Faculty of medicine

University of Dhaka

Effectiveness of PEP Therapy in Patient with COPD

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Session: 2019-2020

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for acceptance this dissertation entitled. "**Effectiveness of PEP Therapy of Patient with COPD: A Randomized Controlled Trail"** Submitted by **Rakib Hossain Jisan** for the partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy.

DECLARATION

I declare that the work presented here in my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also decline that for any publication or dissemination of information of the study be bound to take written consent of my supervisor.

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LIST OF CONTENT

ACKNOWLEDGEMENT

First of all, I would like to pay my gratitude to Almighty Allah who has given me the ability to complete this project in time with success. The second acknowledgement must go to my parents who have always inspired me for preparing the project properly. I am extremely grateful to my honorable and praiseworthy Supervisor Zahid Bin Sultan (PT), Asst. Professor & Head of Department of Physiotherapy of SCMST. Mirpur-14, Dhaka for giving me his valuable time, his keen supervision and excellent guidance without which I could not be able to complete this project.

I am also very thankful to Dr. Abul Kasem Mohammad Enamul Haque. Principal, SCMST; Md. Shahidul Islam, Associated Professor & Clinical Head Department of Physiotherapy, SCMST: Asma Arzo, Asst. Professor, Department of Physiotherapy. Md. Furatul Haque, Asst. Professor Department of Physiotherapy, Md. Billal Hossain, Lecturer, Department of Physiotherapy, Md. Forhad Hosen, Lecturer, Department of Physiotherapy, Shahid Afridi, Lecturer, Department of Physiotherapy and also all of my respected teachers for helping me in this study.

I wish to thanks to all respectable Physiotherapy staff working at 250 Bedded TB Hospital, Shyamoli, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh, for helping me in collection of my data.

I am grateful to the intern physiotherapists, Department of Physiotherapy, SCMST, Mirpur-14, Dhaka for their support throughout the period of this study. I wish to thank the Management of SCMST and Liberian to find out related books, journals and also access to internet.

Finally, I would like to thanks all the participants who willingly participated as the study population during the conduction of my study and the entire individual who were directly or indirectly involved with this study.

LIST OF ACRONYMS

ACBT Active Cycle of Breathing Technique

BMI Body Mass Index

BMRC Bangladesh Medical Research Council

BP Blood Pressure

CAT COPD Assessment Test

COPD Chronic Obstructive Pulmonary Disease

DU University of Dhaka

FEV_1 Forced Expiratory Volume in 1 second

GERD Gastroesophageal Reflux Disease

GOLD Global Initiative for Chronic Obstructive Lung Disease

LABA Long-Acting β_2-Adrenergic Agonist

LMICs Low- and Middle-Income Countries

LTOT Long-Term Oxygen Therapy

mMRC Modified Medical Research Council (Dyspnea Scale)

NMES Neuromuscular Electrical Stimulation

NIPPV Non-Invasive Positive Pressure Ventilation

NIV Non-Invasive Ventilation

PaO_2 Arterial Partial Pressure of Oxygen

PEP Positive Expiratory Pressure

PR Pulmonary Rehabilitation

RCT Randomized Controlled Trial

SPSS Statistical Package for the Social Sciences

TB Tuberculosis

WHO World Health Organization

LIST OF FIGURES

LIST OF TABLES

ACKNOWLDGEMENT

Introduction: Positive Expiratory Pressure (PEP) Therapy is a type of physiotherapy that involves patients breathing out through a resistive apparatus, forming a positive pressure in the airways and preventing airways collapse, improving collateral ventilation, mucus mobilization, and overall lung operation; it is typically prescribed in treatment of such conditions as cystic fibrosis, COPD, bronchiectasis, and in patients who have undergone surgery to help them clear secretions and avoid complications. **Objectives:** To evaluate the effectiveness of PEP therapy in people with Chronic Obstructive Pulmonary Disease (COPD) at 250 Bedded TB Hospital. **Methodology:** A Randomized Controlled Trial (RCT) was conducted involving 30 participants diagnosed with chronic obstructive pulmonary disease. Participants were divided into two groups: one group was receiving PEP therapy with conventional therapy. Intervention was administered over 24 sessions. COPD assessment test by CAT scale, Level of breathlessness by Dyspnea scale, Functional out come by 6MWT. **Analysis of Data:** Data were analyzed using SPSS version 27, with Man Whitney U test and Wilcoxon Signed Rank test comparing pre and post - intervention scores within and between group. **Result:** Both groups showed significant reduction in CAT scale, Dyspnea scale & 6MWT score experimental demonstrated that slightly better improvement. Post treatment CAT scale score lowers in the experimental group (mean 12.37) compared to the control group (mean 18.63). Post treatment Dyspnea scale score lowers in the experimental group (mean 13.23) compared to the control group (mean 17.77). Post treatment 6MWT scale score lower in the experimental group (mean 19.13) compared to the control group (mean 11.87). **Conclusion:** PEP therapy, combined with conventional physiotherapy, enhance out Comens in patient with COPD offering a promising adjunct to standard care. Further studies should explore long - term effect and refine intervention protocol.

***Key Words**: Chronic Obstructive Pulmonary Disease (COPD), Positive Expiratory pressure (PEP), CAT scale, Dyspnea scale, 6MWT distance.*

CHAPTER – I INTRODUCTION

1.1: Background

Chronic Bronchitis is a progressive breathing illness that causes a decrease in airflow and lung function gradually and is irreversible. Inflammation, airway remodeling, and loss of lung tissue are mainly the consequences of contact to danger issues like smoking, air pollution, and occupational exposures. A short summary of COPD is a disease of the lung considered by breathing difficulty, chronic coughing, sputum construction, and exercise intolerance, significantly limiting value of life and work capacity in persons affected (Brochard et al. 2025, p.9). COPD has been recognized worldwide as one of the ten leading health problems with respect to disease burden. There has been a steady expansion in the understanding of the disease along with some therapeutic advancements, but COPD has become an increasing public health problem, characterized by a growing occurrence, high levels of aggravations, and challenging targeting of late disease stages (Vogelmeier et al. 2020, p.50).

Chronic obstructive pulmonary disease (COPD) is an important worldwide health competition, affecting a valued 391 million cases worldwide, corresponding to a frequency of 10.3% (Adeloye et al. 2022, p.2). Factors such as an elderly population, continued exposure to environmental risk factors, and an increase in global rates of smoking should ensure that the spread of this trend continues, especially over the coming decades. Data from the Global Problem of Disease Learning (Boers et al. 2023, p 12) estimate that by 2050, 592 million individuals across the globe will be affected by COPD. In high-income nations such as the United States and many European countries, chronic obstructive pulmonary disease has a rate that takes plateaued or is decreasing, consistent with reductions in smoking and improved health systems. Even so, in low- and middle-income countries, the disease burden is becoming an even larger burden as more individuals begin smoking, move to urban settlements, (Adeloye et al. 2022, p. 122).

Chronic obstructive pulmonary disease (COPD) remains among the leading causes of mortality worldwide and the third leading cause of death globally, according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) report. It is responsible for nearly 3 million deaths each year. This is a staggering number, and it reflects to us

how necessary our global efforts serving as both prevention and treatment for this disease are. Moreover, COPD exacerbations, which are usually provoked by infection or environmental factors, contribute to a rise in hospitalization and well-being maintenance costs. In addition to healthcare costs, the disease leads to substantial indirect economic loss due to early disability and absenteeism (Boers et al. 2023, p.10).

This condition progresses through a complicated cycle that includes inflammation, airway obstruction, and lung tissue injury. Inflammation pattern in COPD progression is characterized by chronic inflammation, which results in neutrophil, macrophage, and T-cell accumulation in the airway and lung parenchyma. Inflammation Chronic airway reactivity from inflammatory response, which narrows the bronchial airways, causing subsequent chronic excesses (fibrosis and mucus hypersecretion along with smooth muscle hypertrophy). These types resulting in obstruction of air flow and increased resistant to breathing (Wedzicha et al. 2016, p. 200).

Although not as well-known as airway disease, emphysema is also a contributor to the pathobiology of COPD. The loss of alveoli surface area is emphysema, and the demolition of alveolar walls decreases gas exchange capacity. The lungs become incapable of effectively pushing air out; this impairment is also due to wasting of lung tissue. This phenomenon subsequently leads to air trapping on expiration, causing dynamic hyperinflation and the sensation of breathlessness (Rabe et al. 2025, p. 14). This abnormal air clearance from the lungs is a major donor to the hallmark symptom of palpitation, significantly impairing the ability to perform physical activity and exercise tolerance. (Baughman et al. 2021, p. 101).

Crucially, it is now recognized that beyond the lung, COPD is a multisystem disorder with systemic effects. These include cardiovascular problems such as core pulmonale (right-sided heart failure), muscle wasting, osteoporosis, and metabolic disorders. Such comorbidities impact the complete survival and value of lifecycle of patients. Indeed, this systemic inflammation, owing to mediators such as cytokines released from lungs, plays a important part in the pathophysiology of these comorbidities then even substantially contributes to the aggravation of CSPD (Vogelmeier et al. 2020, p. 5).
Chronic Obstructive Pulmonary Disease is a mixed condition defined by insistent respiratory system dysfunction that is related through variety of modifiable and non-

modifiable danger issues. COPD is mainly due to cigarette smoking (the first cause of COPD, 80%-90% of COPD in high-income countries (Adeloye et al. 2022, p. 7). Smoking causes chronic oxidative stress and airway remodeling through direct destruction of airway epithelium and alveolar walls. In addition, it also turns off the lung clearance mechanisms and leaves the lung inclined to multiple poisons, which together aggravate the illness (Barnes 2016, p. 9).

In addition to smoking, environmental pollutants, i.e., inside air pollution after biomass burning and outdoor air trash, are notable risk factors for COPD, particularly in little- and middle-income nations (Boers et al. 2023, p.8). This covers occupational exposures to dust, fumes, and chemicals, which have been found to be a important danger issue, especially among mine, construction, and textile manufacturing workers (Gershon et al. 2019, p.1). More recent evidence, however, has emphasized air pollution, either ambient (Yang et al. 2020, p. 3) or indoor related (Karanika-Murray et al. 2020, p.243), as a substantial component of the worldwide problem of COPD.

Other risk factors Family history Alpha-1 antitrypsin absence is a occasional, but significant, hereditary reason of childhood-onset pulmonary emphysema (Silverman, 2020 p.6). Similarly, recurrent respiratory infections in childhood, low birth weight, and smoke and/or environmental pollutants during early life could serve as risk factors for the development of COPD in later years (Vogelmeier et al. 2020, p.3).
Treatment of COPD includes a combination of drug therapy, non-drug therapy, and ventilatory support. Specific goals of therapy are for symptom relief, preservation of lung function, prevention of worsening, and improvement in value of lifecycle (Toren et al. 2024, p.16).

Bronchodilators are the support of pharmacotherapy for bronchodilation, improving airflow and reducing symptoms. β2-adrenergic agonists (LABAs) and long-acting muscarinic antagonists (LAMAs) are first-line bronchodilators used in the maintenance treatment of stage II COPD. LAMA drugs are well documented to improve lung function, symptoms, and exacerbation rates (Rabe et al. 2025, p. 15). This population of patients with reasonable to simple disease has added symptomatic controlled ability and lower risk of exacerbation with LABA/LAMA combination therapy than with monotherapy (Wedzicha et al. 2016, p.13).

Inhaled corticosteroids (ICS) are given to patients with recurrent exacerbations or those with evidence of eosinophilic irritation. They reduce airway inflammation and contribute to the prevention of exacerbation frequency, but long-term usage comes with an enhanced pneumonia risk (Agusti et al. 2018, p. 14). Phosphodiesterase-4 inhibitors are used for patient role with long-lasting bronchitis and repeated exacerbations, such as roflumilast; they contribute to decreased airway crossness and aggravation prevention (Baughmen et al. 2021, p. 34).

However, pharmacological therapies are not the sole treatment of COPD; pulmonary rehabilitation is this disease's analogous and most fundamental treatment. Methods This is a multidimensional package consisting of exercise drill, breathing exercises, education, and psychosocial support. Workout volume, dyspnea level, and value of life improve in patient role with COPD in pulmonary rehabilitation (McCarthy et al. 2015, p.12). Further, it is imperative in cases of chronic hypoxemia that adequate oxygen saturation in patients is maintained to prevent harmful effects like cardiac dysfunction, thus necessitating longstanding oxygen therapy (McCarthy et al. 2015, p.200).

Acute exacerbations or respiratory failure most often require ventilatory support. Noninvasive ventilation: NIV has become the new usual care for COPD patients with serious hypercapnic breathing letdown. Because of its noninvasive character, NIV improves gas exchange, minimizes the need for intubation, and lowers the risk of death due to exacerbations. (Brochard et al. 2025, p.9), for COPD patients. Furthermore, further significant research about the role of early intervention and preventive strategies for potentially reducing COPD incidence and severity is necessary to mitigate the growing worldwide COPD disease burden (Vogelmeier et al. 2020, p.2).

American Lung Association has mortality statistics that indicate that additional females than males currently pass away of COPD annually, despite their higher prevalence in men. Such an epidemiological change implies that rehabilitation and self-management interventions such as PEP therapy should be available to both genders and clinicians should be sensitive to underdiagnosis in women (Xu et al. 2023, p.6). COPD pathophysiology includes limitation of the expiratory flow, dynamic hyperinflation, and mucus retention. PEP therapy directly aims at these mechanisms. PEP: By establishment of back-pressure on exhalation, the following, small airways dilate,

lowering the collapse and trapping of gases. Enhances collateral ventilation and secretion mobilization (Liu et al. 2022, p.9).

Enhances ventilatory efficiency, exercise performance and symptoms.These are validated by recent trials. Rendering to the study led by Nicolini et al. (2017, p.897), temporary PEP proved to be a significant reduction in exacerbations compared to controls in the 1-3 months (Kenis-Coskun et al. 2022, p.199). showed the improvement of low-cost bottle-PEP added to breathing exercises in 6-minute walk distance after three months. According to (Xu et al. 2023, p.6), long-term domiciliary PEP was safe and resulted in long-term improvements in both dynamic hyperinflation and patient-reported outcome.

Systematic reviews support these findings. An update Cochrane review has indicated PEP-based airway clearance methods to be safe and potentially offer more short-term benefit than alternatives, especially in hypersecretory phenotypes (Lee et al. 2021, p.12). Similar moderate positive changes were observed in the signs and excellence of lifespan reported by (Moran et al.2021, p.18). PEP, therefore, is an inexpensive, scalable, and simple addition to COPD care- especially in high prevalence and low accessibility to specialist rehabilitation settings. early relevant in settings with high prevalence and limited access to specialist rehabilitation

1.2Justification:

Chronic Obstructive Pulmonary Disease remains one of the main public health challenges worldwide, contributing significantly to illness, disability, and premature death. Affected role with COPD often involvement difficulties such as poor lung function, excessive mucus retention, breathing difficulty, and a decline in overall quality of life. Positive Expiratory Pressure (PEP) therapy has been recommended a simple, non-invasive technique to progress breathing, promote mucus clearance, and possibly reduce the regularity of exacerbations. Although this technique is increasingly being used in clinical settings, its effectiveness in COPD patients is not yet well established. For this reason, I have chosen to conduct this study to generate more reliable evidence and to explore whether PEP therapy can show a meaningful part in the organization of COPD. Although PEP therapy has been studied in other respiratory conditions such as cystic fibrosis, here is still inadequate evidence regarding its benefits for COPD patients. The available studies are often inconsistent, with differences in sample size, treatment protocols, and measured outcomes, making it difficult to draw strong conclusions. Another noticeable gap is the lack of research conducted in low- and middle-income countries, where the burden of COPD is high but resources are limited. Additionally, many existing studies focus mainly on clinical or physiological outcomes, while aspects such as patient comfort, adherence to treatment, and improvements in day-to-day quality of life have received less attention. These gaps highlight the necessity for further investigate to clarify the true impact of PEP therapy in COPD management. This research has the potential to make important contributions both clinically and socially. From a clinical perspective, it may provide evidence on whether PEP therapy can help progress lung function, reduce secretion buildup, and lessen the rate of COPD flare-ups. The results could also support the growth of clearer, evidence-based guidelines for physiotherapists and other health care professionals. On a broader level, if PEP therapy is proven effective, it might decrease hospital charges and health care charges associated with COPD, which would be highly beneficial for both patients and health systems. Beyond clinical outcomes, the study also aims to shed light on patient-centered benefits, such as improvements in mobility, independence, and overall quality of life.

1.3: Research Question:

Is PEP Therapy effective in patients with COPD?

1.4 Aim:

The aim of this study was to find out the effectiveness of PEP therapy in patient with COPD.

1.5: Objectives

1.5.1: General Objective

- To evaluate the effectiveness of PEP therapy in patient with Chronic Obstructive Pulmonary Disease (COPD).

1.5.2: Specific Objectives

- To compare the baseline characteristic of the participants between the experimental and control group.
- To explore the level of breathlessness by Dyspnea scale before and after intervention between the experimental and control group.
- To identify the level of disease impact by CAT scale before and after intervention between the experimental and control group.
- To evaluate the improvements of functional status by 6MWT before and after intervention between experimental and control group.
- To determine the association between socio demographic characteristic and CAT scale.
- To find out the association between socio demographic characteristic and Dyspnea scale.

1.6 Statement of Hypothesis

Null hypothesis (H_0):

PEP therapy along with conventional therapy is not effective than only conventional therapy in patients with COPD.

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

Alternative Hypothesis (H_1):

PEP therapy along with conventional therapy is effective than only conventional therapy in patients with COPD.

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

Here,

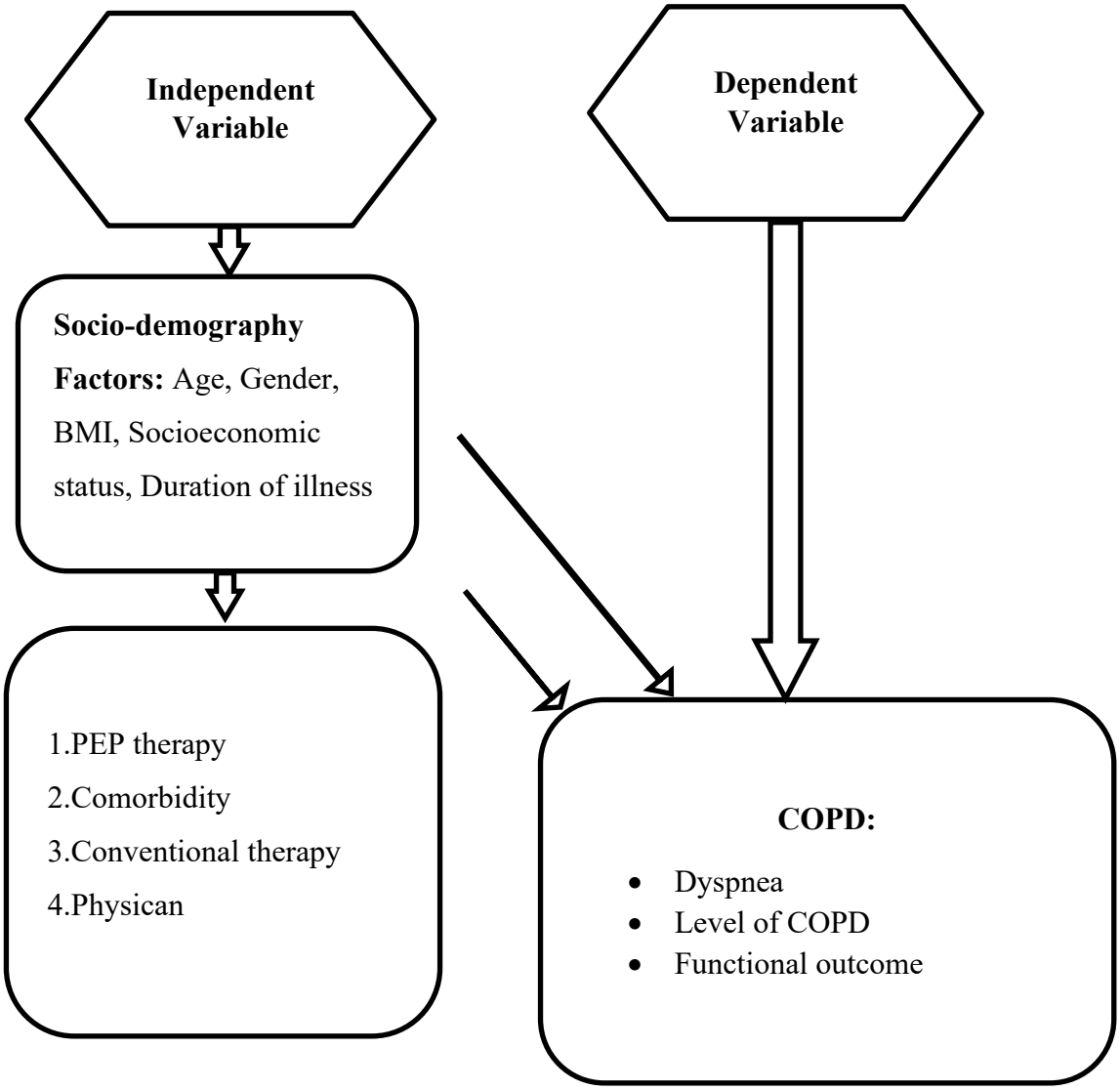
Ho = Null hypothesis

Ha = Alternative hypothesis

μ_1 = Mean of population 1

μ_2 = Mean of population 2

1.7: CONCEPTUAL FRAMEWORK



1.8: Operational Definition

PEP therapy:

Positive Expiratory Pressure (PEP) therapy is a breathing treatment that benefits get clear of secretion in the lungs by making the patient breathe out against resistance with a special device. When you breathe out, this resistance makes the airways have positive pressure, which helps keep them open and move mucus toward the larger airways, anywhere it can be coughed up more easily. Persons with cystic fibrosis, bronchiectasis, and chronic obstructive pulmonary disease (COPD) often use PEP therapy to help their lungs work better and lower their risk of getting sick.

COPD (Chronic Obstructive Pulmonary Disease): COPD is a lung illness categorized by chronic obstruction of lung airflow that interferes with normal breathing and is not fully reversible.

Pulmonary Disease: Pulmonary disease is characterized by chronic typically irreversible airway obstruction resulting in a slowed rate of exhalation.

Pulmonary Function: Pulmonary function means Lung function, defined as the exchange of oxygen and carbon dioxide between the blood and the air within the lungs.

Dyspnea:

Dyspnea is the sensation of breathlessness or impaired breathing. Many people say they feel like they don't get enough oxygen or that they have to work harder to breathe. This is a common sign. This can happen all at once or over time, and it is commonly caused by problems with the heart or lungs, like asthma, COPD, heart failure, or even worry.

6MWT:

The Six-Minute Walk Test is a physical test that measures how faraway someone can walk in six minutes on a flat, tough surface. It helps doctors see how fit and strong a person is. They often use it to check on people with COPD, heart failure, or pulmonary hypertension, which are all problems with the heart or lungs. It shows how healthy your heart, lungs, and muscles work together when you work out. People usually use it to keep track of their progress during therapy or rehab.

CHAPTER – II LITERATURE REVIEW

2.1 Introduction to COPD

It is widely accepted that chronic obstructive pulmonary disease is a destructive and progressive lung disease and is a chief cause of morbidity and mortality around the globe. It takes remained recognized as the 3rd top worldwide cause of death, with an estimated 3.23 million deaths each year (World Health Organization, 2020, p. 4). As of 2019, over 391 million people worldwide have COPD among adults aged 30-79 years old, which equates to a 10.3 percent prevalence (Adeloye et al. 2022, p. 5). Some estimates estimate that this number will reach almost 592 million cases by 2050 due to aging populations and continuous exposure to danger factors, e.g., cigarette smoking and biomass fuel exposure (Boers et al. 2023, p.5).

The burden of COPD on society and the economy goes beyond its occurrence. As it continues to be one of the most mutual motives for hospital admissions, it leads to prolonged inpatient stays, increased rates of readmissions, and a considerable financial problem on the health care organization (Gershon et al., 2019, p. 10,24).

COPD is an ever-advancing disease with deterioration of lung function, the accompanying sensation of breathlessness (dyspnea), and exercise tolerance with a great compromise in the quality of life. Hence, COPD is a disease with a high comorbidity problem, especially with cardiovascular disease, osteoporosis, and depressive disorders (Vogelmeier et al. 2020 p.3).

Against this ventilatory aids such as positive expiratory pressure (PEP) therapy have gained increasing interest. PEP devices are designed to reduce dynamic hyperinflation (DH), improve airway clearance, and enhance exercise performance (Padkao et al. 2018, p.4). As the occurrence of COPD continues to growth globally, the exploration of innovative interventions, including low-cost alternatives such as Bottle-PEP, becomes increasingly relevant (Kenis-Coskun et al. 2022, p.195).

2.2 COPD definition and pathophysiology

COPD is a mutual, unnecessary, and correctable disease characterized by persistent respiratory symptoms and airflow restriction due to abnormality of the air route and the alveoli which are almost always caused by significant exposure to noxious elements or airs (Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD), 2021, p. 2). Chronic obstructive pulmonary disease (COPD) comprises features of chronic bronchitis and emphysema, with most patients demonstrating features of both (Barnes, 2016, p. 17).

The pathophysiology of COPD is characterized by airway inflammation, obstruction of airflow, and damage to lung parenchyma. Inhalation of noxious agents such as tobacco smoke and biomass fuels leads to an inflammatory response that causes bronchoconstriction, mucus hypersecretion and destruction of alveolar walls (Barnes, 2016, p. 11), which impairs gas exchange. Progressive loss of airway function occurs due airway remodeling due to infiltration of inflammatory cells, followed later by fibrosis, smooth muscle hypertrophy and mucus gland hyperplasia, resulting in irreversible airflow limitation (Gershon et al. 2019, p.8)

More recent studies have hint at the idea that COPD can also be a systemic disease. Introduction Chronic systemic inflammation is related with muscle wasting, cardiovascular disease, and diabetes, which leads to increased morbidity and poor prognosis in COPD (Vogelmeier et al. 2020, p. 7). Hence, the handling of COPD must comprise the treatment of both pulmonary and systemic aspects of this disease (Barnes et al. 2016, p.17)

2.3 Epidemiology and Global Prevalence

Chronic obstructive pulmonary disease (COPD) is a main contributor to the global illness burden, with known regional variation in prevalence. Group-based global burden of disease (GBD 2019) study with COPD prevalence for adults' years rate at 10.3% in 2019 and COPD cases globally at 391.9 million (Adeloye et al. 2022, p. 5). Demographic changes and continued contact to risk reasons such as smoking and air pollution is responsible for an increase in the prevalence this is predictable to grow to 592 million people by 2050 (Boers et al. 2023, p. 2).

COPD remains the third most frequent cause of death on the planet, accounting for >3.23 million deaths annually (World Health Organization, 2020, p. 4). Over 90% of

deaths due to COPD are in low- and middle-income countries (Salvi & Barnes, 2017,2016 p.733 p.16) due to higher burden from low access to health and infrastructure and continued home exposure to biomass oils for cooking and heating. In these areas smoking and workplace exposures are only part of the story although non-cigarette indoor air pollution with continuing high prevalence in western India and other less developed parts of the world is an important driver of COPD risk which is increasing in these regions (Silverman et al. 2020, p. 20).

Geographic and demographic variations in obesity rates. The rates of COPD are higher in North America and Europe due to smoking being widespread, although the association with exposure is less concerning than South Asia and Sub-Saharan Africa, where a stronger association has been reported with indoor air trash due to biomass fuel use (Kurmi et al. 2019, p. 1716). There is now also a change in the gender ratio of COPD. COPD was previously recognized as a disease mainly among men, however, the prevalence of COPD in females is rising world-wide in regions where biomass fuel (Wang et al. 2024, p.8) and smoking are common.

2.4 Risk Factors and Causes of COPD

Chronic obstructive pulmonary disease (COPD) is a complex clinical condition with multiple environmental, behavioral, and genetic determinants.

1. **Tobacco Smoking**

   Cigarette smoking is the most imperative risk factor for this disease, accounting for about 80–90% of the cases in high-income countries (Salvi and Barnes, 2017, p. 733). High and extended smoking exposure increases the risk of COPD in proportion to the amount consumed; the risk of COPD in long-term users is two- to three-fold that of non-smokers (Vogelmeier et al. 2020, p.12)

2. **Biomass Fuel Exposure**

   Household air pollution from the practice of solid energies (wood, coal, dung, and crop residues) for cooking in low- and middle-income countries is a leading risk factor. Households that use solid fuels, especially in rural settings, expose their women and children to high concentrations of pollutants, and this helps explain a high fraction of non-smoker COPD (Kurmi et al. 2019, p. 17, 18).

3. **Occupational Exposure**

   Exposure in the workplace to dusts, vapors, and chemical fumes like those found in mining, agriculture, and construction raises COPD risk. Occupational exposures are thought to account for 15–20% of global cases of COPD (Toren, 2024, p. 16,56).

4. **Air Pollution**

   Long-term exposure to outdoor air poisons, such as particulate matter (PM2.5) and NO_2, has been associated with higher prevalence and exacerbations of COPD.

5. **Genetic Susceptibility**

   Of all genetic risk factors for COPD, deficiency of alpha-1 antitrypsin is the most well-defined and represents 1–5% of patients (Silverman, 2020, p. 15). Affected patients usually develop emphysema at a young age.

6. **Respiratory Infections**

   It has been suggested that frequent respiratory infections in childhood induce airway obstruction and abnormal lung growth, and that this could lead to a higher risk of adult COPD (Lange et al. 2015, p. 49).

   Hence, the interaction of environmental exposures with genetic predispositions leads to COPD, with smoking and air pollution being the most important modifiable risk factors.

2.5 Clinical Features and Assessment Tools

We use the term COPD to mention to a combination of respiratory symptoms, functional impairments, and exacerbations of breathlessness. Dyspnea (shortness of breath), chronic cough, and sputum production are among its key symptoms (Vogelmeier et al. 2020, p. 3). Dyspnea, in particular, is the most distressing symptom and is strongly linked with impaired value of life and decreased physical activity.

Aggravations, severe worsening of respiratory indications necessitating intensified therapy, are common in COPD and are linked to accelerated lung function failure, improved hospitalization, and increased mortality.

A few tools are used to assess severity and monitoring of disease progression, including the following:

• **Output quality of spirometry:** As per the GOLD definition, post-bronchodilator FEV1/FVC < 0.70 (hourglass term) (GOLD, 2021, p. 5) is considered to be the gold standard diagnosis.

• **COPD Assessment Test (CAT):** An 8-item instrument to assess health status, with a high score representing a high level of burden of symptoms (Jones et al. 2016, p. 230).

• **Modified Medical Research Council (mMRC) scale:** A 5-point scale to assess the impact of dyspnea.

• **Six-Minute Walk Test (6MWT):** assessed by measuring the distance a patient was able to walk in six minutes, 6MWT is an objective measure of workout tolerance and functional status in COPD patients.

• **BODE Index:** A multidimensional scale measuring Body mass index (B), airflow obstruction (O), dyspnea (D), and exercise capacity (E) as predictors of prognosis.

When combined with these varying assessment tools, clinicians can control the severity of disease, predict outcomes, and customize management strategies.

2.6 Current Management Approaches

The management of COPD is complex and contains pharmacologic, non-pharmacological, and ventilatory interventions. This goal is not only to relieve symptoms but also to decrease the number of exacerbations, improve the functional capacity, and improve the quality of life (Vogelmeier et al. 2020, p. 3). Treatment strategies are generally constructed on the severity of airflow limitation, the intensity of signs, and exacerbation history.

2.6.1 Pharmacological Interventions

Despite clinical practice changes introduced in the recent GOLD strategy cycle, pharmacological therapy continues to be a mainstay of the management of COPD, with bronchodilators, inhaled corticosteroids (ICS), and the long-term maintenance of all three treatment modalities being the focus of care. Long-acting bronchodilators, including long-acting β2-agonists (LABAs) and long-acting anticholinergic agents (LAMAs), are the first step in pharmacological management in patients expected to benefit from improved airflow, decreased symptoms, and decreased exacerbation risk (Rabe et al. 2025, p. 157). In severe COPD, combination therapy with LABA/LAMA however provided greater symptomatic control (Wedzicha et al. 2025, p. 967).

In patients with normal exacerbations and markedly raised eosinophil counts, combinations of an inhaled corticosteroid (ICS) and a long-acting beta agonist (LABA) reduce airway inflammation and the risk of hospitalization (Agusti et al. 2018, p. 117). But long-term ICS therapy may increase the risk of pneumonia (Yang et al. 2020, p. 187). Other agents include phosphodiesterase-4 inhibitors that can decrease inflammation in individuals with chronic bronchitis and frequent exacerbations (Baughman et al. 2021, p. 25). Macrolides, including azithromycin, are also effective in stopping exacerbations in specific patients (Albert et al. 2017, p.690).

2.6.2 Non-Pharmacological Interventions

Along with pharmacological measures, non-pharmacological measures are of great status in the holistic remedy of COPD. It is the most powerful approach for halting the evolution of the disease, as it contributes to a fall in lung function decline and enhances survival (Anthonisen et al. 2017, p. 1565). In addition to smoking cessation, vaccination against influenza and pneumococcal infections is suggested, as these can trigger a significant frequency of exacerbations (Karner, 2017, p. 142).

Pulmonary rehabilitation (PR) is thought to be one of the pillars of management and comprises exercise training, education, and behavior support. It is well established that exercise-based pulmonary rehabilitation (PR) improves exercise acceptance, reduces dyspnea, and results in improved quality of life (McCarthy et al. 2015, p. 210). Patients with severe resting hypoxemia ($PaO_2 \leq 55$ mmHg) should be treated by long-term oxygen therapy (LTOT), as it improves survival when given for a minimum of 15 hours per day (Nocturnal Oxygen Therapy Trial Group, 1980, p. 683). For patients with comorbid depression and anxiety, nutritional support and psychosocial counseling also play a role in making positive impacts (Yohannes et al. 2017, p. 97).

2.6.3 Ventilatory Strategies

Current research has emphasized the role of positive expiratory pressure (PEP) therapy as an effective ventilatory strategy for patients with chronic obstructive pulmonary disease (COPD), particularly in reducing dynamic hyperinflation and easing exertional dyspnea. By maintaining airway pressure during exhalation, PEP prevents premature airway collapse, improves gas exchange, and supports more efficient ventilation, especially during exercise. Clinical trials have shown that its use after physical activity accelerates recovery of inspiratory capacity and reduces breathlessness, enabling

patients to tolerate greater training volumes in pulmonary rehabilitation (Padkao et al. 2018, pp. 2–4).

Long-term approaches, such as bottle-PEP, have been investigated as affordable and accessible options, representative improvements in exercise volume and quality of life, even if pyrometric gains remain modest (Kenis-Coskun et al. 2022, pp. 196–198). More advanced modalities, including oscillatory and temporary PEP devices, have also been reported to redistribute lung volumes, reduce hyperinflation, and improve ventilatory patterns in severe COPD cases (Nicolini et al. 2017, pp. 2–4). Furthermore, combining PEP with adjunctive techniques, such as Russian current stimulation, has yielded superior outcomes in muscle strength, functional performance, and symptom control compared with PEP alone, suggesting that integrated interventions may further optimize respiratory mechanics in this population (Habib et al. 2024, pp. 50–52). Collectively, these findings confirm that PEP therapy, whether applied independently or alongside other methods, offers a valuable and versatile ventilatory strategy for managing dyspnea, supporting exercise tolerance, and enhancing pulmonary rehabilitation in COPD.

2.7 Positive End-Expiratory Pressure (PEP) Therapy

2.7.1 Mechanism of Action of PEP

In COPD, small-airway collapse, flow limitation and mucus hypersecretion drive dynamic hyperinflation (DH) and dyspnea. PEP devices impose a resistive load during expiration that raises intraluminal pressure, shifts the equal-pressure point peripherally, and helps splint small airways open; this increases expiratory time and alveolar ventilation, improves collateral ventilation, and facilitates secretion mobilization—particularly when oscillations are added (OPEP) to reduce mucus viscoelasticity (Nicolini et al. 2017, pp. 2–3; Kenis-Coskun et al. 2022, p. 196–197)

PEP can therefore redistribute ventilation, modestly increase functional residual capacity in a therapeutically controlled way, and enhance aerosol deposition when used with drug delivery

2.7.2. The use of PEP in patients with COPD is discussed in this section.

Clinically, PEP may be deployed in several ways. First, as a post-exercise recovery strategy to unload DH and reduce symptoms: a randomized, placebo-controlled trial found that brief post-exercise extrinsic PEP reduced Borg dyspnea and the magnitude of DH (inspiratory capacity fall) compared with sham, although walking endurance itself did not improve with PEP during the exercise bout (Padkao et al. 2018, pp. 2–4, 6).

Second, as a home-based adjunct to standard breathing retraining: a six-month single-blind RCT of "bottle-PEP" (≈10 cmH_2O water-column) added to diaphragmatic and thoracic expansion exercises reported within-group gains in 6-min walk distance at 3 and 6 months and short-term improvements in CAT/SGRQ scores, but no superiority versus breathing exercises alone (Kenis-Coskun et al. 2022, pp. 195–198, 203).

Third, device-specific airway-clearance approaches can be considered in hypersecretory phenotypes: in severe–very severe COPD, a 26-week RCT showed both T-PEP and O-PEP improved dyspnea scales and health-status measures; only T-PEP reduced exacerbations versus control, and both were well tolerated (Nicolini et al. 2017, p. 1, pp. 1–2).

finally, combined ventilatory/muscle strategies may amplify benefit: adding neuromuscular electrical stimulation ("Russian current") to threshold-PEP three times weekly for 10 weeks yielded greater improvements in expiratory muscle strength, dyspnea and 6-MWT distance than threshold-PEP alone in moderate COPD (Habib et al., 2024, pp. 50–53)

2.7.3 Risks and Limitations of PEP Related to its uses

Adverse events are uncommon when PEP is applied in stable COPD under supervision; in the 6-month bottle-PEP RCT, one infective exacerbation occurred per group and no therapy-related unwanted effects were reported (Kenis-Coskun et al. 2022, p. 201). Nevertheless, several limitations temper routine use. Efficacy versus active comparators: bottle-PEP was not superior to structured breathing exercises for functional or quality-of-life outcomes, and neither approach changed spirometry significantly (Moran et al. 2021, pp. 10–14).Passive PEP during walking offered no endurance benefit and was associated with worse SpO_2 compared with sham in one trial, arguing against using PEP on the move for performance gains (Padkao et al., 2018, p. 6).

Device issues and hygiene: low-cost assemblies (e.g., bottle-PEP) are attractive where access to commercial devices is limited, but require patient training and meticulous cleaning; investigators cautioned that infection control outside study conditions may be inadequate effects vary by device (e.g., T-PEP vs O-PEP) and phenotype (hypersecretory vs emphysematous), trials are modest in size, and long-term mechanistic outcomes (e.g., lung volumes) are often not assessed (Nicolini et al., 2017, pp. 7–8; Kenis-Coskun et al. 2022, p. 203).

2.8 Previous Studies on PEP in COPD Patients

Across contemporary trials, PEP has shown symptom and physiology benefits in targeted scenarios but mixed effects on endurance or spirometry. demonstrated that post-exercise PEP reduced dyspnea and DH versus sham, while PEP during walking conferred no endurance benefit and could depress oxygen saturation (Padkao et al. 2018, pp. 2–4).

In home rehabilitation, found bottle-PEP plus breathing retraining improved 6-MWD within-group but was not superior to breathing exercises alone and did not change spirometry, although it was safe and feasible .Device-specific trials suggest differential effects: in severe COPD, both T-PEP and O-PEP improved dyspnea and strength position, but only T-PEP reduced exacerbations over 26 weeks, supporting airway-clearance-focused PEP in hypersecretory disease (Lin et al. 2019, pp. 8–10).

Finally, coupling ventilatory loading (threshold-PEP) with peripheral or respiratory muscle facilitation enhances outcomes: reported larger improvements in expiratory muscle power, dyspnea and 6-MWD when Russian-current NMES was added to threshold-PEP compared with PEP alone (Habib et al. 2024, p. 50).

Overall, contemporary evidence supports PEP as a targeted ventilatory strategy effective to relieve post-exercise DH, assist secretion management, and train expiratory muscles (particularly when combined with NMES or structured breathing) while highlighting the need to match device and timing to patient phenotype and to pay attention to training, hygiene and adherence (Koutsoukou et al. 2021, pp 120-123).

2.9 Research Gaps and Future Directions

Although positive expiratory pressure (PEP) therapy has gained increasing recognition as a ventilatory strategy for patients with COPD, several gaps remain that limit its wider clinical implementation. One key issue is the lack of phenotype-specific evidence.

Current trials rarely distinguish between COPD patients with predominantly emphysematous disease and those with chronic bronchitis or high secretion burden. (Nicolini et al. 2017, pp. 2–3) emphasized that oscillatory PEP (O-PEP) and temporary PEP (T-PEP) devices may act through different mechanisms, yet the literature has not clarified which subgroups benefit most from each device type. This gap underscores the need for tailored therapeutic methods slightly than a one-size-fits-all application of PEP.

A further limitation relates to the duration and scale of existing studies. Most clinical trials remain relatively short, often lasting between two weeks and six months, and typically involve modest sample sizes. For example, the home-based bottle-PEP study conducted by (Kenis-Coskun et al. 2022, p. 200).

Exposed improvements in exercise tolerance and quality of life, but the benefits plateaued after a few months and spirometry measures remained unchanged. Larger, multicenter lessons with extended follow-up are therefore required to assess whether PEP has a sustained impact on exacerbation rates, hospital admissions, and disease progression over a period of 12 months or more (Moran et al. 2021, p.15).

Another important area concerns the management of acute exacerbations of COPD While non-invasive ventilation (NIV) is the established standard for acute NIV is unavailable or poorly tolerated. reported that the use of in emergency section settings better-quality lung function (FEV1 and FVC) and reduced hospitalization compared with standard care, highlighting the potential of PEP during acute episodes. However, these findings are based on single-center studies and require confirmation through larger, controlled trials before PEP can be formally integrated into exacerbation protocols. (Sarcan et al. 2025, pp. 4–5).

Emerging novel device formats also warrant further exploration. For instance, evaluated the “PEP-Buddy”, a hands-free device designed for use during walking and daily activity, reporting significant developments in dyspnea and superiority of life. While such innovations are appealing for enhancing patient adherence, the evidence is limited to early feasibility studies. More rigorous trials comparing these new designs with conventional devices are essential to determine whether they deliver genuine long-term ventilatory advantages. (Zafar et al. 2023, pp. 3–4).

There is also a promising case for multi-modal rehabilitation strategies.) demonstrated that combining threshold PEP with neuromuscular electrical stimulation (NMES) yielded greater gains in expiratory muscle strength and six-minute walk distance

compared with PEP alone. This suggests that integrating PEP with other rehabilitation modalities such as inspiratory muscle training or structured pulmonary rehabilitation programs could optimize outcomes by targeting both ventilatory mechanics and peripheral muscle performance. (Habib et al. 2024, pp. 52–53).

Finally, a major research gap lies in the integration of technology and telehealth into PEP therapy. Current studies have relied heavily on supervised clinical settings, but adherence in unsupervised home use is less well documented. Incorporating wearable sensors or AI-driven feedback systems could allow real-time monitoring of breathing patterns, adherence, and early exacerbation warning signs (Xu et al. 2023, pp. 5–6). Noted that PEP effectively reduced dynamic hyperinflation in short-term rehabilitation, but acknowledged that more sophisticated, technology-assisted interventions will be required to sustain benefits in everyday life. (Padkao et al. 2018, p.5).

In summary, future directions for research should priorities larger and longer trials, stratification of COPD patients by phenotype, robust evaluation of PEP during acute exacerbations, comparative studies of new device designs, and the integration of multi-modal rehabilitation and telehealth technologies. Addressing these gaps will be essential to establish PEP as a mainstream ventilatory strategy with clear evidence-based guidance for clinician.

CHAPTER – III METHODOLOGY

3.1 Study Desing

The study design was Randomized Controlled Trial (RCT). This design was best for comparing the effectiveness of PEP therapy in patients with COPD.

3.2 Study Place

The present study was conducted at Saic College of Medical Science and Technology (SCMST), Mirpur-14, Dhaka-121

3.3 Study Area

Study place at 250 Bedded TB Hospital, Shyamoli, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh.

3.4 Study Period

The study period was 1 year from the July 2024 to July 2025.

3.5 Study Population

A population refers to the entire group of people or items that meet the criteria set by the researcher. The populations of this study were COPD patients.

3.6 Sampling Technique

Convenience sampling technique was adopted to select the patients with effectiveness of PEP therapy in patients with COPD, 250 Bedded TB Hospital, Shyamoli, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh. After that, the patients were screened based on the criteria for inclusion. The patients who met the criteria for inclusion were included. After by using lottery method was used to allocate the participants into the experimental and control groups.

3.7 SAMPLE SIZE

Sample size is calculated by following equation,

$$n = \frac{2\,SD^2\,(Z\,{}^{\alpha}/_{2} + Z\beta)^2}{d^2}$$

$$= 2 \times (9.26)^2 \frac{(1.96+0.84)^2}{(8.59)^2}$$

$$= 2 \times 85.74 \frac{7.84}{73.78}$$

$$= 171.49 \times 0.10$$

$$= 18.22$$

Here,

Standard deviation = 9.26 (Zafar et al. 2023, p. 407)

From Z table type 1 error of 5% $Z\alpha$= 1.96

From Z table 80% power $Z\beta$ = 1.64

Effect size difference between mean values = 73.78 (Zafar et al. 2023, p. 407)

n = number of sample size

Consort Flow-chart of the phases of randomized control trial design

Randomly select 54 Patients with COPD Inpatient at 250 Bedded TB Hospital.

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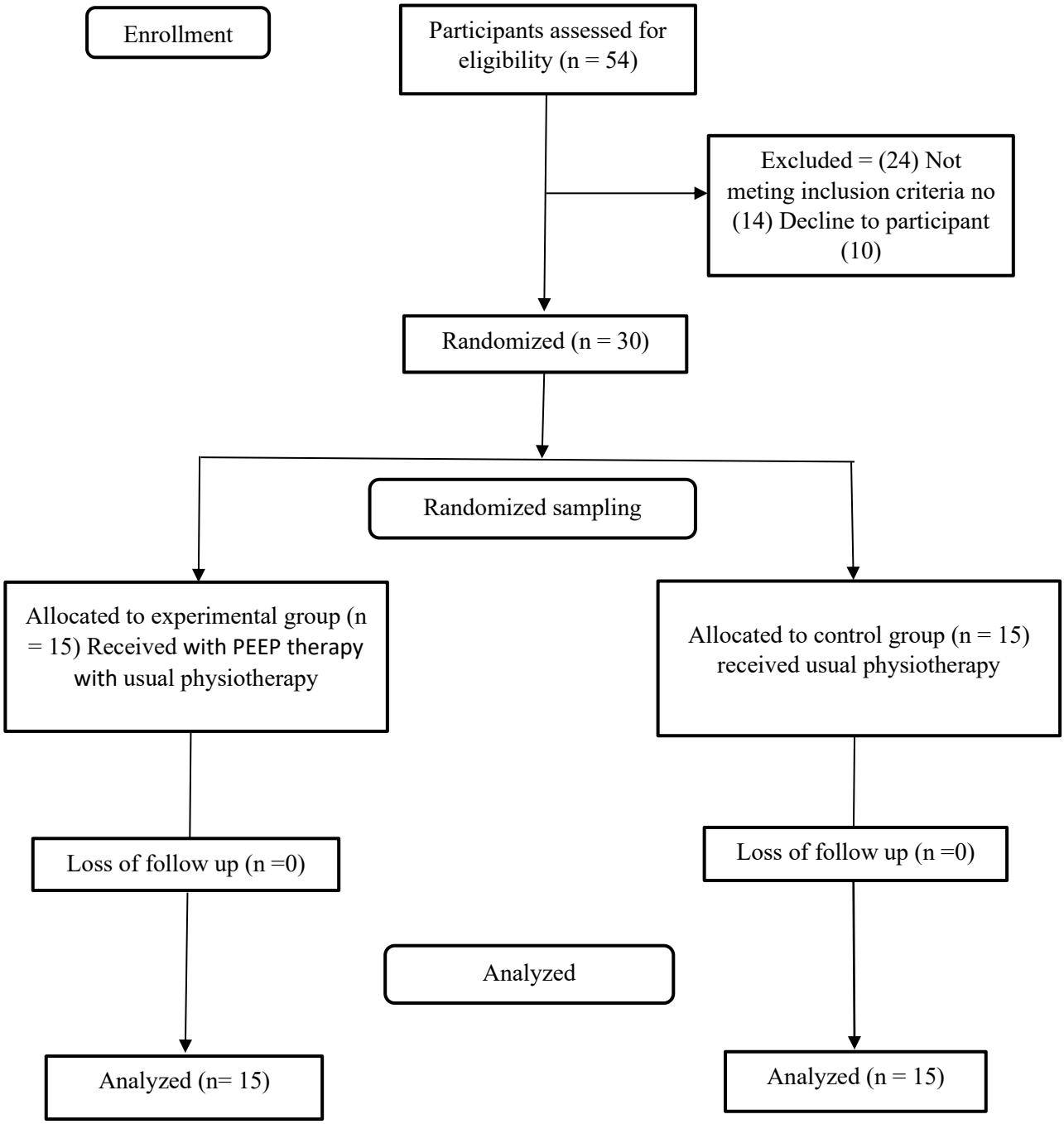

3.8 Eligibility Criteria

3.8.1 Inclusion Criteria

The following criteria made people eligible to take part in the study:

- Age: People who are ten or older.
- Gender: Both men and women.
- Diagnosis: Clinically diagnosed COPD, based on spirometry evidence of airflow restriction (post-bronchodilator FEV_1/FVC ratio < 0.70), in agreement with the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria (GOLD, 2024, p.8).
- Disease Severity: Based on FEV_1 % anticipated (GOLD, 2024, p.13), it is classified as moderate to very severe (GOLD, 2024, p.9).
- Physical Capacity: Patients who could do breathing exercises and follow verbal instructions.

3.8.2 Exclusion Criteria

If any of the resulting conditions applied to a participant, they were not allowed to take part in the study:

- Recent worsening of COPD that needed hospitalization or a change in treatment in the recent four weeks (Langer et al., 2015, p.100).
- Unstable heart disorders such high blood pressure that isn't regulated, a recent heart attack, or severe arrhythmias (Gosselink et al., 2011, p.13).
- Neurological or musculoskeletal diseases that make it hard to take part in physical training (Beaumont et al., 2015, p.1417).
- Beaumont et al. (2015), p. 1418, say that you are currently taking part in any pulmonary rehabilitation or respiratory training program.
- A mental condition or cognitive impairment that makes it hard to understand or follow directions.

3.9 Method of Data Collection

We used the in-person formal interviewing technique to gather data from the selected patients with COPD at 250 Bedded TB Hospital,Shyamoli,Sher-e-BanglaNagar,Dhaka-1207.

3.10 Instrument and Tools of Data Collection:

Instrument of data collection:

A questionnaire was prepared according to the objectives and variables of the present study. The questionnaire contained both open-ended and closed-ended queries. The questionnaire had six parts. The first part contained questions on socio-demographic information (a structured inquiry form was used for socio-demographic information). The second part included anthropometric information, and the third part is disease related information, and the fourth part is COPD assessment test (CAT) questionnaire, and fifth is assessment of Dyspnea level by Modified Medical research council (mMRC) dyspnea scale, and sixth is 6MWT test scale.

Tools of data collection:

In my research purpose I use these tools,

- Exercise Capacity Tests: Six-Minute Walk Test (6MWT)
- Assess the severity of breathlessness by Dyspnea scale
- Quality of Life and Symptom Assessment: COPD Assessment Test (CAT)
- Monitoring Tools: Oximeter, BP Machine
- Weight machine
- Hight measure tape were used

3.11 Management of Data

3.12 Procedure of data collection

Out of the 56 patient, 56 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 26 patients were excluded on basis of the exclusion criteria. The 30 patients were allocated by randomization to experimental and control groups thereafter. PEP therapy 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 patients were in control group. Twenty-four sessions of the treatment were completed by every patient in both groups. COPD level and dyspnea level and 6MWT distance data was collected and that information viewed as pretest data. For the present intervention both PEP and conventional physiotherapy was given for experimental group. Conventional physiotherapy was given for control group only. Both groups 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 and 6MWT distance for functional outcome after completion of the intervention. Post test data of 30 COPD patients have been regarded as information after the intervention.

The interview and examination were in a cordial environment. At the end of the interview and examination, the researcher thanked the participants.

Interpretation of the questionnaire:

COPD Assessment Test (CAT):

The CAT is an instrument to assess the effect of COPD on a patient's health-related quality of life. It includes 8 items concerning indicators of cough, phlegm, chest tightness or wheeze, breathlessness when you are at rest(bed/chair), during car rides or short walks in the street on the level buildings, activities that leave you rather breathless (house work shopping etc.), confidence leaving to go away distant from home house and family?

sleeping well becoming taken over by your condition leaving you too tired for things and energy.

Each item is scored from 0 (no limitation) to 5 (total limitation), resulting in scoring levels between 0 and 40. Increasing score indicates increasing severity of symptoms. The interpretation is as follows:

1–10: Low impact

11–20: Medium impact

21–30: High impact

31–40: Very high impact

mMRC Dyspnea Scale:

This scale measures the degree of patient breathlessness, primarily in symptomatic COPD. It involves 5 grades (0 to 4), corresponding to levels of shortness of breath resulting from varying degrees of physical activities:

Grade 0: I only get breathless with strenuous exercise.

Stage 1: I get short of breath when hurrying on level ground or walking up a slight hill.

Grade 2: I walk slower than people of the same age on level ground because of breathlessness, or I have to stop for breath.

Grade 3: I stop for breath after walking about 100 meters or after a few minutes on level ground.

Grade 4: I am too breathless to leave the house or I get breathless when dressing or undressing.

6-Minute Walk Test (6MWT):

This test checks how far a person can walk in six minutes. It can help you figure out how fit they are, how well their lungs work, and how capable they are in general.

The pre-test questions help find any things (such chest pain, dizziness, or medication) that could make performance worse.

The test keeps track of:

- Distance walked.
- The amount of time it takes to walk.
- Arterial oxygen saturation before and after the test.
- Heart rate at rest before and after the test.

These numbers can also be used to quantify a patient's stamina and evaluate improvements in their overall health.

3.12.1 Data Editing

After gathering the data, the filled-up questionnaires were wisely checked for any mistakes or wrong answers or wrong interpretation of test. If any information was missing or unclear, it was reviewed again and, if needed, the participants were asked for clarification. Changes were made to make sure the data was correct and complete Data editing by Surface Laptop 3 (Windows 11 Pro, 21H2 Version).

3.12.2 Data Entry

The collected information was entered into a computer. First, the researcher added the variable names in SPSS under the “variable view” tab, including their types, values, decimals, labels, alignment, and measurement levels. After that, the actual data were entered into the “data view” tab in SPSS. Once all the data were entered, the researcher carefully checked everything to make sure that the information matched the questionnaires correctly. After confirming the accuracy, the data was ready for analysis using SPSS.

3.12.3 Data Analysis

The data for the education was analyzed with SPSS (Statistical Package for the Social Sciences) version 27 and Microsoft Excel 2024. Initially, the data were cleansed by checking questionnaires for any missing or ambiguous information. In SPSS, variable names were entered in the variable view, together with their types (numeric, string), values, decimal places, labels, and measurement levels (nominal, ordinal, ratio). Data were then entered into the data view to ensure appropriate transcription of the questionnaires. After that, descriptive statistics including frequencies, percentages, and means were computed. Bivariate analysis, including chi-square tests, was used to investigate the associations between independent and dependent variables. The findings were then evaluated and presented in tables and charts to facilitate comprehension.

3.12.4 Statistical Test

The variables were classified as nominal, ordinal, and ratio data, and appropriate parametric or non-parametric statistical tests were selected based on the type and nature of the data, following standard procedures

3.12.5 Ethical Consideration

Bangladesh Medical Research Council (BMRC) and World Health Organization (WHO) guideline also were followed to manner the study. The Research proposal was submitted to the ethical committee that ethical review board of SAIC College of Medical Science and Technology approval was obtained from the Board. Written informed permission was taken at the time of enrolling the respondents. All participants were informed that they are free to leave or to refuge to take part in this study at any time The personal information of the respondents was kept totally confidential.

3.13 Intervention:

Dosage: The total duration of the trial regimen was four weeks, at 2 session per day, and 3 days sessions per week, total 24 session and the duration of each session of treatment was 20-40 minutes.

The experimental group participants received PEP therapy technique along with usual physiotherapy treatment. The usual physiotherapy treatments. In control group, members were given only the usual physiotherapy treatment. Both groups received treatment for 24 sessions. Treatment has been given by qualified physiotherapists who were trained in Joint play technique for the experimental group.

3.14 Treatment Protocol:

• **Experimental Group (Received 4 weeks and 24 sessions of PEP therapy with conventional physiotherapy 20-40 minutes)** • PEP therapy used 4 weeks ,2 set each day for 3 days per week. • Perform 15 deep breaths through the PEP device (inhale, 3-second hold, steady exhale), then huff or cough to clear mucus; repeat this cycle for 15–20 minutes per session (Banbury, Landry & Pazienza 2023, p .03) • Procedure: Participants in the intervention group were asked to breathe using the model) as illustrated below. They breathe in and then endeavored to breathe out through the pipe. The end of the pipe is submerged underwater up to 10–15 cm. (Lin,Q et al. 2019 p. 476-681). • Continuous monitoring of SpO2, respiratory rate to assess oxygenation status.	• **Control group (Received 4 weeks and 24 sessions of only conventional therapy 20-40 minutes)** • Conventional therapy used 4 weeks ,2 set each day for 3 days per week. • Standard Oxygen Therapy: Patients will receive oxygen therapy via nasal cannula or face mask, maintaining oxygen saturation levels between 88-92%. • Duration: Oxygen therapy will be administered for 4 hours daily for 2 weeks. • ACBT (active cycle of berthing technique) duration 10-15 minutes. • Positioning • Postural drainage

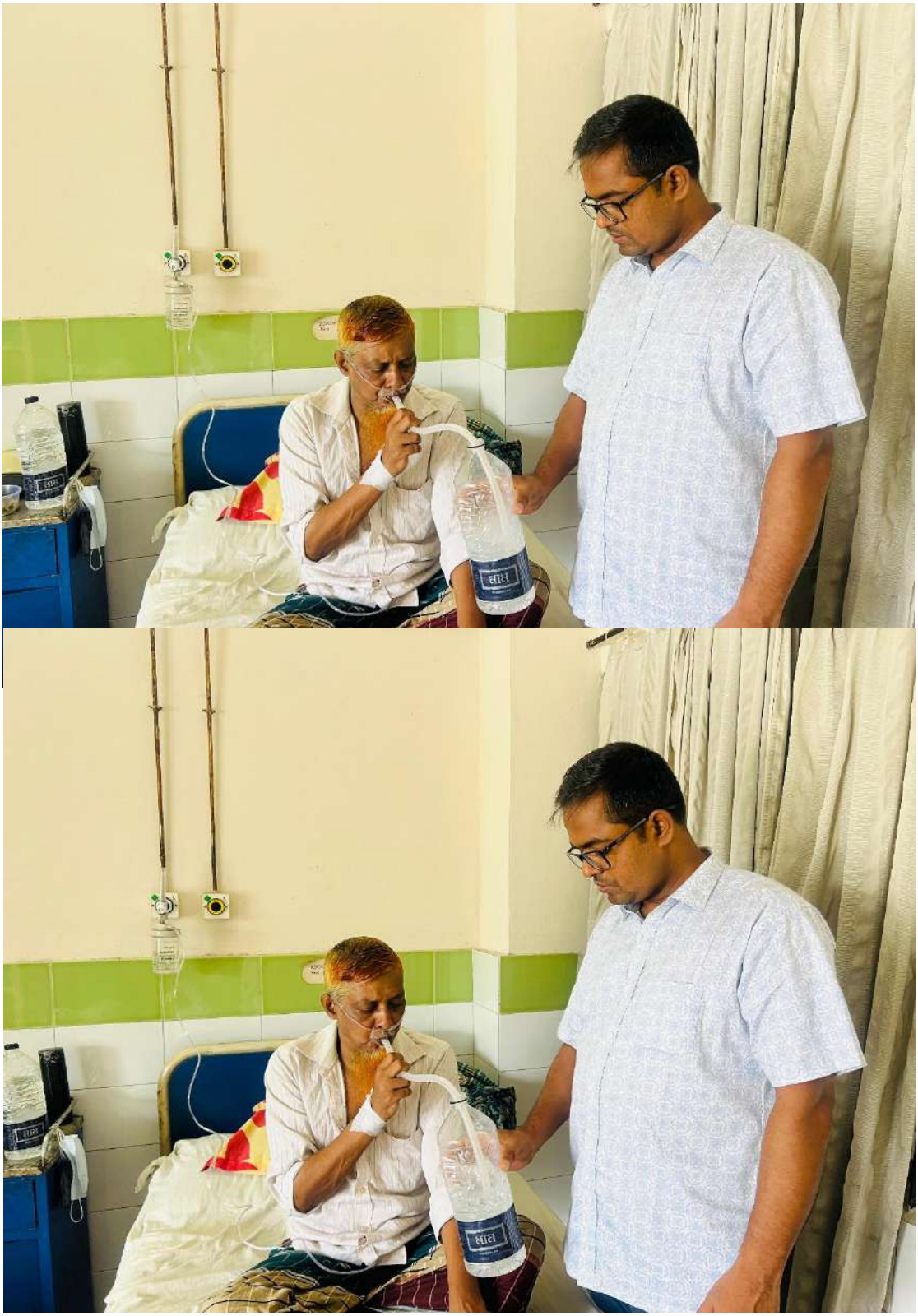

Figure 3.1: PEP therapy

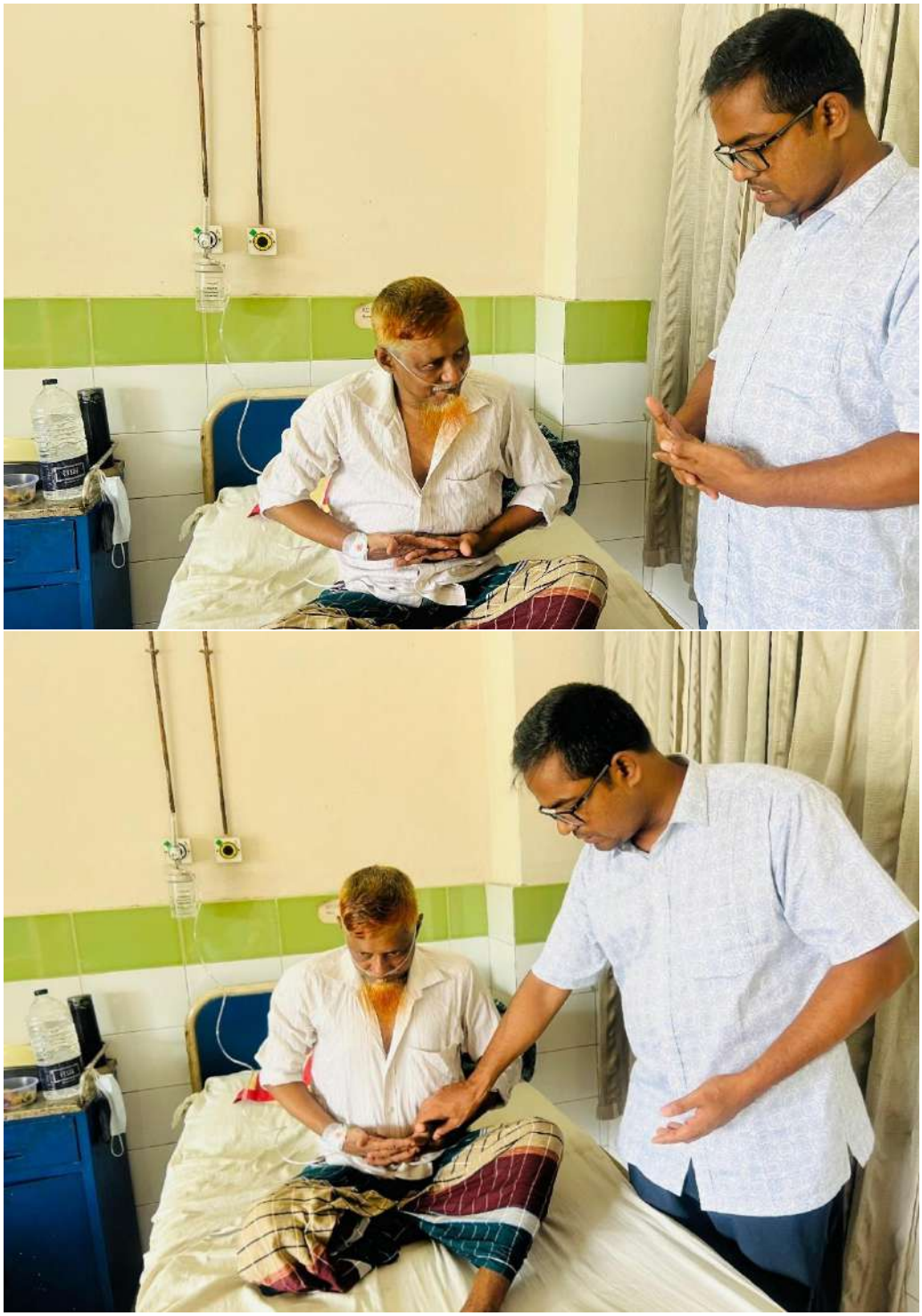

Fig 3.1.2: Diaphragmatic breathing

Figure 3.2: Patient counselling before performs Active Cycle Breathing Technique. (ACBT) treatment

CHAPTER-IV RESULTS

This study aims to find out the effectiveness of Positive Expiratory Pressure (PEP) therapy in patient with COPD. A total of 30 participant is included in this study who is suffering from COPD. The SPSS 27 version software was used to numerically code and data analyze. The result was recorded in Microsoft Excel, calculated and percentages and shown the tables, bar chart and pie chart.

Table 4.1: Descriptive statistics of continuous variables Comparison of baseline characteristics of the participants Mann–Whitney U test:

Variables	Experimental	Control
Age	44.40 ±16.21	42.00±19.39
BMI (score)	19.17±4.45	19.19± 4.93
Distance walked Pre-test	296.40±66.18	254.67±106.62
CAT scale- Pre-test	29.40±3.06	26.13± 6.74
Dyspnea scale-Pre-test	2.06± 0.96	2.40±0.63

The baseline comparison shows that participants shows that participants in both the experimental and control groups were broadly similar before the intervention. The average age was slightly higher in the experimental group (44.4 years) compared with the control group (42 years), but this difference was not statistically significant. Body mass index values were almost identical across group with mean scores of 19.17 and 19.19, again showing no meaningful difference. In terms of functional capacity, the experimental group walked a greater distance on the pretest (296.4 m vs 254.7 m), but variation between groups was not significant. Similarly, pretest symptom scores on the CAT scale and Dyspnea scale showed minor difference between groups, yet none reached statistical significance. Overall, these finding suggest that both groups started from a comparable baseline with no significant difference in age, BMI, walking distance, or respiratory health measures. this indicates that any changes observed later are more likely due to the intervention slightly than pre – existing group difference.

Table 4.2: Sociodemographic information of the Experimental group and Control group Chi- square test:

Variable	Experimental N (%)	Control N (%)	Total N (%)	*p*-value
Age category yeasr				0.648
10-29	4 (50.0%)	4 (50.0%)	8 (26.7%)	
30-49	3 (37.5%)	5 (62.5%)	8 (26.7%)	
50-69	7 (63.6%)	4 (36.4%)	11 (36.7%)	
>70	1 (33.3%)	2 (66.7%)	3 (10.0%)	
Mean ± SD	43.20 ± 17.610			

The sociodemographic comparison between the trial and control groups indicates theta the two groups broadly similar across most variables. Age distribution was comparable, with participants ranging from 10 to above 70 years. The majority fell in the 50-69 category (36.7%) and the mean was 43.2 years. The Chi-square test showed no significant difference between groups in terms of age (p = 0.648).

BMI	Experimental N%	Control N%	Total N%	*p*-value
Underweight<18.5	6(46.2%)	7(53.8%)	13(34.3%)	
Normal 18.5 -24.9	7(63.6%)	4(36.4%)	11(36.7%)	
Overweight 25 - 29.9	1(25.0%)	3(75.0%)	4(13.3%)	0.594
Obe's >30.0	1(50.0%)	1(50.0%)	2(6.7%)	

Body Mass Index (BMI) categories also showed a balance distribution, with most participants being of normal weight (36.7%) or underweight (34.3%). Differences among groups were not statistically significant (p =0.594).

Gender	Experimental N%	Control N%	Total N%	*p*-value
Male	5(55.6%)	4(44.4%)	9(30.0%)	0.690
Female	10(47.6%)	11(52.4%)	21(70.0%)	
Marital status				
Unmarried	2(40.0%)	3(60.0%)	5(16.7%0	
married	13(52.0%)	12(48.0%)	25(83.3%)	.624

In terms of gender, there were 9 males and 21 females in total. Among the males, 5 (55.6%) were in Group 1, and 4 (44.4%) were in Group 2. Among the females, 10 (47.6%) were in Group 1, and 11 (52.4%) were in Group 2. The P-value for gender is 0.690, which indicates that gender is not significantly related to the groups being compared (since a P-value above 0.05 typically suggests no strong relationship).

For marital status, there were 5 unmarried individuals and 25 married individuals. Among the unmarried people, 2 (40.0%) were in Group 1, and 3 (60.0%) were in Group 2. Among the married people, 13 (52.0%) were in Group 1, and 12 (48.0%) were in Group 2. The P-value for marital status is 0.624, meaning that marital status also does not appear to have a significant impact on the groups being compared.

Occupation	Experimental N%	Control N%	Total N%	*P*- value
Service holder	1(100%)	0(0.0%)	1(3.3%)	
Businessman	0(0.0%)	2(100%)	6.7%	
Housewife	7(53.8%)	6(46.2%)	43.3%	
student	1(25.0%)	3(75.0%0	13.3%	.210
Labor	2(66.7%)	1(33.3%)	10.0%	
Farmer	3(100%)	0(0.0%)	10.0%	
Others	1(25.0%)	3(75.0%)	4(13.3%)	

The occupations are distributed as housewives occupied the first place (43.3%), students and others (13.3% each), followed by farmers and laborers (10 each), businessmen (6.7%), and service holders (3.3). Whereas, businessmen occupied all positions in the second category, whereas all farmers and the service holder occupied all positions in the first category, all others were distributed evenly. Nonetheless, the p-value of 0.210 shows that there is no statistically significant correlation between occupation and group membership, these differences are probably caused by chance, but not a real trend.

Living Area	Experimental N%	Control N%	Total N%	*P*- value
Rural	8(57.1%)	6(42.9%)	14(46.7%)	.464
Urban	7(43.8%)	9(56.3%)	16(53.3%)	
Family type				
Nuclear	9(45.0%)	11(55.0%)	20(66.7%)	
extended	6(60.0%)	4(40.0%)	10(33.3%)	.439
Access road				
Mud	2(40.0%)	3(60.0%)	5(16.7%)	
Brick	4(66.7%)	2(33.3%)	6(20.0%)	
Pitch	9(47.4%)	10(52.6%)	19(100%)	.632

Living area was almost evenly split between rural (46.7%) and urban (53.3%) participants, without significant differences (p = 0.464).

Family structure also showed balance, with nuclear families making up two-third of the sample (66.7%), again showing no significant variation (p = 0.439).

Accessibility to living areas, assessed through the type of access road, did not vary meaningfully (p = 0.632), with the majority having pitched road, did not differ significantly (p =0.632), with the majority having pitched roads

Disease related information:

Duration of suffering	**Experimental N%**	**Control N%**	**Total N%**	***P*- value**
1 year	1(20.0%)	4(80.0%)	5(16.7%)	0.219
2 year	5(45.5%)	6(54.5%)	11(36.7%)	
3 year	9(64.3%)	5(35.7%)	14(46.7%)	
Relieving factor	**Experimental N%**	**Control N%**	**Total N%**	***P*- value**
Rest and pacing	6(85.7%)	1(14.3%)	7(23.3%)	.031
Medication	9(39.1%)	14(60.9%)	23(76.7%)	

Among participants, 16.7% had been suffering for 1 year, with most (80%) in the second group. About 36.7% reported a 2-year duration, almost evenly distributed between the two groups (45.5% vs. 54.5%). The largest proportion, 46.7%, had been suffering for 3 years, with nearly two-thirds (64.3%) in the first group. The p-value of 0.219 suggests that the difference in duration across groups is not statistically significant.

When asked about what provided relief, 23.3% mentioned rest and pacing, with the vast majority (85.7%) in the first group. Meanwhile, 76.7% relied on medication, most of whom (60.9%) were in the second group. The p-value of 0.031 indicates a statistically significant connotation between relieving factor and group membership

Comorbidity Questioner for COPD Patient:

Hypertension	**Experimental N%**	**Control N%**	**Total N%**	***P*- value**
yes	3(42.9%)	4(57.1%)	7(23.3%)	
no	12(52.2%)	11(47.8%)	23(76.7%)	.666
Diabetes				
yes	3(60.0%)	2(40.0%)	5(16.7%)	
No	12(48.0%)	13(52.0%)	25(83.3%)	.624
Heart disease				
yes	2(66.7%)	1(33.3%)	3(10.0%)	
No	13(48.1%)	14(51.9%)	27(90.0%0	.543
Asthma				
yes	13(50.0%)	13(50.0%)	26(86.7%)	1.000
No	2(50.0%)	2(50.0%)	4(13.3%)	
Tuberculosis				
yes	14(63.6%)	8(36.4%)	22(73.3%)	0.13
No	1(12.5%)	7(87.5%)	8(26.7%)	

The data indicates that hypertension, diabetes, heart disease, asthma, and tuberculosis are prevalent among COPD patients; however, none of these illnesses demonstrate a significant correlation with COPD in our group. For instance, 42.9% of people with high blood pressure also have COPD, yet 76.7% of those with COPD do not have high blood pressure. Diabetes, heart disease, asthma, and tuberculosis are also present in different amounts in COPD-positive patients. However, the p-values for all of these

conditions (from 0.13 to 1.000) are higher than the usual 0.05 level of statistical significance, which means that these comorbidities don't seem to have a big effect on the chance of having COPD in this group.

Depression /anxiety	**Experimental N%**	**Control N%**	**Total N%**	***P*- value**
Yes	15(50.0%)	15(50.0%)	30(100%)	
No				
Osteoporosis				
yes	1(50.0%)	1(50.0%)	2(6.7%)	1.000
No	14(50.0%)	14(50.0%)	28(93.3%0	
Chronic kidney disease				
yes	1(50.0%)	1(50.0%)	2(6.27%)	1.000
No	14(50.0%)	14(50.0%)	28(93.3%)	

The data shows that depression and anxiety are evenly spread out in both the experimental and control groups (50% in each), making up 100% of the total sample. Osteoporosis and chronic kidney disease are infrequent, affecting only 6.7% of the total cohort, with a similar distribution in both the trial and regulator groups. The p-values for osteoporosis and chronic kidney disease are both 1.000, which means that the groups are not significantly different for these diseases.

Gastroesophageal reflux	Experimental N%	Control N%	Total N%	*P*- value
Yes	15(51.7%)	14(48.3%)	29(96.7%)	0.309
No	0(0.0%)	1(100.0%)	1(3.3%0	
Stroke or transient reflux				
yes	0(0.0%)	2(100.0%)	2(6.7%)	0.143
No	15(53.6%)	13(46.4%)	28(93.3%)	
Anemia				
Yes	8(44.4%)	10(56.6%)	18(60.0%)	
No	7(58.3%)	5(41.7%)	12(40.0%)	0.456

The data showed that gastroesophageal reflux was very common in both groups: 51.7% of the experimental group and 48.3% of the control group. This made up 96.7% of the whole sample. The p-value of 0.309 shows that the groups are not very different in this snakebite envenoming category. For stroke or transient reflux, 100% of the control group and 0% of the experimental group are affected, with a p-value of 0.143 indicating no significant differences between the experimental and control groups. Sixty percent of all subjects are anemic, with a higher percentage in the control group (56.6%). However, p = 0.456 indicates no significant differences in the proportion between groups. Overall, there are no substantial differences in these symptoms between the experimental and control groups.

4.3 Gender of the participant of experimental and control group:

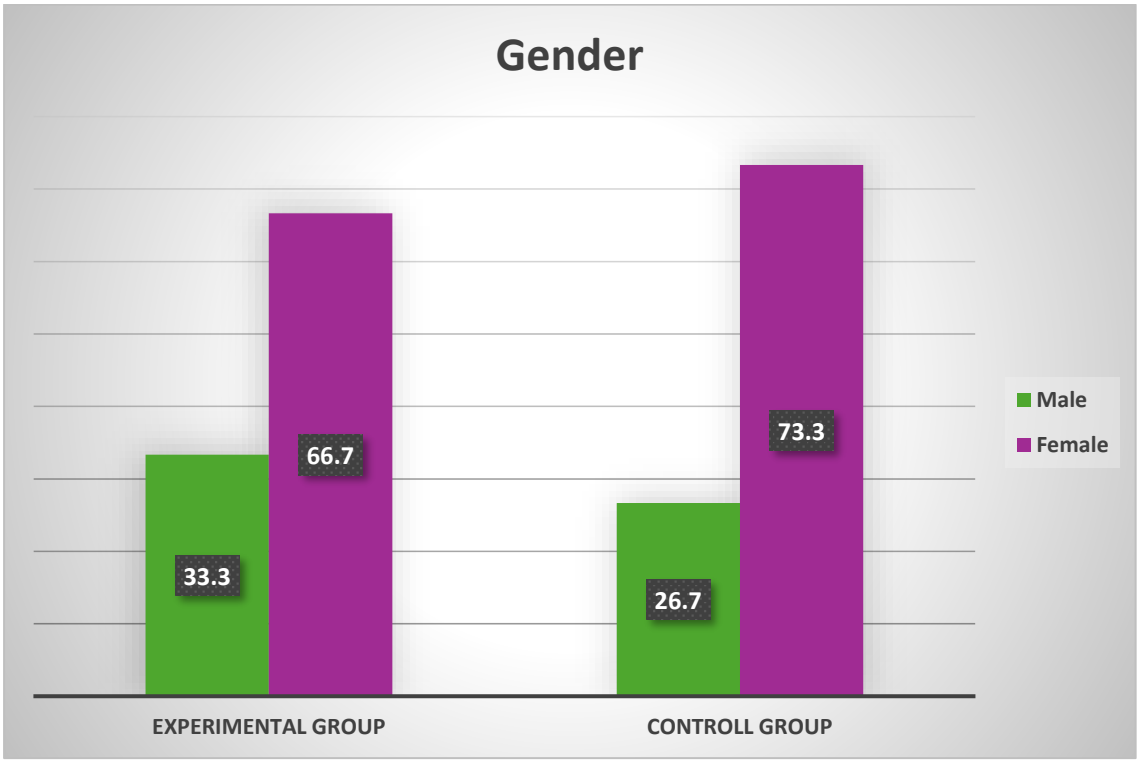

Fig: Gender of the participant of experimental and control group.

The chart shows that female was the majority in both groups. In the experimental group, 66.7% were female and 33.3% male, while in the control group, 73.3% were female and 26.7% male. Overall, females were more represented than male in both groups.

4.5 Marital status of the participant of experimental and control group:

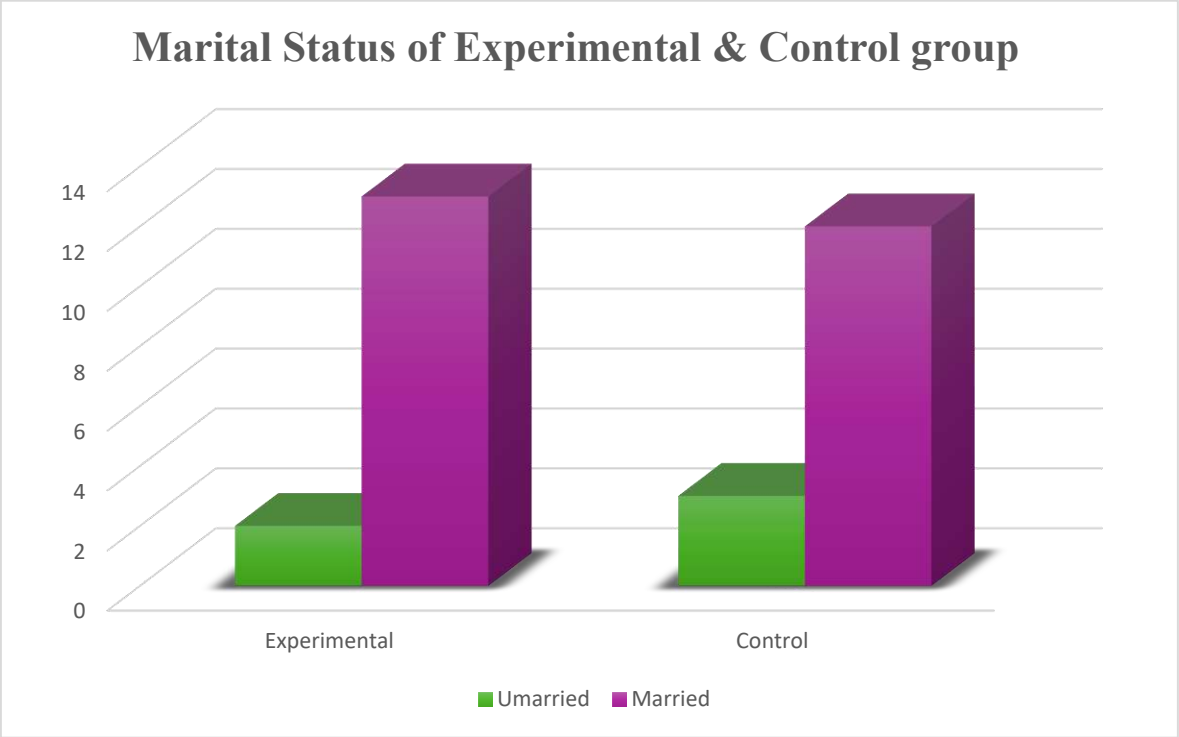

Fig 4.5: Marital Status of Experimental & Control group.

The chart shows that most participants in both groups were married. In the experimental group, 13 (≈83%) were married and 2 (≈17%) unmarried, while in the control group, 12 (80%) were married and 3 (20%) unmarried. Overall, marital status distribution was similar between the two groups.

Table 4.6: Difference between within group comparison of 6MWT pretest and posttest score in experimental group by Wilcoxon signed rank test:

Posttest-Pretest 6MWT scores	N	Means Rank	Sum of Ranks	Wilcoxon signed-rank test based on Z rank	P-Value
Negative Ranks	0	.00	.00	3.413	<0.001
Positive Ranks	15	8.00	120.00		
Ties	0				
Total	15				

(*= < 0.05, ** = < 0.01, ***= < 0.001)

Table 4.6 shows that all 15 participants in the experimental group had higher 6MWT (walking distance) scores after treatment, with no decrease or ties. The Wilcoxon signed-rank test result ($Z = 3.413$, $p < 0.001$) confirms that this improvement is statistically significant. In short, the treatment greatly enhanced the participants' physical performance.

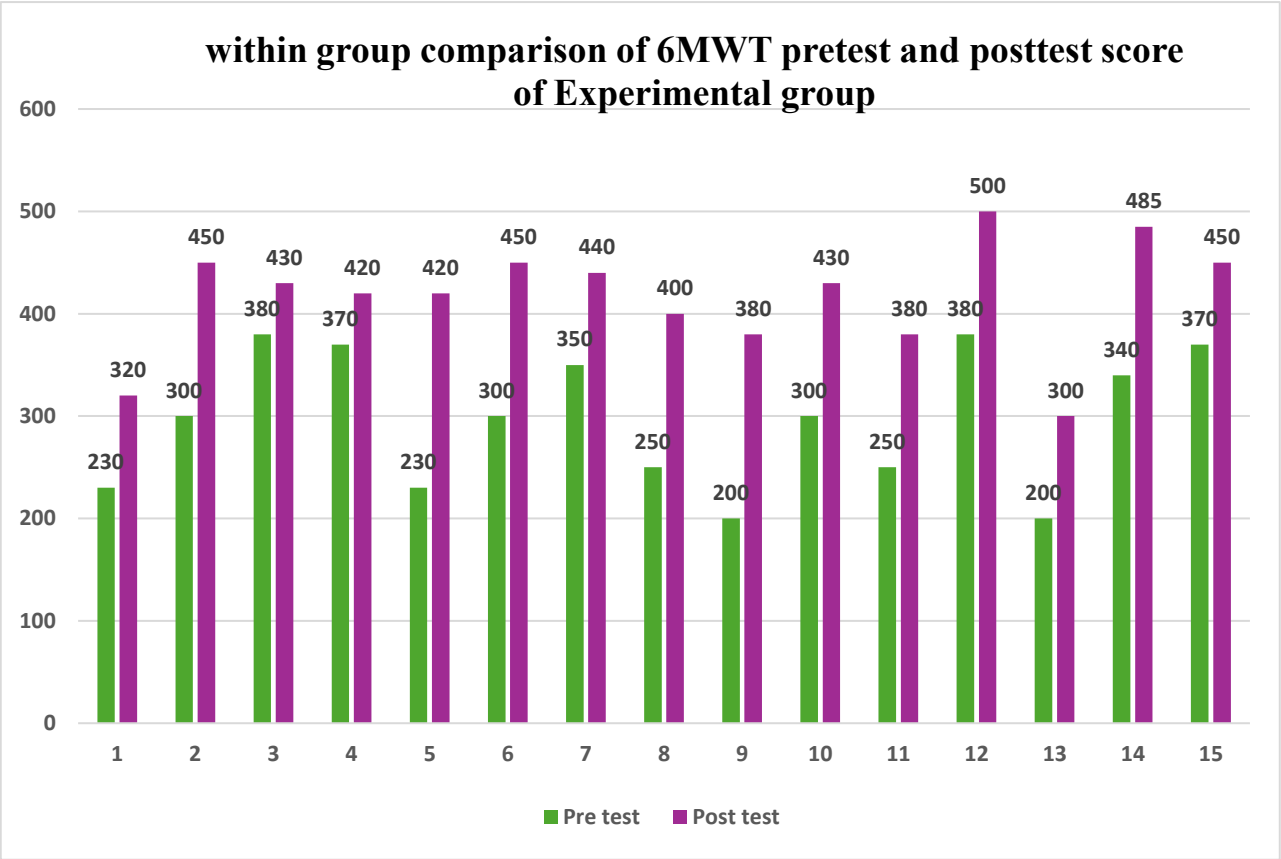

Fig 4.6: within group comparison of 6MWT pretest and posttest score of Experimental group.

Table 4. (6.1): Difference between within group comparison of pretest 6MWT score and Posttest 6MWT score in Control group by Wilcoxon signed rank test:

Posttest-Pretest 6MWT scores	N	Means Rank	Sum of Ranks	Wilcoxon signed-rank test based on Z rank	P-Value
Negative Ranks	0	.00	.00	3.416	<0.001
Positive Ranks	15	8.00	120.00		
Ties	0				
Total	15				

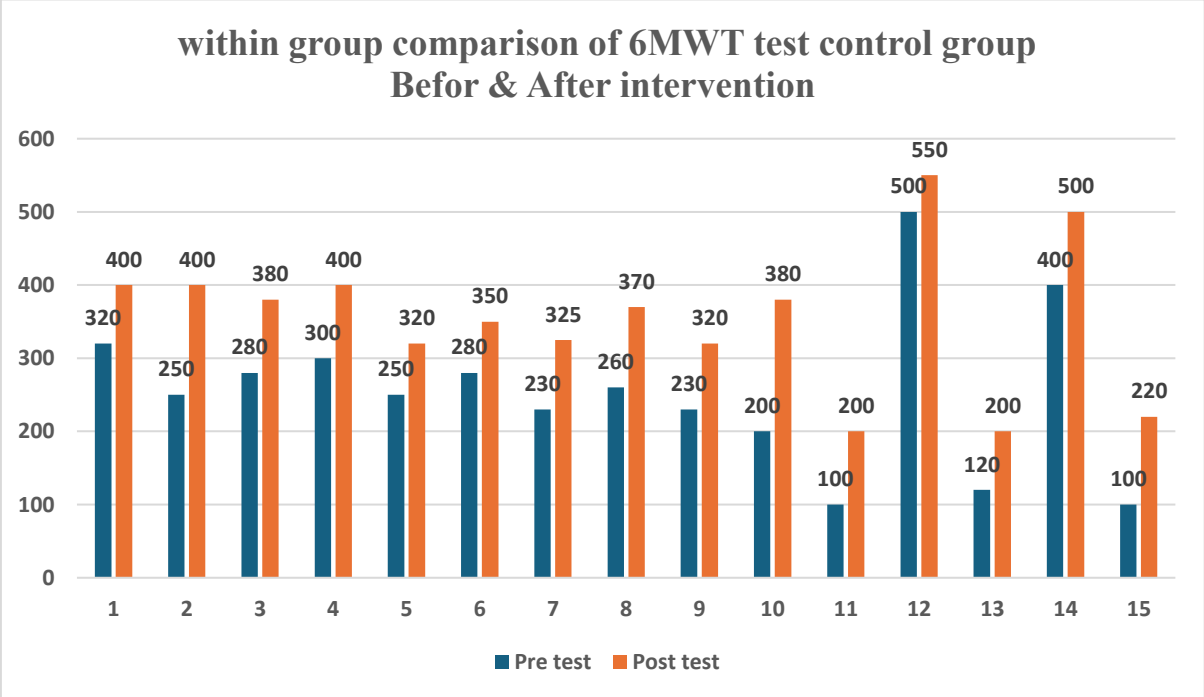

Fig 4 (6.1): within group comparison of 6MWT test control group Befor & After intervention

This chart shows the results of the 6-Minute Walk Test (6MWT) in the control group before and after the intervention. Overall, most participants showed an improvement in walking distance after the intervention compared to their pre-test scores. For example, participant 1 increased from 320 m to 400 m, and participant 12 improved from 500 m to 550 m. However, the amount of improvement varied among participants, and in some cases the change was smaller. In summary, the control group generally demonstrated better post-test performance, but the gains were modest and not consistent across all individuals.

Table 4.7: Difference between within group comparison of Dyspnea scale pretest score and Post test score in Experimental group by Wilcoxon signed rank test.

Posttest-Pretest Dyspnea scores	N	Means Rank	Sum of Ranks	Wilcoxon signed-rank test based on Z rank	P-Value
Negative Ranks	15	8.00	120.00	3.578	<.001
Positive Ranks	0	.00	.00		
Ties	0				
Total	15				

(*= < 0.05, ** = < 0.01, ***= < 0.001)

The Wilcoxon signed-rank test in Table 4.7 shows that all 15 participants in the experimental group had lower Dyspnea (breathlessness) scores after treatment compared to before, with no cases of improvement in the opposite direction and no ties. The test result ($Z = 3.578$, $p < .001$) indicates this reduction is highly statistically significant. In simple words, the treatment was very effective in reducing Dyspnea symptoms among the participants.

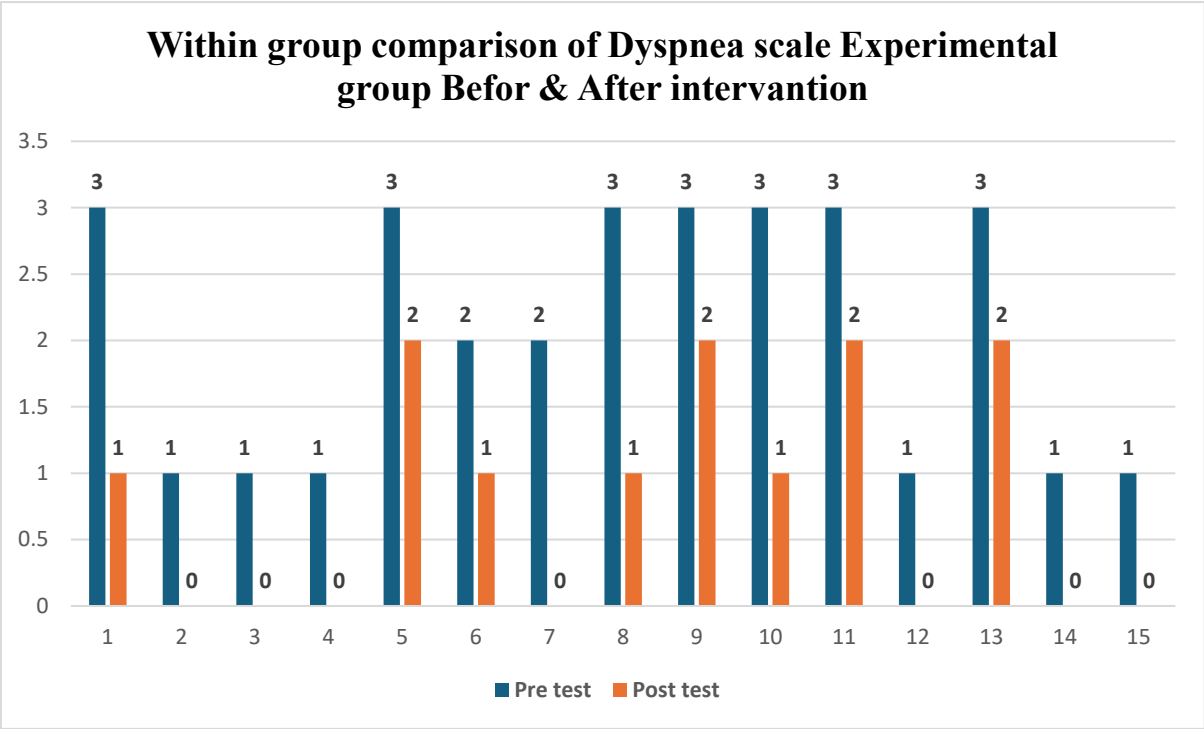

Fig 4.7: Within group comparison of Dyspnea scale Experimental group Befor & After intervention.

Table 4. (7.1): Difference between within group comparison Dyspnea scale of pretest and Post test score in control group by Wilcoxon signed rank test:

Posttest-Pretest Dyspnea scores	N	Means Rank	Sum of Ranks	Wilcoxon signed-rank test based on Z rank	P-Value
Negative Ranks	15	8.00	120.00	-3.690	<.001
Positive Ranks	0	.00	.00		
Ties	0				
Total	15				

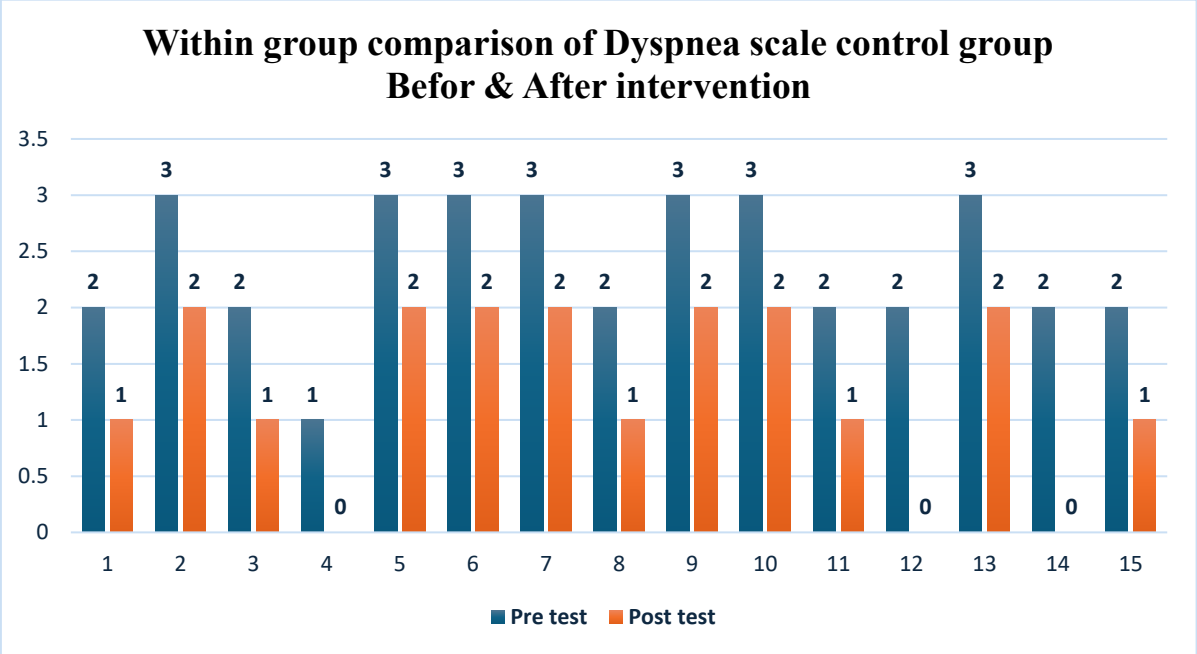

Fig 4 (7.1): within group comparison of Dyspnea scale control group Befor & After intervention.

Most participants' scores stayed the same or showed only a slight reduction in breathlessness after the intervention. For example, some individuals dropped from 3 to 2, or from 2 to 1, but many remained unchanged.

Table 4.8: Difference between within group comparison of CAT scale pre test and Post test score in Experimental group by Wilcoxon signed rank test:

Posttest-Pretest CAT scores	N	Means Rank	Sum of Ranks	Wilcoxon signed-rank test based on Z rank	P-Value
Negative Ranks	15	8.00	120.00	3.415	<0.001
Positive Ranks	0	0.00	0.00		
Ties	0				
Total	15				

(*= < 0.05, ** = < 0.01, ***= < 0.001)

The Wilcoxon signed-rank test results (Table 4.8) indicate that all participants in the experimental group showed improvement in their CAT scores after treatment, with 15 negative ranks and no positive ranks or ties. The test statistic (Z = 3.415) and the highly significant p-value (<0.001) confirm that the reduction in scores was not due to chance. This finding demonstrates that the treatment had a clear and statistically significant positive effect on reducing CAT scores within the experimental group.

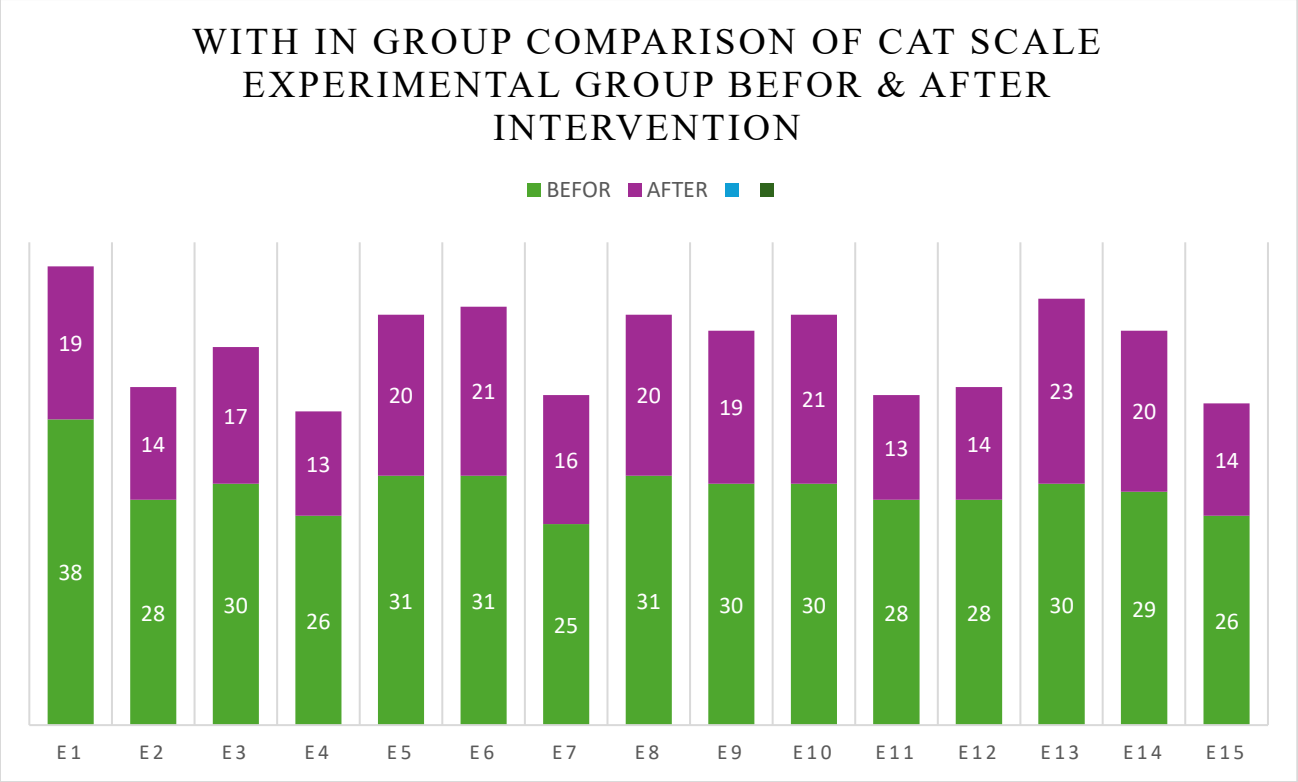

Fig 4.8: within group comparison of CAT scale experimental group Befor & after intervention**.**

Table 4. (8.1): Difference between within group comparison of CAT scale pre test and Post test score in Control group by Wilcoxon signed rank test:

Posttest-Pretest CAT scores	N	Means Rank	Sum of Ranks	Wilcoxon signed-rank test based on Z rank	P-Value
Negative Ranks	15	8.00	120.00	3.424	<0.001
Positive Ranks	0	.00	.00		
Ties	0				
Total	15				

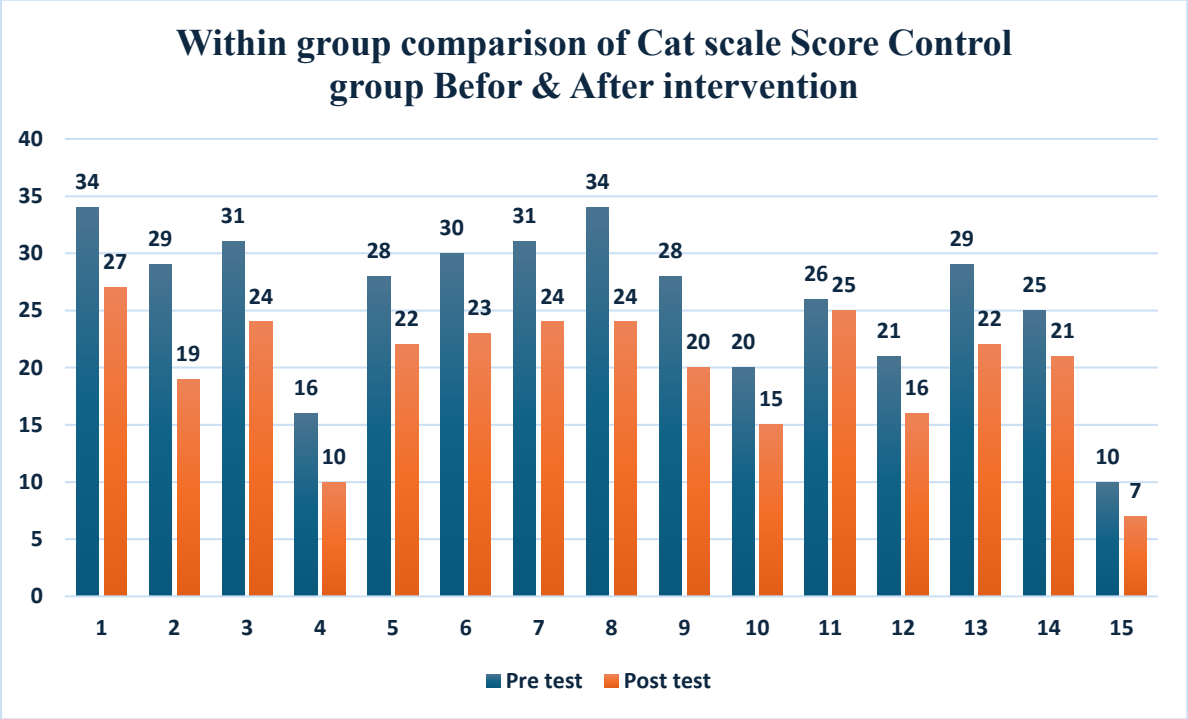

Fig 4 (8.1): with in comparison of Cat scale Score Control group Befor & After intervention.

Most participants showed a slight reduction in CAT scores after the intervention, meaning their symptoms improved a little, but the change was not large. For example, participant 1 dropped from 34 to 27, and participant 10 from 20 to 15. However, some participants' scores remained close to their pre-test values, suggesting limited overall improvement.

Table 4.9: Difference between posttest Dyspnea scale, CAT scale and 6MWT between Experimental and Control group, by Mann-Whitney U test.

Variable	Experimental Mean Rank	Control Mean Rank	Mann-Whitney U	Z-Value	p-Value (2-tailed)
Dysnea scale	**13.23**	**17.77**	**78.500**	**-1.497**	**0.134**
CAT score	**12.37**	**18.63**	**65.500**	**-1.956**	**0.050**
6MWT	**19.13**	**11.87**	**58.000**	**-2.269**	**0.023**

(*= < 0.05, ** = < 0.01, ***= < 0.001)

The Mann-Whitney U took test between the Experimental and Control groups in Dyspnea scale, CAT score, and 6-minute walk distance (6MWT). The results are tabulated in Table 4.9. The On the Dyspnea scale, the mean rank of the Experimental group in comparison to the Control was significantly lower (13.23 vs. 6.88,.0001) group (17.77) but the difference was not statistically significant (U = 78.500, p = 0.134). For the CAT score, the average rank in the Experimental group (12.37) was smaller than in the Control group (18.63), and the difference approached statistical significance (U = 65.500, p = 0.050). Significantly, the Distance walked was significantly different between the Control group (5 5.145 experimental group, which had a higher mean rank (19.13) than did Groups. because they showed higher means that is they performed better (U = 58.000, p = 0.023). This suggests that the intervention had a good impact on performance, as evidenced by the observed distance walked.

5.0Table: The Association between the Cat scale and key socio-demographic variable of the participant by using Chi-square test.

Variable	1-10 low impact	11-20 medium impact	21-30 high impact	Total N (%)	*p*-value
Age category					
10-29	1(12.5%)	5 (62.5%)	2(25.0%)	8 (26.7%)	0.830
30-49	0 (0.0%)	4(50.0%)	4(50.0%)	8 (26.7%)	
50-69	1(9.1%)	6 (54.5%)	4(36.4%)	11 (36.7%)	
>70	0 (0.0%)	1 (33.3%)	2(66.7%)	3 (10.0%)	

The Chi-square test showed no significant association between age and CAT scale scores (p = 0.830). This means that the impact level of COPD symptoms, as measured by the CAT scale, was quite similar across all age groups. For example, younger participants (10–29 years) mostly fell into the medium impact category (62.5%), while in the 30–49 years group, half reported high impact. Among those aged 50–69 years, more than half (54.5%) reported medium impact, and in the >70 years group, two-thirds (66.7%) reported high impact. However, since the differences were not statistically significant, age did not appear to influence CAT scores in this study.

5.1: The Association between the Dyspnea scale and key socio-demographic variable of the participant by using Chi-square test.

Variable	Very mild	Mild	Moderate	Sever	Total N (%)	*p*-value
Age category						
10-29	5(62.5%)	1 (12.5%)	2(25.0%)	0(0.0%)	8 (26.7%)	
30-49	1(12.5%)	2(25.0%)	5(62.5%)	0(0.0%)	8 (26.7%)	0.20
50-69	3(27.3%)	4 (36.4%)	3(27.3%)	1(9.1%)	11(36.7%)	
>70	0 (0.0%)	0 (0.0%)	1(33.3%)	2(66.7%)	3 (10.0%)	

The Chi-square test showed no significant association between age and the dyspnea scale (p = 0.20). This indicates that breathlessness severity did not differ significantly across age groups. Younger participants (10–29 years) mostly reported very mild symptoms (62.5%), while those aged 30–49 years more often experienced moderate symptoms (62.5%). In the 50–69 years group, responses were more evenly distributed across very mild, mild, and moderate categories, with a small proportion reporting severe symptoms (9.1%). Among participants over 70 years, two-thirds (66.7%) reported severe dyspnea. Although some variation was seen across age groups, these differences were not statistically significant.

CHAPTER-V DISCUSSION & LIMITATIONS

5.1 Discussion:

COPD is a progressive respiratory disease characterized by permanent airflow restriction and other related symptoms of chronic cough, sputum, and dyspnea (Global Initiative for Chronic Obstructive Lung Disease [GOLD], 2023). COPD is a world-wide public health concern with an estimated 3.5 million deaths each year as well as over 213 million individuals (World Health Organization [WHO], 2021, p. 1). Men are more likely to have the disease, yet, in low and middle-income countries (LMICs), 90 percent of COPD deaths are in people under 70 years old (WHO, 2021, p. 1). In Asia, COPD is even more of a burden, as in 2021, more than 10.5 million new cases, almost 3 million deaths were reported (Research Square, 2021, p. 2). Environmental factors, including indoor air pollution (biomass cooking fuels, which pose a significant risk of COPD) and high prevalence in Asia, play a large role in the prevalence of COPD (Times of India, 2021, p. 1). Moreover, underdiagnosis and delayed diagnosis are also a persistent problem because numerous parts of Asia do not have proper healthcare facilities, resulting in late-stage diagnosis and deteriorated patient outcomes (Chest Journal, 2015, p. 1045). A low-accessibility rate of spirometry testing and overall rural-based ignorance contribute to the worsening of these conditions, and it is hard to detect them at an early stage and manage them effectively (Chest Journal, 2015, p. 1046). It is essential to tackle them by providing more public health campaigns, access to healthcare, and environmental hazards to reduce the problem of COPD, not only on the global scale but also in Asia (Research Square, 2021, p. 3).

COPD is a condition that needs proper measurement tools to ascertain the brutality of the disorder and its effect on the value of life of the patient. Assessment instruments widely used are the COPD Assessment Test (CAT), the Modified Medical Research Council (mMRC) Dyspnea Scale and the Six-Minute Walk Test (6MWT). This discussion provides the comparison and contrast of these tools with references to the new research findings and a discussion of implications of the findings.

CAT scale:

The CAT is an 8-item questionnaire, which is used to evaluate the effect of COPD on the patient well-being status. It assesses the symptoms that include cough, tightness in the chest, breathlessness, and the effect on the daily activities (Jones et al.,2009,p.1094). An increase in the CAT scores implies an increased symptom load and poor quality of life. The CAT has proven itself to be very reliable and valid among diverse population groups. As an example, research including more than 1.500 COPD patients in Europe and the United States indicated that internal consistency (Jones et al., 2009, p. 1091). Another area that the CAT is strongly correlated with is other quality of life tools such as the St George's Respiratory Questionnaire (r = 0.80), which also confirms its usefulness in the tool of determining the severity of COPD (Jones et al., 2009, p. 1093). Moreover, the CAT was also found to be valid to replace the St George's Respiratory Questionnaire in rural Uganda, indicating that the tool can also be used in low-resource communities (Kiggundu et al., 2021, p. 201).

Dyspnea scale:

mMRC Dyspnea Scale is a scale employed in assessing the intensity of COPD patients. The scale is based on a scale of 0 to 4, and the higher the score, the more severe dyspnea is. The scale is very common because it is a simple and easy to use scale in clinical practice. It has been revealed that the mMRC can be used as a reliable instrument to determine the severity of dyspnea and is associated with the overall health condition of the patient (Hwang et al., 2014, p. 1834). The subjectiveness nature of the mMRC might however restrict its capability to adequately measure functional limitations brought about by dyspnea especially in patients with mild symptoms. A study by McNicholl et al. (2022, p. 273) established that mMRC is not as sensitive as other COPD severity measures to detect subtle dyspnea changes, implying that the measure may be more appropriate to use in more late phases of COPD.

6MWT:

The 6MWT is an objective, simple test, which is applied to determine the exercise capacity of a patient, i.e., the distance they can cover in six minutes. This test represents functional status and endurance that are significant predictors of COPD severity (Troosters et al., 2011, p. 246). This study by Puhan et al., (2015, p. 560) established that the distance covered during the 6MWT is strongly linked to survival in patients with COPD, with the shorter distance covered during the 6MWT, the greater the

mortality rate. Also, the 6MWT proves to be substantially correlated with the outcomes of spirometry and the mMRC Dyspnea Scale, which also contributes to the idea that it may be used as a multi-faceted instrument of COPD severity (Puhan et al., 2015, p. 561). The 6MWT can also be useful in evaluating changes in the functional capacity after such interventions as pulmonary rehabilitation (Gosselink et al., 2020, p. 103).

Although both of these assessment instruments are helpful, they are not the same in terms of focus. The CAT determines the effects of COPD on the overall health and quality of life of a patient, and the mMRC looks at the extent of breathlessness. Instead, the 6MWT is used to assess the exercise capacity and the functional endurance. Together, these instruments provide a multidimensional perspective of the disease that is much needed to facilitate treatment planning on a personalized basis (Jones et al., 2009, p. 1094). In some cases, such as a patient with the high CAT score but lower 6MWT distance, may need more intense symptom management and pulmonary rehabilitation, and vice versa, a patient with the high mMRC score but the relatively good 6MWT distance may need the interventions focused on breathlessness (Troosters et al., 2011, p. 247).

Important instruments in the evaluation of COPD include the CAT, mMRC Dyspnea Scale and the 6MWT.

All of the tools offer a different viewpoint on the disease, and in combination, they can give a full picture of the effects of COPD on the patient. Continued research and validation of these tools in different populations will lead to an improvement in their clinical use and will result in better patient outcomes. The implementation of these tools in the clinical practice may inform the decisions on the interventions of pharmacotherapy, rehabilitation, and the use of oxygen that will result in the improvement of patient care (Hwang et al., 2018, p. 1100).

5.2 Limitation of the study:

- The generalizability of the result is quite difficult due to small sample size.
- The research only shows the complication of COPD. It was needed to show the other variable like inspiratory muscle strength, psychological status, Awareness of COPD.
- The researcher collect data from only one Hospital but sample should be collected from larger area.
- No follow up study was included it was quite important to take a fallow up session. The fallow up of the participants could not be done due to shortage of time.
- Doesn't have much financial support for continue this study.
- Doesn't have much opportunity for collect data and Patients don't have much supportiveness.

CHAPTER-VI CONCLUSION & RECOMMENDATIONS

Conclusion:

This training aimed to evaluate the effectiveness of Positive Expiratory Pressure (PEP) therapy in patients' sorrow from Chronic Obstructive Pulmonary Disease (COPD). After analyzing the data of 30 participants, we found that both the experimental and control groups were comparable in baseline physical appearance, including age, BMI, walking distance, and respiratory health measures. This suggests that any changes observed in the outcomes were likely due to the intervention itself rather than initial disparities between the groups.

The intervention showed significant improvement in several parameters for the experimental group. The 6-Minute Walk Test (6MWT) results, Dyspnea scores, and COPD Assessment Test (CAT) scores all demonstrated substantial improvement post-treatment. These findings are consistent with previous research supporting the positive impact of PEP therapy on the physical performance and symptom management of COPD patients.

While the control group also showed some improvements, these were not as pronounced as in the experimental group, particularly in the 6MWT and symptom scales. Importantly, the sociodemographic and clinical characteristics did not significantly affect the intervention outcomes, reinforcing the effectiveness of the treatment across a diverse range of participants.

Recommendation:

Larger Sample Size: Upcoming studies should aim to include a larger sample size to improve the generalizability of the results. A larger population would provide a more robust analysis and strengthen the evidence for the effectiveness of PEP therapy in COPD management.

Inclusion of Additional Variables: Future research could explore additional variables such as inspiratory muscle strength, psychological status, and awareness of COPD to gain a more comprehensive understanding of the factors influencing treatment outcomes. Multisite Data Collection: Expanding data collection to multiple hospitals or geographical areas would enhance the diversity of the sample and make the results more applicable to a broader population.

Follow-up Studies: Conducting follow-up studies after the intervention would be valuable to assess the long-term effects of PEP therapy. Long-term monitoring would also help understand the sustainability of improvements in physical performance and symptom reduction.

Tailored Interventions: Given the varied responses to the intervention, future studies could explore personalized treatment plans based on individual characteristics, including baseline symptom severity and comorbidities, to optimize outcomes.

This study offers valuable insights into the positive effects of PEP therapy in managing COPD symptoms and improving patients' functional capacities. However, further research is required to address the limitations and refine the intervention protocols for better patient outcomes

Recommendations:

1. PEP therapy is most useful for COPD patients who have chronic cough and mucus retention (especially chronic bronchitis type).
2. Regular PEP use can reduce breathlessness, improve sputum clearance, and may increase exercise tolerance.
3. PEP should not be used alone. It works best when combined with standard treatments such as inhalers, exercise training, and breathing exercises.
4. Patients must be taught how to use the device properly for best results. Monitoring and follow-up improve compliance.
5. Studies suggest PEP therapy progresses value of life and helps reduce airway blockage.
6. However, more large-scale studies are still needed to confirm long-term benefits in COPD compared to its strong evidence in cystic fibrosis.
7. PEP devices are simple, affordable, and suitable even in low-resource settings.

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APPENDIX: A

Institutional Review Board (IRB) Permission Letter

SCMST-BPT/IRB/03-11/25/18

To
Rakib Hossain Jisan
4th Year Student of B.Sc. in Physiotherapy
Session: 2019-20, Registration No: 8813
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Subject: Approval of the thesis proposal **"Effectiveness of Inspiratory Muscle Training with Manual Therapy in Patients with COPD"** by ethics committee.

Dear Rakib Hossain Jisan
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 Inspiratory Muscle Training with Manual Therapy 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 from 250 Bedded TB Hospital

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 inspiratory muscle training in patients with COPD:** A Randomized Controlled Trial" and the aim of the study is to identify the Effectiveness of inspiratory muscle training in patients with COPD. This is A Randomized Controlled Trial study under the supervisor Mr Dr. Zahid Bin Sultan (PT), Ass. Professor & Head Department of Physiotherapy of 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

Rakib Hossain Jisan

Rakib Hossain Jisan
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

Supervisor Concern From

SAIC COLLEGE OF MEDICAL SCIENCE AND TECHNOLOGY

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

Ref: SCMST-BPT/SC/03-20/25/02 Date : 20/07/25

To Whom It May Concern

This is to certify that **Rakib Hossain Jisan, a 4th-year student of B.Sc. in Physiotherapy (Session: 2019-2020) at SAIC College of Medical Science and Technology (SCMST), Mirpur-14, Dhaka-1216**, is conducting a research project as a partial requirement for the completion of his degree. His research title **"Effectiveness of Inspiratory Muscle Training in Patients with COPD: A Randomized Controlled Trial."**

I am **Zahid Bin Sultan Nahid, Assistant Professor & Head of the Department of Physiotherapy at SCMST**, hereby confirm that I am supervising Rakib Hossain Jisan for this research project. This study aims to evaluate the effectiveness of inspiratory muscle training in patients with COPD.

I certify that he is under my supervision, and I fully support his research work. If any further information is required, please feel free to contact me.

Sincerely,

Zahid Bin Sultan Nahid
Assistant Professor & Head
Physiotherapy Department
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216

Zahid Bin Sultan Nahid

Assistant Professor & Head,

Department of Physiotherapy,

SAIC College of Medical Science and Technology

Mirpur-14, Dhaka-1216, Bangladesh.

Email: ranacrpphysio@outlook.com

01717-704776

APPENDIX: 01

Informed consent

Respondent ID no:

Dear participant,

I am Rakib Hossain Jisan student of Bachelor of physiotherapy program in the Department of physiotherapy Saic Collage of Medical Science and Technology (SCMST) affiliated by UNIVERSITY OF DHAKA conducting the study entitle "Effectiveness of PEP therapy in patients with COPD Person: A Randomized Control Trial Study" as a part of my thesis work for the partial fulfillment of Bachelor degree. There is list of question you need to fill up which include Effectiveness of PEP therapy in patients with COPD in Dhaka city. for spending your time to participate in this self-administered interview, which will take around 10-15 minutes. There is list of questionnaires and you need to fill up each answer. The information gained from this questionnaire will be used for academic purpose and will be kept confidential. Your participation in this study is voluntarily and you have the right to withdraw from the interview without any clarification at any moment. You can ask any question to the researcher regarding the study to meet up your quarry. Looking forward your kind cooperation.

Declaration of the participant

Nave been answered in this survey. The foregoing information has been read to me and that have been answered to my satisfaction. I have noticed that my participation in this study is voluntary and I have the right to withdraw from the interview at any clarification. I give my consent voluntarily to be participants in this study.

Respondent name:

Signature and date:

Witness signature:

Fingerprint:

Questionnaire (English)

Effectiveness of PEP therapy in patients with COPD

CONSENT STATEMENT (English)

Please Read It Carefully

Assalamualaikum,

I am Rakib Hossain Jisan, 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 PEP therapy in patients with in COPD Patients**."** In this study, I would like to find out the effect of PEP therapy 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 Rakib Hossain Jisan or the research supervisor Md. Dr. Zahid Bin Sultan, Ass. Professor and Head Department of Physiotherapy of SCMST, Mirpur-14, Dhaka-1216.

Do you have any questions before I start?	Yes	No
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……

Questionnaire (English)

Title: Effectiveness of PEP Therapy Technique in COPD patients.

Questionnaire (English)

This questionnaire is developed to assessment of PEP in COPD patients and this section will be filled by physiotherapist using a black ball pen.

Patient ID:		
Date of test:		
Name of participants:		
Code:		
Address:	**Village:** **Upazila:**	**Post-Office:** **District:**
Phone:		

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 of the participant
1.1	Age	……Year
1.2	Gender	0= Male 1= Female
1.3	Marital status	0 = Unmarried 1 = Married
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= Other.....
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

[Tick √ the point, which is able to perform patient]

Question No	Questions	Response of the participants
2.1	Height	……...
2.2	Weight	……...
2.3	BMI	

Section-3: Disease Related Information

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

QN	Question	Response
3.1	1.Duration of Sufferings	☐ 0 ☐ 1 ☐ 2 ☐ 3
3.2	Relieving Factor	☐ 0 ☐ 1 ☐ 2 ☐ 3

Comorbidity Questionnaire for COPD Patients

Instructions: Please tick (✓) YES if you currently have or have ever been diagnosed with the following conditions. Otherwise, tick NO.

Sl.	Condition	Yes (✓)	No (✓)	বাংলা (অনুবাদ)
1	Hypertension (High blood pressure)	☐	☐	উচ্চ রক্তচাপ
2	Diabetes mellitus	☐	☐	ডায়াবেটিস মেলিটাস
3	Heart disease (e.g., heart failure, IHD)	☐	☐	হৃদরোগ (যেমন, হৃদযন্ত্রের অক্ষমতা, আইএইচডি)
4	Asthma	☐	☐	হাঁপানি
5	Tuberculosis (past or present)	☐	☐	যক্ষ্মা (অতীত বা বর্তমান)
6	Depression or Anxiety	☐	☐	বিষণ্নতা বা উদ্বেগ
7	Osteoporosis or frequent bone fractures	☐	☐	অস্টিওপোরোসিস বা বারবার হাড় ভেঙে যাওয়া
8	Chronic kidney disease	☐	☐	দীর্ঘস্থায়ী কিডনি রোগ
9	Obesity (BMI ≥ 30)	☐	☐	মোটা (বিএমআই ≥ ৩০)
10	Gastroesophageal Reflux (GERD/Acidity)	☐	☐	গ্যাস্ট্রোইসোফেজিয়াল রিফ্লাক্স (জিইআরডি/অ্যাসিডিটি)
11	Stroke or transient ischemic attack (TIA)	☐	☐	স্ট্রোক বা অস্থায়ী মস্তিষ্কের রক্তপ্রবাহ বন্ধ (টিআইএ)
12	Anemia	☐	☐	রক্তস্বল্পতা (এনিমিয়া)

Pre test

<u>Section-4:</u> COPD Assessment Test (CAT) questionnaire.

This questionnaire is designed for the COPD Assessment Test (CAT), which is widely used in the evaluation of Chronic Obstructive Pulmonary Disease (COPD). The CAT was developed to provide a simple and standardized method for assessing the health status of individuals with COPD. It is a self-administered questionnaire consisting of 8 items that evaluate key symptoms and the overall impact of COPD on a patient's daily life. The items include assessments of cough, phlegm, chest tightness, breathlessness, activity limitations, confidence, sleep, and energy.

The items are scored from 0 to 5, which correspond to:
0 = No impairment and 5 = Maximum impairment for each item.

The scores are summed up to produce a total CAT score, with a possible score range of 0 to 40. Based on the total score, the impact of COPD on the patient is categorized as:

1–10 = Low impact
11–20 = Medium impact 21–
30 = High impact
31–40 = Very high impact

Higher scores on the CAT indicate greater symptom severity and functional limitation due to COPD. This section of the questionnaire will be filled by the physiotherapist using a pencil, based on the patient's self-reported answers.

(Please circle the appropriate rating for each item the point, which is able to perform patient.)

COPD Assessment Test (CAT) – Standard Table in Bangla

আইটেম নম্বর	প্রশ্ন	০	১	২	*	৪	৫
১	আমি কখনো কাশি নেই → আমি সব সময় কাশি করি	☐	☐	☐	☐	☐	☐
২	আমার বুকের মধ্যে একটুকু কফ (শ্বাসনালী) নেই → আমার বুক কফে পূর্ণ	☐	☐	☐	☐	☐	☐
৩	আমার বুক একদম টাইট নয় → আমার বুক খুব টাইট অনুভূত হয়	☐	☐	☐	☐	☐	☐
৪	যখন আমি একটি পাহাড়ে উঠি বা একতলা সিঁড়ি উঠি, আমি শ্বাসকষ্ট অনুভব করি না → আমি খুব শ্বাসকষ্ট অনুভব করি	☐	☐	☐	☐	☐	☐
৫	আমি বাড়িতে কোন কার্যক্রমে সীমাবদ্ধ না → আমি খুব সীমাবদ্ধ	☐	☐	☐	☐	☐	☐
৬	আমি আমার শ্বাসকষ্ট থাকা সত্ত্বেও বাড়ি থেকে বের হওয়ার ব্যাপারে আত্মবিশ্বাসী	☐	☐	☐	☐	☐	☐
৭	আমি ভালোভাবে ঘুমাই → আমি শ্বাসকষ্টের কারণে ভালোভাবে ঘুমাতে পারি না	☐	☐	☐	☐	☐	☐
৮	আমার প্রচুর শক্তি আছে → আমার একটুও শক্তি নেই	☐	☐	☐	☐	☐	☐

COPD Assessment Test (CAT) – Standard Table

Item No.	Question	0	1	2	3	4	5
1	I never cough ⟶ I cough all the time	☐	☐	☐	☐	☐	☐
2	I have no phlegm (mucus) in my chest at all ⟶ My chest is completely full of phlegm	☐	☐	☐	☐	☐	☐
3	My chest does not feel tight at all ⟶ My chest feels very tight	☐	☐	☐	☐	☐	☐
4	When I walk up a hill or one flight of stairs I am not breathless ⟶ I am very breathless	☐	☐	☐	☐	☐	☐
5	I am not limited doing any activities at home ⟶ I am very limited	☐	☐	☐	☐	☐	☐
6	I am confident leaving my home despite my lung condition ⟶ I am not at all confident	☐	☐	☐	☐	☐	☐
7	I sleep soundly ⟶ I don't sleep soundly because of my lung condition	☐	☐	☐	☐	☐	☐
8	I have lots of energy ⟶ I have no energy at all	☐	☐	☐	☐	☐	☐

<u>Section-4: Assessment of dyspnea level by</u> Modified Medical Research Council (mMRC) Dyspnea Scale.

The Modified Medical Research Council (mMRC) Dyspnea Scale is a widely used tool to assess the severity of breathlessness (dyspnea) in patients with chronic respiratory diseases, particularly Chronic Obstructive Pulmonary Disease (COPD). It is simple, quick to administer, and focuses on the patient's perception of breathlessness during various physical activities.

The mMRC scale consists of five grades (0–4), where each grade reflects the level of activity that provokes dyspnea:

Grade	Statement (English)	Statement (বাংলা অনুবাদ)	Tick (✓)
0	I only get breathless with strenuous exercise.	আমি কেবল কঠিন শারীরিক পরিশ্রমের সময় শ্বাসকষ্ট অনুভব করি।	☐
1	I get short of breath when hurrying on level ground or walking up a slight hill.	আমি সমতল মাটিতে দ্রুত হাঁটার সময় বা সামান্য পাহাড়ে ওঠার সময় 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.	আমি সমবয়সী লোকদের চেয়ে সমতল মাটিতে ধীর গতিতে হাঁটি কারণ শ্বাসকষ্ট অনুভব করি, অথবা আমাকে শ্বাস নিতে থামতে হয়।	☐
3	I stop for breath after walking about 100 meters or after a few minutes on level ground.	আমি প্রায় ১০০ মিটার হাঁটার পর বা কয়েক মিনিট সমতল মাটিতে হাঁটার পর শ্বাস নিতে থামতে হয়	☐
4	I am too breathless to leave the house or I get breathless when dressing or undressing.	আমি বাড়ির বাইরে বের হতে পারি না অথবা কাপড় পরা বা খোলার সময় শ্বাসকষ্ট অনুভব করি।	☐

6-Minute Walk Test (6MWT) Questionnaire:

Pre-Test Questions

1. Any chest pain or tightness today? ☐ Yes ☐ No
2. Feeling dizzy or unwell now? ☐ Yes ☐ No
3. On medication that affects performance? ☐ Yes ☐ No
    - If yes, list: _____

Physical Activity

4. Usual activity level:

    ☐ Daily ☐ Weekly ☐ Rarely ☐ Never
5. Can walk 500m without help? ☐ Yes ☐ No
6. Use of walking aid? ☐ Yes ☐ No — Type: _____

Test Performance

7.Distance walked: _____ meters

8.Stops during walk: _____

9.SpO_2: Before _____% / After _____%

10.Heart Rate: Before _____ bpm / After _____ bpm

৬-মিনিট হাঁটার পরীক্ষা (6MWT) প্রশ্নাবলী:

প্রাক-পরীক্ষা প্রশ্নাবলী:

১. আজ কি আপনার বুকব্যথা বা চাপ অনুভূত হচ্ছে?

□হ্যাঁ□না

২. এখন কি আপনি মাথা ঘুরানো বা অসুস্থ অনুভব করছেন?

□হ্যাঁ□না

৩. আপনি কি এমন কোন ওষুধ খাচ্ছেন যা আপনার পারফরমেন্সে প্রভাব ফেলতে পারে?

□ হ্যাঁ □ না

- যদি হ্যাঁ, তবে লিখুন: _____

শারীরিক কার্যকলাপ:

৪.আপনারসাধারণকার্যকলাপেরস্তরকী?

□ প্রতিদিন □ সাপ্তাহিক □ কম □ কখনও না

৫. আপনি কি ৫০০ মিটার হাঁটতে পারবেন সাহায্য ছাড়াই?

□হ্যাঁ□না

৬. হাঁটার জন্য কোনো সহায়ক ব্যবহার করেন?

□ হ্যাঁ □ না – প্রকার: _____

পরীক্ষার কার্যকারিতা:

৭. হাঁটার মোট দূরত্ব: _____ মিটার

৮. হাঁটার সময় বিরতি: _____

৯. SpO_2: পরীক্ষা আগে _____% / পরে _____%

১০. হৃদস্পন্দন: পরীক্ষা আগে _____ bpm / পরে _____ bpm

Post Test

<u>Section-4:</u> COPD Assessment Test (CAT) questionnaire.

This questionnaire is intended for the COPD Assessment Test (CAT), a tool commonly utilized for evaluating Chronic Obstructive Pulmonary Disease (COPD). The CAT was created to offer an easy and standardized way to assess the health status of those with COPD. It is a self-administered questionnaire made up of 8 items that examine important symptoms and the overall effect of COPD on a patient's daily life. The items assess cough, phlegm production, feelings of chest tightness, breathlessness, limitations on activity, level of confidence, sleep quality, and energy levels.

The items are scored from 0 to 5, which correspond to:

0 = No impairment and 5 = Maximum impairment for each item.

The scores are summed up to produce a total CAT score, with a possible score range of 0 to 40. Based on the total score, the impact of COPD on the patient is categorized as:

1–10 = Low impact11–20 =Medium impact 21– 30 High impact

31–40 = Very high impact

Higher scores on the CAT indicate greater symptom severity and functional limitation due to COPD. This section of the questionnaire will be filled by the physiotherapist using a pencil, based on the patient's self-reported answers.

Please circle the appropriate rating for each item the point, which is able to perform patient)

COPD Assessment Test (CAT) – Standard Table in Bangla

আইটেম নম্বর	প্রশ্ন	০	১	২	*	৪	৫
১	আমি কখনো কাশি নেই → আমি সব সময় কাশি করি	☐	☐	☐	☐	☐	☐
২	আমার বুকের মধ্যে একটুকু কফ (শ্বাসনালী) নেই → আমার বুক কফে পূর্ণ	☐	☐	☐	☐	☐	☐
৩	আমার বুক একদম টাইট নয় → আমার বুক খুব টাইট অনুভূত হয়	☐	☐	☐	☐	☐	☐
৪	যখন আমি একটি পাহাড়ে উঠি বা একতলা সিঁড়ি উঠি, আমি শ্বাসকষ্ট অনুভব করি না → আমি খুব শ্বাসকষ্ট অনুভব করি	☐	☐	☐	☐	☐	☐
৫	আমি বাড়িতে কোন কার্যক্রমে সীমাবদ্ধ না → আমি খুব সীমাবদ্ধ	☐	☐	☐	☐	☐	☐
৬	আমি আমার শ্বাসকষ্ট থাকা সত্ত্বেও বাড়ি থেকে বের হওয়ার ব্যাপারে আত্মবিশ্বাসী	☐	☐	☐	☐	☐	☐
৭	আমি ভালোভাবে ঘুমাই → আমি শ্বাসকষ্টের কারণে ভালোভাবে ঘুমাতে পারি না	☐	☐	☐	☐	☐	☐
৮	আমার প্রচুর শক্তি আছে → আমার একটুও শক্তি নেই	☐	☐	☐	☐	☐	☐

COPD Assessment Test (CAT) – Standard Table

Item No.	Question	0	1	2	3	4	5
1	I never cough ⟶ I cough all the time	☐	☐	☐	☐	☐	☐
2	I have no phlegm (mucus) in my chest at all ⟶ My chest is completely full of phlegm	☐	☐	☐	☐	☐	☐
3	My chest does not feel tight at all ⟶ My chest feels very tight	☐	☐	☐	☐	☐	☐
4	When I walk up a hill or one flight of stairs I am not breathless ⟶ I am very breathless	☐	☐	☐	☐	☐	☐
5	I am not limited doing any activities at home ⟶ I am very limited	☐	☐	☐	☐	☐	☐
6	I am confident leaving my home despite my lung condition ⟶ I am not at all confident	☐	☐	☐	☐	☐	☐
7	I sleep soundly ⟶ I don’t sleep soundly because of my lung condition	☐	☐	☐	☐	☐	☐
8	I have lots of energy ⟶ I have no energy at all	☐	☐	☐	☐	☐	☐

<u>Section-4: Assessment of dyspnea level by</u> Modified Medical Research Council (mMRC) Dyspnea Scale.

The Modified Medical Research Council (mMRC) Dyspnea Scale is a widely used tool to assess the severity of breathlessness (dyspnea) in patients with chronic respiratory diseases, particularly Chronic Obstructive Pulmonary Disease (COPD). It is simple, quick to administer, and focuses on the patient's perception of breathlessness during various physical activities.

The mMRC scale consists of five grades (0–4), where each grade reflects the level of activity that provokes dyspnea:

Grade	Statement (English)	Statement (বাাাংলা অনুবাদ)	Tick (✓)
0	I only get breathless with strenuous exercise.	আমি কেবল কঠিন শারীরিক পরিশ্রমের সময় শ্বাসকষ্ট অনুভব করি।	☐
1	I get short of breath when hurrying on level ground or walking up a slight hill.	আমি সমতল মাটিতে দ্রুত হাঁটার সময় বা সামান্য পাহাড়ে ওঠার সময় 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.	আমি সমবয়সী লোকদের চেয়ে সমতল মাটিতে ধীর গতিতে হাঁটি কারণ শ্বাসকষ্ট অনুভব করি, অথবা আমাকে শ্বাস নিতে থামতে হয়।	☐
3	I stop for breath after walking about 100 meters or after a few minutes on level ground.	আমি প্রায় ১০০ মিটার হাঁটার পর বা কয়েক মিনিট সমতল মাটিতে হাঁটার পর শ্বাস নিতে থামতে হয়	☐
4	I am too breathless to leave the house or I get breathless when dressing or undressing.	আমি বাড়ির বাইরে বের হতে পারি না অথবা কাপড় পরা বা খোলার সময় শ্বাসকষ্ট অনুভব করি।	☐

6-Minute Walk Test (6MWT) Questionnaire

Post-Test Questions

1. Any chest pain or tightness today? ☐ Yes ☐ No
2. Feeling dizzy or unwell now? ☐ Yes ☐ No
3. On medication that affects performance? ☐ Yes ☐ No
    - If yes, list: _____

Physical Activity

4. Usual activity level:

☐ Daily ☐ Weekly ☐ Rarely ☐ Never

5. Can walk 500m without help? ☐ Yes ☐ No
6. Use of walking aid? ☐ Yes ☐ No — Type: _____

Test Performance

7. Distance walked: _____ meters
8. Stops during walk: _____
9. SpO_2: Before _____% / After _____%
10. Heart Rate: Before _____ bpm / After _____ bpm

৬-মিনিট হাঁটার পরীক্ষা (6MWT) প্রশ্নাবলী:

প্রাক-পরীক্ষা প্রশ্নাবলী:

১. আজ কি আপনার বুকব্যথা বা চাপ অনুভূত হচ্ছে?

☐ হ্যাঁ ☐ না

২. এখন কি আপনি মাথা ঘুরানো বা অসুস্থ অনুভব করছেন?

☐ হ্যাঁ ☐ না

৩. আপনি কি এমন কোন ওষুধ খাচ্ছেন যা আপনার পারফরমেন্সে প্রভাব ফেলতে পারে?

☐ হ্যাঁ ☐ না

- যদি হ্যাঁ, তবে লিখুন: _____

শারীরিক কার্যকলাপ:

৪. আপনার সাধারণ কার্যকলাপের স্তর কী?

☐ প্রতিদিন ☐ সাপ্তাহিক ☐ কম ☐ কখনও না

৫. আপনি কি ৫০০ মিটার হাঁটতে পারবেন সাহায্য ছাড়াই?

☐ হ্যাঁ ☐ না

৬. হাঁটার জন্য কোনো সহায়ক ব্যবহার করেন?

☐ হ্যাঁ ☐ না — প্রকার: _____

পরীক্ষার কার্যকারিতা:

৭. হাঁটার মোট দূরত্ব: _____ মিটার

৮. হাঁটার সময় বিরতি: _____

৯. SpO_2: পরীক্ষা আগে _____% / পরে _____%

১০. হৃদস্পন্দন: পরীক্ষা আগে _____ bpm / পরে _____ bpm

APPENDIX: 02

Gant Chart

Activates/ month	Jun 24	July 24	Aug 24	Sep 24	Oct 24	Nov 24	Dec 24	Jan 25	Feb 25	Mar 25	Apr 25	May 25	June 25	July 25
Proposal presentation														
Introduction														
Literature review														
Methodology														
Data collation														
Data Analysis														
Results														
1st progress presentation														
Discussion														
Conclusion & Recommendation														
2nd progress presentation														
Communication with supervisor														
Final submission														