenation, and slowing the respiratory rate[26]. It is important to remember that COPD is potentially controllable and that every effort should be made to keep the patient free of symptoms. Buteyko Breathing Exercises technique aimed to reduce chronic hyperventilation[27]. The technique would bypass the adverse effects of steroids, patient's QoL could be improved and most importantly this would be cost-effective. Also, the patient compliance could be better than steroids[28]. Moreover, BBT 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 through BBT.

III. Aim of the study

The aim of the study was to examine the effect of Buteyko Breathing Exercises technique (BBT) on severity of common respiratory symptoms (breathlessness, cough, sputum and fatigue), pulmonary function and lung collapse among patients with chronic obstructive pulmonary diseases (COPD).

IV. Research Hypothesis:

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

Hypothesis1: The study group who receive Buteyko Breathing Exercises technique (BBT) plus traditional management will have a lower severity level of breathlessness, cough, sputum and fatigue than control group who receive traditional management only.

Hypothesis2: The level of pulmonary function tests scores will be significantly improved among study group who will receive Buteyko Breathing Exercises technique (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 Breathing Exercises technique (BBT) plus traditional management than control group who will receive traditional management only.

V. Subjects and Methods

Research Design

A quazi – experimental design was utilized to conduct the research aim. Polit & Beck (2011) pointed out that Quasi – experimental design can examine the cause-and-effect relationship between studied variables. So, it is congruent with the research purpose because it can examine the impact of intervention (BBT) on the dependent variables (dyspnea, chronic cough, sputum expectoration, fatigue, pulmonary function and lung collapse among COPD).

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 sexes, diagnosed as COPD stage II(Moderate) and stage III(Severe) and clinically stable were included in this study. The diagnosis of COPD was made based on the GOLD criteria, (2011). 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.

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 Breathing

exercises technique (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:

* **Socio-demographic and Clinical Data Sheet**: 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.

***Breathlessness, Cough, and Sputum Scale (BCSS)**: According to McCarroll et al., (2013), 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.

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

According to Zakerimoghadam et al., (2011), 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.

* **Pulmonary Function Test Scale (PFTS):** According to Johnson and Theurer ,(2014) 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).

* **Respiratory rate & 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.

***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 Petty, (2006). 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.

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. 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 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 2015. 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.

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 (Vestbo et al.,2013). Patients in the study & control groups were followed up for 6 weeks based on the plan for data collection.

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)	√			√	√			√

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 Breathing exercises Technique:
*Step1: The ‘‘Control pause’’ 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 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. Try to maintain the need for air for about 4 min (Courtney,2008 and Patrick,2009).

*** 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.

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

VII. Results

Socio-demographic and clinical data characteristics of the study and control groups are illustrated in Table (1). 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 COPD for more than 2 years and (64% & 80%) had COPD 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 1. Description of Socio-demographic and Clinical Data 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**
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 (2) compares 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 2. Comparison of Breathlessness Severity as a common respiratory symptom among patients with COPD 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***
- Moderate(BCSS=2)	**6**	**24.0%**	**2**	**8.0%**		
- Marked(BCSS=3)	**10**	**40.0%**	**14**	**56.0%**		
- Severe(BCSS=4)	**3**	**12.0%**	**8**	**32.0%**		
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

A comparison of cough severity as common respiratory symptoms among patients in the two groups is displayed in Table (3). 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). Also, a statistically significant difference was revealed among the two groups after 6 weeks of the study, P= 0.001). It is evident that less patients in the study group (12%) had almost constant of cough severity, compared to (56%) of control group.

Table 3. Comparison of Cough Severity as a common respiratory symptom among patients with COPD 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						
*** 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

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 4. Comparison of Sputum Severity as a common respiratory symptoms among patients with COPD 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%**		
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 (5) compares 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 5. Comparison of Fatigue Severity as a common respiratory symptoms among patients with COPD 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%**		
- 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 (6) illustrates 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.

Table 6. Comparison of pulmonary function test score's Level among patients with COPD 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%**		
-Severe(≤ 38%)	**15**	**60.0%**	**22**	**88.0%**		
*** After 6 Weeks:**						
Mild(≥ 70%)						
-Moderate(69% - 39%)	**8**	**32.0%**	**1**	**4.0%**	**8.45**	**0.01***
-Severe(≤ 38%)	**6**	**24.0%**	**4**	**16.0%**		
	11	**44.0%**	**20**	**80.0%**		
(FEV1/FVC) Level:						
***At Baseline:**						
-Mild Severity(≥70%)	**2**	**8.0%**	**1**	**4.0%**	**0.35**	**0.55**
-Moderate Severity (<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 (7) demonstrates 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 was 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.

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

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%).

Table 8. Comparison of Lung Collapse Index Score among the patients with COPD 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:**						
-Normal Expansion	**5**	**20.0%**	**6**	**24.0%**	**1.60**	**0.65**
-Single Lobe Collapsed	**11**	**44.0%**	**9**	**36.0%**		
-2 Lobes Collapsed	**4**	**16.0%**	**7**	**28.0%**		
-Multiple Lobes Collapsed	**5**	**20.0%**	**3**	**12.0%**		
*** After 6 Weeks:**						
-Normal Expansion	**9**	**36.0%**	**6**	**24.0%**	**11.22**	**0.01***
-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

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 effect 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.

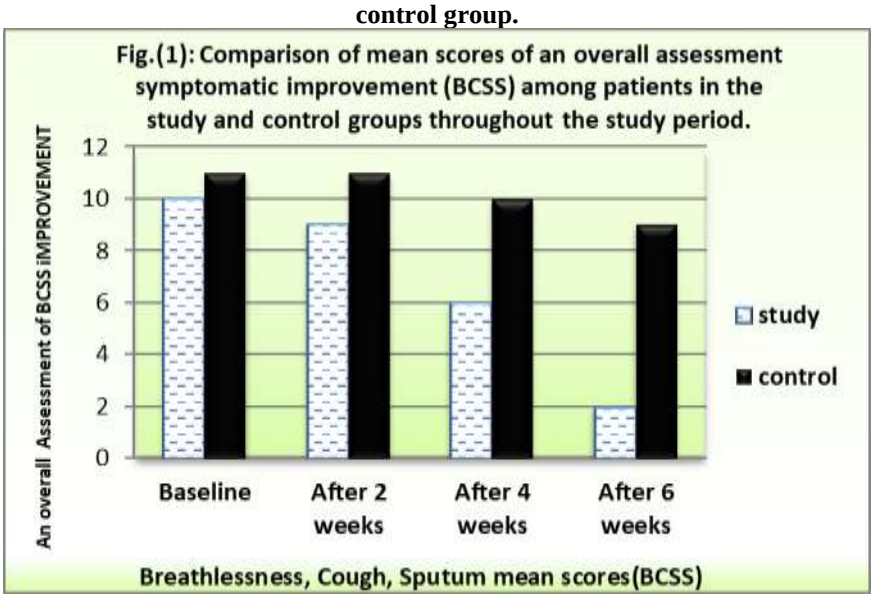
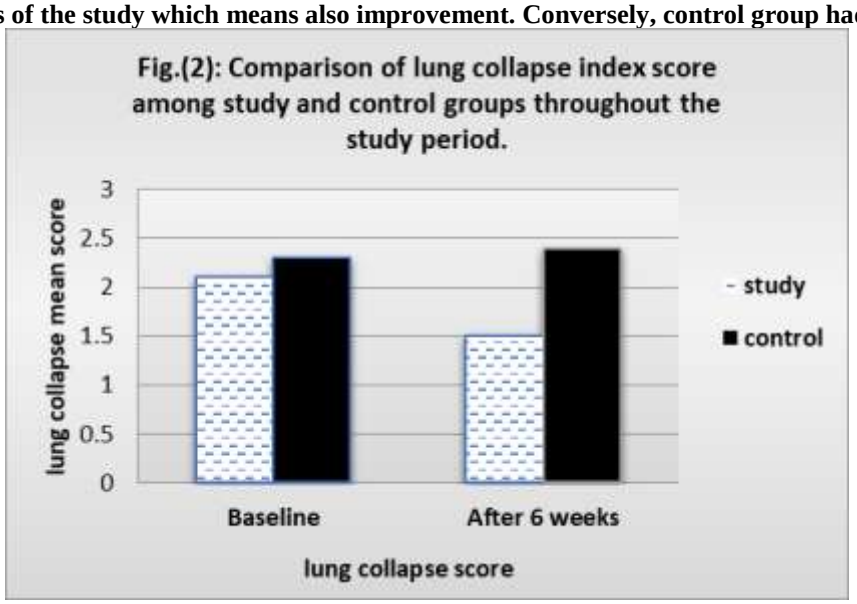


Figure (2) points to decrease in the mean scores of lung collapse in the study group from baseline and after 6 weeks of the study which means also improvement. Conversely, control group had no change.



VIII. 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 (Cosio et al.,2009). 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 (Calverley, 2013). 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 (Prasanna et al., 2016).

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 COPD. 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 socio-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. This result goes in accordance with a more recent meta-analysis of studies from several countries published between 1990 and 2004, the studies reported that average age among adults with COPD is above 50 years (Halbert, 2006). Most of the study sample was male; this finding is congruent with Mohamed, (2005) who found that, all of the study sample were male. But it is incongruence with Laws & Mc Intyre, (2008) 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 due to the high prevalence of COPD 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 National Heart, Lung, and Blood Institute (2013), who found that COPD 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 COPD never smoked. A study done by Thompson & St-Hilaire, (2010) supported the result of the current study and concluded that COPD was found to be more prevalent in smokers and males. As regards the clinical characteristics of the studied subjects, it was found that more than half of the patients had a disease more than 2 years and had a stage II COPD (moderate), and less than half of them were hospitalized before. This result was similar to Baghai et al. (2009) who stated that, hospitalization rates in the patients with COPD are increasing especially with aging. Also, similar to Tel et al.(2012) who illustrated that, high fatigue score and score of the daily activities affected by fatigue were presented by those who had the COPD for ≥ 12 years. The study and control groups were homogeneous in respect to their socio-demographic and clinical data characteristics. This similarity in both groups was necessary to obviate any undesirable confounding effect of these variables on the outcome of the study.

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 Baxi & Phipatanakul,(2010), 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, Courtney, (2008) explained that in COPD, hyperventilation lies partially in the mechanics of breathing and the elastic recoil of the chest wall resist hyperinflation of the lungs causing breathlessness. Hassan et al.,(2012) added 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, Buteyko and Genina,(2013) believed that BBT reducing volume and using breath holding techniques, raised CO2 levels and reversed bronchoconstriction. In addition, Campbell et al., (2011) 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 Cowie and Conley (2008) 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, Liao et al., (2015) 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. Calverley, (2013) have highlighted that excess mucus accumulation was the main factor driving cough in COPD. In the same line, Greening et al., (2014) who have reported that the patients in

the 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 also compares the fatigue severity as a common respiratory symptom among patients in the study and control groups throughout study period. It was expected that when breathlessness in the study group improved after 4 weeks, fatigue also will improve at the same time, but the study result showed that there was no statistical significant difference in fatigue among study and control groups. This finding can be interpreted in the light of the fact that fatigue is a multi-factorial phenomenon, patients may suffer from fatigue because of pain, dietary impairment, and/or anxiety from hospital admission or disease consequences, therefore, it may need more than one intervention and it may be not correlated with dyspnea relief only. But after 6 weeks of the study, the current study revealed that more than one quarter of patients in the study group had lack of fatigue compared with only less than one tenth of patients in the control group and the differences was statistically significant. The possible explanation that fatigue is not an easy health problem to treat it, as it might need relatively long time to be relived, so the patients may need more time to apply BBT in order to gain the effect of BBT on fatigue relief. The present study is congruent with the results of the recent study carried out by Zakerimoghadam et al., (2011) that showed a reduction in the fatigue intensity among COPD patients performing BBT. Their study also pointed that it was change of respiratory pattern that caused the reduction of fatigue intensity among sampling study. Agnieszka et al., (2009) explained that fatigue in the COPD occurs due to the hypoxia resulting from an obstruction of the airways and an increase of respiratory activities and is an unavoidable problem related to the type and quality of respiration. Villareal et al., (2014) added that Buteyko exercises train patient to breathe through nose, reduce their breathing to normal levels, keep mouths closed and retain a higher proportion of the CO2 produced by the body, thus reduction of hyperinflation makes the muscles of breathing function more efficiently and significantly decreases feeling of fatigue intensity. Meanwhile, Al-Ashkar et al., (2008) could not reveal any statistically significant differences among study and control groups as regards fatigue intensity.

As regards to pulmonary function test, the current study documents that the majority of the whole patients in the study and control groups had low FEV1 at baseline and after 2 weeks. It was ≤ 38% (which indicates severe stage of COPD), while after 4 and 6 weeks the FEV1 improved to ≥70% (which indicates mild severity of COPD) 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. Moreover, 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 COPD), while after 4 and 6 weeks the (FEV1/ FVC) improved to ≥70% (which indicates mild severity of COPD) 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. In the same vein, Nishimura et al., (2011) mentioned that when BBT performed before discharge revealed that the FEV1/ FVC was over 70%.

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 statistical 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 Tsay et al.,(2005) on COPD 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. Ban et al.,(2012) added that patients with COPD have a shallow, fast and insufficient breathing and through BBT, this type of respiration has improved to diaphragm respiration in which the breathing speed is reduced leading to an increase of alembic aeration.

Concerning O_2 saturation, the results revealed that there was a statistical 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 Van et al. (2012) 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 COPD.

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 Greening et al., (2014), who found that BBT is able to reduce lung collapse among COPD patients as the condition continuous to improve with BBT performing up to one month. In the same line, Laws & Mc Intyre, (2008), have explained that the use of repeatedly BBT could help in expansion of distal lung areas which generates increasing airflow from those areas and decreasing lung collapse. Conversely, these present study results are in contradiction with Agnieszka et al., (2009) who have reported that BBT was not significantly improved lung collapse for COPD patients.

When an overall assessment of symptomatic (BCSS) improvement were 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 Clark et al., (2009), 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. Nici and Zuwallack,(2011) added that BCSS helps to identify changes that may occur during the treatment. Also, McCarroll et al., (2013) stated that the BCSS was developed to provide a quick and easy method of evaluating the severity of respiratory symptoms common in COPD patients.

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, Villareal et al., (2014) explained that the patient is considered to be responding positively to BBT with improved dyspnea, cough, sputum, vital signs, lung collapse and increased oxygen saturation in the blood as measured by ABGs values.

IX. 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 COPD. Therefore, the study findings support all the study hypothesis.

X. Recommendation

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

- Conducting comprehensive health education programs for patients with COPD 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 COPD 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.

XI. Implications for nursing practice

-This study provides nurses with research findings to support decisions to implement nursing education for BBT.

-Nurses should continue to use the clinical judgment in selecting the type of breathing exercises that they believed to be the most appropriate for COPD patients.

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