



A STUDY TO COMPARE THE EFFECT OF PURSED-LIP BREATHING AND NADI- SODHANA PRANAYAMA ON CARDIO- RESPIRATORY PARAMETER IN PATIENT WITH COPD.

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ABSTRACT:

BACKGROUND: The term Chronic Obstructive Pulmonary Disease (COPD) refers to chronic disorder that causes disturbance in the airflow. COPD is a major health problem with increasing morbidity and mortality. In COPD other than its Pulmonary pathology disease and disease gradually worsen and dynamic hyperinflation occur. Leads, to dyspnea and alteration in hemodynamic function in COPD patients. So, aim of present study is to find out to compare the effect of pursed-lip breathing and Nadi-Sodhana pranayama on Cardio-Respiratory parameter in patient with COPD.

METHOD: 20 COPD patients according to inclusion criteria were selected and divided into two groups. Experimental group:1 given pursed-lip breathing and group:2 given Nadi-Sodhana pranayama. Pre and post data for cardio-respiratory parameter taken. Cardio-Respiratory parameter was (HR, RR, SPO2, SBP, DBP and RPP).

RESULT: Data was analyzed using SPSS version 20. Both paired-T test and Unpaired T-test applied for statistically analysis of outcome measure and it showed there was statistically significance improvement in HR, RR, SPO2, SBP, DBP and RPP.in both group:1 and group:2. With 95% of confidence interval 0.05 taken as level of significance.

CONCLUSION: from present study it can be concluded that pursed-lip breathing and Nadi-Sodhana pranayama both are statistically significant improvement in HR, RR, SBP, DBP, and RPP. But in saturation of oxygen Nadi-Sodhana pranayama was more significant effect then Pursed-lip breathing.

KEY WORDS: Chronic Obstructive pulmonary Disease, pursed-lip breathing, Nadi-Sodhana pranayama.

INTRODUCTION

COPD (Chronic obstructive pulmonary disease) is a general term for airflow limitation developed as a result of tobacco smoking and exposure to biomass fuels. and is composed of group of problems that affects the airways, and lung parenchymal structure which then produce obstruction to the expiratory airflow. ^(1,2)

COPD is currently fourth leading cause of death in the world but it is projected to be increasing & become the third leading cause of the death by 2020. Prevalence of COPD is higher in smoker and Ex-smoker compared to non-smoker individuals. Based on burden of obstructive lung diseases the estimated cases are 384 million in 2010. In 2060 there may be over 5.4 million death annually due to COPD & associated conditions.⁽³⁾ In 1990 the prevalence of COPD in India was 3.3%, after that it increased to 4.2% in 2016.⁽⁴⁾ COPD was the ninth leading cause of death in Gujarat in 1990 and in 2016 it became the 2nd leading cause of death after ischemic heart disease. ⁽⁵⁾

COPD is a spectrum of disorder with pure “CHRONIC BRONCHITIS” at one end and pure “EMPHYSEMA” at another end. ⁽⁶⁾ CHRONIC BRONCHITIS: “pulmonary catarrh is inflammation of mucus membrane of bronchia.” Chronic bronchitis terms as the presence of a chronic productive cough for three months in each two successive year provided that other cause of mucus production disease rule out. ⁽¹⁾

EMPHYSEMA: the word emphysema is a Greek word which means “voluminous lung” and was described by bonet in 1679.⁽²⁾ Emphysema is defined as a condition of lung characterised by destruction of alveolar wall and enlargement of distal to terminal bronchioles.⁽¹⁾ Symptoms of COPD includes expectoration, chronic productive cough, exertional dyspnoea, central cyanosis, digital clubbing, hypertrophy of accessory muscle of neck e.g. Sternocleidomastoid, scaleni, trapezius, expiratory wheeze and crackle present.⁽⁷⁾

There are several other approaches used for the treatment of COPD. Pursed-lip breathing is widely performed in lung rehabilitation as well as during activities of daily living.⁽⁸⁾ Pursed lip breathing improves gas exchange and reduce breathing frequency and it also helps in faster recovery from dyspnoea and slows down the respiratory rate.⁽⁸⁾

Research suggests 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.⁽⁹⁾

Pranayama is a special & specific breathing technique. ‘Prana’ means breath, or respiration, ‘Ayama’ means expansion or stretching. Pranayama is an art of controlling the breath. Nadi-sodhana pranayama helps to maintain balance between the Nadis. Pranayama has effects on various systems such as Respiratory, cardiovascular and Central nervous system of the body.⁽¹⁰⁾

Pranayama training also decreases the basal sympathetic tone and Nadi-sodhana pranayama increase parasympathetic activity which produces calming physiological effects on respiratory, cardiovascular and nervous system.⁽¹¹⁾

As Nadi-sodhana pranayama has effect on parasympathetic tone so it decreases the heart rate and systolic blood pressure and research also suggests that slow pranayama and nostril breathing (right and left nostril) significantly increases the oxygen consumption and metabolic rate⁽¹²⁾

AIMS OF THE STUDY:

The purpose of the study is to compare the effectiveness of Pursed-lip breathing and Nadi-Sodhana pranayama, on Cardio-respiratory parameter in COPD patients.

NEED OF THE STUDY:

According to evidences found pursed lip breathing & Nadi-Sodhana pranayama both are effective for the treatment of COPD. and there is significant immediate effect of pursed-lip breathing & Nadi-sodhana pranayama on oxygen saturation, dyspnoea and blood pressure as well as both are (pursed-lip breathing and Nadi-sodhana pranayama) used in immediate management for dyspnoea reliving.^{(11), (13), (14)} But which Manuver is most effective for improving the cardiorespiratory parameter and time efficacious for clinical use in COPD patients so there is need to compare in present study.

RESEARCH METHODOLOGY:

- **SOURCE OF DATA:** G.G.G. Hospital, Jamnagar
- **STUDY DESIGN:** comparative interventional study
- **SAMPLING TECHNIQUE:** Simple random sampling
- **SAMPLE SIZE:** 20
- **STUDY POPULATION:** COPD patients
- **STUDY SETTING:** Government physiotherapy college, Jamnagar
- **STUDY DURATION:** 1 year

INCLUSION CRITERIA:

- Patient with COPD in age group of 40-80 years.
- Both male and female will be included.
- Subjects who are able to understand and follow commands.
- Patients who are willing to participate in study
- Patient with FEV₁ ≥ 80% to FEV₁ ≤ 50% - < 80% predicted. (mild to moderate) stage.

EXCLUSION CRITERIA:

- Acute exacerbation of COPD
- Uncontrolled hypertension
- Patients with other systemic illness
- Surgery involving chest or abdominal area
- Patient with other cardiac abnormality (e.g. Ischemic heart disease)
- Patient who are unable to understand and follow command.

MATERIAL & METHOD:

- Chair
- Sphygmomanometer
- Pulse oximeter
- Stethoscope
- Pen
- Paper
- Data collection sheet
- Consent form

METHODOLOGY:

Sample size was calculated using previous article's mean and SD was found to be 10 in each group. Ethical clearance was obtained from institutional ethical committee of Shree M.P. shah medical college, Jamnagar-361008 (Ref.No.IEC/Certi/123/04/2019).

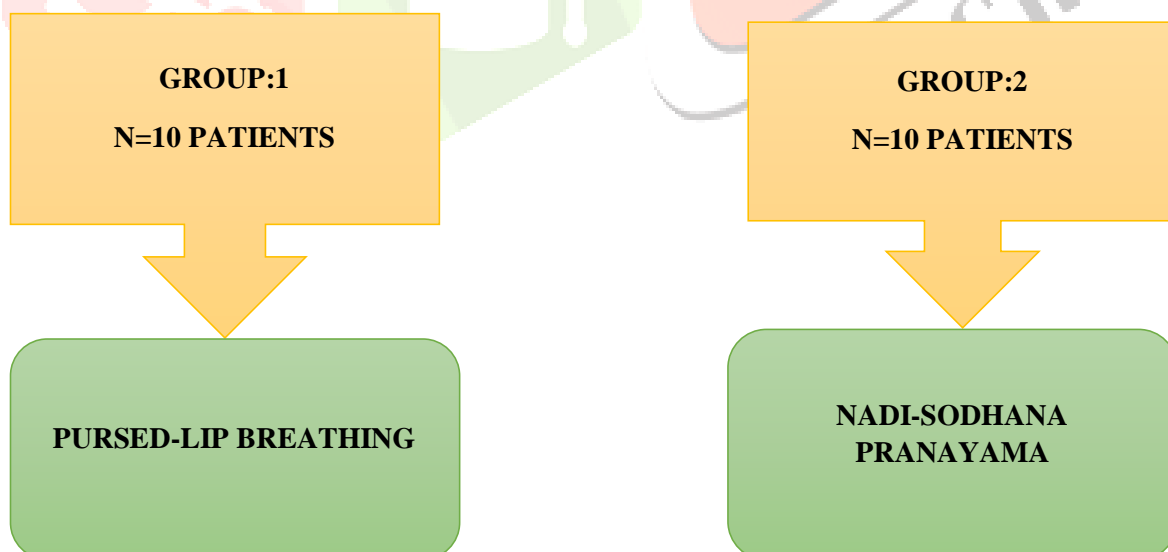
Total number of 30 patient of COPD diagnosed by MD pulmonologist were selected for the study. After proper explanation about the purpose and procedure of the study, patient who are were found suitable according to inclusion criteria were requested to sign consent form.

The selection of the patients was done by simple Random sampling. And divided the patients in two groups. Total 20 patients were divided into two groups; 10 patients in group 1 and 10 patients in group 2.

HR, RR, SPO₂, SBP, DBP, RPP was measure before the treatment in both group:1 and group:2 and 20 minutes after the treatment in both the groups.

CLINICAL INTERVENTION:

Table:1 THERAPEUTIC PROTOCOL FOT GROUP:1 AND GROUP:2



- ✚ GROUP:1: - Received pursed lip breathing exercise (PLB)
- ✚ GROUP:2: - Received Nadi-sodhana pranayama (NSP)

✚ PURSED LIP BREATHING: ⁽¹⁵⁾

- In pursed lip breathing exercise patient be in comfortable and upright position such as sitting. Relax his/her shoulder and neck muscles
- With the mouth closed, slowly inhale (breath in) through nose for at least 2 seconds. Also, it may help to count to themselves.
- With them mouth closed slowly exhaled (breath out) all the air in their lungs with your lips pursed “as if them going to whistle of gently flicker the flame of a candle,” don’t force the air out. Breathing out should be twice as breathing in. Perform pursed lip breathing in 20 minutes in this procedure.



figure:1 Inspiration phase of PLB

figure:1 Expiration phase of the PLB

✚ NADI-SODHANA PRANAYAMA: ⁽¹¹⁾

- In Nadi-sodhana pranayama first of all patient assumed “Sukhasana” posture (the comfortable posture).
- Open the right hand and bend index and middle finger against palm. The thumb was used for closing right nostril while the fourth and fifth fingers were used for the left nostril.
- Place the right thumb against the ala at the end of the nostril to close it and similarly press the fourth and fifth fingertips against the left nostril.
- Start the exercise in the ‘relax sittings posture’ with the relaxed attitude.
- Exhale slowly and deeply without closing the nostrils.
- Inhale slowly and quietly through the left nostril while closing the right.
- At the end of the inhalation, closed both nostril and hold the breath for a while (not more than 1-2 seconds)
- Keep the left nostril closed and exhale through the right as quietly as possible.
- After exhaling completely, inhale slowly as quietly through the right nostril.
- Close both nostril and wait for a while, the open the left nostril and exhale slowly and silently, Inhale through the same nostril. & the Nadi-sodhana pranayama continued for 20 minutes.



figure:2 inhalation phase of the NSP



exhalation phase of the NSP

OUTCOME MEASURES:⁽⁷⁾

- ❖ **Heart rate, SPO₂:** measurement of saturation of oxygen and heart rate measurement pulse oximeter instrument was used.
 - Oxygen saturation via pulsed oximetry is reported as SPO₂ and HR also measure via pulsed oximeter, first patient assuming comfortable position and finger wear the device. Patients hand warm, relaxed and held below the level of the heart.
- ❖ **Respiratory rate:** Respiratory rate measurement is typically monitored with the patient either supine or sitting position.
 - Patients should be in a quiet resting position for at least 5 minutes prior to monitoring respirations.
 - Expose chest area; if area cannot be exposed and respiration are nor readily observable, place patient's forearm across the chest area.
 - as the patient breaths, observe the rise and fall of the chest, also, observer second hand of a watch or clock determine the rate by counting the respirations either the inspiration or expiration for 30 seconds and multiply by 2.
- ❖ **Blood pressure:** Explain procedure and rationale in terms appropriate to the patient's understanding.
 - In during measurement of blood pressure patient was relaxed quiet setting for a period of time.
 - Guide the patient to the desired position. The sitting position is recommended with the back supported, the legs uncrossed, and feet flat on floor.
 - placing the chair next to a treatment table will facilitate UE positing. The UE should be free of clothing (rolling up garment sleeve was not acceptable owing to the tourniquet effect produced and interference with cuff positioning)
 - the midpoint of arm should be at the heart level with the elbow slightly flexed and the palm up.
 - Wrap the deflated cuff snugly and evenly around the patient's bare arm approximately 1 inch (2.5cm) above the antecubital fossa; the centre of the cuff should be in line with the brachial artery guide positing over the artery
 - A mercury manometer must be on a level surface at eye level
 - Place the diaphragm of the stethoscope on the brachial artery medial to the antecubital fossa.
 - After the inflate the cuff to approximately 30mm hg above the estimated systolic pressure.
 - Realised the thumb valve carefully, allowing air should be released at a rate of 2mmhg per heartbeat. Listen for the appearance of Korotkoff's sounds.
 - watch the manometer closely and the note the point at which the first rhythmic tapping sound is heard.
 - After that note the sound first become muffled because quickly thereafter the sound will disappear this recorded as the diastolic pressure.
- ❖ **Rate pressure product:** Rate pressure product (RPP) or Double product (DP) reflects myocardial (heart) oxygen demand or consumption (mVO₂).
 - The RPP can be thought of as the heart's power output. The oxygen demand of the heart is related to the work of the heart. The RPP is the product of HR and SBP.

RPP= HR*SBP

 - Heart rate into systolic blood pressure ultimate given rate pressure product.

RESULT:

- Statistical analysis was done using SPSS version 20 and Microsoft Excel 2019, Microsoft word, and Microsoft excel and SPSS were used to generate tables and graphs.
- Mean was calculated as a measure of central tendency for HR, RR, SPO2, SBP, DBP, RPP. Standard deviation was calculated as measure of dispersion. Level of significance was kept at 5% with confidence interval (CI) at 95% (P value=0.05)
- Shapiro wilk test was performed taking pre-outcome measure and P value was >0.05 for HR, RR, SPO2, SBP, DBP, RPP this showed that this following outcome measure in both groups was normally distributed
- So, for HR, RR, SPO2, SBP, DBP, &RPP parametric test T-test was used
- In both group within group comparison and group analysis after 20 minutes of intervention for HR, RR, SPO2, SBP, DBP, & RPP were done using paired T-test used.
- In between group comparison of data Unpaired T-test applied.

Table:2 Age, Height, Weight and BMI Distribution in Two groups:

	Group	N	Mean	SD	P value
AGE (years)	1	10	62.60	9.65	0.230
	2	10	58.10	6.15	
HEIGHT (cm)	1	10	158.10	5.78	0.683
	2	10	159.60	9.84	
WEIGHT (kg)	1	10	51.70	10.65	0.384
	2	10	55.40	7.61	
BMI (kg/m ²)	1	10	20.80	4.74	0.980
	2	10	20.85	3.94	

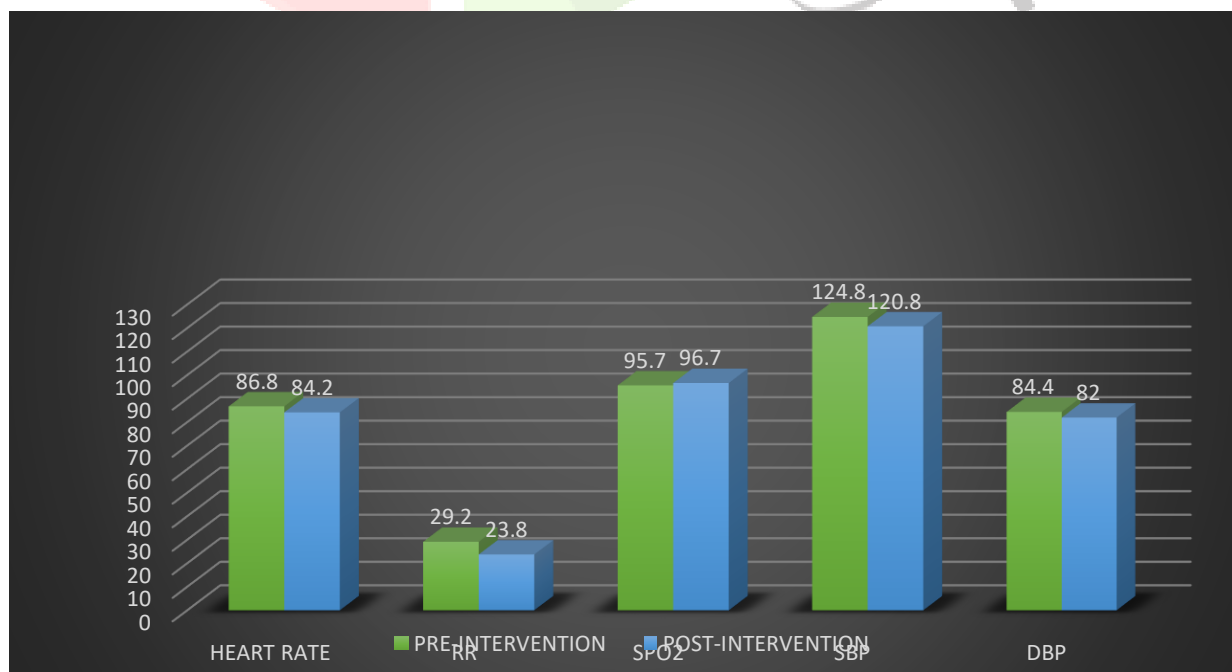
INTERPRETATION: The above table shows the mean \pm SD of age, height, Weight, BMI shows $p > 0.05$ for all data so baseline data was comparable.

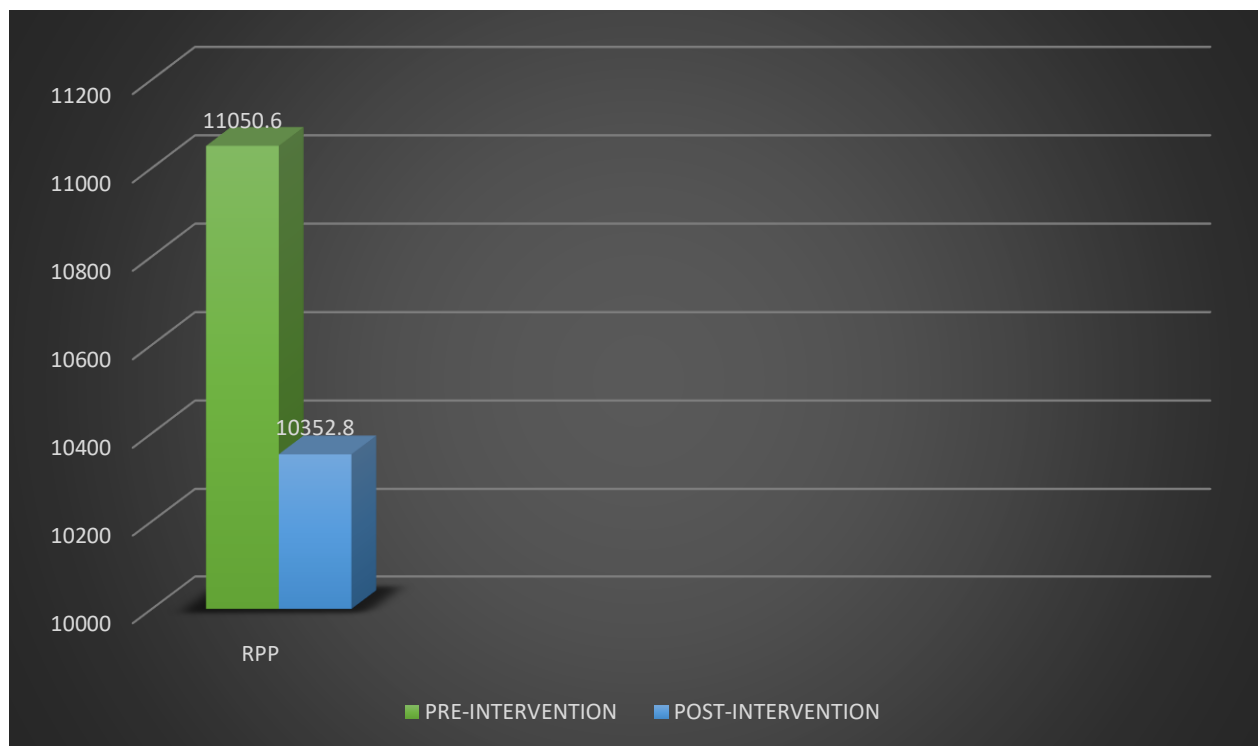
TABLE-3 : GROUP:1: PLB within group comparison

Heart Rate	86.80 ± 5.16	84.20 ± 3.82	3.98	0.003	SIGNIFICANT
RR	29.20 ± 1.93	23.80 ± 3.04	4.26	0.002	SIGNIFICANT
SPO2	95.70 ± 2.00	96.70 ± 1.76	-3.35	0.008	SIGNIFICANT
SBP	124.80 ± 7.31	120.80 ± 6.81	3.72	0.005	SIGNIFICANT
DBP	84.40 ± 5.48	82.00 ± 4.52	2.34	0.044	SIGNIFICANT
RPP	11050.60 ± 1302.02	10352.80 ± 1051.52	6.06	0.000	SIGNIFICANT

INTERPRETATION:

The above table:2 shows mean ± SD of pre HR, SPO2, SBP, DPP, RPP is 86.80 ± 5.16(SD), 29.20 ± 1.93(SD), 95.70 ± 2.00(SD), 124.80 ± 7.31(SD), 84.40 ± 5.48(SD), 11050.60 ± 1302.02(SD) Respectively and mean ±SD of Post HR, SPO2, SBP, DBP AND RPP is 84.20 ± 3.82(SD), 23.80 ± 3.04(SD), 96.70 ± 1.76(SD), 120.80 ± 6.81(SD), 82.00 ± 4.52(SD), 10352.80 ± 1051.52(SD) Respectively . The results show significant difference for pre and post parameter (p<0.05). Hence, the alternate hypothesis was accepted for the within group-A comparison

GRAPH:2 GROUP:1 within group group comparison

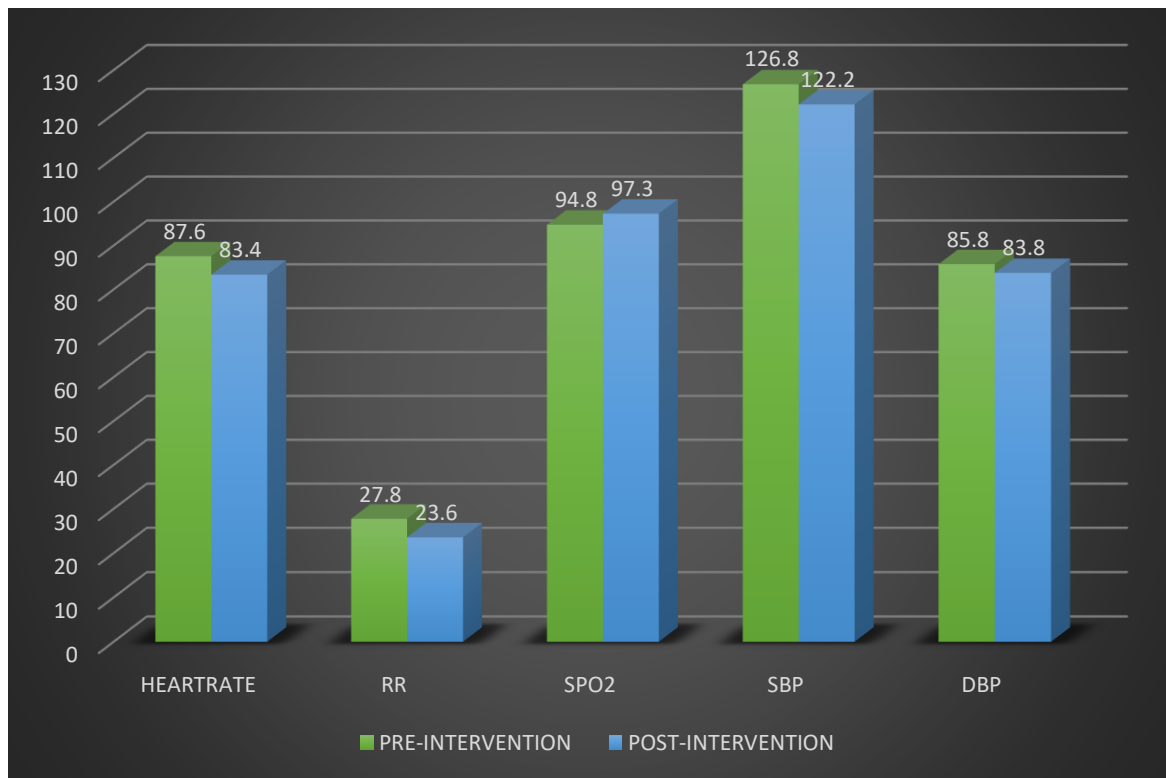
GRAPH:3 GROUP:1 Rate pressure product within group comparison**TABLE:4: GROUP:2 NSP WITHIN GROUP COMPARISON**

Parameter	Pre (mean± SD)	Post (mean± SD)	t value	P value	Significance
Heart Rate	87.60 ± 6.80	83.40 ± 5.14	2.56	0.031	SIGNIFICANT
RR	27.80 ± 3.58	23.60 ± 3.97	6.67	0.000	SIGNIFICANT
SPO2	94.80 ± 2.53	97.30 ± 2.49	-5.51	0.000	SIGNIFICANT
SBP	126.80 ± 7.37	122.20 ± 7.45	3.63	0.005	SIGNIFICANT
DBP	85.80 ± 4.26	83.80 ± 3.82	2.37	0.042	SIGNIFICANT
RPP	11127.20 ± 1293.17	10193.00 ± 907.35	3.20	0.011	SIGNIFICANT

➤ INTERPRETATION:

The above table:3shows mean± SD of pre HR, RR, SPO2, SBP, DPP, RPP is 87.60 ± 6.80 (SD), 27.80 ± 3.58(SD) 94.80 ± 2.53 (SD), 126.80 ± 7.37 (SD), 85.80 ± 4.26 (SD), 1127.20 ± 1293.17 (SD) Respectively and mean ±SD of Post HR,RR, SPO2, SBP, DBP AND RPP is 83.40 ± 5.14 (SD), 23.60 ± 3.97(SD), 97.30 ± 2.49 (SD), 122.20 ± 7.45 (SD), 83.80 ± 3.82 (SD), 10193.00 ± 907.35 (SD)Respectively . The results show significant difference for pre and post parameter (p<0.05). Hence, the alternative hypothesis was accepted for the within group-2 comparison.

GRAPH:4 : GROUP:-2 within group comparison



GRAPH:5 : GROUP:2 RPP within group comparison

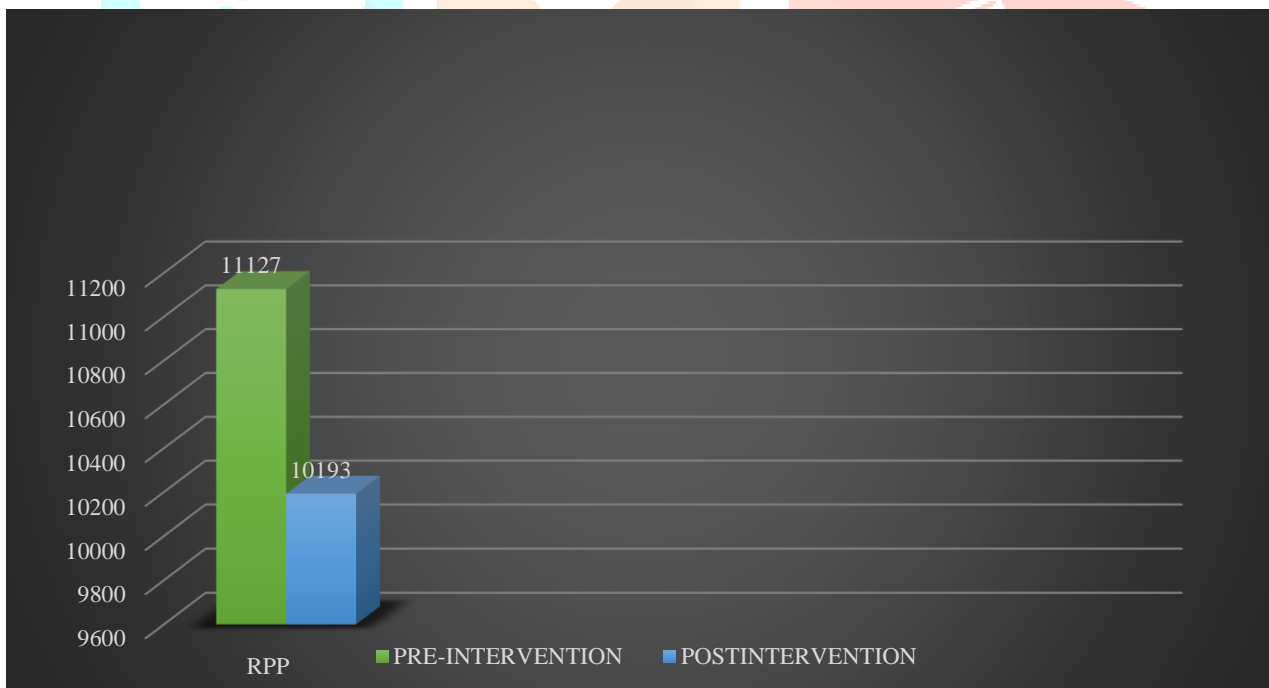


TABLE:5 between group comparison of group:1 and group:2

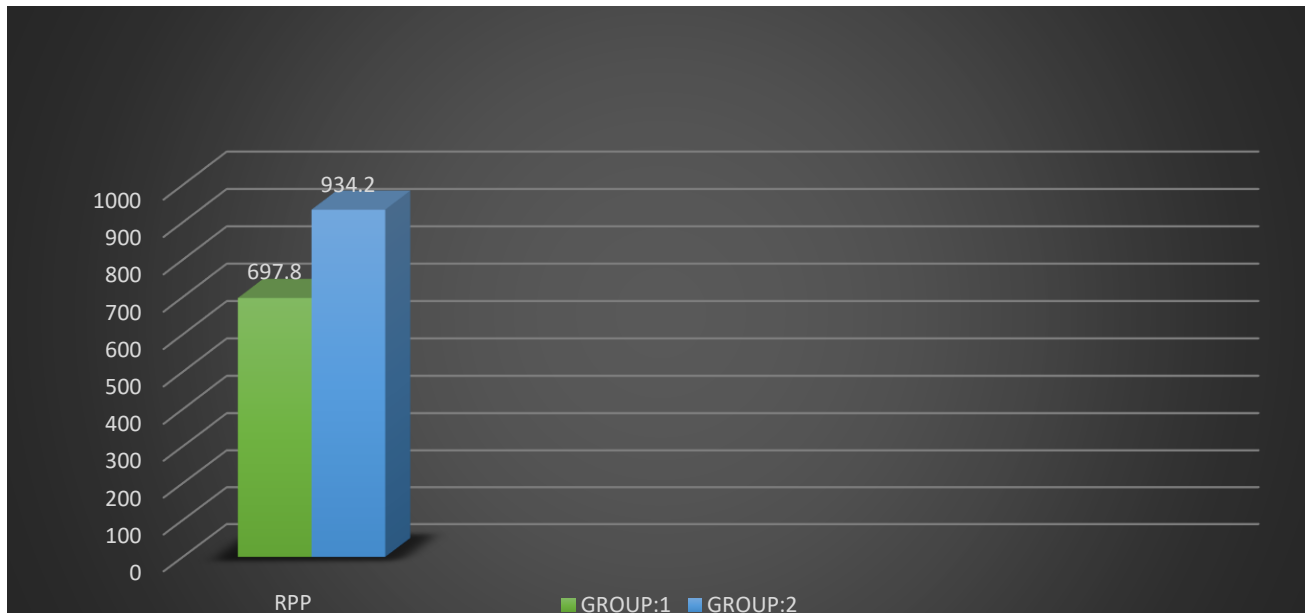
PARAMETERS	MEAN DIFFERENCE ± SD		t value	P value	DIFFERENCE
	GROUP:1	GROUP:2			
HEART RATE	-2.60 ± 2.066	-4.20 ± 5.18	0.907	0.376	NON-SIGNIFICANT
RR	-5.40 ± 4.00	-4.20 ± 1.98	-0.849	0.407	NON-SIGNIFICANT
SPO ₂	1.00 ± 0.94	2.50 ± 1.43	-2.764	0.013	SIGNIFICANT
SBP	-4.00 ± 3.39	-4.60 ± 4.00	0.361	0.722	NON-SIGNIFICANT
DBP	-2.40 ± 3.23	-2.00 ± 2.66	-0.302	0.766	NON-SIGNIFICANT
RPP	-697.80 ± 363.60	-934.20 ± 922.32	-0.754	0.461	NON-SIGNIFICANT

➤ INTERPRETATION:

The above table:4 shows that between group comparison of MEAN DIFFERENCE ± SD using UNPAIRED t-test. and group:1 parameter HR, RR, SPO₂, SBP, DBP, RPP is -2.60 ± 2.066(SD), -5.40 ± 4.00(SD), -1.00 ± 0.94(SD), -4.00 ± 3.39(SD), -2.40 ± 3.23(SD), -697.80 ± 363.60(SD), Respectively and MEAN DIFFERENCE ± SD of group:2 parameter HR, RR, SPO₂, SBP, DBP, RPP is -4.20 ± 5.18(SD), -4.20 ± 1.98(SD), 2.50 ± 1.43(SD), -4.60 ± 4.00(SD), -2.00 ± 2.66(SD), -934.20 ± 922.32(SD) Respectively. Above finding suggested that for SPO₂ t=-2.764 and p=0.013 (P<0.05) on group:2 (NSP) suggested that in SPO₂ in group:2 shows significant improvement then group:1. And other parameter of both group:1 & 2 showed statistically similar value. Other outcome measure for group:1 and group:2 there is p>0.05 so result shows no significant effect.

GRAPH:6: GROUP:1 & 2 BETWEEN GROUP COMPARISON



GRAPH:7:: GROUP:1 & 2 BETWEEN GROUP COMPARISON OF RPP

GROUP:1: (pursed-lip breathing): -Above finding suggest that there was significant improvement in post intervention finding in HR, RR, SPO2, SBP, DBP, and RPP in patients with COPD

GROUP:2 (Nadi-Sodhana pranayama): Above finding suggest that there was significant improvement in post intervention finding in HR, RR, SPO2, SBP, DBP, and RPP in patients with COPD.

BETWEEN GROUP: above finding of mean difference of both groups suggest that there was significant difference in post intervention finding in SPO2 suggested that better improvement in oxygen saturation after group:2 (NADI-SODHANA PRANAYAMA). And another parameter was statistically non-significant in in both groups.

These results proved that there was statistically same effect of pursed-lip breathing and Nadi- Sodhana pranayama in heart rate, respiratory rate, saturation of oxygen, and both types of blood pressure systolic and diastolic type in COPD patients.

DISCUSSION:

The intent of the present study was to compare the effect of pursed-lip breathing and Nadi-sodhana pranayama on cardio-respiratory parameter in patient with COPD.

Result of present study favoured the experimental hypothesis for within group analysis for all parameters and in between group comparison of SPO2, and null hypothesis accept for between group comparison in HR, RR, SBP, DBP, and RPP. Parameters.

In between group analysis shows that there was statistically significant difference in SPO2. Mean difference of SPO2 in group:2 is having more effect than group:1 and other parameters HR, RR, SBP, DBP and RPP are having same improvement in in both groups.

Pursed-lip breathing maintain arterial baroreceptors, chemoreceptors, and cardio-pulmonary receptors that all linked with central nervous system. Central nervous system activating autonomic nervous system which regulate **heart rate** and **blood pressure** also heart rate and blood pressure regulated by breathing exercise by controlling strength of heart and decrease the diameter of blood vessels and decrease the activity of sympathetic.

It also improves the activity of vagal activity therefore decreasing blood pressure and heart rate by both sympathetic and parasympathetic activity alteration.

Sahiriari Sukhaei et al. (2018) studied that impact of pursed-lip breathing maneuver in cardiac, respiratory and oxygenation parameter that conducted studied on 60 patients of COPD. And studied concluded that pursed lip breathing as an easy inexpensive non-invasive and non-pharmacological method for improving status of oxygenation and physiological indicator in patient with COPD. ⁽¹³⁾

Jincy calias et al. (2013) studied that effectiveness of pursed-lip breathing exercise on selected physiological parameter among 50 COPD patient and concluded that statistically significant changes in HR, RR, SPO2 in their study and parameter that supported our present study. ⁽¹⁶⁾

N.K. Subbalakshmi et.al (2005) studied that immediate effect of Nadi-Sodhana pranayama on some selected parameters of cardiovascular pulmonary, and higher function of brain study was done on 10 healthy subjects and concluded that Nadi-sodhana pranayama significant effect of HR, SBP this parameter supported our present study but in their study they was not significant changes on diastolic blood pressure because of they studied on normal college going student but in present study we studied on COPD patients so we have significant changes in DBP. ⁽¹¹⁾

pranayama increases the frequency of inhibitory impulse to stretch receptors of lungs during inhalation phase above the tidal volume seen in Hearing Breuer's reflex (HBR) and pranayama heightens the generation of hyperpolarisation current by stretch of connective

tissue.it recognized that inhibitory impulse, produced by slowing adapting receptors (SARs) in the lungs during inflation. This mechanism plays an autonomic function in such as breathing pattern, airway smooth muscle tone, systemic vascular resistance and heart rate. ⁽¹²⁾

CONCLUSION:

From present study it can be concluded that both pursed-lip breathing and Nadi-Sodhana pranayama has significant positive effect on heart rate, respiratory rate, saturation of oxygen, blood pressure and rate pressure product in patients with COPD. So, it should be included in part of rehabilitation protocol in COPD patients.

So, null hypothesis is rejected and alternate hypothesis is accepted.

CLINICAL IMPLICATION:

In COPD, as the disease progress it gets worsen dyspnoea, changes in cardio-pulmonary hemodynamic status and ultimately at last stage its failure the heart. This present study demonstrated that statistically significant improvement in heart rate, respiratory rate, saturation of oxygen, blood pressure and rate pressure product in after pursed-lip breathing and Nadi-sodhana pranayama but saturation increase significantly after using Nadi-Sodhana pranayama.

Both interventions are statistically same result so both are added in rehabilitation for in patients with COPD

So, in emergency situation for dyspnoea relieving Nadi-Sodhana pranayama should be added in rehabilitation programme for COPD patients.

LIMITATION OF STUDY:

- ❖ Small sample size
- ❖ There was no blinding for this study.
- ❖ Only two breathing exercise was compared in this study.

FUTURE RECOMMENDATION:

- ❖ Study can be done with larger sample size
- ❖ considering different stage of COPD.
- ❖ Study can be considering all type of breathing exercise and pranayama.
- ❖ Study can be done in other respiratory or cardiac disease.

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