RESPIRATORY MUSCLES TRAINING (RMT) TO DYSPNEA SCALE OF COPD: A SYSTEMATIC REVIEW

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ABSTRACT

Background: COPD can decrease patients' activity because of dyspnea Objectives: To critically evaluate the effect of RMT as a treatment of COPD. Method: Five databases were found from 2008, a randomized clinical trials (RCTs) research will be a reference if they evaluated RMT against any type of control in patients with any form of respiratory muscle weakness. Result: Five trials met the inclusion criteria. One journal has the good of sampling technic by using the COPD patient from 3 hospitals. Only four journals show the significant effect of RMT to decrease dyspnea of COPD. The impact of RMT is going to increase the lung capacity, lung function, activity, respiratory muscle straightness, and minimize the effort of breathing. Only one journal does this intervention for 12 weeks. Conclusion: The evidence for the effect of RMT to decrease the dyspnea scale has a significant impact. For future studies, it will be better to use RMT longer to get a more considerable impact.

ARTICLE INFO

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Respiratory Muscles Training; Dyspnea Scale; COPD

ABSTRAK

Latar Belakang: PPOK dapat menurunkan aktivitas pasien karena dispnea Tujuan: Mengevaluasi secara kritis efek RMT sebagai pengobatan PPOK. Metode: Lima database ditemukan dari tahun 2008, penelitian uji klinis acak (RCT) akan menjadi referensi jika mereka mengevaluasi RMT terhadap semua jenis kontrol pada pasien dengan segala bentuk kelemahan otot pernapasan. Hasil: Lima uji coba memenuhi kriteria inklusi. Salah satu jurnal memiliki teknik sampling yang baik dengan menggunakan pasien PPOK dari 3 rumah sakit. Hanya empat jurnal yang menunjukkan efek signifikan RMT untuk menurunkan dispnea pada PPOK. Dampak RMT akan meningkatkan kapasitas paru-paru, fungsi paru-paru, aktivitas, kelurusan otot pernapasan, dan meminimalkan upaya pernapasan. Hanya satu jurnal yang melakukan intervensi ini selama 12 minggu. Kesimpulan: Bukti pengaruh RMT terhadap penurunan skala dyspnea memiliki dampak yang signifikan. Untuk penelitian selanjutnya sebaiknya menggunakan RMT lebih lama untuk mendapatkan dampak yang lebih besar.

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Kata kunci :
Pelatihan Otot Pernapasan; Skala Dispnea; COPD

Introduction

According to the World Health Organization (WHO) data in 2015, three million people died (5% of all deaths in the world) because of COPD. In Indonesia, 3.7% of Indonesia's population suffers from COPD (WHO, 2016). In West Sumatra in 2013, 3% of West Sumatra people had COPD (2). Chronic Obstructive Pulmonary Disease (COPD) is a disease when the amount of oxygen enters the body is decreasing while the oxygen demand is high (3). Besides of COPD symptoms such as increased sputum production, weakness of lung function, and increased levels of biomarker inflammation (4) of patients make dyspnea get worse (5). The chest wall resistance, increased oxygen demand by the body, disturbance of gas exchange within lungs, obstruction of the airway, and weakness of the respiratory muscles were other factors of dyspnea (6).

The function of respiratory muscle can be optimal by regular treatment at the hospital, and consistent training in the respiratory muscle called Respiratory Muscles Training (RMT). RMT trains weak breathing muscles like a skeletal muscle to work more optimally. RMT has benefits in some disease conditions that cause weakness in the respiratory muscles, one of which is in COPD patients (7). Muscle stretching can increase the length, elasticity, and overlapping of actins and myosin bond in the muscle fibers (8). These activities can optimize respiratory muscle function in

patients with COPD (9). This study is purposed to evaluate the dyspnea scale in COPD patients after implementing RMT.

Method

The writer is using Meta-Analysis (PRISMA) writing guidance type in writing a systematic review.

Eligibility Criteria

This systematic review consists of few studies with RCTs design to evaluate the effect of RMT on COPD patient with inclusion criteria that who is > 40 years, with body mass index is 18 kg/m2 to < 30 kg/m2, in stable condition, without oxygen supplemental therapy, and never get the cardiac surgery before, never get the pulmonary rehabilitation for three months (9). All of the study which is published or unpublished included as literature of this systematic review. This study consists of the RMT to COPD, which combined to aerobic and stretching of peripheral muscles. The patients who get unstable conditions during the RMT will be eliminated from this study.

Information Sources

The writer uses data sources or electronic journal websites starting from 2008: three journals of Science Direct, one journal of NCBI, and one journal of Respiratory Medicine..

No	Research (Year)	Research Title	Research Methods	Number & Criteria Sample	Intervention	Results	Strength & Weaknesses
1.	Wada et al., 2016	Effects Of aerobic training combined with respiratory muscle stretching on the functional training capacity and thoracoabdominal kinematics in patients with COPD: a randomized and controlled trial	A randomized and controlled trial with blinded assessments	n = 30 patients TG = 15 patients CG = 15 patients **Inclusion Criteria:** The study inclusion criteria were the age of > 40 years, had a body mass index range of 18 kg/m^2 to < 30 kg/m^2, in stable condition, received no additional oxygen therapy, had no history of heart and thorax surgery, no defects, and never received any physical therapy related to the respiratory system in the past three months. **Exclusion Criteria:** Clients that experienced exacerbations and deterioration and required further treatment	Experimental and control groups received aerobic warming therapy using a treadmill for 30 minutes. Subsequently, the experimental group received additional RMT therapy for 30 minutes per session. The control group received sham therapy like warming up the upper and lower extremities for 30 minutes per session. The intervention was performed 24 sessions over 12 weeks with the help of two physiotherapists, except for the last session before valuation.	Evaluation results showed that respiratory aspiratory muscle training increases chest wall expansion ($p < 0.001$), minute volume ($p < 0.001$), and expiratory volume ($p < 0.001$). From analysis results, regarding muscle strength, respiratory muscle training in the experimental group decreases excessive effort in breathing. In the analysis of training capacity using 6MWT, there is a 33,2 m difference between the experimental group and the control group, and the experimental group has lower breath sensation than in the control group ($p <$ 0,001).	**Strength:** This study uses a true experimental method so that it can be used in the highest level of procedural clinic. Besidesxdzc, the measuring tool used in this study is valid. **Weaknesses:** The sample in this study is relatively small by using only one hospital. So it is difficult to generalize the result.
2.	Elmore, Eldesoky, Mohsen, Shalaby, &Abdalla, 2016	Effect of aspiratory muscle training on training performance and quality of life in patients with Chronic Obstructive Pulmonary Disease	Prospective comparative interventional study	n = 60 male patients **Inclusion Criteria:** COPD patients age 45 to 65 years, COPD level according to GOLD are COPD level II, III, and IV assessed by FEV after consuming bronchodilators **Exclusion Criteria:** Patients with heart disease, uncontrolled hypertension, a history of pneumothorax, a history of abdominal	Respondents are classified into three groups of 20 members in each group (A, B, and C). Group A receives only peripheral muscle stretching. Group B receives peripheral muscle stretching treatment and RMT training. Group C does not receive any muscle training at all. Intervals are given daily for two months with a duration of 30 minutes per training session.	There are no significant changes in three groups related to the PI max, PE max, and 6MWD. There is a significant impact in the dyspnea level in groups A and B compared to group C from evaluation result on 0 weeks to 8 weeks after training.	**Strength:** In this study, interventions are given daily, so minimal interruption is obtained and results obtained are more accurate **Weakness:** The level of short-breathing using MRC of patient sample selection is not specified

				surgery or thoracic surgery, neuromuscular disorders, liver or kidney disease, connective tissue disorder, and endocrine system disease			
3.	Tout, Tayara, &Halimi, 2013	The effects of respiratory muscle training on improvement of the internal and external thoracic-pulmonary respiratory mechanism in COPD patients	Prospective Study	n = 40 COPD patients **Inclusion Criteria:** COPD patients aged 45 to 75 years, a medical diagnosis of COPD grades 1 and 2, spirometry test results obtained FEV1 of 50% to 80%, improvement FEV1 more than 15% when using a bronchodilator. **Exclusion Criteria:** The presence of pathological heart disorders, previous history of lung and heart surgery, oxygen-dependent patients and cortisone therapy, neuromuscular disorders.	Patients were grouped into four groups, three control groups, and one experimental group Group 1: 10 patients with COPD receive RMT and chest physiotherapy. Group 2: 10 COPD patients receive Aspiratory Muscle Training and respiratory physiotherapy. Group 3: 10 COPD patients receive Expiratory Muscle Training and respiratory physiotherapy. Group 4: 10 patients with COPD and receive only respiratory therapy. Intervention is given 16 times over 8 weeks.	There is a significant influence on PImax after 7 weeks of training (p-value 0.04)	**Strength:** This study used a comparison of samples from 3 different hospitals. So that study results can be generalized. **Weakness:** In the exclusion criteria, there was no mention of additional oxygen-dependent patients for exclusion from the study.
4.	Nikoleta et al., 2016	Evaluation of the effectiveness of a home-based aspiratory muscle Training program in patients with the chronic obstructive pulmonary disease using multiple aspiratory muscle tests	A double-blind randomized controlled trial	n = 68 COPD patients with moderate COPD and severe COPD were grouped into experimental and control groups. **Inclusion Criteria:** Average [SD], FEV1 / FVC 35.7 [11.2]%; FEV1 36.1 [13.6]%, COPD patients from King's College Hospital, GP practices and the British Lung Foundation Breathe Easy, patients who are willing to sign informed consent, no COPD with exacerbations, and no change in medical therapy and drugs in the last four weeks **Exclusion Criteria:** Patients with anti-trypsin disorders, patients with heart disease, cor-pulmonale, patients with a long history of corticosteroid use, patients with spinal abnormalities, patients with a cardiac pacemaker	IMT is implemented in two sessions in one day, morning, and afternoon with a span of 5 hours for six days in one week. Patients were in the experimental group and control group. The experimental group received a threshold training of more than 30% of the maximum inspiration pressure (PImax) for seven weeks.	There is a significant influence on PImax after 7 weeks of training (p-value 0.04)	**Strength:** This study used a comparison of samples from 3 different hospitals. So that study results can be generalized. **Weakness:** In the exclusion criteria, there is not included variable of additional oxygen-dependent patients for exclusion.
5.	Hellweg, Reissig, Hoehn, Siemon, &Haidl, 2017	Respiratory muscle training during rehabilitation in successfully weaned hypercapnic patients with COPD	Randomized, controlled fashion	n = 29 patients 15 = experimental group 14 = control group **Inclusion criteria:** Patients with persistent hypercapnia using noninvasive	The experimental group received four weeks of RMT and the control group received RMT sham training; after one week of therapy, patients enrolled in lung function test, aspiratory muscle strength and endurance	There was a increase in 6MWD for control group of 93 ± 52 m from the baseline of 196 ± 85m at week 4 (p = 0.019, 95% CI: 11 to 196 m). The experimental group experienced an	**Strength:** in this study, patients get kidney testing before intervention; it can bring a new focus of research to examine the relationship

		ventilation, patients with COPD grade 3 and 4, COPD patients without exacerbations, patients who get inhaled antagonistic beta therapy, and long term anti-muscarinic. **Exclusion Criteria:** Patients with kidney creatinine serum > 2 mg/dL, patients with impaired heart function who had ejection fraction < 40%.	measurements, 6 MWD, and blood gas analysis. These measurements will be repeated at the end of the fourth week of training.	increase of 6MWD value of 94 ± 32 to 290 ± 75 m (p <0.0001 [107 to 286 m]; the difference between both groups was p = 0.04 [3 to186 m]. PImax experimental group increased from -35 ± 8 to - 55 ± 11 cmH_2O (p = 0.001; -6 to -33 cmH_2O); in control group PImax did not increase (-29 ± 10 to -37 ± 13 cmH2O [-22 to 6 cmH2O].) Aspiratory muscle strength increased from 9.6 ± 5.4 (7.6 ± 4.2 joules /min) in the beginning of study and 11.1 ± 6.9 joules /min [- 5.2 to 12.3 joules /min] at the end of the study.	between the respiratory system and level of creatinine serum of patients. **Weakness:** The sample used is relatively small so it can not be generalized in COPD patients

Search Strategy

The title and reference abstract are selected based on their compatibility with the topic in this systematic review. Irrelevant tests or data will be eliminated from the discussion.

Table 2 Search Result of Electronic Database

No	Keyword	Search Sources		
		Taylor and Francis	**Sciencedirect**	**Respiratory Medicine**
1.	*COPD*	Found 54 journals, reduced by nursing into 18 journals, five related journals	Found 61,934 journals, reduced by nursing into 1,678 journals, reduced by 2017 to 24 journals, six related journals	Found 72,860 journals, decreased by RCT to 5329, reduced by nursing to 1964, reduced by 2017 to 605 journals, reduced by an adult to 422, reduced by clinical trial to 48 journals, 12 related journals
2.	*Respiratory Muscles Training (RMT)*	Found 10,609 journals, reduced by nursing into 6,447 journals, reduced by 2017 to 390 journals, reduced by RCT to 53 journals, eight related journals	Found 125 journals, reduced by RCT into three journals, one related journal	Found 1599 journals, reduced by clinical trial to 376, reduced by 2017 to eight journals, four related journals
3.	*COPD management guideline*	Found 807 journals, reduced by nursing into 700 journals, reduced by 2017 to 80 journals, three related journals	Found 3,532 journals, reduced by nursing into 395 journals, reduced by 2017 to 137 journals, reduced down by acute into 30 journals, three related journals	Found 859 journals, reduced by nursing to 75 journals, reduced by 2017 to nine journals, four related journals
4.	*Dyspnea Scale*	Found 4,626 journals, reduced by nursing to 3,752, reduced by 2017 to 325 journals, reduced by an adult to 140 journals, reduced by lung disease to 84 journals. ten related journals	Found 22,092 journals, reduced by nursing into 1,427 journals, reduced by 2017 to 91 journals, reduced by lung disease to 74 journals, nine related journals	Found 2,958 journals, reduced by nursing into 229 journals, reduced by 2017 to 25 journals, three related journals

Selection Process

The writer (IR, SDKB) found more than 200 journals matched to predefined keywords. However, it was only 20 non-duplicated journals that were determined by the writer. Furthermore, the writer will discuss five related journals that are relevant to this topic

Data Selection Process

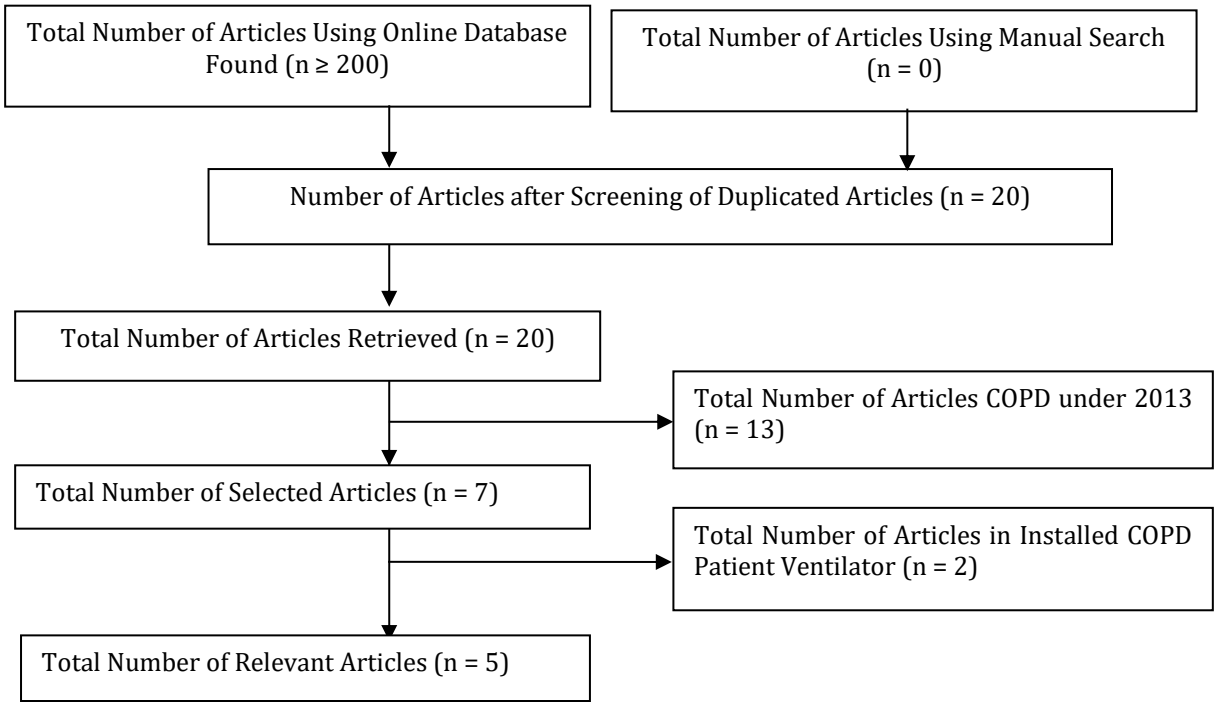

Figure 1 PRISMA diagram for included studies

Risk of Bias (ROB)

Two RCTs had unclear ROB, and three RCTs had high ROB. Overall of the studies had poor and limitation of methodological.

Discussion

The purpose of the following systematic review is to conclude and critically evaluate the effect of RMT on the level of dyspnea in COPD patients. There were five journals relevant to the topic, three journals with Randomized Control Trials (RCT) designs (9–11).

From five journals, four journals say there is a significant effect of RMT on increasing lung function of COPD patients (experimental group) (3,9–11). One journal suggested there is no significant effect after the intervention (12). The study with the great sample sizes and good sample selection was Nikoletou et al. (2016) study using samples from three different hospitals. A study that showed a significant effect of chest wall expansion, increased minute volume, increased expiratory volume, decreased effort in breathing, 6MWT evaluation results, and level of dyspnea (p-value < 0.001) of RMT is conducted by Wada et al. (2016).

Overall therapy is associated with respiratory muscles. A total of two journals (3,9) give therapy in all components of respiratory system muscle. While three other journals (10–12) give the treatment only in respiratory muscle. The time required to perform RMT therapy (9,12) was 30 minutes for several weeks, 12 weeks (9), eight weeks (3,12), seven weeks (11), and four weeks (10).

The effect of RMT on improving lung function of COPD patients can be applied to patients after extubation from ventilators (10). RMT stretching of the muscle causes an increase in the length

of muscle fibers that can increase muscle elasticity and increase the overlapping of the actins and myosin bonds in the muscle (8). It helps to optimize respiratory muscle function in patients with COPD (9). RMT can increase the ability or strength of respiratory muscles in some conditions of chronic illness, chronic heart failure, and COPD (13). RMT helps to improve the coordination of the respiratory-neuromuscular system when contracting or working so that it can train respiratory muscles to work regularly and coordinated during daily activities to decrease the congested response during patients activities (3). COPD patients are improving in their activity after passing several therapies, one of which is pulmonary rehabilitation physiotherapy(14). RMT is one of the most beneficial pulmonary rehabilitation in improving physical activity abilities in patients with COPD (15) and is useful in improving patient quality of life (16).

The conclusion is respiratory muscle training (RMT) affects the level of short-breathing in COPD patients. The suggestion for further research is to assess diaphragm muscle activity and increase the intensity and duration of RMT in previous studies.

References

1. World Health Organization (WHO). Chronic Obstructive Pulmonary Disease (COPD). New York; 2016.
2. Riskesdas. Riset Kesehatan Dasar Indonesia Tahun 2013. 2013.
3. Tout R, Tayara L, Halimi M. The effects of respiratory muscle training on improvement of the internal and external thoraco-pulmonary respiratory mechanism in COPD patients. Ann Phys Rehabil Med. 2013;56(3):193–211.
4. Soriano JB. An Epidemiological Overview of Chronic Obstructive Pulmonary Disease: What Can Real-Life Data Tell Us about Disease Management? COPD J Chronic Obstr Pulm Dis. 2017;14(S1):S3–7.
5. Wan ES, Kantorowski A, Homsy D, Teylan M, Kadri R, Richardson CR, et al. Promoting physical activity in COPD: Insights from a randomized trial of a web-based intervention and pedometer use. Respir Med. 2017;130:102–10.
6. Mahler DA, Fierro-Carrion G, Baird JC. Evaluation of dyspnea in the elderly. Clin Geriatr Med. 2003;19(1):19–33.
7. McConnell A. Respiratory Muscle Training. Respir Muscle Train. 2013;(1):97–131.
8. Izumizaki M, Satake M, Takahashi H, Sugawara K, Shioya T, Homma I. Effects of inspiratory muscle thixotropy on the 6-min walk distance in COPD. Respir Med. 2008;102(7):970–7.
9. Wada JT, Borges-Santos E, Porras DC, Paisani DM, Cukier A, Lunardi AC, et al. 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. Int J COPD. 2016;11(1):2691–700.
10. Dellweg D, Reissig K, Hoehn E, Siemon K, Haidl P. Inspiratory muscle training during rehabilitation in successfully weaned hypercapnic patients with COPD. Respir Med. 2017;123:116–23.
11. Nikoletou D, Man WD-C, Mustfa N, Moore J, Rafferty G, Grant RL, et al. Evaluation of the effectiveness of a home-based inspiratory muscle training programme in patients with chronic obstructive pulmonary disease using multiple inspiratory muscle tests. Disabil Rehabil. 2016;38(3):250–9.
12. Elmorsi AS, Eldesoky ME, Mohsen MAA, Shalaby NM, Abdalla DA. Effect of inspiratory muscle training on exercise performance and quality of life in patients with chronic obstructive pulmonary disease. Egypt J Chest Dis Tuberc. 2016;65(1):41–6.
13. de Medeiros AIC, Fuzari HKB, Rattesa C, Brandão DC, de Melo Marinho PÉ. Inspiratory muscle training improves respiratory muscle strength, functional capacity and quality of life in patients with chronic kidney disease: a systematic review. J Physiother. 2017;63(2):76–83.
14. Chalmers JD. Management of chronic airway diseases: What can we learn from real-life data? COPD J Chronic Obstr Pulm Dis. 2017;14(sup1):S1–2.

15. Mesquita R, Meijer K, Pitta F, Azcuna H, Goërtz YMJ, Essers JMN, et al. Changes in physical activity and sedentary behaviour following pulmonary rehabilitation in patients with COPD. Respir Med. 2017;126:122–9.
16. Elbouhy MS, AbdelHalim HA, Hashem AMA. Effect of respiratory muscles training in weaning of mechanically ventilated COPD patients. Egypt J Chest Dis Tuberc. 2014;63(3):679–87.