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Effect of Pursed-Lip Versus Pranayama Breathing Exercises on Selected Vital Parameters Among Patients With COPD

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Abstract
Background: Chronic obstructive pulmonary disease is a serious health issue which classified as the third most common cause of death globally. It causes dynamic hyperinflation as the illness deteriorates over time, causing dyspnoea and changes in the heart's functioning in individuals. Patients with pulmonary disease frequently employ pursed lip and/or pranayama breathing exercise to alleviate dyspnoea, improve gas exchange, and increase ventilation efficiency. **Aim:** To investigate the effect of pursed-lip versus pranayama breathing exercises on selected vital parameters among patients with chronic obstructive pulmonary disease. **Design:** Quasi-experimental design (non-equivalent, pre-post-test control group) was utilized**. Setting:** This study was conducted at one of the teaching hospital of Cairo University, Egypt**. Sample:** A purposive sample of 90 adult male & female patients. **Tools:** three tools were used (1) Demographic and Medical History Data Sheet, (2) Observational sheet, & (3) Dyspnoea Index questionnaire. **Results:** Statistical significant difference was observed at 4 weeks following interventions between the three groups regarding dyspnoea score (F = 197.463, P value: 0.000), respiratory rate (F = 213.112, P value: 0.000) and oxygen saturation (F = 25.779, P value: 0.040). **Conclusion:** With an exception of heart rate, high statistical significant difference was observed in the control group and the two intervention groups regarding the rest of selected vital parameters and dyspnoea score. Significant improvement was observed among the pursed lip intervention group. **Recommendations:** Pulmonary rehabilitation program should be offered to those patients including pursed lip and pranayama breathing exercises.

Keywords: COPD, Pranayama, Pursed-Lip Breathing Exercises & Selected Vital Parameters.

Introduction
Chronic obstructive pulmonary disease (COPD) is a common and treatable respiratory disease characterized by progressive airflow limitation and tissue destruction. It is associated with structural lung changes due to chronic inflammation that results in irreversible airflow obstruction and decreased lung recoil **(Agarwal, et al., 2022)**. Approximately 10 percent of patients aged 40 years or older had COPD. It was the third leading cause of death worldwide **(World Health Organization, 2022)**. It is ranked among the top causes of death in the United States, killing more than 120,000 patients each year **(Ahmad & Anderson, 2021).**

Chronic obstructive pulmonary disease (COPD) includes chronic bronchitis and emphysema. Chronic bronchitis refers to the presence of chronic productive cough for three months during each of two consecutive years with the production of phlegm that results from inflammation of the airways. While emphysema refers to the destruction of the tiny air sacs at the end of the bronchioles in the lungs **(American Lung Association, 2022).**

The pathogenesis of COPD is a dynamic and cumulative process that is bound up with the external environment, intrinsic genes, smoking, and air pollution are the main risk factors for COPD **(Chen & Wu, 2022).** On the same line, **Saliem, et al., (2022)** added that the most common risk factors for COPD are smoke, tobacco, indoor air pollution, occupational exposure, and alpha1-antitrypsin deficiency. COPD is often characterized by dyspnoea, coughing, sputum production, wheezing, chest tightness, and confusion. Symptoms can range from being asymptomatic to respiratory failure. The most common symptom of COPD, which develops slowly and often occurs at greater ages, is dyspnea, which patients define as air hunger or shortness of breath. This condition is usually accompanied by cough, phlegm, wheezing, restriction of daily activities, fatigue, insomnia, and pain. Increased symptoms and restriction of daily activities also decrease the quality of life of those patients. An accurate and regular pharmacological treatment is the most important approach in relieving dyspnea and other symptoms of COPD **(Agarwal, et al., 2022).**

Although comprehensive and effective management of COPD symptoms remains a challenge, various strategies for managing COPD symptoms have been developed, including pharmacological and non-pharmacological methods. Pharmacological treatment for COPD may include the administration of anti-

inflammatory, inhalers, antihistamines, steroids, and oxygen. One of the most common effective pharmacological treatment is the use of an inhaler drug because, it allows the drug to be delivered directly to the airways and causes fewer side effects compared to systemic treatment **(Choratas, Papastavrou, Charalambous & Kouta, 2020; Ceyhan, & Kartin, 2022).**

One of the non-pharmacological methods used for COPD symptoms is breathing exercises. They don't improve lung function more effectively, but rather have an impact on strengthening the respiratory muscles. Breathing exercises include diaphragmatic breathing, pursed-lips breathing, Pranayama, active expiration; relaxation breathing; and ventilation feedback training **(Al Kazaleh et al., 2020; Budiman & Garnewi, 2021).**

The benefits of these breathing exercises have been recommended to decrease lung hyperventilation, reduce the intensity of dyspnea, as well as improve respiratory muscle function, peripheral muscle strength, gas exchange, and exercise tolerance. Moreover, reduce exacerbation rate, heart rate, respiratory rate, oxygen consumption, anxiety, and depression associated with COPD. In addition, decrease the number of hospitalizations and days in the hospital. So, reducing the mortality, morbidity rate in patients and also greatly decrease health care costs and promote patient's quality of life **(Mayer, Karloh, Santos, de Araujo & Gulart, 218; Mohamed, 2019; Widoroni, Andri & Kristian, 2021; Grover & Goyal, 2021).**

Pursed lip breathing is one of the breathing exercises that improve gas exchange and reduces breathing frequency; it also helps in faster recovery from dyspnea and slows down the heart rate. Researchers suggested that pursed lip breathing improves arterial blood gas level (Sao2) as well as transcutaneous oxygen saturation (Spo2) level and it also reduces the respiratory rate and minute ventilation, improves tidal volume and oxygenation at rest **(Rupareliya, & Jagad, 2021; Maharem, et al., 2021)**. While Pranayama is a type of breathing technique in Yoga. There are different methods of practicing pranayama. Some are on a slow and soft rhythm and some are on a fast and forceful rhythm that increases the depth of breathing. Nadi shodhana pranayama is a slow and soft rhythm pranayama that increases respiratory stamina, relaxes the chest muscles, expands the lungs, raises energy levels, calms the body, and causes an overall improvement in lung functions **(Swathi, et al., 2021).**

Moreover, because humans breathe through both nostrils alternately, pranayama breathing pattern is known as alternate nostril breathing. Yoga literature states that the right nostril is known as Pingala Nadi, which symbolises physical energy and the body, while the left nostril is known as "ida Nadi," which represents mental energy and the mind. The body and mind will be out of harmony if Pingala and Ida are not. By harmonising these two forces-mental and physical energy-alternate nostril breathing seeks to bring the body and mind into harmony. Nadi shodhana pranayama enables patients to increase cardiopulmonary resistance through breath control, thus increasing lung capacity and decreasing respiratory rate **(Chen, & Su, 2021).**

The nurse's main role in COPD is to increase the patient's knowledge about how to prevent a recurrence of the dyspneic attack. Prevention of dyspnea is carried out by pharmacological and non-pharmacological treatments. Non-pharmacological treatments include performing lung hygiene; breathing exercises, physical exercise, such as walking to train the skeletal muscles to be more effective; avoiding irritants, such as cigarette smoke; preventing allergens from entering the body; and eating a balanced diet **(Anugrah, 2021).**

Nurses have a crucial role in managing patients with COPD including assessing vital parameters of those patients as pulse rate, respiratory rate, blood pressure, and oxygen saturation considered the most important physiological criteria and valuable issues for evaluating their hemodynamic status. The early prediction of the patient's physiological conditions based on vital signs is important for proper decisions and the provision of necessary care to those patients **(Sakhaei, et al., 2018).**

Along with measuring vital signs, it is important to monitor and record the level of dyspnea that may occur before, during, or after practicing the training exercise which can help adjust the individualized exercise training program for patients **(Chen, & Su, 2021).** Therefore, the aim of the current study is to assess the effect of different types of breathing exercises as pursed-lip versus pranayama breathing exercises on selected vital parameters such as (pulse rate, respiratory rate, oxygen saturation, and Dyspnea Index (DI) questionnaire) among patients with COPD.

Significance of the study

Chronic obstructive pulmonary disease (COPD) is one of the most common life-threatening diseases affecting populations globally **(WHO, 2019)** approximately 300 million people have COPD globally, with a prevalence of approximately 12.2% **(Ruvuna & Sood, 2020)**. According to the World Health Organization (2018), chronic diseases were the cause of 71% of deaths in the world in ages ranging between 30 and 70 years old. Of these, chronic obstructive pulmonary disease (COPD) is the

third leading cause of death worldwide, killing 3.23 million in 2019 **(WHO, 2022).**

Statistical analysis of COPD prevalence in Egypt showed that three million people in the Egyptian population have COPD. In different studies, prevalence rates varied from 3.3 to 10%. The prevalence rate in men was 6.7%, whereas it was 1.5% in women. A study published in 2014 showed that the prevalence of COPD among high-risk Egyptians by GOLD criteria was 9.6% **(Elassal, et al., 2018)**. Furthermore, other study estimated that the prevalence of COPD in Egypt around 3.5% of the general population, and the gender-specific distribution was higher in males with a frequency of 6% **(Hosny et al., 2022).**

Patients with COPD usually have physiological abnormalities that are mainly associated with alteration in respiratory muscle function; weakness of the respiratory muscles in patients with COPD often leads to hypercapnia, dyspnea, and decreased exercise capacity. Therefore, the implementation of breathing exercises such as pursed-lip or pranayama breathing exercises can enhance respiratory muscle function, improve gas exchange and potentially reduce the severity of symptoms in patients with COPD **(Sakhaei, et al., 2018; Yun, et al., 2021; Li, et al., 2022; Ceyhan, & Kartin, 2022).**

Moreover, pursed-lip and pranayama breathing exercises had positive results and evidence to reduce heart rate, respiratory rate, oxygen consumption and the intensity of dyspnea. So, it was relevant to investigate the effect of pursed-lip versus pranayama breathing exercises on selected vital parameters and dyspnea score to identify which one of them is more effective to improve vital parameters and reduce the intensity of dyspnea than other exercise or both of them have the same effect; especially there is a scanty number of researches have been conducted on the effect of different types of breathing exercises as pursed-lip versus pranayama breathing exercises on selected vital parameters as (pulse rate, respiratory rate, oxygen saturation, and level of dyspnea scale) among patients with COPD worldwide and in Egypt.

Therefore, hoping that the result of the current study help nurses to assess intensity of dyspnea level, provide the required care for reliving or reducing the severity of dyspnea, use different types of breathing exercises as pursed-lip and pranayama breathing exercises properly for improving the hemodynamic status of those patients and alleviate patients suffering from the side effects of the medications used for COPD. Moreover, it is hoped that the findings of this study might help in improving the quality of patient care and establish evidence-based data that can promote nursing practice and research.

Methods

Aim of the study

The current study aimed to investigate the effect of pursed-lip versus pranayama breathing exercises on selected vital parameters such as pulse rate, respiratory rate, oxygen saturation, and dyspnea index questionnaire among patients with COPD.

Research hypotheses

In order to accomplish this study aim, two hypotheses were formulated:

H1: The total post- mean scores of selected vital parameters of patients with COPD who receive either pursed-lip or pranayama breathing exercises will be a statistically significant differ from the total post-mean scores of selected vital parameters of patients with COPD who receive only routine hospital care.

H1a: The total post- mean scores of selected vital signs of patients with COPD who receive either pursed-lip or pranayama breathing exercises will be a statistically significant difference from the total post-mean scores of selected vital signs of patients with COPD who receive only routine hospital care.

H1b: The total post-mean scores of oxygen saturation of patients with COPD who receive either pursed-lip or pranayama breathing exercises will be a statistically significant difference from the total post-mean scores of oxygen saturation of patients with COPD who receive only routine hospital care.

H1c: The total post-mean scores of dyspnea index questionnaire of patients with COPD who receive either pursed-lip or pranayama breathing exercises will be a statistically significant difference from the total post-mean scores of dyspnea index questionnaire of patients with COPD who receive only routine hospital care.

H2: The total post-mean scores of vital parameters will differ from applying pursed-lip versus pranayama breathing exercises among the intervention groups.

Operational definitions

Selected vital parameters:

a. **Vital signs:** Variable measurements include selected vital signs (heart rate, **respiratory** rate).
b. **Oxygen Saturation (SpO2):** Oxygen saturation of the hemoglobin was measured by non-invasive pulse oximetry. (Normal range: 97%to 99%).
c. **The Dyspnea Index (DI) questionnaire:** It is quantitative scores **used** to assess severity of dyspnea measured by **(Gartner-Schmidt et al., 2014)**.

- **Pursed-lip breathing exercises**: It is a breathing technique that consists of inhaling slowly through the nose and then exhaling against pursed lips. Its session is repeated 3 times /day for 5-10 breath cycles (around 10-15 minutes) for 5 days per week for one month.
- **Pranayama Breathing Exercise:** Is one type of breathing exercises, also known as Alternate-nostril breathing that uses 2 nostrils in the breathing exercises. Its session is repeated 3 times /day for 5-10 breath cycles (around 10-15 minutes) for 5 days per week for one month.
- **Patients with COPD**: It refers to adult male & female patients with a confirmed diagnosis of chronic obstructive pulmonary disease during the first week of their admission to the hospital.

Research Design

Quasi-experimental design (nonequivalent, pre-post test control group). The quasi-experimental research design involves manipulating the independent variable to observe the effect on the dependent variable. The pre-test and post-test results helped establishing the effectiveness of the intervention measures proposed in the research **(Polit, & Beck, 2017).**

Setting

This study was conducted at one of the teaching hospitals of Cairo University, Egypt, which provide medical treatment for patients with COPD.

Sample

The research population included all patients admitted to teaching hospital at one of the Cairo University hospitals in Cairo governorate, Egypt. Besides, the research sample was the patients who met the following inclusion criteria: (1) patients diagnosed with COPD during the first week of their admission to the hospital, (2) adult male and female patients whose ages ranged from 20 to less than 60 years old, (3) free from any other respiratory disorders such as tuberculosis (4) conscious patients and able to communicate with the researchers. While exclusion criteria included: (1) patients with dyspnea due to complications of other diseases, (2) patients with permanent physical disorders of the neck, chest, and upper extremities (3) free from any associated co-morbid diseases that affect blood gases results as uncontrolled diabetes mellitus, or uncontrolled hypertension, renal disease, liver disease, and congestive heart failure, (4) not participated in any respiratory exercise-training program throughout the last 3 months and (5) acute exacerbation of COPD.

Over a period of six months, purposive sample of at least 90 male and female adult patients constituted the study sample. A sample of adult male and female patients who met the inclusion criteria were invited to share in the research. The researchers started firstly with control group, after finishing the data collection from the control group (G1). Two intervention groups were randomly allocated by using the patient's bed code number (G2) and (G3).

Data collection tools

In order to accomplish the aim of the study, three instruments were used to collect the data:

1. **Demographic and Medical History Data Sheet**: This sheet was designed by the researchers to collect the baseline characteristics and medical data of the patients, it had 2 parts: part (1) related to demographic data such as; age, gender, marital status, education, employment status, and part (2) related to medical data of COPD such as duration of the disease, co morbid diseases, and main complains of COPD…….etc.
2. **Observational sheet was designed by the researchers** to record the selected vital parameters particularly, heart rate, respiratory rate, oxygen saturation by using pulse oximeter.
3. **Dyspnea Index (DI) questionnaire:** It is an adopted tool developed by **(Gartner-Schmidt et al., 2014)**, used to assess the severity of dyspnea. The questionnaire includes 10 questions related to dyspnea; its location, perceived sense of worsening, weather, stress, or exercise aggravation, presence of stridor, or straining, and its effect on stress or social life. All were rated according to a 5-point Likert scale. On this scale, 0 stands for 'never,' and 4 stands for 'always. The scoring system of the tool: (0) indicates to never patient had dyspnea, (1-10) indicates almost never had dyspnea, (11-20) indicates sometimes had dyspnea, (21-30) almost always had dyspnea, (31-40) patients had always dyspnea. Reliability statistics of the Arabic version of this tool showed a high value of internal consistency among the items (Cronbach's alpha = 0.93) **(Alrabiah et al., 2022).**

Ethical considerations

Initial written approval was obtained from the Research Ethics Committee of the Faculty of Nursing- Cairo University **(IRB 2019041701)**. Official permission was also obtained from the head of the department in the hospital. Written informed consent was obtained from each patient after explaining the nature and the purpose of the study. Researchers emphasized that participation in the study is voluntary. The confidentiality of patients was assured through the coding of all data. In addition, the patients were informed that they had the right to refuse or withdraw from the study at any time without giving a reason.

Procedure of the study

Once official permission was granted from the appropriate authoritative personnel in the college and the head of the department in the hospital, the proposed study was preceded and conducted. Patients meeting the inclusion criteria were interviewed individually, the researchers started firstly with control group, after finishing the data collection from the control group (G1:30 patients) who received the only routine hospital care. Two intervention groups were randomly allocated by using the patient's bed code number as the **odd** code number of the patient's bed was assigned to the first study group (G2: 30 patients) who followed routine hospital care alongside with pursed-lip breathing exercise. In addition, the **even** code number of the patient's bed in the department was assigned to the second study group (G3:30 patients) who followed routine hospital care alongside with pranayama breathing exercise.

This study was conducted in three phases as the following:

Assessment phase: The researchers interviewed the patients, who met the inclusion criteria and willing to participate in the study, and explained the nature and the aim of the study, in order to obtain their informed consent. At this phase, demographic and medical data sheet, observational sheet for selected vital parameters, as well as dyspnea index questionnaire were filled by the researchers, it takes about 10 to 20 minutes in order to obtain baseline data from control and two intervention groups.

Implementation phase: At this phase, the researchers applied **pursed lip breathing exercises (PLB)** for the first intervention group (G2). Demonstration of pursed lips breathing exercises included, asking the patient to breathe by relaxing the neck and shoulder muscles and with the mouth closed, slowly inhale (breathing in) through the nose counting up to the number 2, then closing the mouth, slowly exhaling (breath out) all the air in the lungs with the lips pursed "as if them going to whistle of gently flicker the flame of a candle," didn't force the air out. Breathing out should be through the pursed lips counting from 1 to 5. Pursed lip breathing exercise is repeated 3 times /day for 5-10 breath cycles (around 15-20 minutes) for 5 days per week for one month (Sakhaei et al., 2018; Maharem et al., 2021).

Pranayama Breathing Exercise: For the second intervention group (G3). Demonstration of Pranayama Breathing Exercise included, a) asking the patient to seat in a comfortable position and take a few slow and steady breaths, b) bring the right hand up towards the face and let the right elbow drop down to keep the right arm relaxed throughout then, c) keep the thumb rest gently over the right nostril and the ring (fourth) finger over the left nostril, d) close the left nostril with the thumb of the left hand and inhale through the right nostril for 6 sec. e) Then close the right nostril by using the index finger and hold the breath for 6 sec. f) After that exhale through the left nostril slowly for 6 sec. g) Then inhale through the left nostril, keeping the right nostril closed for 6 sec. h)Then exhale through the right nostril, keeping the left closed for 6 sec. This exercise was repeated 3 times/day for 5-10 breath cycles (around 15-20 minutes) for 5 days per week for one month **(Jahan et al., 2020).**

On the other hand, patient who reported any discomfort or pain, the intervention was discontinued immediately, and the patient was monitored until he/she felt much better. The patients in the intervention groups demonstrated breathing exercises in front of the researchers and continued the exercises in their homes by using the teaching flyers that include pictures and steps of two types of breathing exercises in the Arabic language.

Evaluation phase:

Patients were followed up for four weeks. Observational sheet of selected vital parameters, as well as dyspnea index questionnaire were filled by the researchers for control group and after each intervention of breathing exercises for both two intervention groups and the readings by the end of the 2^{nd} week was considered as the 1^{st} post intervention reading, the readings by the end of the 4^{th} week was considered as the 2^{nd} post-intervention reading applied for two study groups and control group who received routine hospital care.

Data analysis

The collected data was scored, tabulated and analyzed by personal computer using statistical package for the social science (SPSS) program version 23. Descriptive as well as inferential statistics utilized to analyze data pertinent the study. Moreover, ANOVA used to compare results of more than two groups. Level of significance was adopted at $p \leq 0.05$.

Results

Results of the current study presented into three sections. Section I) Highlighted the description of the study samples' demographic characteristics, and medical data related to COPD disease (Tables 1 and 2). Section II) Delineated hypothesis testing for being supported or not (Table 3) and (Figures 1 to 4). Section III) Clarified other additional findings such as the correlation between age and duration of COPD disease with dyspnea scores, heart rate, respiratory rate and oxygen saturation. (Table 4).

Section I) Description of the study samples' demographic characteristics, and medical data related to COPD of the control and the two intervention groups.

Table (1): Frequency and percentage distribution of demographic characteristics among control and intervention groups (n=90).

Variables	Control group (G1), n = 30		Intervention groups: pursed lip (G2), n = 30		Intervention groups: Pranayama (G3), n = 30		X^2 Test	p-value
	No.	%	No.	%	No.	%		
Age (years):								
- 18- < 30	7	23.4%	5	16.7%	8	26.7%	2.950	0.815
- 30- < 45	5	16.6%	9	30.0%	5	16.6%		
- 45- ≤ 60	18	60.0%	16	53.3%	17	56.7%		
Mean ± SD	42.47+10.976		43.57 +11.079		42.03+11.131			
Gender:							1.710	0.425
- Male	16	53.3%	17	56.7%	19	63.3%		
- Female	14	46.7%	13	43.3%	11	36.7%		
Marital status							4.864	0.561
- Married	22	73.4%	24	80.1%	20	66.7%		
- Divorced	1	3.3%	1	3.3%	0	0.0%		
- Single	6	20.0	4	13.3%	6	20.0%		
- Widow	1	3.3%	1	3.3%	4	13.3%		
Residence:							0.117	0.943
- Urban	22	73.3%	23	76.7%	22	73.3%		
- Rural	8	26.7%	7	23.3%	8	26.7%		
Education Level:							14.719	0.257
- Cannot read or write	11	36.7%	9	30.0%	9	30.0%		
- Can read and write.	4	13.3%	2	6.7%	8	26.7%		
- Primary School	1	3.3%	0	0.0%	2	6.7%		
- Preparatory	2	6.7%	4	13.3%	6	20.0%		
- Secondary	7	23.3%	10	33.3%	2	6.7%		
- University	5	16.7%	5	16.7%	3	10.0%		
Occupation:							5.651	0.686
- Employee	3	10.0%	4	13.3%	1	3.3%		
- Causal work	11	36.7%	17	56.7%	14	46.7%		
- Didn't work	9	30.0%	4	13.3%	9	30.0%		
- House wife	7	23.3%	5	16.7%	6	20.0%		
Smoking:							3.271	0.195
- Yes	11	36.7%	5	16.7%	7	23.3%		
- No	19	63.3%	25	83.3%	23	76.7%		

**P-value≤ 0.05 is significant at two tailed*

Table (2): Frequency and percentage distribution of medical data among control and intervention groups (n=90).

Variables	Control group (G1), n = 30		Intervention groups: pursed lip (G2), n = 30		Intervention groups: Pranayama (G3), n = 30		X^2 Test	p-value
	No.	%	No.	%	No.	%		
Duration of COPD disease:							7.417	0.284
- Less than 1 year.	10	33.3%	8	26.7%	5	16.6%		
- 1- <3 years.	15	50.0%	14	46.7%	20	66.7%		
- 3- <6 years.	2	6.7%	1	3.3%	3	10.0%		
- 6- <10 years	3	10.0%	7	23.3%	2	6.7%		
Mean ± SD	2.23±1.591		2.80±1.678		2.43±1.569			
Family history of COPD :							2.223	0.329
- Yes:	13	43.3%	12	40.0%	13	43.3%		
- No:	17	56.7%	18	60.0%	17	56.7%		

Variables	Control group (G1), n = 30		Intervention groups				X^2 Test	p-value
			pursed lip (G2), n = 30		Pranayama (G3), n = 30			
	No.	%	No.	%	No.	%		
`Main complains of COPD								
- Dyspnea, cough, and chest pain.	21	70.0%	18	60.0%	24	80.0%	6.257	0.618
- Dyspnea and chest pain	7	23.3%	9	30.0%	4	13.3%		
- Dyspnea and cough	2	6.7%	3	10.0%	2	6.7%		
Other chronic diseases:								
- No	12	40.0%	10	33.4%	14	46.7%	4.636	0.990
- Diabetes Mellitus.	6	20.0%	6	20.0%	6	20.0%		
- Hypertension	2	6.7%	4	13.3%	3	10.0%		
- Cardiac diseases	6	20.0%	5	16.6%	3	10.0%		
- Diabetes and hypertension	3	10.0%	3	10.0%	3	10.0%		
- Renal disease	1	3.3%	2	6.7%	1	3.3%		
Medications of COPD:								
- Bronchodilator, anti-inflammatory and sputum expectorant.	17	56.7%	15	50.0%	19	63.3%	7.673	0.263
- Bronchodilator and Antibiotic	9	30.0%	8	26.7%	9	30.0%		
- Anti-inflammatory and antibiotic.	4	13.3%	7	23.3%	2	6.7%		
Using of Sprayer device								
- Yes	26	86.7%	26	86.7%	28	93.3%	0.900	0.638
- No	4	13.3%	4	13.3%	2	6.7%		
Using of nebulizer device								
- Yes	27	90.0%	28	93.3%	29	96.7%	1.239	0.538
- No	3	10.0%	2	6.7%	1	3.3%		
Using Oxygen mask								
- Yes	27	90.0%	27	90.0%	29	96.7%	1.239	0.538
- No	3	10.0%	3	10.0%	1	3.3%		

**P-value≤ 0.05 is significant at two tailed*

Section II) Delineates hypothesis testing for being supported or not

Table (3) Frequency and categorical distribution of dyspnea scale among control and intervention groups regarding (n=90).

Variables	Control group (G1), n = 30		Intervention groups				X^2 Test	p-value
			pursed lip (G2), n = 30		Pranayama (G3), n = 30			
	No.	%	No.	%	No.	%		
Dyspnea before intervention:								
- Never.	0	0.0%	0	0.0%	0	0.0%	0.833	0.934
- Almost Never.	0	0.0%	0	0.0%	0	0.0%		
- Sometimes.	2	6.7%	1	3.3%	1	3.3%		
- Almost always.	11	36.6%	12	40.0%	10	33.4%		
- Always.	17	56.7%	17	56.7%	19	63.3%		
Dyspnea at the end of 2 weeks:								
- Never.	0	0.0%	0	0.0%	0	0.0%	10.383	0.034*
- Almost Never.	0	0.0%	0	0.0%	0	0.0%		
- Sometimes.	9	30.0%	12	40.0%	8	26.7%		
- Almost always.	7	23.3%	4	13.3%	7	23.3%		
- Always.	14	46.7%	14	46.7%	15	50.0%		
Dyspnea at the end of 4 weeks:								
- Never.	0	0.0%	0	0.0%	0	0.0%	10.700	0.030*
- Almost Never.	0	0.0%	0	0.0%	0	0.0%		
- Sometimes.	5	16.6%	16	53.3%	9	30.0%		
- Almost always.	17	56.7%	8	26.7%	11	36.7%		
- Always.	8	26.7%	6	20.0%	10	33.3%		

**P-value≤ 0.05 is significant at two tailed*

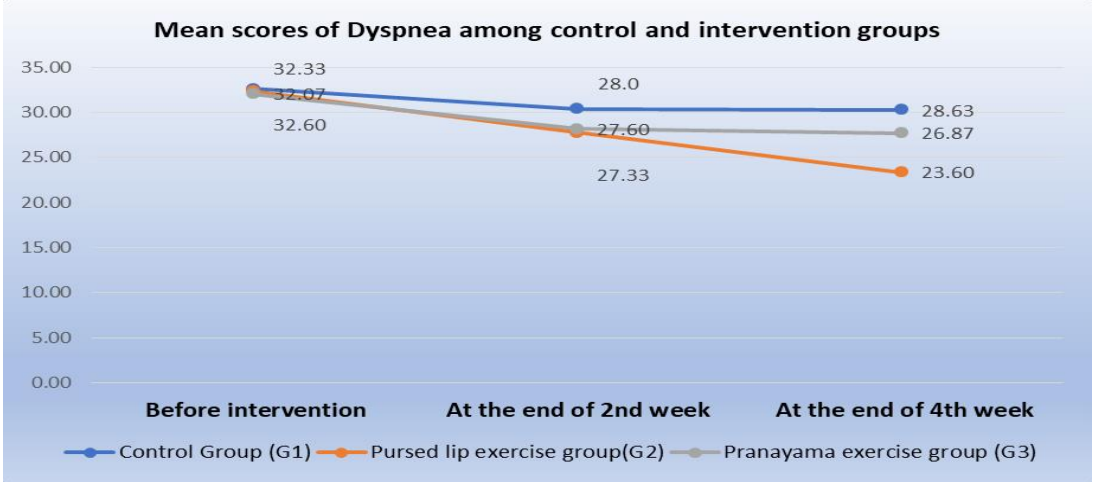

Figure (1): Comparison of mean scores of dyspnea among control and intervention groups during pre-intervention period (base line assessment), at the end of the 2nd week (post intervention 1), and at the end of the 4th week (post intervention 2) (n=90).

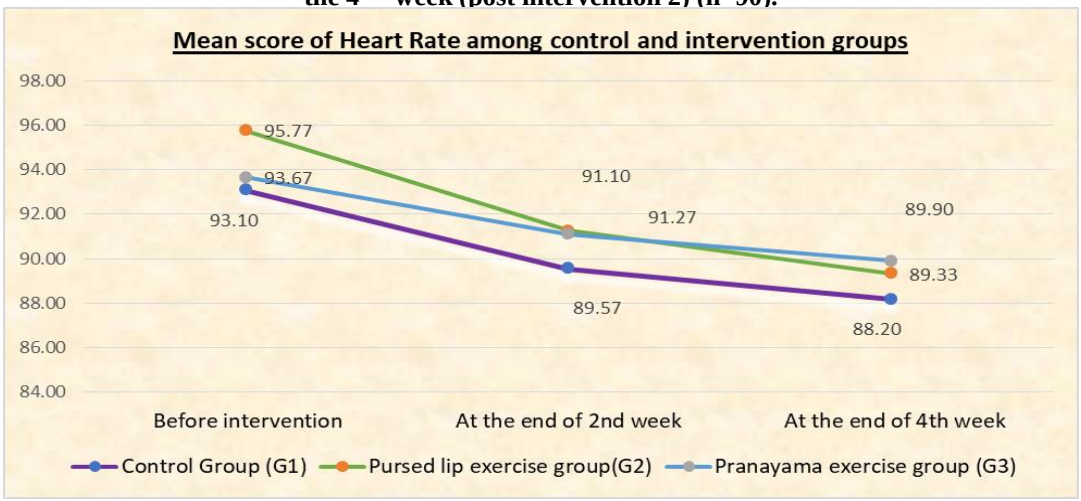

Figure (2): Comparison of mean scores of heart rate among control and intervention groups during pre-intervention period, at the end of the 2nd week (post intervention 1), and at the end of the 4th week (post intervention 2) (n=90).

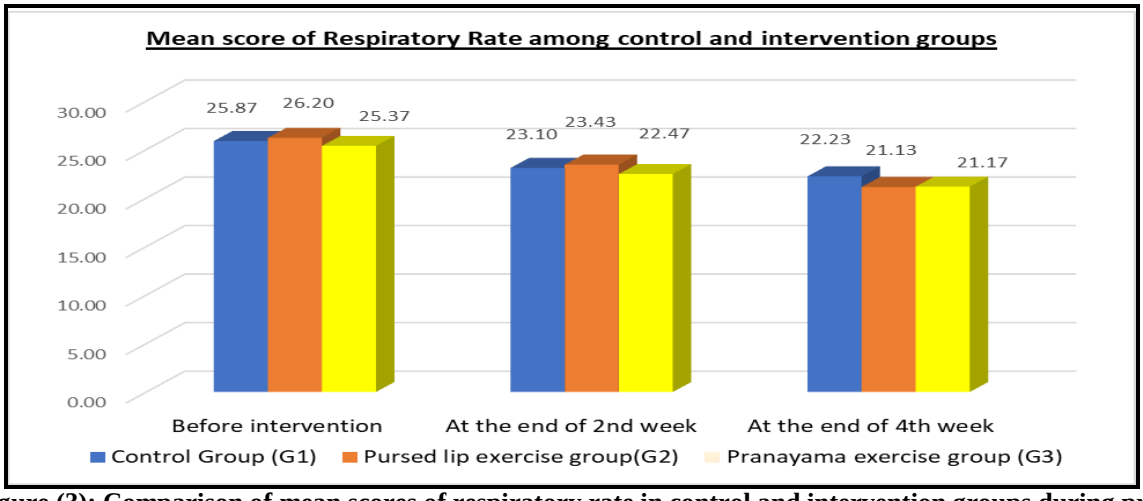

Figure (3): Comparison of mean scores of respiratory rate in control and intervention groups during pre-intervention period, at the end of the 2nd week (post intervention 1), and at the end of the 4th week (post intervention 2) (n=90).

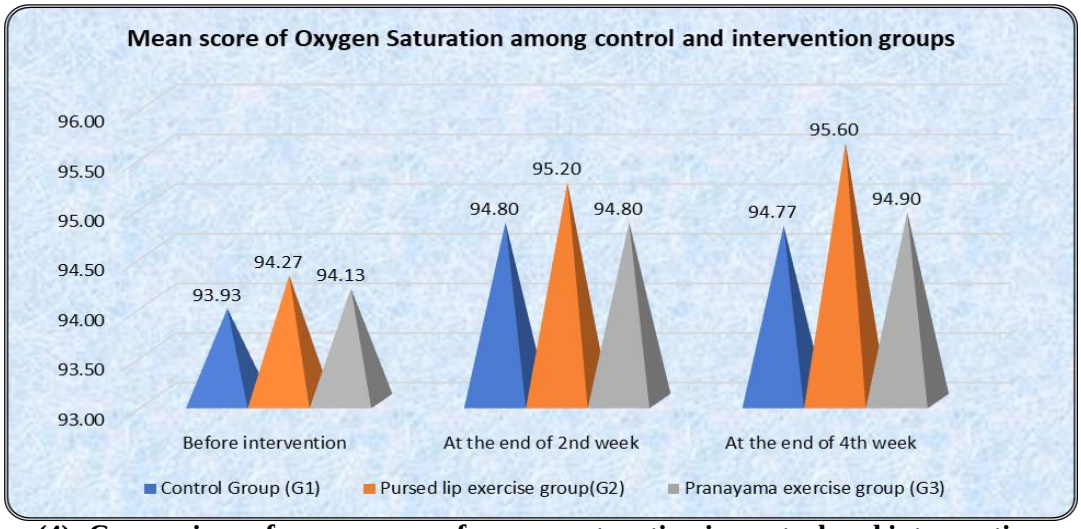

Figure (4): Comparison of mean scores of oxygen saturation in control and intervention groups during pre-intervention period, at the end of the 2nd week (post intervention 1), and at the end of the 4th week (post intervention 2) (n=90).

Section III): Correlation between age and duration of COPD disease with dyspnea scores among the control and the two intervention groups

Table (4): Correlation between age and duration of COPD disease with dyspnea scores, heart rate, respiratory rate, and oxygen saturation scores among the control and the two intervention groups (n=90)

Selected Vital Parameter	Age	Duration of COPD disease
- **Dyspnea Scores**	r: 0.129 P: 0.227	r: 0.346 P: 0.001*
- **Heart Rate**	r: 0.041 P: 0.702	r: -0.073 P: 0.495
- **Respiratory Rate**	r: 0.168 P: 0.113	r: -0.032 P: 0.763
- **Oxygen Saturation Rate**	r: -0.216 P: 0.041*	r: -0.083 P: 0.435

** P-value≤ 0.05 is significant at two tailed*

Table (1): Demographic characteristics, shows that (60.0%, 53.3%, and 56.7% respectively) of the control, pursed lip breathing exercise and pranayama breathing exercise groups had age ranged from 45 to less than or equal 60 years with mean of age (42.47±10.976) for the control group, and (43.57 ±11.079) for pursed lip group, and (42.03±11.131) for pranayama group. Male gender constitutes (53.3%, 56.7%, and 63.3% respectively) of the control group, pursed lip and pranayama groups. Regarding marital status, (73.4%, 80.1%, 66.7% respectively) of the control, pursed lip and pranayama groups were married. In relation to residence, (73.3%, 76.7%, and 73.3% respectively) of the control, pursed lip and pranayama groups had lived in urban region. In addition, (36.7%, 30.0%, and 30.0% respectively) of the control, pursed lip and pranayama groups can't read or write. With reference to occupation, (36.7%, 56.7%, and 46.7% respectively) of the control, pursed lip and Pranayama groups had causal work. Moreover, (63.3%, 83.3%, and 76.7% respectively) of the control, pursed lip and pranayama groups were non-smokers. There was no statistically significant difference among the three study groups regarding demographic variables.

Table (2): Medical data, clarifies that (50.0%, 46.7%, and 66.7% respectively) of the control, pursed lip breathing exercise and pranayama breathing exercise groups had COPD from 1 to less than 3 years with mean of duration of COPD (2.23±1.591) for the control group, and (2.80±1.678) for pursed lip group, and (2.43±1.569) for pranayama group. According to family history of COPD (56.7%, 60.0%, and 56.7% respectively) of the control group, pursed lip and pranayama groups had no family history of COPD. Regarding main complains of COPD, (70.0%, 60.0%, 80.0% respectively) of the control, pursed lip and pranayama groups had Dyspnea, cough, and chest pain. In addition (40.0%, 33.4%, and 46.7% respectively) of the control, pursed lip and pranayama

groups had no other chronic diseases. In relation to medication, (56.7%, 50.0%, and 63.3% respectively) of the control, pursed lip and pranayama groups received bronchodilator, anti-inflammatory and sputum expectorant medications. With reference to using of inhelar device, (86.7%, 86.7%, and 93.3% respectively) of the control, pursed lip and pranayama groups were used sprayer device. Moreover, (90.0%, 93.3%, and 96.7% respectively) of the control, pursed lip and pranayama groups were used nebulizer device. While (90.0%, 90.0%, and 96.7% respectively) of the control, pursed lip and pranayama groups were used oxygen mask. There was no statistically significant difference among the three study groups regarding medical data.

Table (3): Categorical distribution of dyspnea, represents that (56.7%, 56.7%, and 63.3%respectively) of the control, pursed lip breathing exercise and pranayama breathing exercise groups had always dyspnea before intervention. After two weeks (46.7%, 46.7%, and 50.0% respectively) of the control group, pursed lip and pranayama groups had always dyspnea. While after four weeks (56.7%) of the control group were had almost always dyspnea. (53.3%) of the pursed lip group had sometimes dyspnea. (36.7%) of pranayama group had almost always dyspnea. There was no statistically significant difference among the three study groups before intervention of breathing exercises. While there were statistically significant difference among the three study groups after two weeks as χ^2 =10.383, p=0.034 and also after four weeks as χ^2 =10.700, p=0.030.

Figure (1): Mean scores of dyspnea, shows that mean and standard deviation of dyspnea scores before intervention was (32.33± 5.561) for control group, (32.60± 5.928) for pursed lip group and (32.07± 4.856) for pranayama group. T- Test and P. value before intervention were (T= 0.180, P=0.858) for pursed lip and control groups. (T= 0.381, P=0.704) for pranayama and control groups. (T= 0.198, P=0.844) for pursed lip and pranayama groups.

Mean and standard deviation of dyspnea scores **after two weeks** was (28.00 ± 6.057) for control group, (27.33± 6.645) for pursed lip group and (27.60± 5.581) for pranayama group. T- Test and P. value were (T= 0.406, P=0.686) for pursed lip and control groups. (T= 0.266, P=0.791) for pranayama and control groups. (T= 0.168, P=0.867) for pursed lip and pranayama groups.

Mean and standard deviation of dyspnea scores **after four weeks**, was (28.63 ± 5.449) for control group, (23.60± 5.787) for pursed lip group and (26.87± 5.438) for pranayama group. T- Test and P. value were (T= 3.468, P=0.001) for pursed lip and control groups. (T= 1.257, P=0.214) for pranayama and control groups. (T= 2.253, P=0.028) for pursed lip and pranayama groups. ANOVA value was F (df: 1.655) = 197.463 P value was 0.000. P-value≤ 0.05 is significant at two tailed

Figure (2): Mean scores of heart rate, denotes that mean and standard deviation of heart rate scores before intervention was (93.10± 9.286) for control group, (95.77± 9.171) for pursed lip group and(93.67± 7.963) for pranayama group. T- test and P. value before intervention were (T= 1.119, P=0.268) for pursed lip and control groups. (T= 0.254, P=0.801) for pranayama and control groups. (T= 0.947, P=0.348) for pursed lip and pranayama groups.

Mean and standard deviation of heart rate scores **after two weeks** was (89.57 ± 9.141) for control group, (91.27± 8.342) for pursed lip group and (91.10± 8.786) for pranayama group. T- Test and P. value were (T= 0.752, P=0.455) for pursed lip and control groups. (T= 0.662, P=0.510) for pranayama and control groups. (T= 0.075, P=0.940) for pursed lip and pranayama groups.

Mean and standard deviation of heart rate scores **after four weeks**, was (88.20 ± 8.556) for control group, (89.33± 7.801) for pursed lip group and (89.90± 8.872) for pranayama group. T- Test and P. value were (T= 0.536, P=0.594) for pursed lip and control groups. (T= 0.755, P=0.453) for pranayama and control groups. (T= 0.263, P=0.794) for pursed lip and pranayama groups. ANOVA value was F (df: 1.686) = 34.321 P value was 0.514. P-value ≤ 0.05 is significant at two tailed

Figure (3): Mean scores of respiratory rate, clarifies that mean and standard deviation of respiratory rate scores before intervention was (25.87± 1.570) for control group, (26.20± 1.769) for pursed lip group and (25.37± 1.790) for pranayama group. T- Test and P. value before intervention were (T= 0.772, P=0.443) for pursed lip and control groups. (T= 1.150, P=0.255) for pranayama and control groups. (T= 1.813, P=0.075) for pursed lip and pranayama groups.

Mean and standard deviation of respiratory rate scores **after two weeks** was (23.10 ± 2.203) for control group, (23.43± 2.192) for pursed lip group and(22.47± 1.995) for pranayama group. T- Test and P. value were (T= 0.587, P=0.559) for pursed lip and control groups. (T= 1.167, P=0.248) for pranayama and control groups. (T= 1.786, P=0.079) for pursed lip and pranayama groups.

Mean and standard deviation of respiratory rate scores **after four weeks**, was (22.23 ± 2.079) for control group, (21.13± 1.306) for pursed lip group and (21.17± 1.913) for pranayama group. T- Test and P. value were (T= 2.454, P=0.017) for pursed lip and control groups. (T= 2.068, P=0.043) for pranayama

and control groups. (T= 0.079, P=0.937) for pursed lip and pranayama groups. ANOVA value was F (df: 1.936) = 213.112 P value was 0.000. P-value≤ 0.05 is significant at two tailed.

Figure (4): Mean scores of oxygen saturation, shows that mean and standard deviation of oxygen saturation scores before intervention was (93.93± 1.311) for control group, (94.27± 1.361) for pursed lip group and (94.13± 1.479) for pranayama group. T- Test and P. value before intervention were (T= 0.965, P=0.338) for pursed lip and control groups. (T= 0.554, P=0.582) for pranayama and control groups. (T= 0.363, P=0.718) for pursed lip and pranayama groups.

Mean and standard deviation of oxygen saturation scores **after two weeks** was (94.80 ± 1.157) for control group, (95.20± 1.186) for pursed lip group and (94.80± 0.997) for pranayama group. T- Test and P. value were (T= 1.322, P=0.191) for pursed lip and control groups. (T= 0.000, P=1.000) for pranayama and control groups. (T= 1.414, P=0.163) for pursed lip and pranayama groups.

Mean and standard deviation of oxygen saturation scores **after four weeks**, was (94.77± 1.547) for control group, (95.60± 1.248) for pursed lip group and (94.90± 0.855) for pranayama group. T- Test and P. value were (T= 2.296, P=0.025) for pursed lip and control groups. (T= 0.410, P=0.683) for pranayama and control groups. (T= 2.506, P=0.015) for pursed lip and pranayama groups. ANOVA value was F (df: 1.727) = 25.779 P value was 0.040. P-value≤ 0.05 is significant at two tailed

Table (4): Correlation between selected demographic characteristics and vital parameters represents that, there was negative correlations between age and oxygen saturation rate and positive correlation between duration of COPD disease and dyspnea scores.

Discussion

Globally, one of the main causes of death is COPD. To improve outcomes, it is crucial to identify the personal and co-morbid diseases linked to it. Analysis of the results pertaining to the present study revealed that, more than half of the study sample (both control & intervention groups) were males and aged from 45 to ≤60 years. In addition, more than two thirds of them were married, non-smokers, as well as residing in urban areas. About one third of them had chronic co-morbid diseases which exaggerate the COPD clinical manifestations. Supporting these results was a study conducted **by Coulson, et al., (2022)** and showed that, living in an urban region, being older, and male gender was found to be associated with increased odds of COPD morbidity in all patients. Conversely, women, and living in a more rural region were linked to decreased odds of all-cause morbidity.

Although more than two quarters of the study sample did not report having a family history of COPD, genetics may make COPD development more likely. Individuals who lack alpha-1 antitrypsin, for instance, may be at a higher risk of developing the disease, particularly if they are frequently exposed to other lung irritants **(Robichaux et al., 2023).**

In literature, the primary cause of COPD flare-ups is smoking. Smoking harms lungs' lining, air sacs, and airways. Study finding opposed the data stated in literature, supporting the present study findings regarding smoking habits, were **Rochester & Nici (2022)** who stated that, although COPD is a lung disease that is typically brought on by smoking, some smokers for years never get COPD, and other people develop COPD even if they have never smoked.

Many of the COPD comorbidities have similar risk factors. A comorbid condition may raise a person's risk of acquiring COPD, or vice versa. Furthermore, because COPD and prevalent concomitant illnesses typically arise in older age groups, COPD comorbidities may exist. **Mazzuco et al., (2020)** clarified this relation and mentioned that patients with COPD seem to have comorbidities earlier in life than those without COPD. The increased prevalence of comorbidities in COPD may be explained by a number of mechanisms, such as cellular senescence, a decrease in endogenous anti-aging molecules, and the premature ageing process, which may be brought on by high levels of oxidative stress. The six most common comorbidities—diabetes, atrial fibrillation, other arrhythmias, chronic heart failure, mental illnesses, and coronary artery disease—showed a strong correlation with higher morbidity and mortality.

Results of the present study also demonstrated that, about two quarters of the study sample complained of chronic COPD manifestations lasted for one to less than three years in the form of dyspnea, cough and chest pain. With an emphasis on dyspnea as a common complain reported in both pre-intervention and two weeks after intervention periods within the three groups. Regarding this concern, **Scheermesser et al., (2021)** illustrated that COPD is a progressive condition that worsens over time and can be fatal if left untreated. It obstructs the airways, making breathing difficult. One of the earliest signs of COPD is frequently a chronic or persistent cough. It is possible for someone to have a persistent chesty cough that does not go away. Breathing difficulties may result from the blockage of the airways, which may exacerbate shortness of breath—another typical sign of COPD. Some people become less active as a coping mechanism for their respiratory problems, which can make them less physically fit and liable to have chronic diseases.

Although pharmacotherapy remains the cornerstone of COPD treatment, complementary and alternative medicine is nevertheless often utilized, particularly for patients with this disease. Breathing exercises have been shown to enhance COPD control and quality of life in a number of recent Cochrane reviews **(Santino, 2020)**. Furthermore, a tiny randomised trial conducted in India revealed a notable improvement in lung function following a single 10-minute session of focused breathing exercises. Breathing exercises have been linked to improved quality of life, decreased drug use, decreased intensity of dyspnea attacks, and increased physical activity. This workout promotes daily activity while reducing the need for rescue inhalers **(Wu, et al., 2019).**

Comparing the three groups in our present study, it was obvious that significant improvement was observed in patients' dyspnea scores after 4 weeks of intervention in pursed lip intervention group. While Nadi-Sodhana pranayama intervention group showed the highest percentage in complaining of always having dyspnea. Moreover, no statistical difference was observed in the pre intervention and 2 weeks after intervention among the three groups. While, high statistical significant difference was found between pursed lip & control groups, as well as between pursed lip & Nadi-Sodhana pranayama group.

Pursed-lip breathing preserves cardiopulmonary receptors, chemoreceptors, and arterial baroreceptors, all of which are connected to the central nervous system. The autonomic nervous system, which is activated by the central nervous system, regulates blood pressure and heart rate. Breathing exercises also control heart strength, blood vessel diameter, and sympathetic nervous system activity. Additionally, it increases vagal activity, which lowers blood pressure and heart rate by modifying both sympathetic and parasympathetic nervous system activity **(WHO, 2022).**

Although no statistical significant difference was observed in the three groups throughout the three observations regarding heart rate, statistical significant difference was observed between pursed lip intervention group and the control group in both respiratory rate and oxygen saturation. In a study including 60 COPD patients, **Sahiriar & Hassan (2018)** investigated that the effect of pursed-lip breathing manoeuvre on cardiac, respiratory, and oxygenation parameters. The research found that pursed lip breathing is a simple, low-cost, non-invasive, and non-pharmacological way to improve COPD patients' oxygenation and physiological indicators. Moreover, **Hanafin (2019)** investigated the impact of pursed-lip breathing exercise on a few physiological parameters in fifty COPD patients. They found statistically significant changes in HR, RR, and SPO2, which corroborated our findings except the results concerning heart rate.

Vaibhav & Vijayakumar (2022) conducted a study comparing pursed lip & Nadi-Sodhana pranayama (PLB to ANB) exercises among patients with COPD, and revealed that PLB results in altered chest wall muscle activation patterns and enhanced COPD ventilation. PLB causes a decrease in the inspiratory muscle and respiratory rate duty cycle, an increase in the recruitment of abdominal and accessory muscles during expiration, and an increase in the activation of the rib cage and auxiliary muscles during inspiration and expiration. Additionally, increased SaO2 suggests a way to use PLB to improve breathing while preventing diaphragm fatigue in patients with COPD. Dyspnea may improve when there is a change in the pattern of respiratory muscle recruitment with PLB. After two weeks of PLB, there were no appreciable changes in pulse rate, which could indicate that PLB had no effect on autonomic parameters. Respiratory rate significantly decreases following two weeks of ANB and PLB. The decrease in respiratory rate can be caused by the ventilator pattern being altered by yoga breathing, which results in a notable extension of expiratory energy. **Widiyaningsih, et al., (2022)** added that COPD progresses, dyspnea, alterations in cardiopulmonary hemodynamic state, and finally heart failure are all made worse. Pursed-lip breathing resulted in statistically significant improvements in heart rate, respiratory rate, oxygen saturation, blood pressure, and rate pressure product; however, saturation increased significantly after practicing Nadi-Sodhana pranayama.

Contrary to our study findings , **Enilari & Sinha (2019)** conducted a study on 10 healthy volunteers to examine the immediate effects of Nadi-Sodhana pranayama on specific parameters related to cardiovascular pulmonary health and brain function. The study concluded that Nadi-sodhana pranayama had a substantial impact on respiratory, heart rate and blood pressure, indicating that this measure is not backed with our current research. From the researchers' point of view, this result could be explained in the light of conducted on healthy people not on patients with COPD.

Shephali & Kavita (2019) added that pranayama elevates the formation of hyperpolarization by stretching connective tissue and increases the frequency of inhibitory impulse to stretch lung receptors during the inhalation phase over the tidal volume observed in Hearing Breuer's reflex (HBR).It identified the inhibitory impulse that is generated during inflation by the lungs' slowing adapting receptors (SARs). This system regulates autonomic processes like heart rate, systemic vascular resistance,

breathing rhythm, and smooth muscle tone in the airways.

To sum it up, by the end of the four weeks after intervention, patients with COPD have improved autonomic dysfunction by practicing pursed lip and paranyama breathing exercises. Additionally, respiratory function has also improved. So, pranayama can be used in addition to Pursed Lip Breathing to help managing COPD respiratory manifestations.

Conclusion

The results of this study indicate that in patients with COPD, by the end of 4 weeks post- intervention, statistical significant difference was observed among the control and the two intervention groups. With an exception of heart rate, pursed-lip breathing and the Nadi-Sodhana pranayama significantly improve dyspnea level, respiratory rate, and oxygen saturation. Therefore, it ought to be a component of the COPD patient's rehabilitation regimen. Thus, the alternative hypothesis is accepted and the null hypothesis is rejected.

Recommendations:

- Comprehending the effects of comorbidity in COPD is crucial for developing more individualized and efficacious nursing management strategies.
- Pulmonary rehabilitation programme should be offered to COPD patients, helping them manage their dyspnea during daily activities and increase their breathing efficiency.
- Individualized counselling-based rehabilitation programmes have the potential to increase the level of activity and motivation among patients with COPD in managing their symptoms.
- A larger sample size might be used for the study, considering the various stages of COPD.
- Alternate Nostril Breathing, or Pranayama (ANB), is a useful addition to Pursed Lip Breathing in the nursing care of COPD.

Clinical Implication:

In hospitals and communities, nurses can assist patients with COPD feel better by using breathing exercises and pursed-lip breathing techniques. These can help patients with dyspnea. The requirement for non-invasive mechanical ventilation may be lessened with the use of this technique. The nurse should instruct trainees in breathing exercises and let them know when this method will be beneficial. All queries and worries should be answered, along with a full explanation of the technique's advantages and disadvantages. The nurse must be able to recognise patients who have respiratory issues and be knowledgeable about the typical symptoms and indicators of asthma.

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