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# Respiratory muscle stretch gymnastics (RMSG) and pursed lip breathing exercise (PLB) on increasing forced expiratory volume 1 (FEV1) on patients of chronic obstructive pulmonary disease

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## ABSTRACT

### Background

Lung's inability to carry out its function due to the stiffness of the respiratory muscles that can cause a decrease in Forced Expiratory Volume 1 (FEV1). Respiratory Muscle Stretch Gymnastics (RMSG) and Pursed Lip Breathing Exercise (PLB) can help improve lung function in patients with Chronic Obstructive Pulmonary Disease (COPD).

### Objective

This study aims to determine the effectiveness of Respiratory Muscle Stretch Gymnastics (RMSG) and Pursed Lip Breathing Exercise (PLB) on the increase in Forced Expiratory Volume 1 (FEV1).

### Methods

This research quasi experimental with design was pretest and posttest control group design. Retrieval of data in the Magelang region public health center involving 32 respondents selected through techniques non-probability sampling with method consecutive sampling which is divided into 2 groups. The combination of respiratory muscle structure gymnastic and pursed lips breathing exercise was given to the intervention group, while the control group was only given treatment pursed lip breathing exercise without respiratory muscle stretch gymnastic.

### Result

Independent test showed a significant difference with p value 0.014 (<0.05) means that the intervention group is better at increasing Forced Expiratory Volume 1 (FEV1) than the control group with the difference in the intervention group 0.54 higher than the control group 0.16.

### Conclusion

Giving a combination of respiratory muscle stretch gymnastic and pursed lips breathing exercise for 4 days with 5 measurements is very effective in increasing Forced Expiratory Volume 1 (FEV1) in patients with Chronic Obstructive Pulmonary Disease (COPD).

**Keywords:** Respiratory Muscle Stretch Gymnastics (RMSG), Pursed Lip Breathing Exercise (PLB), Forced Expiratory Volume 1 (FEV1), Chronic Obstructive Pulmonary Disease (COPD).

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is an obstructive disease of the respiratory system that is not completely reversible. COPD systemic disease that has a relationship between muscle metabolic involvements with molecular genetics. COPD patients will have limitations in terms of quality of life. The long term of COPD disease is disability. This is caused by not functioning normally in skeletal muscle in COPD patients. In addition, systemic inflammation, weight loss, osteoporosis increase the risk of cardiovascular disease, and psychological problems such as depression [1].

According to World Health Organization (WHO) COPD is the fourth leading cause of death in the United States, is predicted to increase and will increase in 2020, as a burden of disease in the world. In addition, in the same year an estimated 65 million people worldwide will suffer from COPD in the moderate to severe category [2]. COPD has accounted for more than 3 million people died, and 6% of all causes of death. In Asia awareness of COPD is also very low, according to research in China, they consider shortness of breath and chronic coughing are congenital symptoms in old age even in patients who have a history of smoking [3].

The incidence rate in Indonesia, according to basic health research in 2018, the COPD prevalence is 3.7% per mile with the highest prevalence rate being male at 4.2%. Occupy the top three in the prevalence of diseases of the respiratory tract [4, 5]. With the highest prevalence, East Nusa Tenggara (10.0%) [6]. According to the Central Java provincial health office in 2016 the estimated prevalence of incidence in COPD patients was 2.49%. While based on age, namely in the elderly aged ≥65 years is estimated at 14.2% (11-18%), at the age of ≥40 years it is estimated to be 9.9% (8.2-11.8%) [7]. This prevalence will double with an increase in the age of 10 years [8]. So that it can lead to increased morbidity and mortality of COPD patients who have reached more than 5% of the total population, such as cardiovascular, bronchial cancer, lung infections, asthma, hypertension, osteoporosis, thrombo embolic disorder, joint pain and depression anxiety [9].

Factors causing COPD disease include smoking, air pollution, bronchial hyperactivity, a history of lower respiratory infections and deficiency alpha-trypsin alpha (in Indonesia it is rare) [10]. Smoking is a major factor in COPD, both active and passive smokers, [11] smoking is a leading cause of death and disability that can be prevented in the world [12]. Even when smoking has stopped but its effects such as inflammatory stress continue to damage lung tissue.8 Data from basic health research in 2013, an average person will spend 12 sticks per day [4].

Data in 2016 by the Ministry Health of Republic Indonesia, the Indonesian people allocated 13.8% for cigarettes from 14%, this data was supported by the Central Statistics Agency for the last ten years, and cigarette expenditure outperformed other food needs namely, such as eggs consistently [5]. The longer exposure to nicotine, the greater the impact on health, namely respiratory disorders, lung function and circular disease.13 The content in cigarette smoke is 1,015 – 1,071 free radical oxidants and around 4,700 hazardous chemicals namely aldehydes/carbonyls, NO2, and SO2. Causing oxidative stress and triggering an inflammatory response in the lungs [14].

COPD is classified based on the severity of lung function that is emphysema, chronic bronchitis with airway obstruction. But some events show a combination. In COPD patients with emphysema there is damage to the alveolar septa, decreased elasticity, increased alveoli air space and loss of gas diffusion function. Whereas in COPD bronchitis with airway obstruction, airway inflammation occur hyperplasia goblet cell and mucus hyper secretion [15].

Clinical symptoms in COPD patients, cough, sputum production, shortness of breath and physical limitations. COPD patients also have difficulty breathing, so using the muscles of breathing aids so that the impact on chest shape changes antero-posterior chest diameter and transverse is comparable (Barrel chest) [16]. If this happens for a long period of time there will be muscle hypertrophy and enlargement of rib cells. If you have experienced right heart failure,

enlargement of the jugular will increase and edema occurs in the lower extremities [17].

Fluid buildup due to the inability of the heart pump causing tactile fremitus in patients with emphysema will feel palpable, percussion sounds hypersonor, the heart area limits shrink, the location of the diaphragm is low, and the occurrence of the liver push down. Breath sounds will sound normal or weak vesicular, at the time of ordinary breathing or forced expiration there is a crackdown. Expiration will sound elongated and heart sounds will be heard to weaken [18].

The impact caused in addition to the respiratory muscles, COPD patients will experience a decrease in Forced Expiratory Volume 1 (FEV1) and a FEV1/lung vital capacity <0.70/70%, this is a characteristic of COPD namely peripheral airway obstruction causing trapped air and causing hyperinflation. Pathophysiologically, COPD patients experience inflammation, hyperinflation, increased numbers of exudates and air trapping [1]. COPD patients experience infusion at the time of expiration due to obstruction in the air flow that can cause collapse. When the patient is carrying out daily activities, there is a limitation in the flow of air which causes disruption in the expiratory phase to be imperfect, air trapping and dynamic hyperinflation.19 When the lungs are not functioning properly there is a risk of hypoxia [1, 20]. Part of COPD patients will experience hypoxia and decreased oxygen saturation (SpO2) [21].

This situation will cause the final volume of expiration to increase. As a mechanism of homeostasis in the body, COPD patients will increase efforts in breathing with hyperventilation due to decreased tidal volume when doing maximum inspiration. Causing lung volume to increase and upon expiration, air is unable to exit normally due to a decrease inelasticity recoil and will cause dyspnea. At the time of dyspnea, treatment can be given by extending the expiratory time to dynamically reduce compressed airway and air trapping. So that breathing retraining is needed to provide an exercise in extending expiratory time [22].

Symptoms of shortness of breath in COPD patients can cause a decrease in the ability of individuals to carry out daily activities, so the quality of life in COPD patients will decrease. The higher the degree of COPD the worse the quality of life [23] basic human needs is not effectively met in COPD patients. Abraham Maslow in his theory gives eight classifications of basic human needs namely, oxygen demand and gas exchange, fluid and electrolyte needs, nutritional requirements, urine and elimination needs, rest and sleep needs, shelter needs, temperature needs and sexual needs. COPD patients have limited oxygen requirements and gas exchange, thus causing an impact on other needs [24].

Nursing problems that arise in COPD patients include ineffective breathing patterns, because the inspiration and expiration phases are inadequate in meeting ventilation needs. This problem will have an impact on gas exchange disruption, where there is an imbalance of oxygen and carbon dioxide in the alveoli-capillary membrane [18]. One of the roles of nurses in the management of COPD patients is supportive educative related with lung rehabilitation management with breathing control and exercise training activities [23]. COPD patients have a deficit so that there will be dependence on others, and need treatment and assistance from others in meeting their needs. According to Dorothea E Orem's theory of self-care deficit nursing theory, that is, if a patient is unable to meet his own needs in maintaining its function, then that patient needs nursing care [25].

Pulmonary rehabilitation programs are given to COPD patients, including pre-rehabilitation assessments, such as lower extremity exercise programs such as (walking, static bicycles and treadmills), strength training for atrophy muscles, upper extremity exercises, neuromuscular electrical stimulation (NMES) and exercise training respiratory muscles. Exercises to improve respiratory muscles, this is an exercise program given to COPD patients. Breathing muscle exercises will have an impact on increasing the patient's ventilation abilities so that it will improve the patient's quality of life. If the patient experiences respiratory muscle fatigue, the portion of the breathing muscle exercise is enlarged [1].

Pulmonary rehabilitation therapy with breathing control that is, Pursed Lips Breathing is a ventilation technique by pursing the lips during expiration [26]. Pursed-lips breathing (PLB) is a ventilation strategy that is often adopted spontaneously by patients with COPD to relieve dyspnea and reduce air trapping in the alveoli. This technique can provide assistance in maximizing air expenditure during expiration. So there is a

reduction in the accumulation of air volume in the lung is reduced and ventilation will be stable. This condition will reduce respiratory rate. So that it can cause ineffective breathing patterns [27]. According to research conducted by Ferracini pursed lip breathing increases oxygen saturation and daily activities for COPD patients [28].

Other disorders of the respiratory ventilation system, there are also problems in the respiratory muscles that experience fatigue due to COPD. Increases in respiratory rhythm with prolonged expiration as compensation for dyspnea. In state dyspnea sensory muscles the neck and upper chest will be used excessively to move the chest muscles. So it will cause fatigue and cannot be used long term. Can cause activity tolerance so that it can disrupt the daily activities of patients? [18].

Exercises that can be given to COPD patients for respiratory muscles, namely, Respiratory Muscle Stretch, Gymnastic (RMSG), is a stretching exercise of breathing muscles in the chest, aimed at extending inspiration and expiration muscles in the ventilation process. RMSG can increase lung vital capacity (CV), decrease functional residual capacity (FRC) and reduce shortness of breath [29]. Muscle stretching exercises will benefit from increased development of the chest wall and lung function.30 This exercise is related to several respiratory muscles, namely, the sternocleidomastoid, the muscle pectoralis major and trapezius, tricep brancii and muscle serratus anterior for 10-15 minutes [31].

In improving oxygenation function while providing prevention against the occurrence of respiratory muscle stiffness in COPD patients with accompanying interventions or non-pharmacological therapy, this is very important. So researchers are interested in conducting research on "Respiratory Muscle Stretch Gymnastics (RMSG) and Pursed Lip Breathing Exercise (PLB) On Increased Forced Expiratory Volume 1 (FEV1) in Patients with Chronic Obstructive Pulmonary Disease".

## METHODS

This type of research is a quasi-experimental study using a research pre-test and post-test control group design. This study arranged two groups, namely the intervention group given a combination of Respiratory Muscle Structure Gymnastic and pursed lips breathing exercise, while the control group was only given treatment pursed lip breathing exercise without respiratory muscle stretch gymnastic. Giving combination therapy respiratory muscle structure gymnastic and pursed lips breathing exercise given for 4 days with 5 measurements. Measurement of Forced Expiratory Volume 1 (FEV1) can be done using instruments spirometry and results are recorded on the observation sheet. Measurement of Forced Expiratory Volume 1 (VEP1) of respondents experiencing Chronic Obstructive Pulmonary Disease (COPD) was carried out before (pre-test) and after the therapeutic measures (post-test 1, post-test 2, post-test 3 and post-test 4).

The population in this research were target population of COPD patients with a FEV1 / lung vital capacity ratio <0.7 who came to the Magelang region Public Health Center. Determination of the minimum sample size using techniques non probability sampling with method consecutive sampling and based on inclusion and exclusion criteria as many as 32 respondents divided into two groups with 16 respondents each in the intervention group (Combination of respiratory muscle structure gymnastic and pursed lips breathing exercise) and 16 respondents in the control group (pursed lip breathing exercise without respiratory muscle stretch gymnastic).

In this study, researchers conducted data collection by means of observation, identification, interviews and filling in the observation sheets. The data collected was analyzed through the IBM SPSS program version 24.0, and continued with a different test, namely the parametric test (Paired t test and Independent t test). The processed data is used as a basis for discussing statement matters, which are then presented in tabular form so that conclusions can be drawn.

## RESULTS

**Table 1 Frequency distribution of respondents from gender and smoking history based on demographic data**

| Characteristics | Intervention (n=16) | | Control (n=16) | | P |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Gender | | | | | |
| Men | 13 | 81.25 | 13 | 81.25 | 1.000 |
| Women | 3 | 18.75 | 3 | 18.75 | |
| Smoking History | | | | | |
| Yes | 13 | 81.25 | 13 | 81.25 | |
| No | 3 | 18.75 | 3 | 18.75 | 1.000 |
| Total | 16 | 100 | 16 | 100 | |

*Homogeneous test

Based on the table above we get the data that the frequency of gender and smoking history in intervention group and control group have the same significant value p 1.000 (>0.05) means the same or homogeneous.

**Table 2 Description of the mean and standard deviation in forced expiratory volume 1 (FEV1) in the intervention group and control group**

| Variable | Group | N | Mean ± SD Before treatment (Pre) | After treatment (Post) |
|---|---|---|---|---|
| FEV 1 | Intervention | 16 | 1.73±0.84 | 2.27±0.82 |
| | Control | 16 | 1.42±0.66 | 1.58±0.68 |

*Descriptive Statistics

Based on the table above shows that the average value of the forced expiratory volume 1 (FEV1) of the intervention group increased more than the control group with a mean value of 2.27, while the control group 1.58.

**Table 3 Difference in mean forced expiratory volume 1 (FEV1) before and after treatment in the intervention group and control group**

| Group | N | Mean ± SD | | ΔMean | P value |
|---|---|---|---|---|---|
| | | Pre test | Post test | | |
| Intervention | 16 | 1.73±0.84 | 2.27±0.82 | 0.54 | 0.001 |
| Control | 16 | 1.42±0.66 | 1.58±0.68 | 0.16 | 0.000 |

*Paired t test

Based on the table above shows that there are differences in the increase forced expiratory volume (FEV1) before and after treatment in the intervention group and control group. However, the difference in the increase in forced expiratory volume (FEV1) in the intervention group was 0.56 more than in the control group 0.16.

**Table 4 Analysis of the mean difference in forced expiratory volume 1 (FEV1) between the treatment group and control group**

| Variable | Mean ± SD | | ΔMean | P value |
|---|---|---|---|---|
| | Intervention Group | Control Group | | |
| FEV1 | 2.27±0.82 | 1.58±0.68 | 0.69 | 0.014 |

*Independent t test

Based on the table above that there are significant differences between groups statistically significantly different, it can be said that there are differences in the value of forced expiratory volume 1 (FEV1) between the intervention group and control group. If seen from the average difference between the intervention group and control group 0.69 with a p value of 0.014 (<0.05).

# DISCUSSION

## Difference in mean forced expiratory volume 1 (FEV1) before and after treatment in the intervention group and control group

The results showed that there was a combination of treatment respiratory muscle stretch gymnastics and pursed lip breathing exercise. In the intervention group before being given an action, the average condition of forced expiratory volume 1 (FEV1) obtained 1.73 ml after the intervention was given on average it became 2.14 ml. So, we can conclude that there is an increase in Forced Expiratory Volume 1 (FEV1). The analysis showed that the minor hypothesis was accepted, namely an increase in first-second expiratory ventilation after treatment interventions were given giving respiratory muscle stretch gymnastics and pursed lips breathing.

The research of Swanney, FEV1 can be a measuring tool for seeing obstruction in the airways. Obtained by spirometry measurement of the results independent of subsequent pulmonary function decline with a higher risk for developing chronic obstructive pulmonary disease (COPD) [15]. Limited air flow in patients with COPD is very slow but progressive and this occurs in several decades, symptoms appear in middle age or older [32].

Air flow resistance in the process of respiration is the main physiological sign of COPD. Barriers to air flow occur in small conduction airways with a diameter of <2mm caused by airway remodeling, namely fibrosis and constriction. Widespread inflammation, fibrosis, and the presence of exudate in the lumen in the small airways will have an impact on decreasing the value of FEV1 / Lung Vital Capacity [1].

This study is the same as the results of research by Minoguchi and colleagues showing that respiratory muscle stretch gymnastics can increase FEV1. RMSG increases maximum chest wall expansion, this expansion can provide stretching of the respiratory muscles in the intervention of respiratory muscle stretch gymnastics in the process of increasing capacity vital lung, the first step is shrugging the shoulder, the affected breathing muscles in the stretching process are sternocledomastoid muscle, scalene muscle, the second step is opening the chest of the affected breathing muscles in the stretching process, namely muscles pectoralis minor muscle, one hundred anterior, third step opening the back muscles of the breathing muscles that are stretching are muscles external intercostal, internal intercostal, tranversus thotacis muscle, and lifting the lower chest muscles of the affected breathing muscles namely, diaphragm, internal oblique muscle, rectus abdominus, and your external oblique scale [33].

The increase in FEV1 value in the intervention group is likely due to the mechanism of respiratory stretch muscle gymnastics, stretching of the chest muscles that make the breathing muscles supple and not stiff so as to add Abdominal breathing expels blood flow from the veins around the abdomen to the heart. This can affect the increase in lung volume. Improved ability of expiratory muscles reduced airway obstruction and inflammation. Reduction in obstruction causes decreased pulmonary hyperinflation and diaphragmatic movements become better so that the volume of inspiration becomes greater.

Exercise causes higher stimulation of the brain center at the vasomotor center in the brain stem which causes an increase in arterial pressure and pulmonary ventilation. Movement of the body, especially the arms, is considered to increase pulmonary ventilation by stimulating propioseptor joints and muscles, which then transmit the excitation impulses to the respiratory center. Hypoxia, which occurs in muscles during exercise, produces afferent nerve signals to the respiratory center to stimulate breathing. This is also because the muscles that work will form carbon dioxide in an extraordinary amount and use a lot of oxygen so that the pressure of carbon dioxide (CO2) and oxygen (O2) changes significantly between the inspiration cycle and the expiration cycle of breathing so that the Forced Expiratory Volume 1 will increase.

This research is the same as the results of research conducted by Suryantoro lung

rehabilitation techniques with pursed lips breathing can increase first-second expiratory ventilation. This technique helps in the process of emptying the air in the lungs and can give patients the opportunity to regulate the breathing patterns that occur. In pursed lips breathing helps the patient to restore the shape and function of the diaphragm to the patient. During the inspiration process the diaphragm will bend and move downward. While the expiration process pursed lips breathing helps the diaphragm to move upward, so that the process of emptying air will occur [26].

Pressure caused on the oral cavity through technique is pursed lips breathing continued through bronchial branches so that it can prevent collapse and air trapping in the small respiratory tract. Air Trapping is trapped leaving less space in the lungs for fresh air that contains oxygen, which means a person will feel shortness of breath. They may not have enough air available in their lungs to exercise [34].

Research conducted by Suryantoro etc.al states that pursed lip breathing is more effective in increasing FEV1 than sixminutes-walktest (6MWT) in COPD patients. The patient is able to exercise breathing control so as to facilitate the process of expelling air trapped in the lungs by helping to put pressure on the process of expiration [35].

## Analysis of the mean difference in forced expiratory volume 1 (FEV1) between the treatment group and control group

The results showed that the intervention group with the administration of respiratory muscle stretch gymnastics and pursed lips breathing with the control group given the treatment pursed lips breathing. According to the results of statistical tests show there are significant differences and increases in the dependent variable ventilation of first-second lung expiration p value (0.014) < level of significance (alpha = 0.05). The analysis showed that the major hypothesis was accepted that respiratory muscle stretch gymnastics and pursed lips breathing were effective in increasing forced expiratory volume 1 in COPD patients.

Stretching exercises Respiratory Muscle Stretch Gymnastics (RMSG) can reduce the stiffness of the breathing muscles in the chest wall. Reducing dyspnea and improving quality of life, increasing forced expiratory ventilation [1] and endurance exercise so that mobilization of the chest wall does not decrease function and reduce elastance (changes in excess pressure) in the chest skeletal and respirator muscles [36].

Assumptions from researchers why the treatment group contained significant differences compared to the control group. In the treatment group, there were two interventions given to the patient, namely respiratory muscle stretch gymnastics and Pursed lip breathing when stretching the muscles can stimulate the spindles of the muscles so that they experience reduced stiffness resulting in maximal expansion of the chest muscles. When a person breathes normally, they usually use between 10 and 15 percent of their total lung capacity.

Muscle Exercise For respiratory inspiration, a person can usually increase the amount of lung capacity used. Deeper breathing uses a little more energy but also allows more oxygen to enter the bloodstream with each breath while strengthening the breathing muscles [37].

When the patient does a respiratory muscle stretch gymnastics there is a pause of a few seconds between one action to the next. Decreased ability and endurance while doing activities can be improved by doing regular breathing exercises. Where researchers provide intervention namely pursed lip breathing is a breathing technique used to treat shortness of breath in those who have difficulty breathing (usually associated with chronic lung disease). As one method of controlling breathing, this technique is most effective when breathing works or under stress (for example, when doing exercises or other strenuous activities) [38].

In this study the majority of respondents had a history of smoking. When exposure is quite intense or prolonged, it can cause COPD. Studies of the general population and working groups show that around 15-20% of COPD cases are caused by occupational exposure. Various jobs can represent an increased risk of COPD.

In addition, a significant difference is caused because the intervention group experienced a more significant increase. The results of this study are in line with research from mistry hetal that respiratory muscle stretch gymnastics increases lung capacity. Stretching of the respiratory muscles can stimulate muscle spindles to increase alpha gamma, contraction of the respiratory muscles, to create flexibility and to elongate the phase of inspiration and aspiration in the process of respiration.

COPD patients in addition to experiencing stiffness in the respiratory muscles also experience air tapping, so that the air in the lungs cannot get out optimally causing air remaining in the alveoli. Pursed Lips Breathing deep aspirations and long expiration will certainly increase the strength of intra-abdominal muscle contraction so that the intra-abdominal pressure rises beyond the time of passive expiration. Intra-abdominal pressure which increases even stronger will certainly increase the movement of the diaphragm upward making the thoracic cavity smaller [39].

The shrinking of the thoracic cavity causes intra-alveolar pressure to increase so that it exceeds atmospheric air pressure. These conditions will cause air to flow out of the lungs into the atmosphere. Long exhalation during breathing Pursed Lip Breathing Exercise will also cause airway obstruction to be removed so that respiratory resistance decreases. Decreased respiratory resistance will expedite the air that is inhaled and exhaled so that it will reduce shortness of breath [40].

Whereas when seen from clinical respiratory muscle stretch gymnastics and pused lips breathing is more effective in increasing Forced Expiratory Volume 1 with an increase of 31.21% with a pre value of 1.73L to post 2.27L.

Respiratory Muscle Stretch Gymnastics causes higher stimulation of the brain center at the vasomotor center in the brain stem which causes an increase in arterial pressure and pulmonary ventilation. Movement of the body, especially the arms, is considered to increase pulmonary ventilation by stimulating propioseptor joints and muscles, which then transmit the excitation impulses to the respiratory center [41].

Hypoxia, which occurs in muscles during exercise, produces afferent nerve signals to the respiratory center to stimulate breathing. This is also because the muscles that work will form carbon dioxide in an extraordinary amount and use a lot of oxygen so that the pressure of carbon dioxide (CO2) and oxygen (O2) changes significantly between the inspiration cycle and the expiration cycle of breathing so that the Forced Expiratory Volume 1 will increase [42].

In the intervention of Respiratory Muscle Stretch Gymnastics involve will several respiratory muscles, namely inspiratory muscles (diaphragm, scalenus, parasternal intercostals, and external intercostals) while the inspiring auxiliary muscles (sternocleido mastoid, serratus anterior, pectoralis major, pectoralis minor, trapezius, and erector spine) and expiratory muscles (abdominal and intercostal internals) which can provide increased chest mobility thereby reducing the stiffness of the respiratory muscles experienced by COPD patients [18].

Research according to Wada etc. al stated that respiratory muscle stretch gymnastics with a combination of aerobic movements can improve the lung's ability to breathe normally. Because muscle stretching can stimulate muscle stretching it can actively activate muscle spindles, which increases sensory afferent stimulus, which results in an increase in neuromotor response, thereby increasing the likelihood of muscle contractionm [43].

These contractions increase muscle tension, causing an increase in actin and myosin filaments from the respiratory muscles consequently reducing the volume of the lungs. 40,41 The observed effect of the respiratory muscle stretching program may have occurred due to increased muscular viscoelasticity and accommodation in the muscle spindle, consequently reducing muscle stiffness, increasing muscle performance, and increasing thoraco abdominal mobility and will have an effect on Forced Expiratory Volume 1 which will further increase its capacity [44, 45].

In the treatment group respondents were given two interventions namely in addition to respiratory muscle stretch gymnastics that help respondents in the management of respiratory muscles, there is the addition of pursed lips breathing which can help patients manage the respiratory process. Research conducted by Cintia the effects of lip chase on can reduce dynamic hyperinflation and functional capacity in patients with chronic obstructive pulmonary disease.

In Pursed Lips Breathing more CO2 expenditure is caused by an increase in the final expiratory volume resulting in an increase in tidal volume. The decrease in respiratory frequency also occurs due to adjustment of perfusion and ventilation time (VA / Q). Changes in physiological effects on the use of pursed lips breathing exercise techniques cause an increase in intraabdominal pressure during expiration, thereby increasing bronchial diameter, thereby increasing the flow of inspiration and expiration. Positive intra-abdominal pressure can

prevent the collapse of the bronchi during the expiratory phase. This situation causes a decrease in closing volume and increases inspiratory capacity [46].

Patients in the treatment group were able to control their breathing muscles and respiratory management. Thus further increasing the forced seconds of the first expiratory ventilation.

## CONCLUSION

Based on data processing and analysis regarding the combination of respiratory muscle stretch gymnastics and pursed lip breathing exercise, it can be concluded that the average increase in forced expiratory volume (FEV1) in the treatment group was more effective than the control group with a difference of 0.69 and the p value of 0.014 (<0.05).

## REFERENCES

[1]. GOLD. Global Strategy For The Diagnosis, Management, and Prevention Of Chronic Obstructive Pulmonary Disease. USA: GOLD; 2017.
[2]. WHO. Chronic obstructive pulmonary disease (COPD) USA: World Health Organization (WHO); cited 2019, 2017. Available from: https://www.who.int/respiratory/copd/en/.
[3]. Rhee CK, Chau NQ, Yunus F, Matsunaga K, Perng DW, APSR CAot. Management of COPD in Asia: A position statement of the Asian Pacific Society of Respirology. Respirology. 2019.
[4]. RI K. Riset Kesehatan Dasar, Riskesdas. In: RI K, editor. Jakarta: Balitbang; 2013.
[5]. KemenkesRI. Rokok: Akar Masalah Jantung dan Melukai Hati Keluarga. In: Kemenkes R, editor. Jakarta: Biro Komunikasi dan Pelayanan Masyarakat, Kementerian Kesehatan RI; 2018.
[6]. Yatun RU, Widayati N, Purwandari R. Hubungan Nilai Aliran Puncak Ekspirasi (APE) dengan Kualitas Tidur pada Pasien PPOK di Poli Spesialis Paru B Rumah Sakit Paru Jember (Correlation between Peak Expiratory Flow Rate (PEFR) and Sleep Quality of Patient with COPD at B Lung Specialist Unit of. Pustaka Kesehatan. 4(1), 2016, 86-94.
[7]. Tengah DPJ. Profil Kesehatan Provinsi Jawa Tengah Tahun 2016. In: Kesehatan D, editor. Semarang: Dinas Kesehatan; 2016.
[8]. Fasitasari M. Terapi Gizi pada Lanjut Usia dengan Penyakit Paru Obstruktif Kronik (PPOK) Nutrition Therapy in Elderly with Chronic Obstructive Pulmonary Disease (COPD). Sains Medika. 5(1), 2013, 50-61.
[9]. Oemiati R. Kajian epidemiologis penyakit paru obstruktif kronik (PPOK). Media Penelitian dan Pengembangan Kesehatan. 23(2), 2013, 82-8.
[10]. Tuberkulosis P. pedoman diagnosis dan penatalaksanaan di Indonesia. Perhimpunan Dokter Paru Indonesia Jakarta. 2011.
[11]. Hanter MS, Shendy MAEHM. Bioscience Research.
[12]. Hedman L, Katsaounou PA, Filippidis FT, Ravara SB, Lindberg A, Janson C, Receiving support to quit smoking and quit attempts among smokers with and without smoking related diseases: Findings from the Eurest-Plus Itc Europe Surveys. Tobacco Induced Diseases. 16, 2018.
[13]. Kusumawardani N, Rahajeng E, Mubasyiroh R, Suhardi S. Hubungan Antara Keterpajanan Asap Rokok Dan Riwayat Penyakit Paru Obstruktif Kronik (PPOK) di Indonesia. Jurnal Ekologi Kesehatan. 15(3), 2017, 160-6.
[14]. Suryadinata RV. Pengaruh Radikal Bebas Terhadap Proses Inflamasi pada Penyakit Paru Obstruktif Kronis (PPOK). Amerta Nutrition. 2(4), 2018, 317-423.
[15]. Yao H, Rahman I. Current concepts on oxidative/carbonyl stress, inflammation and epigenetics in pathogenesis of chronic obstructive pulmonary disease. Toxicology and applied pharmacology. 254(2), 2011, 72-85.
[16]. Singh D, Agusti A, Anzueto A, Barnes PJ, Bourbeau J, Celli BR, Global strategy for the diagnosis, management, and prevention of chronic obstructive lung disease: the GOLD science committee report 2019. European Respiratory Journal. 53(5), 2019, 1900164.
[17]. Susanti PFE. Influence of Smoking on Chronic Obstructive Pulmonary Disease (COPD). Jurnal Majority. 4(5), 2005.
[18]. Tarigan RB. Pengaruh latihan otot pernapasan terhadap ekspansi dada dan paru pada pasien PPOK di R.S. H. Adam Malik Medan. Depok: Universitas Indonesia; 2008.
[19]. Kurniati ID, Setiawan MR, Rohmani A, Lahdji A, Tajally A, Ratnaningrum K. Buku Ajar: Ilmu Penyakit Dalam. Unimus Press; 2017.

[20]. PDPI. Diagnosis dan Penatalaksanaan Penyakit Paru Obstruktif Kronik. Jakarta: Perhimpunan Dokter Paru Indonesia; 2011.
[21]. Kent BD, Mitchell PD, McNicholas WT. Hypoxemia in patients with COPD: cause, effects, and disease progression. Int J Chron Obstruct Pulmon Dis. 6, 2011, 199-208.
[22]. Joyce Black JH. Keperawatan Medikal Bedah. Singapore: Elsevier; 2014, 2862 .
[23]. Ningsih AD. Pengaruh Kombinasi Home Based Walking Exercise Dan Pursed Lips Breathing Terhadap Forced Expiratory Volume In One Second (Fev1) Dan Dyspnea Pasien PPOK: Univeritas Airlangga; 2018.
[24]. Türkan K, Emine Derya İ. Nursing care for patients with copd on long-term oxygen therapy<p>Uzun süreli oksijen tedavisi alan koah hastalarında hemşirelik bakımı. Journal of Human Sciences. 13(2), 2016.
[25]. Berbiglia VA. Orem's self-care deficit theory in nursing practice. Nursing Theory-E-Book: Utilization & Application. 222, 2013.
[26]. Suryantoro E, Isworo A, Upoyo AS. Perbedaan Efektivitas Pursed Lips Breathing dengan Six Minutes Walk Test terhadap Forced Expiratory. Jurnal Keperawatan Padjadjaran. 5(2), 2017.
[27]. Agustiyaningsih T. Pengaruh Autogenic Training Dengan Pursed Lips Breathing Terhadap Kecemasan Dan Forced Expiratory Volume In 1 Second (Fev1) Pasien PPOK: Universitas Airlangga; 2018.
[28]. L. Ferracini Cabral ea. Pursed lip breathing improves exercise tolerance in COPD: a randomized crossover study. eEuropan Journal Of Physical and Rehabilitation Medicine. 51, 2015.
[29]. Fajriah SN, Isnaini Herawati S, Sari YM. Pengaruh Respiratory Muscle Stretch Gymnastics (Rmsg) Terhadap Peningkatan Mobilitas Dinding Dada Pada Penderita Penyakit Paru Obstruksi Kronik (Ppok): Universitas Muhammadiyah Surakarta; 2014.
[30]. Nishigaki Y, Mizuguchi H, Takeda E, Koike T, Ando T, Kawamura K, Development of new measurement system of thoracic excursion with biofeedback: reliability and validity. Journal of neuroengineering and rehabilitation. 10(1), 2013, 45.
[31]. Yunani. effektivitas latihan peregangan otot pernapasan terhaddap penurunan nyeri pada pasien pasca coronary artery bypass grafting di rumah sakit jantung dan pembuluh darah harapan kita jakarta. Depok: Universitas Indonesia; 2008.
[32]. Menezes KK, Nascimento LR, Ada L, Polese JC, Avelino PR, Teixeira-Salmela LF. Corrigendum to 'Respiratory muscle training increases respiratory muscle strength and reduces respiratory complications after stroke: a systematic review'[J Physiother 62, 2016, 138–144]. Journal of physiotherapy. 64(2), 2018, 73.
[33]. Hetal M, Ashok BP. Respiratory Muscle Stretch Gymnastic In Elderly: Impact on Maximum Breathing Capacity, Peak Expiratory Flow Rate and Exercise Capacity. International Journal of Health Sciences and Research. 10(3), 2020, 145-58.
[34]. Mayer AF, Karloh M, dos Santos K, de Araujo CLP, Gulart AA. Effects of acute use of pursed-lips breathing during exercise in patients with COPD: a systematic review and meta-analysis. Physiotherapy. 104(1), 2018, 9-17.
[35]. Mendes LP, Moraes KS, Hoffman M, Vieira DS, Ribeiro-Samora GA, Lage SM, Effects of diaphragmatic breathing with and without pursed-lips breathing in subjects with COPD. Respiratory care. 64(2), 2019, 136-44.
[36]. Ganesh B, Goud A. Short term effects of respiratory muscle stretch gymnastics versus hold relax PNF on pulmonary functions and chest expansion in elderly individuals-a randomized clinical trial. IJAR. 3(7), 2017, 1018-22.
[37]. Conne; AM. Respiratory Muscle Training United Kingdon: Churchil Livingstone; 2018.
[38]. Associaton AL. Exercise and Lung Health USA: National Health Council; updated 2020; cited 2020.
[39]. Bahat G, Tufan A, Ozkaya H, Tufan F, Akpinar TS, Akin S, Relation between hand grip strength, respiratory muscle strength and spirometric measures in male nursing home residents. The Aging Male. 17(3), 2014, 136-40.
[40]. Borge CR, Hagen KB, Mengshoel AM, Omenaas E, Moum T, Wahl AK. Effects of controlled breathing exercises and respiratory muscle training in people with chronic obstructive pulmonary disease: results from evaluating the quality of evidence in systematic reviews. BMC pulmonary medicine. 14(1), 2014, 184.
[41]. Wang Y, Shao W-b, Gao L, Lu J, Gu H, Sun L-h, Abnormal pulmonary function and respiratory muscle strength findings in Chinese patients with Parkinson's disease and multiple system atrophy–comparison with normal elderly. PLoS One. 9(12), 2014.

[42]. Gomes-Neto M, Saquetto MB, Silva CM, Carvalho VO, Ribeiro N, Conceição CS. Effects of respiratory muscle training on respiratory function, respiratory muscle strength, and exercise tolerance in patients poststroke: a systematic review with meta-analysis. Archives of physical medicine and rehabilitation. 97(11), 2014, 1994-2001.

[43]. Wada JT, Borges-Santos E, Porras DC, Paisani DM, Cukier A, Lunardi AC, Effects of aerobic training combined with respiratory muscle stretching on the functional exercise capacity and thoracoabdominal kinematics in patients with COPD: a randomized and controlled trial. International journal of chronic obstructive pulmonary disease. 11, 2016, 2691.

[44]. Minoguchi H, Shibuya M, Miyagawa T, Kokubu F, Yamada M, Tanaka H, Respiratory Muscle Conditioning: Stretch Gymnastics of the Respiratory Muscles Respiratory Muscle Conditioning: Stretch Gymnastics of the Respiratory Muscles, 1993. Internal medicine. 41(10), 2002, 805-12.

[45]. Menezes KK, Nascimento LR, Ada L, Polese JC, Avelino PR, Teixeira-Salmela LF. Respiratory muscle training increases respiratory muscle strength and reduces respiratory complications after stroke: a systematic review. Journal of physiotherapy. 62(3), 2016, 138-44.

[46]. Parisien-La Salle S, Rivest EA, Boucher VG, Lalande-Gauthier M, Morisset J, Manganas H, Effects of pursed lip breathing on exercise capacity and dyspnea in patients with interstitial lung disease: a randomized, crossover study. Journal of cardiopulmonary rehabilitation and prevention. 39(2), 2019, 112-7.

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