Faculty of Medicine

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Effectiveness of the Active Cycle of Breathing Technique in Patients with Chronic Obstructive Pulmonary Disease (COPD)

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Bachelor of Science in Physiotherapy (B.Sc.PT)

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled.

"Effectiveness of the Active Cycle of Breathing Technique in Patients with Chronic Obstructive Pulmonary Disease (COPD)''

Submitted by **Nahida Begum**, for fulfillment of the requirement for the degree of Bachelor of Science in Physiotherapy (B.Sc. in PT)

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DECLARATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also declare that for any publication, presentation or dissemination of the study. I would be bound to take written consent from the Saic College of Medical Science and Technology (SCMST).

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CONTENTS

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LIST of TABLES

LIST OF FIGURE

ACRONYMS

ACBT	Active Cycle of Breathing Technique
AD	Autogenic drainage
BMI	Body mass index
BMRC	Bangladesh medical research council
CAT	COPD Assessment Test
COPD	Chronic obstructive pulmonary disease
CPT	Chest physical therapy
IPPV	Intermittent positive pressure ventilation
mMRC	Modified Medical Research Council
PD	Postural drainage
PEP	Positive expiratory pressure
PPCs	Postoperative pulmonary complications
PR	Pulmonary rehabilitation
WHO	World health organization

ABSTRACT

Background: COPD is a progressive and chronic respiratory disorder that restricted the airflow and significantly impairs the quality of life of affected individuals which primarily caused by smoking and environmental factors, leads to chronic symptoms like dyspnea and excessive sputum production. Pulmonary rehabilitation techniques, including non-pharmacological interventions like the Active Cycle of Breathing Technique, have been shown to offer symptom relief and improve dyspnea level, overall lung function. **Purpose:** This study aimed to assess the effectiveness of ACBT in minimizing dyspnea and improving COPD level among patients with COPD. **Methodology:** RCT was conducted with 30 participants diagnosed with COPD, randomly imposed to either the experimental group (ACBT) or the control group (conventional physiotherapy). Over a 4-week period, the experimental group received ACBT with traditional physiotherapy sessions, while the control group received only traditional physiotherapy. Data was collected using the CAT and mMRC scales both before and after the intervention. **Result:** The study concluded that, experimental group of the study, which was given ACBT, showed statistically significant difference in the CAT scores ($p = 0.003$) and hence COPD level was lowered. Besides, problems like dyspnea were at a significant lower level in the experimental group with a p-value of 0.003 on the mMRC scale that indicate improved respiratory function and less shortness of breath. On the other hand, in the control group, there were no significant changes in either measure. **Conclusion:** ACBT is a necessary non-pharmacological intervention in the treatment of COPD, especially in reducing dyspnea and COPD level of patients. However, future studies should explore long-term effects, larger sample sizes, and combine ACBT with other rehabilitation techniques to optimize outcomes for COPD patients.

Keywords: *Active Cycle of Breathing Technique (ACBT) & chronic obstructive pulmonary disease (COPD), Dyspnea, CAT.*

CHAPTER-I INTRODUCTION

1.1 Background

Chronic obstructive pulmonary disease (COPD) is a progressive and partially reversible pathology of the respiratory tract that is characterized by restriction of airflow that is due to either chronic bronchitis or emphysema, which, in turn, promotes pulmonary complications (Sutradhar et al. 2019, p.2). Recent systematic review provides a prevalence of 12.5% among the Bangladeshi community of Asia. In the Global Burden of Disease study 2015, an increment of COPD related mortality by around 11 percent is recorded between 1990 and 2015 with a corresponding 44 per cent rise in disease prevalence. In the event that this curve continues, COPD is estimated to become the third most leading cause of global death by 2030 (GBD 2015 Chronic Respiratory Disease Collaborators 2017, p. 631). COPD is estimated to present itself in 251 million people in 2016; 3.17 million deaths in the world in 2015 could be related to COPD, which places the condition in the 3rd position as the deadliest cause of death among people over 40 years old (Rodrigues et al. 2021, p.3).

The three main factors that can account for the economic and societal burden of costs of chronic obstructive pulmonary disease (COPD) at the individual level of sick patients are (1) severity of disease, (2) frequency of exacerbations, and (3) comorbidities that will occur in up to 30 to 57 percent of people with COPD. Hospitalization for exacerbations is the largest single healthcare cost with $18 billion of direct costs per year in the United States alone, and is associated with a 21% one-year mortality and a 55% mortality at 5 years. Such results highlight the necessity of interventions to delay disease progression, preclude exacerbations, and lessen the threat of co-morbidities, which will ease the clinical and economic burden of COPD in developed countries (Lopez et al. 2016, p. 18). However, the burden of chronic conditions like COPD goes beyond just health-care interventions and is more specifically the issue of low-income countries, which have traditionally designed health-care resources for episodic acute disease (mainly infectious disease) and, therefore, poorly equipped for chronic disease care (Beran et al. 2015, p. 160).

Probably an obvious point to mention about COPD is the fact that prognosis is significantly affected by a bundle of comorbid conditions. Bronchial asthma is the most common pulmonary comorbid condition and has been linked to enhanced sputum levels and exacerbations along with advanced age and low body-mass index. Reduced quality of life and exercising potential are associated with cardiovascular comorbidities, such as coronary artery disease, heart failure, and heart attacks, and metabolic disorders, such as diabetes mellitus and peripheral arterial disease. Other prevalent comorbidity include psychiatric and neurologic conditions (e.g. anxiety, depression, dementia), obstructive sleep apnea, lung cancer or osteoporosis (Kahnert et al. 2023, p. 434). There are different causes of the musculoskeletal dysfunction in COPD such as nutritional deficits or changes, inflammation, oxidative stress, pharmacotherapy, and comorbidities. A definite deterioration of postural control in people with COPD is enabled by muscle weakness, lack of physical activity, and reduced mobility, and is linked to increased mortality rates, low level of autonomy and self-reliance, low quality of life, and high risk of falls (Canales-Diaz et al. 2022, p. 2). Pulmonary rehabilitation (PR) is one of the most commonly utilized evidence-based methods because it can help to reduce the symptoms of COPD, restore and improve the functional capacity, help patients to participate in the daily activities, become independent and have the better quality of life. Exercise part of PR enlarge the inspiratory volume and neutralize the effects of dynamic hyperinflation, which reducing the dyspnea upon the performance of tasks but, at the same time, improves muscular performance, increases the capillarity of fatigue and elevates exercise, thereby making exercises increasingly tolerable (Mccarthy et al. 2015, p. 6).

A physical therapy of the chest involves a wide range of modalities used to increase the lung volumes and improve the sputum expectoration. The example of conventional methods includes percussion, vibration, postural drainage, oscillating positive expiratory pressure (PEP), and intermittent positive pressure ventilation (IPPV). Autogenic drainage, positive expiratory flow rate devises, i.e., Flutter or Acapella, and active cycle of breathing technique (ACBT) are advanced methods (Zisi et al. 2022, p. 89). There are many types of non-pharmacologic airway-clearance techniques, and the ACBT is one of the most widely used by the physiotherapists (Westerdahl, Osadnik and Emtner 2019, p. 2). The Active Cycle of Breathing Technique (ACBT) as a product of the pulmonary rehabilitation is a combination of various breathing exercises that

have the effect of mobilizing and clearing surplus pulmonary secretions hence improving general lung function (Mahadewi et al. 2025, p. 75). ACBT follows the following three consecutive steps: (1) breathing control; (2) thoracic expansion exercise; (3) forced expiration technique (Shen et al. 2021, p. 2).

Studies have demostrated that ACBT may be beneficial in improving respiratory function as well as in sputum production among the COPD patients (Shen et al. 2021, p. 4) conducted a randomized clinical trial that compared ACBT with routine management by finding that the former statistically significantly increased sputum volume, especially during the first 24 h but had no significant effect on its viscosity. According to the study conducted by (Shen et al. 2021, p. 7) discussed that one of the main issues of chronic obstructive pulmonary disease (COPD) management is associated with effective sputum clearance because it may become extremely thick and viscous, especially during exacerbatory attacks. Airway clearance techniques (ACTs) are a well explored intervention in terms of alleviating these manifestations through improvement of expectoration and pulmonary function. Also other studies have shown that according to (Chen et al. 2024, p. 7) one of these modalities, the Active Cycle of Breathing Technique (ACBT) has become especially visible and this process involves breathing, thoracic expansion, and forced expiration aims at dislodging, as well as coughing up, sputum in the airway system. Although the results of using ACBT have been very encouraging, some limitations remain, particularly on the applicability of its effectiveness in different degrees of COPD. Few studies have observed any small effects on quality of life, and shorter hospitalization period, especially in more advanced disease patients (Zuriati, Surya and Zahlimar 2020. p. 165).

Active cycle of breathing technique (ACBT) is a useful non-pharmacological intervention tool in the management of the chronic obstructive pulmonary disease (COPD). This study discusses how breathing (airway clearance breathing or ACBT) will remove the severity and dyspnea caused by chronic obstructive pneumonia (COPD) in patients and how this will enhance wellbeing of the whole lung. A critical analysis of the weaknesses and strengths of ACBT will play a major role in developing new, better patient-centered interventions to manage COPD disease in order to assist people with the diagnosed chronic disease increase the quality of their lives.

1.2 Rationale

COPD is a form of progressive respiratory pathology, with a significant effect on the quality of life of the patients, because this disease typically manifests itself in respiratory difficulty (dyspnea), physical activity limitation and generalized well-being. Although pharmaceutical interventions are still considered the primary modality for COPD, the inability of pharmacological interventions to improve pulmonary functional performance and decrease the burden of COPD, particularly dyspnea, has led to the search for alternative or complementary therapies. One of these is the Active Cycle of Breathing Techniques (ACBT), which has been the target of attention as a non-pharmacological intervention. ACBT involves a combination of breathing practice, exhalation forcing training, and controlled coughs as its purpose in order to increase ventilation and reduce airway obstruction as well as, subsequently, enhance pulmonary performance and general quality of life in the kept patient with COPD. However, although interest in ACBT has been growing, there is a lack of empirical research on its effectiveness in reducing dyspnea and COPD severity, especially in the context of the populations of Bangladesh. To this end, an extensive evaluation of the efficacy of the ACBT in reducing severity of COPD and dyspnea in its patients in Bangladesh is needed to give insights to explain the practical use of the intervention and potential improvement in the local settings. Results of the present study may provide healthcare providers with evidence-based recommendations on the incorporation of ACBT into the management of COPD hence improving patient outcomes and promoting the overall goal of limiting morbidity and mortality related to COPD.

1.3 Research question

Is active cycle of breathing technique (ACBT) effective on outcome of chronic obstructive pulmonary disease (COPD) patients?

1.4 Objectives

A. General objective

- To evaluate the effectiveness of the Active Cycle of Breathing Technique (ACBT) in improving COPD & dyspnea level both experimental and control group among patients with Chronic Obstructive Pulmonary Disease (COPD).

B. Specific objective

- To explore the socio-demographic and baseline characteristics of the participants.
- To assess the level of COPD in both experimental and control group by using COPD Assessment Test (CAT) in Chronic Obstructive Pulmonary Disease patients.
- To evaluate the level of dyspnea in both experimental and control group by using in mMRC (Modified Medical Research Council) Dyspnea Scale in Chronic Obstructive Pulmonary Disease patients.

1.5 Research Hypothesis

Null hypothesis (Ho)

Active Cycle of Breathing Technique has no significant effect on patient with COPD compared to conventional physiotherapy.

$$\mu_1 - \mu_2 = 0 \text{ or } \mu_2 \geq \mu_1$$

Alternative hypothesis (Ha)

Active Cycle of Breathing Technique has a significant effect on patient with COPD compared to conventional rehabilitation.

$$\mu_1 - \mu_2 \neq 0 \text{ or } \mu_1 > \mu_2$$

Where,

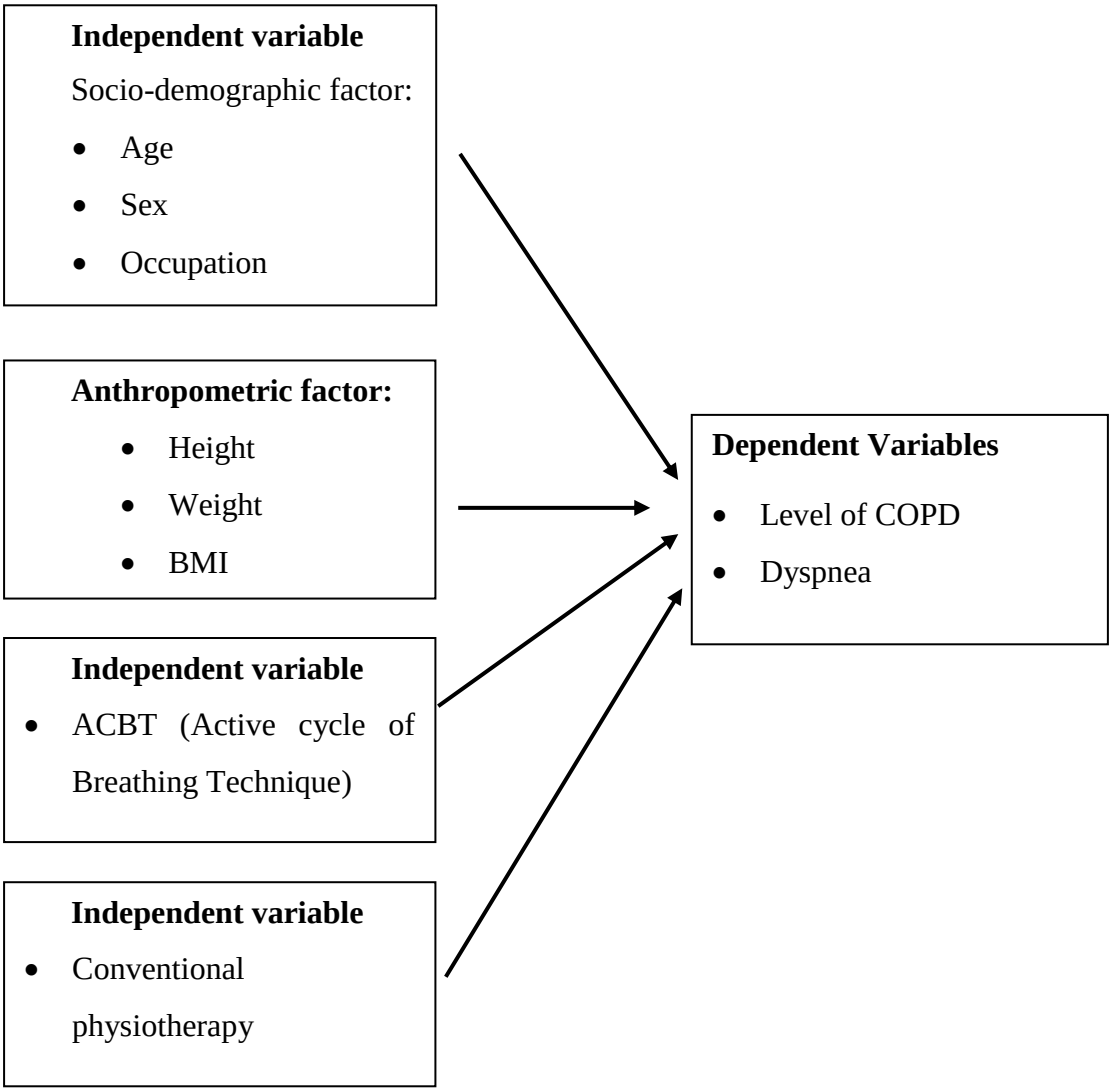
Ho= Null hypothesis

Ha = Alternative hypothesis

$\mu 1$ = Mean of experimental group

$\mu 2$ = Mean of control group

1.6 List of Variables



1.7 Operational definition of variables

Active Cycle of Breathing Technique: Active Cycle of Breathing Technique (ACBT) is a systematic physiotherapeutic airway clearance programme consisting of three consecutive stages, with the following order; (1) the control of breathing, involving relaxed diaphragmatic ventilation; (2) thoracic expansion exercise, with deep inspiration movements and relaxed expiration phases; (3) a forced expiratory manoeuvre (huffing) to mobilize and remove mucus releases.

Chronic Obstructive Pulmonary Disease: Chronic Obstructive Pulmonary Disease (COPD) is a progressive, chronic respiratory syndrome, which is characterized by persistent airflow constriction and which is normally accompanied by some symptoms like chronic cough, sputum, wheeze, and dyspnea.

Dyspnea: Dyspnea is subjective reporting of difficulty in breathing, which is usually described as shortness of breath or as difficulty breathing.

CHAPTER-II LITERATURE REVIEW

Chronic Obstructive Pulmonary Disease (COPD) is a respiratory disease, which is defined as persistent respiratory symptoms and lack of airflows and has been the largest contributor to the morbidity and mortality worldwide. It is defined by the restriction of pulmonary function due to chronic bronchitis or emphysema which will lead to pulmonary complications (Sutradhar et al. 2019, p.2). The burden of COPD in Bangladesh is very high, and it was reported in a recent study that the prevalence of COPD among population is 12.5%. (GBD 2015 Chronic Respiratory Disease Collaborators, 2017, p. 631). Worldwide, COPD afflicts 251 million people, and is the third killer-leading to more than 3 million deaths in 2015 alone (Rodrigues et al. 2021, p. 3).

Educational information on etiological factors of COPD in the different geographical locations may teach new knowledge that enables the reduction of what appeared as an ethnic difference in COPD around the world, and in that way makes prevention of COPD a feasible goal. There is an urgent need to implement preventive health strategies to help reduce the projected increase of COPD in women in low and middle-income countries, especially because preventive policies have proven effective in some high-prevalence areas. Furthermore, a substantive reduction of the large burden caused by undiagnosed COPD is necessary to facilitate the provisions of efficient secondary and tertiary preventive strategies (Montes et al. 2025, p. 709).

Many factors have been determined to pose a risk of COPD and the most important of these is tobacco smoking. Often burnt in open fires or inefficient stoves, the biomass fuels include wood, animal dung, crop residues, and coal contaminate the indoor air which is recognized as a risk factor (Paulin et al. 2015, p. 558). Other pathogenesis factors of COPD include occupational exposures to the coal dust, silica and asbestos, low birth weight, and frequent respiratory infections. The most common genetic predisposition is the Alpha-1 antitrypsin deficiency. Also, a previous pulmonary experience of tuberculosis, persistent asthma, and poor socioeconomic living are remarkable natural hazards, which considerably affect the progression of COPD (Sutradhar et al. 2019, p.2). Even though cigarette smoking was the best studied risk factor of COPD, the epidemiological data imply that non-smokers could get chronic airflow limitation, as well. Relative to smokers who have COPD, never-smokers with

chronic airflow limitation have fewer symptoms, less disease expression, and have less burden of systemic inflammation. Accordingly, never-smokers with persistent airway limitations are not in the danger of treating lung cancer or cardiovascular comorbidity; however, they show a higher predisposition to pneumonia and even cloud, respiratory-related death (Thomsen et al. 2013, p. 546).

Airflow restriction in COPD can be explained by chronic inflammation and airway constriction due to repeated exposure of the respiratory system to noxious substances severe living conditions, such as tobacco smoking, indoor air pollution, and the frequent benefits of respiratory infections that people suffer during childhood. This disease is more often manifested as a complex of disease forms between chronic bronchitis and emphysema although differences in the underlying pathology, clinical symptoms, and similarity to asthma and other chronic pulmonary diseases makes precise diagnosis quite difficult (Jarhyan et al. 2022, p. 216). These mechanisms involved in the pathogenesis of emphysema include the destruction of the alveolar septa, alveolar enlargement, and the loss of elastic recoil due to hyperinflammation and oxidative stress. On the other hand, chronic bronchitis is also characterized by excess mucus and hypersecretion of goblet cells and hence low airflow. The inflammatory cascade triggers structural changes in the bronchi, bronchioles and pulmonary parenchyma successively blocking the airflow, leading to emphysema and chronic bronchitis (Rodrigues et al. 2021, p. 4).

The major clinical symptoms of COPD are dyspnoea, cough, and sputum, but less common were wheeze, chest tightness, and congestion in the chest, which may account for peculiar irritation. Symptom frequencies are reported to have different frequency differences between cohorts of patients and the severity of a given disease (Miravitlles, Marc & Ribera 2017, p. 2). Dyspnea is the ideal presentation of COPD; more so, accruing evidence highlights the overall symptomatic burden consisting of cough, sputum generation, wheeze, and tightness in the chest positively impacting health status, quality of life, and functional capacity, in addition to being associated with increased measures of anxiety and depression, the increased risk of exacerbation, and adverse prognostic outcomes (Miravitlles, Marc & Ribera 2017, p. 2). COPD, on the negative side, has a negative influence on physical activity during the day, and on the other hand, nocturnal symptoms and sleep problems are quite common but not well

understood. The lack of clinical studies that particularly focus on COPD-related nighttime presentations further complicates the evaluation of their protracted effect on pulmonary functionality, the frequency of exacerbation, cardiovascular risks, cognition, depression, lifestyle, and fatalities (Miravitlles, Marc & Ribera 2017, p. 2).

Frequent exacerbations promote the worsening of physical activity. The destruction of respiratory muscles in COPD patients is natural and leads to impaired muscle activity, decreased exercise performance, and decreased activity levels, thus, patients with COPD typically are less activated compared to those without the condition (Chen et al. 2024, pp. 2)

Lack of physical activity has been linked to increased mortality and reduced quality of life among victims of COPD. Exercise training must be prescribed and provided systematically to all COPD patients who have shown to have limited physical capacity or reduced activity in reducing quality of life and mortality. (Chen et al. 2024, pp. 2).

An advantage of using pulmonary rehabilitation (PR) shows specific practices that benefit patients who have advanced forms of COPD (Rugbjerg et al. 2015, pp. 791). PR has been recommended in use by COPD patients with a dyspnoea score of less than 2 using a modified Medical Research Council scale. In these people, PR brings significant changes on health-related quality of life (HRQoL), exercise tolerance, and dyspnea. Less symptoms and less advanced COPD patients receive PR less often yet it may also be beneficial (Rugbjerg et al. 2015, pp. 791)

For pulmonary rehabilitation, there are so many interventions. Chen et al. (2024, p. 7) reported the outcome of a randomized controlled trial comparing the efficacy of Baduanjin exercise with conventional pulmonary rehabilitation (CPR) and usual treatment measures of the outcome of the entire study on patients with chronic obstructive pulmonary disease (COPD) group lives in a rural rural environment in China. Following a 6-month intervention course, participants who were assigned to the Baduanjin condition showed statistically significant advancements in health condition, dyspnoea, exercise tolerance and mental well-being which were echoed in the improved outcomes of the CPR group. Specifically, the Badujanjin cohort recorded high results on COPD Assessment Test (CAT) test scores, six minutes walking distance, and depressions in the level of anxiety and depression. Based on these results, Baduanjin

has the potential to be an effective community-based intervention of COPD, particularly in rural settings that have limited medical services because of its low cost, simplicity, and safety profile (Chen et al. 2024, p. 8).

COPD patients inevitably experience excessive production of sputum, which makes them feel worse and impairs respiration. An important component of COPD therapy is effective airway clearance to optimize sputum expectoration and lung function（Shen et al. 2021, p.2）. Several non-pharmacological measures are used to treat this problem, including traditional methods of chest physical therapy (CPT) with percussion, postural drainage and positive expiratory pressure as well as state-of-the-art techniques such as autogenic drainage (AD) and the Active Cycle of Breathing Technique (ACBT)（Zisi et al. 2022, p. 89).

ACBT is an intervention which has proved to be effective in managing COPD. Active Cycle of Breathing Technique (ACBT) is a progressive pattern of breathing exercises involving breathing control, expansion, as well as forced expiration of the thoracic cavity (Shen et al. 2021, p. 2). In the breathing control, the subjects must sit comfortably and must breathe in a normal rate and depth with the use of diaphragmatic motion. The phase of thoracic expansion requires that the therapist hands-on the epigastrium of the patient and directs him to take slow deep breaths mediated by lower- chest muscle, then holds his breath two seconds, and blows it out as much as he can; this routine is repeated two or three times, and then back to breathing control. During the forced expiration, the physiotherapist will ask the patient to take an deep breath with the abdominal muscles and in a full and open oral and pharyngeal airway, and the patient will be required to hold the breath two seconds after which the pharyngeal sound of ha is then used in administering a vigorous expiration. The gaseous breathing to be restarted is then recalibrated until the patient is ready to start another cycle. The average ACBT session takes about two minutes and is repeated in 15-20 minutes (Shen et al. 2021, p. 2).

The use of Active Cycle of Breathing Technique (ACBT) was shown to significantly improve production of sputum and respiratory status in a randomized controlled trial by Shen et al. (2021, p.2), but only in those subjects who were GOLD stage 3. However, intervention did not suggest any serious changes in sputum viscosity, quality of life

related to health or economic benefit in the short term. The intervention was safe and acceptable (Shen et al. 2021, p. 2). The analysis of ACBT organizes bronchial clearance by enhancing the mucociliary transport and, at the same time, eliminates the negative side effects on airflow of bronchial obstruction compared to hypoxemia and paradoxical acidosis. The overall effects of airway clearance measures are improvements in pulmonary function in individuals with COPD through the normalization of the respiratory muscles and strengthening respiratory muscles as breathing patterns (Gulati et al. 2020, p. 709).

According to Gulati et al. (2020, p. 711) conducted a RCT which demonstrated that both conventional physiotherapy and Active Cycle Breathing Techniques (ACBT) together with Autogenic drainage (AD) produced statistically significant reduction of dyspnea in patients with chronic obstructive pulmonary disease (COPD) but no statistically significant difference between the two groups became available for dyspnea reduction.

According to Zisi et al. (2022, p. 94) conducted a systematic review of the research of ACBT effectiveness in people with chronic respiratory disease and proved that ACBT alone gave similar or greater effect in changing the sputum volume, forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) compared to other therapies in chronic respiratory disease patients, including COPD.. Often, ACBT was shown to be just as effective whenever utilized as other respiratory therapies, including classical physiotherapy and tools like the Flutter or Acapella. Additionally, improvements in quality of life and decreased dyspnea for the participants who received ACBT or forced expiratory techniques (FET) were detected in the studies (Zisi et at. 2022, p. 95)

According to Shen et al. (2021, p. 7) seventy five hospitalized patients of chronic obstructive pulmonary disease (COPD) to show excessive sputum generation were recruited. Subjects were randomly assigned to one of three groups (1) a combined intervention group that received the active cycle of breathing techniques (ACBT) and phonophoresis; (2) a group that received ACBT alone; and (3) a group that received phonophoresis alone. Post-intervention assessment of scores of the COPD Assessment Test (CAT) demonstrated improvement across the intervention cohort, thus suggesting perceived improvement of quality of life. It was found that the usage of the ACBT in

combination with the phonophoresis regimen was superior to the use of either modality alone (ACBT or phonophoresis alone) with the p-value being less than 0.05 for both primary outcome and secondary outcome, establishing statistical significance (Shen et al. 2021, p.6).

Chronic obstructive pulmonary disease (COPD) continues to be an important public health issue around the world, with chronic inflammation, airflow limitation and excess mucus production resulting in breathlessness and impaired quality of life. Non-pharmacological interventions, and in particular airway clearance techniques, have had an increased emphasis for the management of COPD symptoms. Of these, Active Cycle of Breathing Technique (ACBT) has been proven to be the most useful technique to alleviate sputum clearance, improve sputum viscosity, sputum production, lung function (FEV1% and vital capacity), as well as arterial oxygen saturation (SpO2) in patients with COPD. Recent research including a combination of ACBT and phonophoresis has indicated that ACBT combined with other adjuvant therapies may increase the effectiveness of the treatment and lead to greater patient reported outcomes such as quality of life and satisfaction, and a shorter hospital stay (Shen et al. 2021, p.6).

Although promising, the evidence also identifies shortcomings, such as short intervention and study periods, single-center study designs, and differences in adherence by patients, which may result in difficulties with extrapolating the results to the general population. However, the relatively high recurrence rates indicated in a number of trials, consecutive improvements reported provide an excellent reason to integrate ACBT in pulmonary rehabilitation as a. Future studies to establish the long-term efficacy, using standardized protocols and trials in a wider population, should aim to validate and optimize ACBT interventions for those with COPD.

Due to increasing burden of COPD worldwide, evidence-based treatments are increasingly needed to relieve symptoms and improve the patients' quality of life. This study attempts to refine the existing knowledge about the effectiveness of ACBT for treatment of COPD. By focusing on modifiable aspects such as dyspnea and the severity of COPD, this study will not only help further develop treatment strategies for COPD, but will also provide further support for the crucial role of ACBT as an adjunct to pulmonary rehabilitation and for improving breathing function.

CHAPTER- III METHODOLOGY

3.1 Study Design

This study design was a Randomized Controlled Trial (RCT) study. The research investigated the effectiveness of the active cycle of breathing technique in patients with chronic obstructive pulmonary disease (COPD).

3.2 Study Area

The area of the study was 250 Bedded TB Hospital, Shyamoli, Sher-e-Bangla-Nagar, Dhaka-1207.

3.3 Study Place

The study was conducted at Saic College of Medical Science and Technology (SCMST) at Mirpur-14, Dhaka-1216.

3.4 Study Period

Study period was one year, from June 2024 to July 2025.

3.5 Study Population

The population of the study was patients with Chronic Obstructive Pulmonary Disease (COPD) of the 250 Bedded TB Hospital, Shyamoli, Sher-e-Bangla-Nagar, Dhaka-1207.

3.6 Sample Size

$$n = \frac{2\sigma^2 \left(\frac{z\alpha}{2} + z\beta\right)^2}{\Delta^2}$$

$$= \frac{2 \times 2.32 \times (1.96 + 0.84)^2}{(1.3)^2}$$

$$= \frac{2 \times 2.32 \times 7.84}{1.69}$$

$$= \frac{36.06}{1.69}$$

$$= 21.33$$

Here,

σ^2 = variance of the outcome measure = 2.32 (Samuel and Saravankumar 2023, p.716)

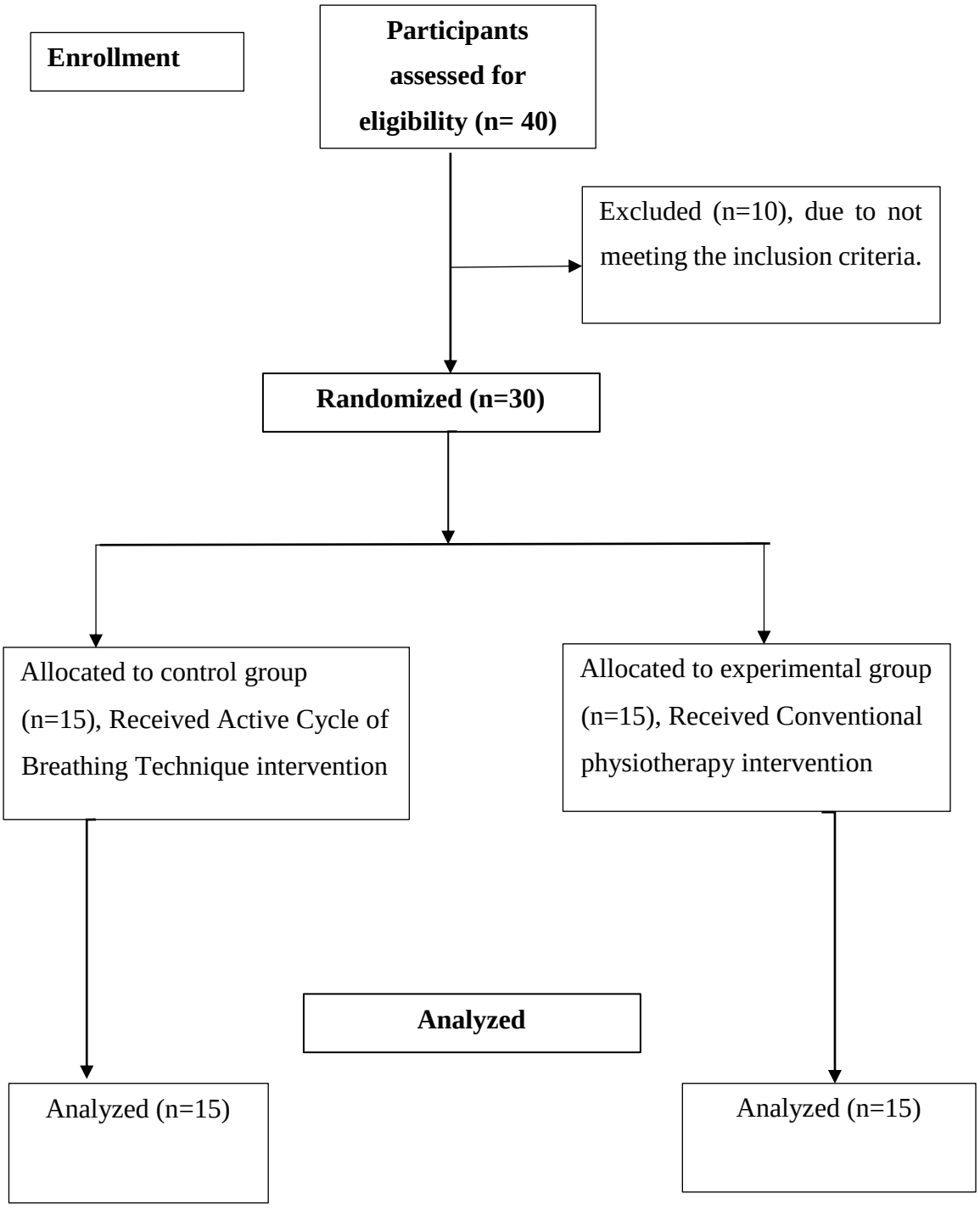
Δ= Mean difference (1.3) (Samuel and Saravankumar 2023, p.716)

$Z\alpha/2$ = For a 5% significance level ($\alpha = 0.05$, two-tailed) = 1.96

$Z\beta = (1 - \beta)$, for 80% power ($\beta = 0.20$) = 0.84

n = Sample size for one group

3.7 CONSORT (Consolidated Standards of Reporting Trials) flow chart:



3.8 Sample Selection

Participants were selected based on inclusion criteria relevant to the study's objectives. A total of 30 participants who met these criteria were included in the study.

3.9 Sampling Technique

Participants were selected using convenience sampling among people diagnosed with COPD from 250 Bedded TB Hospital, Shyamoli, Sher-e-Bangla-Nagar, Dhaka-1207. Then screening of the patients was done on basis of inclusion criteria. The patients were included who met the inclusion criteria. Therefore, simple random sampling (lottery method) was used to allocate the participants into experimental and control group.

3.10 Eligibility Criteria

3.10.1 Inclusion Criteria

1. Hospitalized patients diagnosed with COPD (Shen et al., 2021, p.3)
2. Patient with clear consciousness, stable vital sign, ability to cooperate.
3. Patient who have given informed consent.

3.10.2 Exclusion Criteria

1. Presence of neuromuscular disease or terminal disease (Shen et al., 2021, p.3).
2. History of thoracic and abdominal trauma and surgery.
3. Patient having skin infection at the touch point.
4. Patient having cardiac pacemaker, artificial stent, artificial valve or heart failure.

3.10 Method of Data Collection

3.10.1 Technique of data collection

Face to face formal interview technique was used to collect data from the selected patients with COPD.

For determination of COPD level the COPD Assessment Test (CAT) was used; for dyspnea level, the mMRC (Modified Medical Research Council) Dyspnea Scale to collect data from the selected patients with COPD.

3.10.2 Instrument of Data Collection

The main data collection tool used was a pretested structured questionnaire. The questionnaire itself was organized into multiple sections. The first part had questions on the identification of the patients whereas the second part covered the sociodemographic data. The third part included items of the COPD Assessment Test (CAT) concerning COPD level. The fourth section was the mMRC (Modified Medical Research Council) Dyspnea Scale to assess the dyspnea level. All instruments to be used are standardized, internationally recognized, and validated in order to establish reliability and validity in the evidenced collected.

3.11 Tools for Data Collection

In this particular study, a written questionnaire were used.

3.12 Data Collection Procedure

Out of the 40 patient, 30 cases of COPD patient were selected from the admitted patient of 250 Bedded TB Hospital, Shyamoli, Sher-e-Bangla-Nagar, Dhaka-1207. Patient were screened and thus 10 patients were excluded on basis of the not meeting the inclusion criteria. The 30 patients were allocated by randomization to experimental and control groups thereafter. ACBT was done in experimental group and usual physiotherapy was done in control group. 15 patients were in the experimental group and the same number of patient were in control group. Twelve session of the treatment were completed by every patient in both groups. COPD level and dyspnea level data was collected and that information viewed as pretest data. For the present intervention both ACBT and conventional physiotherapy was given for experimental group. Conventional physiotherapy was given for control group only. Both group receive similar 24 session. COPD Assessment Test (CAT) was used for collecting information about COPD level, mMRC (Modified Medical Research Council) Dyspnea Scale for dyspnea level after completion of the intervention. Post test data of 30 COPD patients have been regarded as information after the intervention. The researcher thanked the participants after the interview.

3.12 Intervention

Experimental Group (Received 4 weeks and 12 sessions of ACBT with conventional physiotherapy)	Control group (Received 4 weeks and 12 sessions of conventional physiotherapy)
Duration: 15-20 minutes	**Duration:** 15-20 minutes
• ACBT method for 4 weeks, 2 set each day for 3 days, 30 repetitions. • Breathing control- Sit comfortably, breathe slowly through the nose and out through pursed lips. Focus on diaphragmatic breathing, avoiding shallow breathing. **Perform** 5-10 seconds. • Thoracic Expansion Exercise (Deep breaths) - Inhale deeply, hold for (2-3) seconds, and exhale slowly. **Perform** 3-5 breaths. • Forced Expiratory Technique (FET) / Huffing **Perform** 2-3 huffs, Inhaling normally and exhaling forcefully, with recovery breathing between cycles. Avoid excessive coughing to minimize discomfort. (Samuel and Saravankumar 2023, p.716)	• Traditional Physiotherapy 1. Percussion 2. Vibration 3. Shaking (All these for 4 weeks, 2 set each day for 3 days) (Samuel and Saravankumar 2023, p.716)

Figure: ACBT application

3.13 Data Analysis

The statistical analysis was conducted using (Statistical Software, e.g., SPSS version 22, MS Excel). Descriptive statistics were used to analyze the pretest and posttest values. To determine pre test and post test intervention between groups, Mann Whitney U test was used and to assess pre test and post test intervention within the group Wilcoxon Signed Rank test was used. The bar diagram and chart use Microsoft Excel 2013.

3.14 Statistical Significance

A p-value of <0.05 was considered significant, indicating that observed differences were unlikely due to chance.

3.15 Informed consent

Informed consent was given to all respondents before filling in the questionnaire in written form. The researcher explained the role of the participants in this study. A written consent form was signed and returned by each participant, including a signature or finger trip for those who could not give a signature, or a witness signature. Thus, the participants were ensured that they understood the consent form and their participation was based on a purely voluntary basis. The subject gave consent for this research. As such, an Informed consent form was signed by each of the patients. The participants were made aware that they had a right to consult an outdoor doctor if they felt the treatment would not be able to keep the condition under control, or if the condition deteriorated. They were also informed that at any point during the study, they could decline to answer any question and were free to withdraw their consent and terminate participation. Every participant was allowed to take up their issue with the higher authority or administration of 250 Bedded TB Hospital and their concerns were answered to the satisfaction.

3.16 Ethical Considerations

Strict adherence to ethical guidelines is paramount in this study. A formal project proposal has been submitted to the Department of Physiotherapy at Saic College of Medical Science and Technology (SCMST), and approval has been obtained from the Institutional Review Board (IRB) of SCMST to conduct the study. This study follows the guidelines set forth by the World Health Organization (WHO) and Bangladesh Medical Research Council (BMRC), ensuring the confidentiality of participant information at all times. Permission to collect data has been obtained from the study area authorities. Participants will be fully informed about the aims and objectives of the study before consenting to participate. Written consent will be obtained from each participant, and the process will be explained verbally as well. Participants will be assured of the confidentiality of their information, which will only be shared with the research supervisor. The participant rights will be informed, which will include providing them with the option to leave the study any time without having any negative repercussions. To protect anonymity, participant names and addresses will not be used; instead, participation numbers will be assigned in all notes and transcripts. It will be made clear that information gathered may be presented in presentations, seminars, or written papers, but in a way that ensures no identification of individuals and poses no harm to them. Participants will be assured of their right to discuss any concerns related to the study with senior authorities. The ethical standards upheld in this study aim to protect participant welfare while maintaining the integrity and confidentiality of the research process.

CHAPTER- IV RESULTS

A total of 30 individuals were used in this study to examine effectiveness of Active cycle of breathing exercise in patients with chronic obstructive pulmonary disease. The following paragraphs provide a summary of the investigation's findings.

Baseline characteristic

Table 4.1: Baseline Characteristics of Experimental (ACBTG) and Control (CPG):

Variable	Experimental (ACBTG)	Control (CPG)
	Mean± SD	
Age	44.47±18.792	42.33±14.941
Pre_cat total score	22.33±5.447	31.60±4.626
Pre_mMRC score	1.20±1.082	1.47±1.125
BMI	2.20±0.775	3.07±1.163

The mean age of participants in the experimental group (ACBTG) was 44.47±18.85 years while that of the control group (CPG) was 42.33±14.94 years. Regarding the baseline functional scores, the mean CAT score was (22.33±5.447) in the experimental group and (31.60±4.626) in the control group. The mean dyspnea score was higher in the control group (1.47±1.125) compared to the experimental group (1.20±1.082). Similarly, the mean BMI score was (2.20±0.775) in the experimental group and (3.07±1.163) in the control group. Overall, indicating general comparability of both groups prior to intervention.

Table 4.2: Sociodemographic information of Experimental (ACBTG) and Control (CPG)

The sociodemographic characteristics of participants in both the experimental (ACBTG) and control (CPG) were comparable at baseline.

Variable	Experimental (ACBTG) n(%)	Control (CPG) n(%)
Age Category		
20 - 40 years	7(46.7)	6(40.0)
41 - 60 years	5(33.3)	7(46.7)
61-80 years	3(20.0)	2(13.3)

The majority of participants in the experimental group were between 20-40 years (46.7%), whereas in the control group were between 41-60 years (40%).

Gender		
Male	7(46.7)	2(13.3)
Female	8(53.3)	13(86.7)

Gender distribution was relatively balanced in the experimental group (46.7% male and female 53.3%), while the control group had a higher proportion of females (86.7%).

Educational Qualification		
Illiterate	8(53.3)	3(20.0)
primary	4(26.7)	6(40.0)
SSC	1(6.7)	5(33.3)
HSC	2(13.3)	1(6.7)

Illiteracy is more common in experimental group (53.3%) whereas control groups had only (20%).

Occupation		
Service holder	1(6.7	0.00
Housewife	4(26.7)	11(73.3)
Student	3(20.0)	1(6.7)
Teacher	0.00	1(6.7)
Labour	2(13.3)	0.00
farmer	3(20.0)	1(6.7)
brick filed worker	0.00	1(6.7)
others	2(13.3)	0.00

The majority of participant in control group were housewife (73.3%), whereas in the experimental group were housewife (26.7%). Teacher and brick filled worker were not in experimental group but present at control group.

Living area		
Rural	10(66.7)	7(46.7)
Urban	5(33.3)	8(53.3)

The majority of the subjects in both groups lived in rural regions though the proportion within the experimental group (66.7 percent) was higher than that of the control group (46.7 percent).

Marital status		
Unmarried	3(20.0)	2(13.3)
Married	12(80.0)	13(86.7)

Both groups were largely married (80% of participants in the experimental, 86.7% in the control group) and few were unmarried (20% and 13.3%, respectively)

Type of family		
Nuclear family	10(66.7)	10(66.7)
Extended family	5(33.3)	5(33.3)

In the experimental group and control group both 66.7% of the participants belonged to nuclear families and extended families.

Type of road access		
Mud	5(33.3)	4(26.7)
Brick	3(20.0)	2(13.3)
Pitch	7(47.7)	9(60.0)

Road access type was observed to be different, with 53.3% of the experimental group having mud roads whereas the control group only had 26.7% of the participant having mud roads.

Table 4.3: Description of comorbidity related information about Experimental (ACBTG) and Control (CPG)

Variable	Experimental	Control
Hypertension	0.00	3(20)
Diabetes	2(13.3)	2(13.3)
Heart disease	1(6.7)	0.00
Asthma	3(20.00)	14(93.3)
Tuberculosis	11(73.3)	9(60)
Depression or Anxiety	14(93.3)	14(93.3)
Osteoporosis	0.00	5(33.3)
Chronic kidney disease	0.00	2(13.3)
Acidity	11(73.3)	14(93.3)
Stroke	1(6.7)	0.00
Anemia	5(33.3)	5(33.3)

The table shows the comorbidity variables of the experimental and the control groups of the study. Hypertension was present in 20% in the control group but was not present in the experiment. The difference is not significant (p-value = 0.073). The frequency of diabetes is the same in both groups (13.3 versus 13.3 percent) with no significant difference (p-value = 1.00). The frequency of heart disease was 6.7% present in the experimental group and the control group did not have it. The p-value is 0.317 and there is no significant difference. Asthma was seen in 20% of the experimental group and 93.3% of control group with a significant difference (p-value = 0.00). Tuberculosis was present in the experimental group, 73.3% and 60% in the control group with no

significant difference (p-value = 0.446). Depression or Anxiety was present in 93.3% in both groups, and the amount is insignificant (p-value = 1.00). Osteoporosis was shown in 33.3% within the control but not in the experimental group. The p-value (0.016) indicates that it is significant. Chronic kidney disease was present in 13.3% in the control group but not in the experimental group, and with no significant variation (p- value = 0.550). Acidity was present in 73.3% and 93.3% of the experimental and control groups, respectively, and with no significant difference (P-value = 0.148). Stroke was present in 6.7% of the experimental and not in the control group, and there was no significant difference (p-value = 0.317). Anemia was present in 33.3% in both groups, and there is no significant difference between them (p-value = 1.00).

Figure 4.4: Age distribution of Participants:

The distribution of the age of the subjects taking part in the study would be analysed in order to understand the demographic profile of COPD patients with ACBT (Active Cycle of Breathing Techniques). From the distribution chart, it was noted that the age group of 41-60 years had the highest number of respondents comprising 46.67% of the total sample. Forty percent followed and between the ages of 20-40. The age groups from 61-80 years recorded a somewhat lower share of the total population of 13.33%. This distribution indicates that middle-aged and older people dominated the sample of people studied, which is in keeping with the distribution of people for whom COPD is diagnosed.

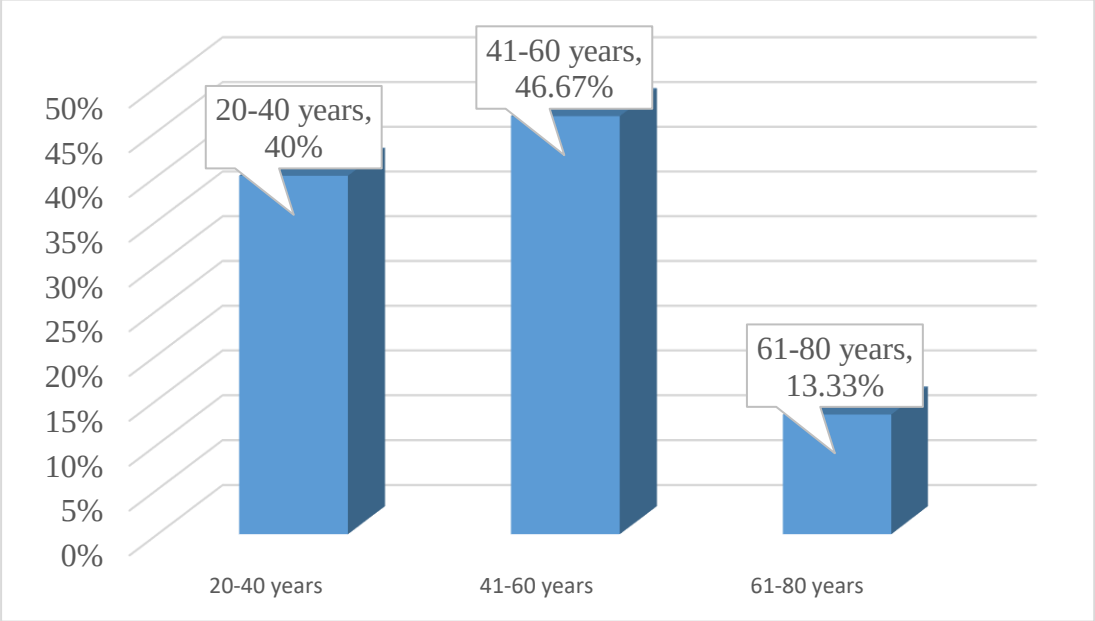


Figure 4.5: Gender distribution of participants:

The study population was unbalanced in terms of the gender of the participants (70% females and 30% males). This is associated with an increase of women enrolled in the study which can be related on one hand to gender-specific COPD manifestation on the other to any other demographic variables that can be represented in the sample. The presence of large numbers of females as subjects in the present study provides a unique insight into the way the institution handles its female population in general.

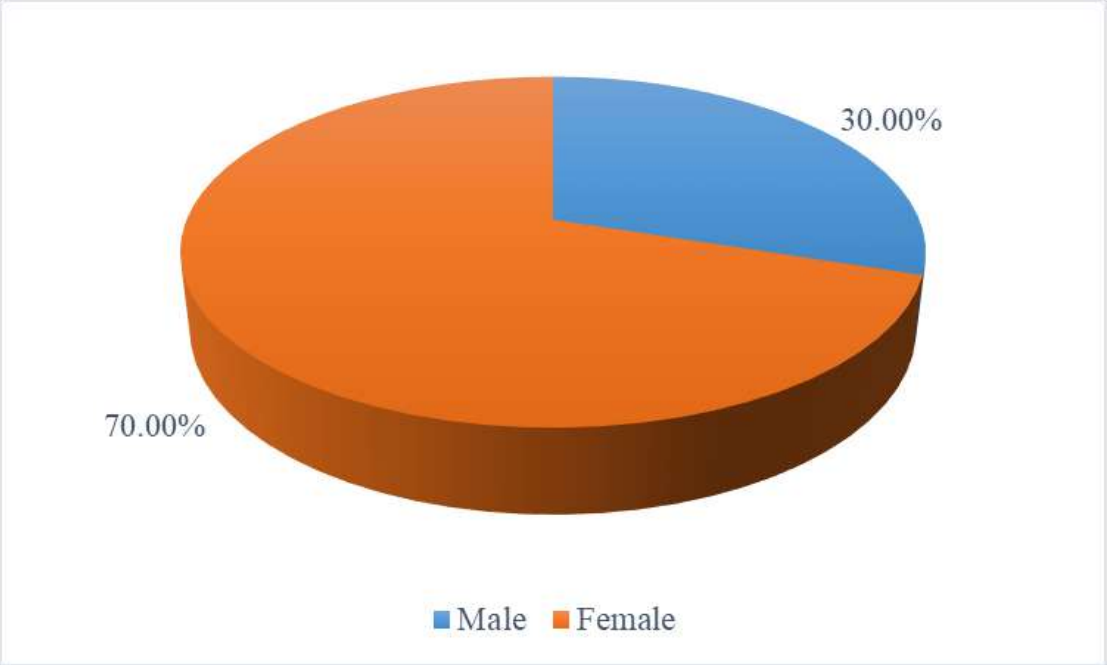


Figure 4.6: Educational qualification distribution of participants:

The level of education was found to be significant among the participants. One of the important descriptions of this study population was that 36.67% of the population were illiterate. Secondly, 33.33% of the respondents reported having attended primary school while 20% reported having sat for secondary school certificate (SSC). Ten percent went to higher secondary school (HSC). This variance suggests that a large proportion of participants may be experiencing literacy-related problems that could impact performance on understanding and participation with COPD management programes, including ACBT.

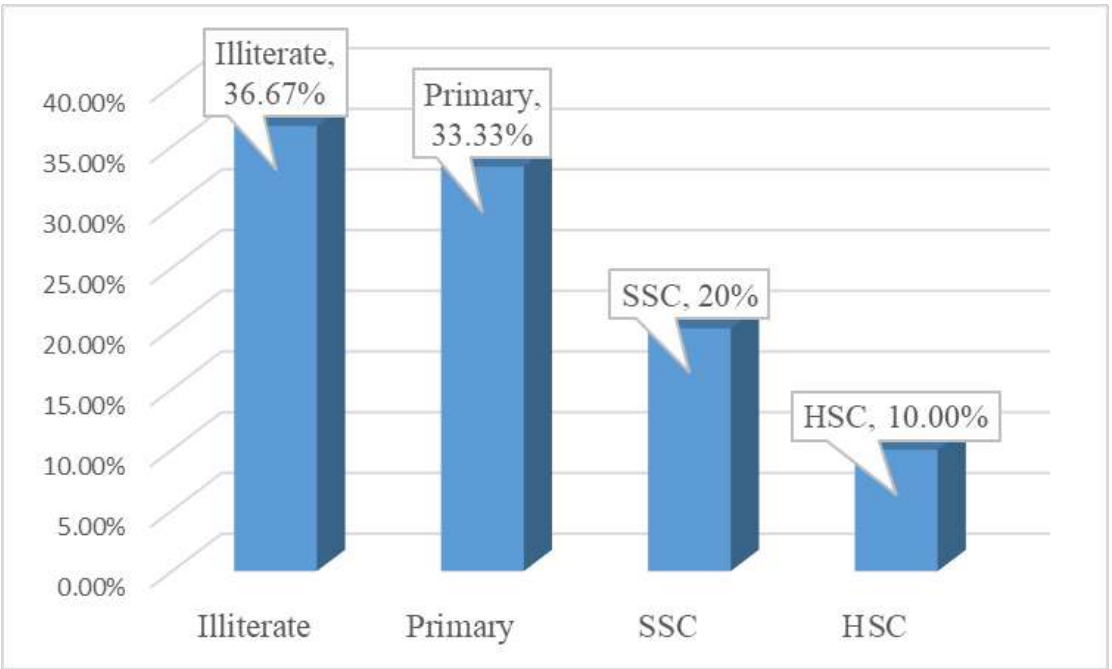


Figure 4.7: Marital status distribution of participants:

Most of the respondents to the study were married, comprising 83% of the total respondents, while 17% were not married. This allocation allows for many practitioners to have access to a support system in the form of a family with which to individually debrief on their experiences of the ACBT programme. Thus, the marital status of the study members is an important factor which needs to be considered when establishing the social support frameworks which may impact the efficacy of COPD management.

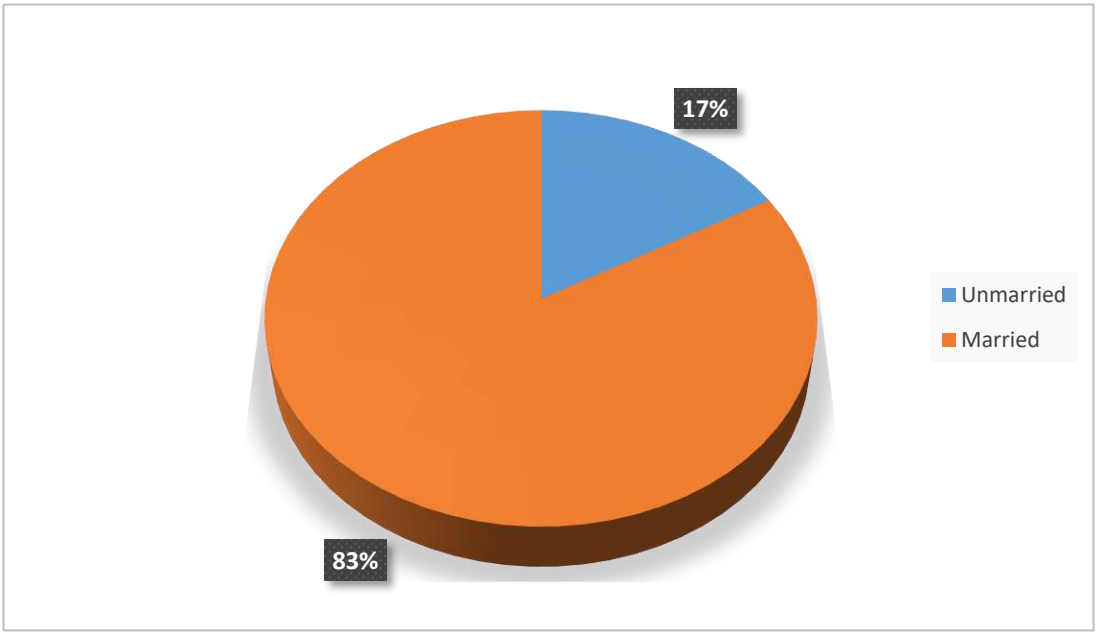


Figure 4.8. Occupation of participants:

The respondents had a wide variety of occupational experience. Housewives were the largest group and they accounted for 50% of people in the sample. Other occupations included students (13%), farmers (13%) and laborers (6.67%). A small percentage of the respondents were holders of service (3.33%), teachers (3.33%), and brick workers (3.33%). There was also the category of others (6.67%). The different occupational positions reflect a range of socioeconomic life circumstances and status that may impact participants' uptake and response to the ACBT programme for COPD management.

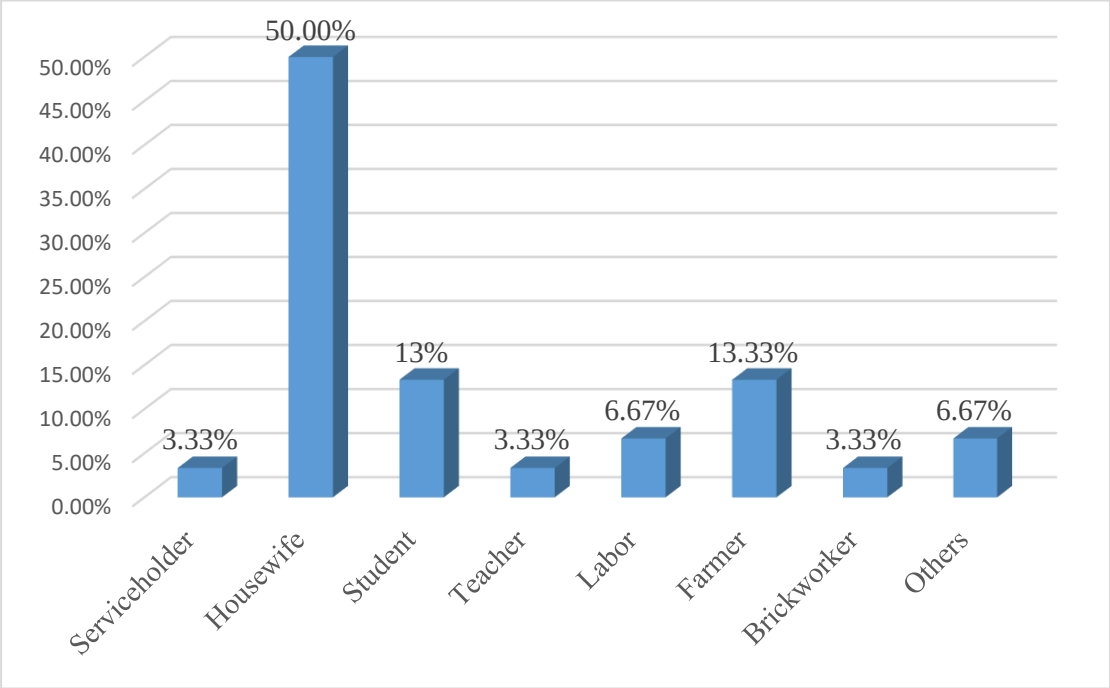


Figure 4.9. Body Mass Index of the Participants:

Analysis of BMI of the subjects showed that there was a significant variation in the nutritional status of the subjects. Results showed that out of the total sample population, 36.67% were underweight, and 13.33% were under the severe category of underweight. Conversely, 26.67% of the participants were in the "severely obese category" and 20% were "moderately obese." Only 3.33% were within normal range of BMI. This suggests that underweight and obesity are widespread in the participants and may have an impact on the outcomes of an ACBT programme in the management of COPD.

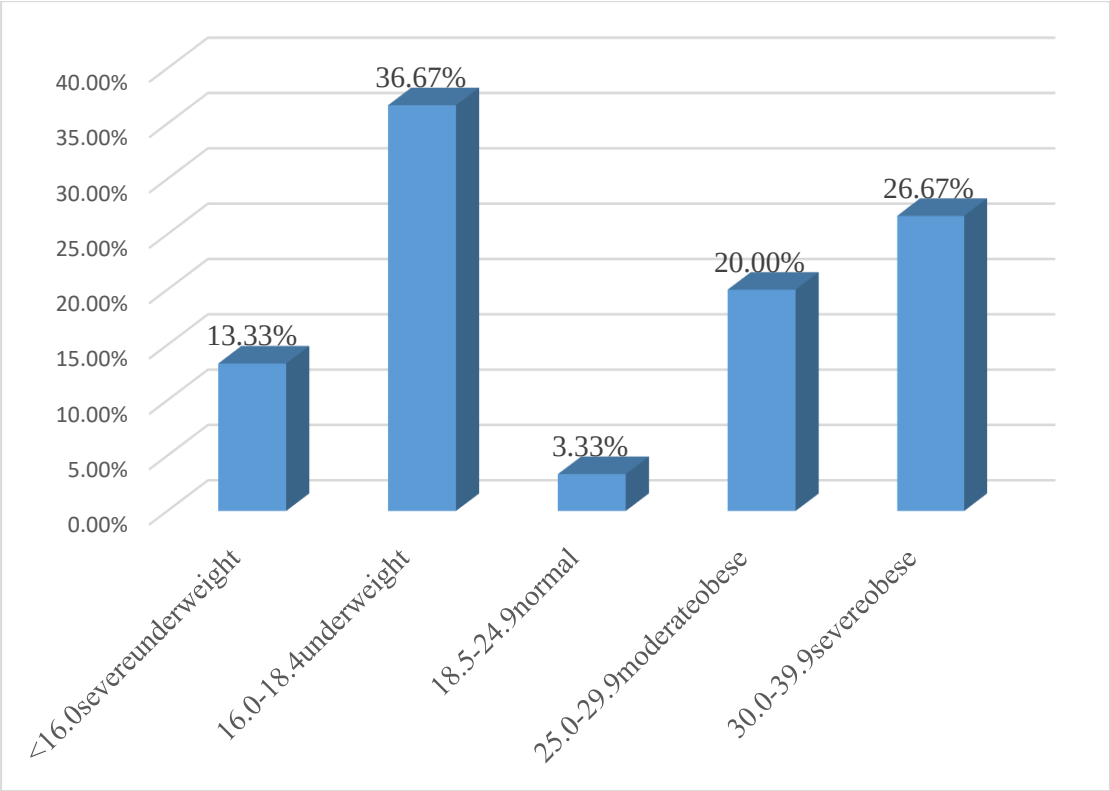


Table 4.10. Between group comparison of COPD (Post CAT):

Difference between CAT scale	**Category of the participants**	**N**	**Mean Rank**	**Sum of Ranks**	**Mann Whitney U Score**	**P**
	Experimental	15	20.30	304.50	40.500	0.003
	Control	15	10.70	160.50		
	Total	30				

The Mann-Whitney U test was performed to compare the differences in CAT scores between the experimental and control groups. For the experimental group (n = 15), the mean rank was 20.30 with a sum of ranks of 304.50, while the control group (n = 15) had a mean rank of 10.70 and a sum of ranks of 160.50. The Mann-Whitney U value was 40.50, with a corresponding p-value of 0.003.

Having the p-value less than 0.05 the results suggest a statistically significant difference in CAT scores between experimental and control group.

Table 4.11. Between group comparison of Dyspnea (Post mMRC):

Difference between mMRC scale	Category of the participants	N	Mean Rank	Sum of Ranks	Mann Whitney U Score	P
	Experimental	15	15.10	226.50	106.500	0.783
	Control	15	15.90	238.50		
	Total	30				

To screen average total scores of the mMRC in the experimental (n = 15) and the control (n = 15) group, a Mann Whitney U test was used. Experimental group had a mean rank of 15.10 and the sum of the ranks was 226.50, on the other hand, control group had a mean rank of 15.90 and a sum of the rank was 238.50.

The statistical result of the U was 106.50 with a p-value of 0.0783. The fact that the p-value was greater than the significance level of 0.05 implied that there was no significant difference in the overall scores in the mMRC between the two groups, meaning that there was no statistically significant populational difference between the scores of the two groups.

Table 4.12. Within group comparison of COPD for experimental group (Post CAT):

Posttest-pretest CAT scores	N	Mean Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P
Negative ranks	15	8.00	120.00	-3.417	0.001
Positive ranks	0	0.00	0.00		
Ties	0				
Total	15				

The Wilcoxon Signed Rank Test was performed to compare the differences in CAT scores within the experimental group (post-test vs pre-test). There were 15 negative ranks (n = 15), 0 positive ranks (n = 0), and no ties (n = 0), with a total of 15 paired observations. The mean rank for the negative ranks was 8.00 (sum of ranks = 120.00), while the mean rank for the positive ranks was 0.00 (sum of ranks = 0.00). The test yielded a Z value of -3.417 with a corresponding p-value of 0.001.

As the p-value is less than 0.05, these results indicate a statistically significant decrease in CAT scores from pre-test to post-test within the experimental group, suggesting that the intervention effectively reduced symptom severity.

Table 4.13. Within group comparison of COPD for control group (Post CAT):

Posttest-pretest CAT scores	N	Mean Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P
Negative ranks	15	8.00	120.00	-3.420	0.001
Positive ranks	0	0.00	0.00		
Ties	0				
Total	15				

The Wilcoxon Signed Rank Test was conducted to evaluate the within-group difference in CAT scores for the experimental group (n = 15). The analysis revealed 15 negative ranks, indicating that all participants demonstrated a reduction in CAT score from pre-test to post-test. There were no positive ranks and no ties. The mean rank for negative ranks was 8.00, with a sum of ranks of 120.00, while positive ranks were all zero.

The Wilcoxon test produced a Z value of -3.420 with a p-value of 0.001 ($p < 0.05$), confirming a statistically significant reduction in CAT scores within the experimental group. This suggests that the intervention was effective in improving respiratory symptoms, as indicated by the lower CAT scores post-intervention.

Table 4.14. Within group comparison of dyspnea for experimental group (Post mMRC):

Posttest-pretest CAT scores	N	Mean Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P
Negative ranks	9	5.00	45.00	40.50	0.003
Positive ranks	0	0.00	0.00		
Ties	6				
Total	15				

The Wilcoxon Signed Rank Test was conducted to evaluate the within-group difference in MMRC scores for the experimental group (n = 15). The analysis revealed 9 negative ranks, indicating that these participants had a lower MMRC score at post-test compared to pre-test (reflecting improvement, as lower MMRC scores indicate reduced dyspnea). There were 0 positive ranks, meaning no participant's MMRC score increased (worsened), and 6 ties, indicating no change.

The mean rank for negative ranks was 5.00, with a sum of ranks of 45.00, while the positive ranks had a mean rank of 0.00 and a sum of ranks of 0.00. The Wilcoxon test produced a Z value corresponding to a sum of ranks of 40.50, with a p-value of 0.003 ($p < 0.05$), confirming a statistically significant improvement in dyspnea severity within the experimental group.

Table 4.15. Within group comparison of dyspnea for control group (Post mMRC):

Posttest-pretest CAT scores	N	Mean Rank	Sum of Ranks	Wilcoxon signed ranktest based on Z rank	P
Negative ranks	8	4.50	36.00	-3.420	0.010
Positive ranks	0	0.00	0.00		
Ties	7				
Total	15				

The Wilcoxon Signed Rank Test was conducted to evaluate the within-group difference in MMRC scores for the experimental group (n = 15). The analysis revealed 8 negative ranks, indicating that these participants had a lower MMRC score at post-test compared to pre-test (reflecting improvement, as lower MMRC scores indicate reduced dyspnea). There were 0 positive ranks, meaning no participant's MMRC score increased (worsened), and 7 ties, indicating no change.

The mean rank for negative ranks was 4.50, with a sum of ranks of 36.00, while the positive ranks had a mean rank of 0.00 and a sum of ranks of 0.00. The Wilcoxon test produced a Z value of –3.420, with a p-value of 0.010 ($p < 0.05$), confirming a statistically significant improvement in dyspnea severity within the experimental group.

CHAPTER-V DISCUSSION & LIMITATION

5.1 Discussion:

The findings of the study indicate that ACBT was efficacious in reducing dyspnea and also in enhancing the COPD severity of the studied patients. In this way, it can be assumed that ACBT is an efficient non-pharmacological treatment of COPD symptoms and quality of life. The major outcome of this study was an improvement of the level of dyspnea in COPD patients following the ACBT implementation. Results of this study showed a significant positive difference in the degree of dyspnea and therefore ACBT has an important place in the treatment process for symptoms. This is consistent with previous evidence that breathing exercises, including ACBT, have a profound effect on dyspnea in COPD patients through reduction of respiratory muscle fatigue and optimization of breathing pattern (Zuriati et al. 2019, p. 165).

ACBT consists of three different exercises: (1) the breathing control exercise, (2) the thoracic expansion exercise and (3) forced expiration. These techniques are helpful because they increase the flow of air through the lungs, reduce air trapping and maximize the force of ventilation of the lung, subsequently decreasing dyspnea symptoms. The second objective of the research was to find out the effects of ACBT on the COPD condition of the research participants in terms of their CAT score. The findings of this study show that there has been a significant difference in the CAT scores in the group of patients who received ACBT versus those in the usual care group. This leaves that in terms of dyspnea, in addition to reducing it, ACBT improves overall state of health of patients, reducing the burden they feel from daily activities and improving the quality of life itself. This result is consistent with other past studies that suggest that pulmonary rehabilitation, including breathing retraining modalities such as ACBT, can contribute to improving the health status measured by the CAT score (Gulati et al. 2020, p. 709). The improvement of CAT scores in the present study is further supported by results from previous COPD studies employing similar nonpharmacological non-invasive interventions.

Shen et al. (2021, p. 6) showed that ACBT resulted in better COPD assessment scale including the aspects similar to those in the CAT, symptoms, activity levels, and health

status. Even though ACBT has shown positive results in improving the dyspnea values and health status, it is vital to pay attention to its role in halting the progression of the disease. This study was not sufficient to address the impact of ACBT on long-term lung function, but the studies have already revealed that breathing exercises can assist in the management of symptoms and quality of life in individuals with COPD, but they help little with the development of the disease at later stages (Zuriati et al. 2019, p. 165).

Conventional pulmonary rehabilitation (CPR) has long been regarded as one of the important options of COPD management and has been shown to increase exercise performance, decrease dyspnea and improve overall quality of life (Chen et al., 2024). Compared with CPR, ACBT showed similar results in alleviating dyspnea but possibly acted less effectively in increasing the exercise capacity and other measures of COPD severity. Combinations of CPR or other exercise modalities and ACBT may also have a potent beneficial effect, especially in terms of physical condition and long-term results. Also, Baduanjin, exercise method as a traditional Chinese method of exercise, has been proven to enhance both subjective symptoms and the functional status of COPD patients (Chen et al. 2024, p. 6).

Baduanjin or other exercises were not used in the current study, and future study examining how ACBT and Baduanjin interact will be of interest in determining the best rehabilitation activities that will benefit COPD patients. In this study, psychological outcomes were not measured, but the decrease in dyspnea and the increment in CAT scores give an indication that ACBT could potentially have positive psychological changes. Dyspnea is not only a burden on the body, but also a mental issue as it has been found to cause anxiety, depression and even deteriorate the quality of life of COPD patients (Chen et al. 2024, p. 6). By relieving dyspnea patients, ACBT can influence the overall mental state of patients, making it ultimately more active in treatment and healthier.

5.2 Limitation of the study:

1. **Small size**: The research was not very large in the number of samples and was not enough statistically sound and capable of generalization.
2. **Single Center Study**: The research was conducted at only one place, which may limit the generalizability of the results across different populations and healthcare settings.
3. **Short Term Evaluation**: The study only investigated the effects of ACBT in the short term (4 weeks), and did not include long-term follow-up, limiting the understanding of the sustained effects of the intervention of the participants.

CHAPTER- VI CONCLUSION & RECOMMENDATIONS

6.1 Conclusion:

The purpose of the study was the assessment of the effectiveness of Active Cycle of Breathing Technique (ACBT) in the decrease of dyspnea and in the improvement of the overall COPD state of the patients. The results indicate that ACBT is a promising treatment method of managing COPD symptoms, namely, reducing dyspnea and improving health status about the COPD Assessment Test (CAT) questionnaire. The present study results indicate that ACBT significantly reduces shortness of breath and enhances quality of life among COPD patients; it can be considered one of the useful methods for the management of COPD. Finally, this study presents the potential for using ACBT as a non-pharmacological approach to the medical management of COPD. Still, using ACBT in combination with other forms of rehabilitation, e.g., as part of a physical exercise programme, or during combination pharmacotherapy can have the potential to improve the quality of life of patients with COPD to a greater extent.

Future studies should attempt to account for these multimodal combinations in an attempt to optimize the effectiveness of treatment in individuals with COPD. Furthermore, while the ACBT technique showed good results in the present research for alleviating the dyspnea and for improving the condition of COPD, it is always important to note that such a finding can vary depending upon the stage and severity of the disease. ACBT is a useful safe and tolerable treatment alternative to COPD patients to achieve a symptomatic improvement and enhance the health status. Its addition to protocols of COPD management could greatly improve the results of treatments, especially when used in combination with other multi-faceted approaches.

6.2 Recommendation:

The sample size of this study was small, and the study was implemented in only one center thus limiting the generalizability of findings. In the future, more and diverse larger populations could be used in the various centers to ascertain the applicability of the results in a larger population of COPD patients.

To gain more evidence about the long-term advantages of ACBT, it will be important to encompass longer follow-up intervals, that is three to six months and even beyond. This will offer useful information, on whether the gains in dyspnea and COPD status are maintained long-term and there is long-term benefit of ACBT.

Although the study utilized the COPD Assessment Test (CAT) in measuring change in COPD condition, which is a useful tool, the objective contribution of lung functions and physical performance measurements, such as Forced Expiratory Volume (FEV1), the six-minute walk test (6MWT), and oxygen levels, among others, would have benefitted the study. Objective scales can be used to validate the gains noted in self-reporting questionnaire.

Future study needs to evaluate the psychological effects of ACBT using valid or reliable scales, anxiety depression and quality of life.

Future research should evaluate the effect of a combined ACBT approach with other rehabilitation methods, i.e., physical exercise training, pulmonary rehabilitation, or pharmacological therapies. A multifaceted approach has the potential to provide greater benefits to COPD sufferers especially with patients at the later stage of illness.

CHAPTER- VII REFERENCE LIST

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Appendix- A

Permission letter for IRB

SCMST-BPT/IRB/.03-10/25/10

To
Nahida Begum
4th Year Student of B.Sc. in Physiotherapy
Session: 2019-20, Registration No: 8819
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Subject: Approval of the thesis proposal **"Effectiveness of Active Cycle of Breathing Technique in Patients with COPD"** by ethics committee.

Dear Nahida Begum
Congratulations.
The Institutional Review Board (IRB) of SCMST has reviewed and discussed your application to Conduct the above-mentioned dissertation, with yourself, as the principal investigator. The Following documents have been reviewed and approved:

Sr. No.	Name of the Documents
1	Dissertation Proposal
2	Questionnaire (English version)
3	Information sheet & consent form.

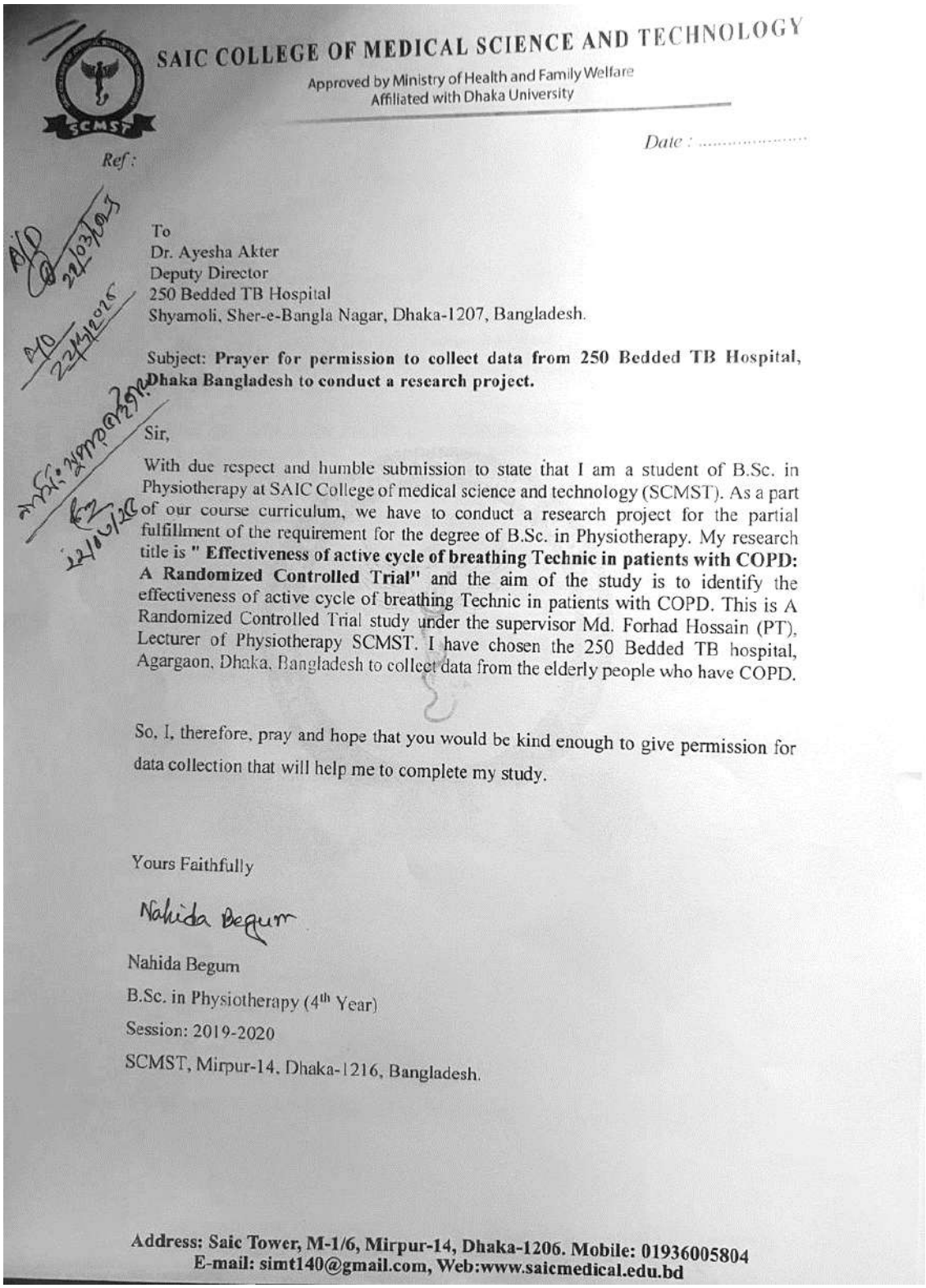
The purpose of the study to assess the level of Effectiveness of Active Cycle of Breathing Technique in Patients with COPD. Data will be collected by close ended questioners that may take 30 to 40 minutes to fill in the questionnaire and there is no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 09.00 AM on 04th September 2024 at SCMST.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring during the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,
04.09.24.
Dr. Abul Kasem Mohammad Enamul Haque
Principal, SCMST &Chairman, Institutional Review Board (IRB)
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Appendix-B

Permission letter for data collection



SAIC COLLEGE OF MEDICAL SCIENCE AND TECHNOLOGY

Approved by Ministry of Health and Family Welfare
Affiliated with Dhaka University

Ref :

Date : .....

To
Dr. Ayesha Akter
Deputy Director
250 Bedded TB Hospital
Shyamoli, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh.

Subject: **Prayer for permission to collect data from 250 Bedded TB Hospital, Dhaka Bangladesh to conduct a research project.**

Sir,

With due respect and humble submission to state that I am a student of B.Sc. in Physiotherapy at SAIC College of medical science and technology (SCMST). As a part of our course curriculum, we have to conduct a research project for the partial fulfillment of the requirement for the degree of B.Sc. in Physiotherapy. My research title is **" Effectiveness of active cycle of breathing Technic in patients with COPD: A Randomized Controlled Trial"** and the aim of the study is to identify the effectiveness of active cycle of breathing Technic in patients with COPD. This is A Randomized Controlled Trial study under the supervisor Md. Forhad Hossain (PT), Lecturer of Physiotherapy SCMST. I have chosen the 250 Bedded TB hospital, Agargaon, Dhaka, Bangladesh to collect data from the elderly people who have COPD.

So, I, therefore, pray and hope that you would be kind enough to give permission for data collection that will help me to complete my study.

Yours Faithfully

Nahida Begum

Nahida Begum
B.Sc. in Physiotherapy (4th Year)
Session: 2019-2020
SCMST, Mirpur-14, Dhaka-1216, Bangladesh.

Address: Saic Tower, M-1/6, Mirpur-14, Dhaka-1206. Mobile: 01936005804
E-mail: simt140@gmail.com, Web:www.saicmedical.edu.bd

Appendix- C

Questionnaire

Assalamualaikum,

I am Nahida Begum, a student of B.Sc. in physiotherapy, 4th year 2019-20 session, at SAIC College of Medical Science & Technology, affiliated with the University of Dhaka under the faculty of Medicine. I am conducting a research program entitled "Effectiveness of Active Cycle of Breathing Technique in COPD Patients**."** In this study, I would like to find out the effect of ACBT for COPD patients.

I would like to request some information regarding your sociodemographic and COPD related questions. Please note that this academic research project will take approximately 20-30 minutes to complete. Participating in this study will not affect your current or future treatment in any way. It is important to mention that the information collected will only be used for academic research purposes, and all your provided data will be kept confidential. In the case of any report or publication, we will ensure that your identity remains anonymous.

Your participation in this study is voluntary, and you may withdraw at any time during this study without any negative consequences. You also have the right not to answer a question you don't like or do not want to answer during the interview.

If you have any questions regarding the study or your rights as a participant, please feel free to contact the investigator Nahida Begum or the research supervisor Md. Forhad Hosen, Lecturer of SCMST, Mirpur-14, Dhaka-1216.

Yes	No

Do you have any questions before I start?

So may I have your consent to proceed with the interview?

Yes	No

Signature of the Participant _____

Date……

Signature of the Interviewer _____

Date……

Signature of the Physiotherapist _____

Date……

PART-1: Socio-Demographic Information

[Please give a tick (√) mark at the left side box of the best correct answer]

Question No	**Questions/ Information on**	Response
1.1	Age	……Year
1.2	Gender	0= Male 1= Female 2= Other
1.3	Marital status	0 =Unmarried 1 = Married 2 = Others
1.4	Educational Qualification	0 = Illiterate 1 = Primary 2 = SSC 3 = HSC 4 = Graduation 5 = Masters or higher
1.5	Occupation	0 = Service holder 1 = Businessman 2 = Housewife 3 = Student 4 = Teacher 5 = Labor 6 = Farmer 7 = Brick field worker 8 = Others
1.6	Living area	0 = Rural 1 = Urban
1.7	Family type	0 = Nuclear family 1 = Extended family
1.8	Access Road	0 = Mud 1 = Brick 3 = Pitch

PART-2: Anthropometric Information

Question No.	Questions	Response of the participants
2.1	Height (উচ্চতা)	…… inch/cm (ইঞ্চি)
2.2	Weight (ওজন)	…… kg (কেজি)
2.3	BMI (বিএমাই)	

Comorbidity Questionnaire for COPD Patients

Sl.	Condition	Yes (✓)	No (✓)	বাংলা (অনুবাদ)
1	Hypertension (High blood pressure)	☐	☐	উচ্চ রক্তচাপ
2	Diabetes mellitus	☐	☐	ডায়াবেটিস
3	Heart disease (e.g., heart failure, IHD)	☐	☐	হৃদরোগ
4	Asthma	☐	☐	হাঁপানি
5	Tuberculosis (past or present)	☐	☐	যক্ষ্মা (বর্তমানে বা অতীতে)
6	Depression or Anxiety	☐	☐	বিষণ্নতা বা উদ্বেগ
7	Osteoporosis	☐	☐	অস্টিওপোরোসিস
8	Chronic kidney disease	☐	☐	দীর্ঘস্থায়ী কিডনি সমস্যা
9	Obesity (BMI ≥ 30)	☐	☐	স্থূলতা (BMI ≥ ৩০)
10	Gastroesophageal Reflux (GERD/Acidity)	☐	☐	অ্যাসিডিটি বা গ্যাস্ট্রিক সমস্যা
11	Stroke or transient ischemic attack (TIA)	☐	☐	স্ট্রোক বা অস্থায়ী ব্রেইন অ্যাটাক
12	Anemia	☐	☐	রক্তশূন্যতা

COPD Assessment Test (CAT) – Pre Test

আইটেম নম্বর	প্রশ্ন	০	১	২	৩	৪	৫
১	আমার কখনো কাশি হয়না → আমি সারাক্ষণ কাশি	☐	☐	☐	☐	☐	☐
২	আমার বুকে একেবারেই কফ (মিউকাস) নেই → আমার পুরো বুকে কফ জমে থাকে	☐	☐	☐	☐	☐	☐
৩	আমার বুকে কোনো টান লাগে না → আমার বুকে প্রচণ্ড টান লাগে	☐	☐	☐	☐	☐	☐
৪	আমি পাহাড় বা সিঁড়ি বেয়ে উঠলেও শ্বাসকষ্ট হয় না → আমি খুব বেশি শ্বাসকষ্ট অনুভব করি	☐	☐	☐	☐	☐	☐
৫	বাসায় আমি কোনো কাজ করতে সীমাবদ্ধ নই → আমি কাজ করতে অনেক সীমাবদ্ধ	☐	☐	☐	☐	☐	☐
৬	আমি আমার ফুসফুসের সমস্যার পরেও বাইরে যেতে আত্মবিশ্বাসী → আমি একদমই আত্মবিশ্বাসী না	☐	☐	☐	☐	☐	☐
৭	আমি শান্তিতে ঘুমাই → ফুসফুসের সমস্যার কারণে আমি শান্তিতে ঘুমাতে পারি না	☐	☐	☐	☐	☐	☐
৮	আমার প্রচুর শক্তি আছে → আমার একদমই শক্তি নেই	☐	☐	☐	☐	☐	☐

(mMRC) Dyspnea Test

Grade	Statement (English)	Statement (বাংলা অনুবাদ)	(✓)
0	I only get breathless with strenuous exercise.	আমি কেবলমাত্র খুব বেশি পরিশ্রম করলে শ্বাসকষ্ট অনুভব করি।	☐
1	I get short of breath when hurrying on level ground or walking up a slight hill.	আমি সমতল রাস্তা ধরে দ্রুত হাঁটলে বা সামান্য উঁচুতে উঠলে শ্বাসকষ্ট অনুভব করি।	☐
2	I walk slower than people of the same age on level ground because of breathlessness, or I have to stop for breath.	আমার বয়সী অন্যদের তুলনায় আমি ধীরে হাঁটি কারণ আমার শ্বাসকষ্ট হয়, অথবা মাঝেমধ্যে থামতে হয়।	☐
3	I stop for breath after walking about 100 meters or after a few minutes on level ground.	আমি প্রায় ১০০ মিটার বা কয়েক মিনিট হাঁটার পর শ্বাস নিতে থামি।	☐
4	I am too breathless to leave the house or I get breathless when dressing or undressing.	আমি এতটাই শ্বাসকষ্টে ভুগি যে বাসা থেকে বের হতে পারি না, অথবা জামা-কাপড় পরা/খোলার সময়ও শ্বাসকষ্ট হয়।	☐

Appendix- D

Gant Chart

Activities/ months	Aug 24	Sept 24	Oct 24	Nov 24	Dec 24	Jan 25	Feb 25	Mar 25	April 25	May 25	Jun 25	July 25
Proposal presentation												
Introduction												
Literature review												
Methodology												
Data collection												
Data Analysis												
Result												
1st progress presentation												
Discussion												
Conclusion & Recommendation												
2nd progress presentation												
Communication with supervisor												
Final submission												