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The Effectiveness of Breathing Exercises for Post Covid-19 Patients during Rehabilitation: A Literature Review

T. Widya Naralia*, Henny Permatasari
Universitas Indonesia, Depok, Indonesia
** Correspondent Author: widya.naralia@gmail.com*

ABSTRACT
Covid-19 is a new disease that has become a world pandemic in 2020 untill today. Post covid patients still feel persistent symptoms such as breathlessness, fatigue, and dyspnea even though it has been declared negative from the coronavirus. These persistent symptoms can continue for months and will not disappear immediately but can be relieved by various exercises such as breathing exercises. This literature study aims to identify the types and effect of breathing exercises on persistent symptoms. Literature search was carried out systematically through online databases with the keyword "Breathing Exercise AND Long Covid AND Covid-19 Rehabilitation". The selected articles were full articles published in 2018-2021 in English and other supporting articles. The result was found 243 articles and 8 articles that met the inclusion and exclusion criteria. There are several deep breathing exercises which is effective in reducing persistent symptoms that is Traditional Chinese exercises, diaphragm and physical exercise.

Keywords: Breathing Exercise, Long Covid, Covid-19 Rehabilitation

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BACKGROUND

Corona Virus Disease-19 (Covid-19) is a new type of disease which found in Wuhan, China at the end of 2019 (WHO). The disease, which is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-Cov-2), quickly spreads from infected people to surrounding people through respiratory droplets and aerosols (World Health Organization [WHO], 2020). Until April 2021, the number of Covid-19 sufferers has exceeded 147 million people with a total death of more than 3.1 million in 219 countries (WHO, 2021). A fairly high incidence of Covid-19 has also occurred in Indonesia, which has reached more than 1.6 million people infected with a cure rate of 1.4 million people (Satgas Covid-19, 2021). A person infected with Covid-19 will generally feel fever (83-99%), cough (59-82%), fatigue (40-84%), breathlessness (31-40%), myalgia (11-35%). , and other non-specific signs such as anosmia, nausea, diarrhea, loss of appetite (Jin et al., 2020). The World Health Organization (WHO) classifies the severity of Covid-19 based on the symptoms that appear to be mild, moderate, severe and critical. The respective percentages of Covid-19 severity are 40% at a mild level, 40% at a moderate level, 15% at a severe / bad level, and 5% at a critical level (Jin et al., 2020; World Health Organization [WHO], 2020).

A person infected with moderate to critical severity will experience decreased lung function, oxygen saturation to severe pneumonia while still infected with Covid-19 (Jin et al., 2020; World Health Organization [WHO], 2020). This can get worse when a person has comorbid diseases such as diabetes mellitus, hypertension, COPD, and cardiovascular disorders (Inamdar et al., 2020; Vetter et al., 2020). However, when a patient with the corona virus is declared negative, the symptoms during Covid-19 infection do not immediately disappear, these symptoms can even continue for months (Fernández-De-las-peñas et al., 2021). More than 50% of people who have been infected with Covid-19 will feel persistent symptoms after Covid-19 such as chronic fatigue, shortness of breath, chest pain, and decreased sensitivity to smell (Moreno-Pérez et al., 2021). Persistent symptoms due to inflammation and post acute Covid-19 organ damage that can continue for months are referred to as "Post Covid-19 Syndrome or Long Covid" (Moreno-Pérez et al., 2021; (Fernández-De-las-peñas et al., 2021).

A study on Long Covid stated that about 87.4% of people reported feeling at least one persistent symptom and the most common was chronic fatigue and shortness of breath (Docherty et al., 2020). Approximately 50-70% of patients hospitalized express some symptoms of Covid-19 for up to three months after completing treatment and being discharged from the hospital (Garrigues, E. et al 2020). In Indonesia, a survey of 463 post-covid-19 patients showed that 63.5% of them had Long Covid Syndrome (FKUI, n.d.). These persistent symptoms that are felt do not disappear immediately, but can be relieved by various exercises. Various researchers have conducted research on actions that can be taken during the rehabilitation period to reduce the symptoms of Long Covid. WHO states that there are at many actions that can be taken during the post-Covid rehabilitation process, including breathing exercises and physical exercise after discharge from the hospital (WHO Europe, 2020). Nurses, especially community health nursing, have the role of managing and providing care and follow-up on the patient's condition. Nurse's role not only as a provider of care at the hospital, but also during the rehabilitation period after discharge from the hospital (World Health Organization [WHO], 2017).

The effectiveness of breathing exercises and physical exercises can be seen from various research experiments pre and post exercise action. There is no specific data yet on the effectiveness of breathing exercises in Post-Covid-19 patients in Indonesia, therefore researcher interested in conducting a literature review to determine the effectiveness and

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stages of breathing and physical exercise during the rehabilitation period for Covid-19 patients. This literature review can be used as a reference for nurses in providing treatment during the rehabilitation period for post-covid patients

METHODS

Identification of article about breathing exercise for patients after Covid-19 in rehabilitation phase is done through electronic databased by 243 article. (Clinicaal Key,n= 41; Scopus, n=46; Science Direct,n=26; Proquest,n=54; Wiley Online,n=60, Springer Link,n=16. The keywords used in this article were : Breathing Exercise AND Covid-19 AND Rehabilitation. Inclusion criteria for this literature are full text, article in English language, publish in 2020 – 2021, use sample of patients post acute Covid-19. In the discussion section using additional literature from 2018 – 2021

RESULTS

The results from the research database are 243 articles, as many as 11 articles have in common or similarities with the title, 224 articles are not relevant. After using inclusion and exclusion criteria, 8 articles were found that are suitable for this literature.

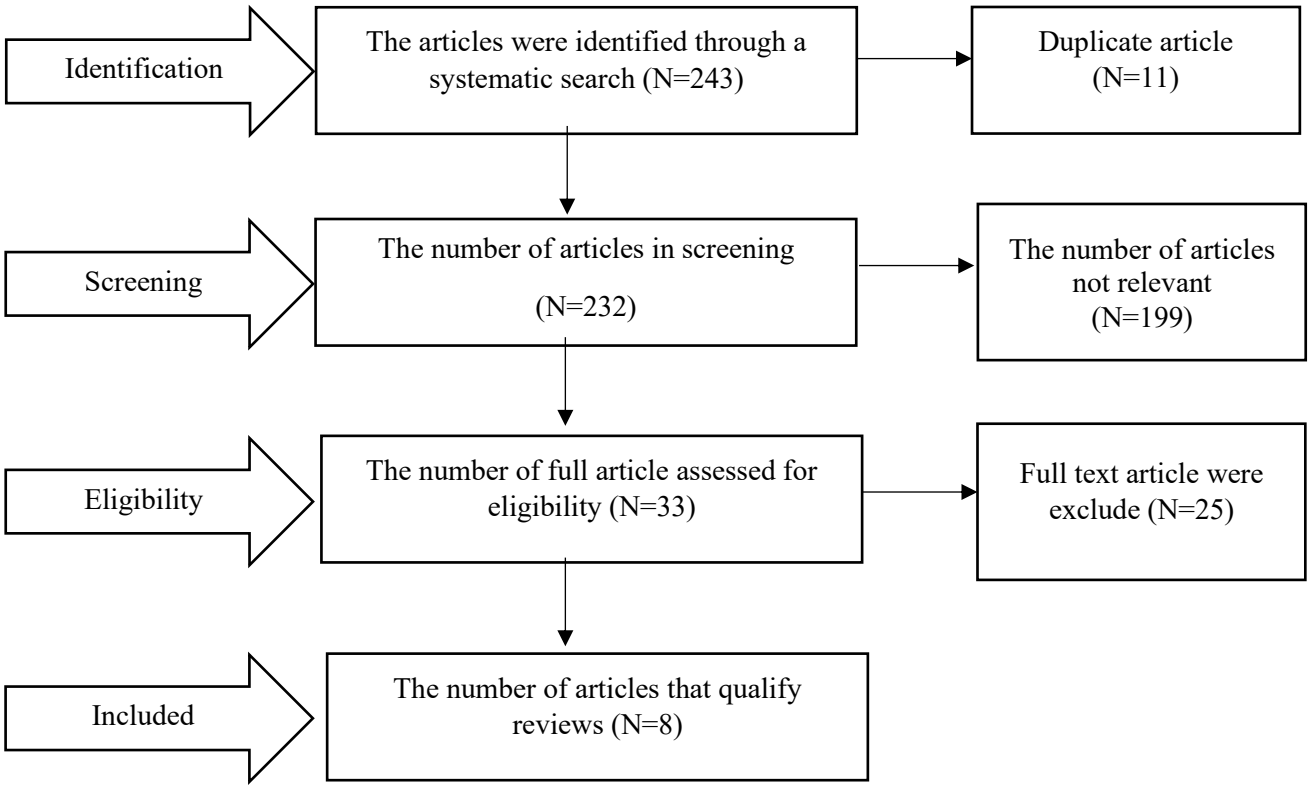

Figure 1. PRISMA Diagram of Article Search

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Table 1: Characteristics of articles reviewed

Researcher/Year	Title	Objective	Research Methods	Sample	Result
(Tang et al., 2021)	Liuzijue is a promising exercise option for rehabilitating discharged Covid-19 patients	Identified the effectiveness of breathing exercises with the Liuzijue technique in Covid-19 patients during rehabilitation	Prospective self-controlled study	33 post Covid-19 adult patients	There was a significant increase in the values of the maximal inspiratory pressure (MIP), peak inspiratory flow (PIF), and diaphragm movement in deep breathing (DM-DB) of patients after 4 weeks of intervention. The dyspnea was also alleviated and exercise capacity was significantly improved
(Al Chikhanie et al., 2021)	Effectiveness of pulmonary rehabilitation in COVID-19 respiratory failure patients post-ICU	Evaluating the effect of the pulmonary rehabilitation program on respiratory exercise, muscle strengthening, balance and walking carried out by Post ICU patients in both Covid-19 and Non-Covid-19 patients	Prospective Cohort Study	21 Covid-19 post ICU patients and 21 non-Covid-19 post ICU patients were evaluated for pre and post Pulmonary Rehabilitation	There was an increase in 6-min walking distance (6MWD) in COVID-19 patients (+205 ± 121 m) than in other respiratory failure patients post-ICU (+93 ± 66 m) after following the pulmonary rehabilitation program. The sooner PR was performed post-ICU, the better patients recovered
(Ferraro et al., 2021)	COVID-19 related fatigue: which role for rehabilitation in post-COVID-19 patients? A case series	Identifying the benefits of a rehabilitation program with physical activity in reducing fatigue in Post Covid-19 patients	Case Series	Seven patients were post Covid-19 with an average age of 65 years	After following the rehabilitation program, 71.4% of Post Covid-19 patients showed no sense of chronic fatigue, and other patients showed only mild fatigue. Rehabilitation interventions are tailored to the patient's needs with the aim of reducing fatigue and increasing the activity of Post Covid-19 patients
(Zha et al., 2020)	Modified rehabilitation exercises (MRE) for mild cases of COVID-19	Observe changes in airflow and efficiency of O_2 and CO_2	Observational study	60 patients aged 38 - 62 years were	There was a decrease in symptoms such as dry cough from 41.7% to 11.7%, productive cough from 43.3% to 11.7%, difficulty in

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		exchange after Covid-19 patients undergo MRE		confirmed with mild COVID-19	expectoration from 35% to 8.3%, and breathlessness from 50% to 15%
(Liu et al., 2020)	Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study	Identifying the effectiveness of breathing exercises during rehabilitation for 6 weeks by monitoring respiratory function, quality of life, mobility and psychological function in elderly Covid-19 patients	Random-ized controlled trial	72 patients with Covid-19 were divided into 2 groups, namely 36 control groups and 36 intervention groups	There was a significant difference, namely an increase in lung capacity and quality of life of patients seen in the intervention group through measurement of lung capacity and quality of life after the intervention for 6 weeks.
(Pancera et al., 2020)	Feasibility and Efficacy of the Pulmonary Rehabilitation Program in a Rehabilitation Center	Observe the efficacy and effectiveness of pulmonary rehabilitation programs in the rehabilitation center	Case Study	A 51-year-old man who underwent tracheostomy and ventilation due to ARDS due to Covid-19	At the end of the respiratory rehabilitation program the patient had reported an increase in respiratory muscle strength by 7% and muscle function increased by 13% as seen in an enlarged quadriceps size
(Senthil & Sivabackiya, 2020)	Effect of structured exercise protocol and tele-counselling in 72 year old male COVID-19 subject with respiratory impairment- A Case report study	To identify the effectiveness of pulmonary rehabilitation exercises and telecounseling	Case report	A 72 year old elderly with mild Covid-19	There was an increase in oxygen saturation of elderly patients from 88% to 97% after the intervention for three weeks
(Wootton et al., 2020)	COVID-19 rehabilitation delivered via a telehealth pulmonary rehabilitation model: a case series	Identifying the effectiveness of the telehealth model of pulmonary rehabilitation	Case Series	Three Post Covid-19 patients with an average age of 73 years	After six weeks of intervention and monitoring, all three patients showed an increase in activity and breathing capacity, although the fatigue levels in two patients did

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	monitored by medical personnel for Post Covid-19 patients	not seem to improve. There was worsening fatigue after the 6-week follow-up process because the patient had difficulty regaining his activities after feeling better.

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DISCUSSION

Many techniques and breathing exercise programs during rehabilitation can be performed on Post Covid-19 patients with the aim of reducing the persistent symptoms felt by patients after testing negative for Covid-19. Various breathing exercise techniques or programs that have been carried out and proven effective will be explained in this discussion.

a. Traditional Chinese Excercie

Liuzijue is a breathing exercise technique from China which is also part of Qigong practice (Zhang et al., 2020). The Liuzijue practice method is to adjust the inspiration and expiration of the breath, whereby when the client expires their lips shape to make 6 different sounds ("xu", "he", "hu", "sī", "chuī", and "xī") along with 6 predefined body movements (Tang et al., 2021). There are several things that must be assessed before conducting this training, namely the measurement of Maximal Inspiratory Pressure (MIP) and Peak Inspiratory Flow (PIF), the ability of the diaphragm to move, assessing the client's quality of life, psychological status, ability to do activities with a 6 minute walking test (6MWT) and dyspnea scale assessment. This exercise was performed on 33 patients who were monitored for 4 weeks, then carried out a post-exercise review of Liuzijue. The results show that there was an increase 13.46±20.06 cmH2O (P<0.001) in Maximal Inspiration Pressure (MIP), 0.74±0.58 L/second (P<.001) in Peak Inspiratory Flow (PIF), and increase quality of life. The Liuzijue exercise method has been shown to reduce symptoms of dyspnea through the modified Medical Research Council (mMRC) assessment (P=.022).. In addition, Liuzijue is also able to reduce symptoms of depression and anxiety in patients as seen from the Hamilton Depression Scale Rating Scale (HAMD) and Hamilton Anxiety Rating Scale (HAMA) (Tang et al., 2021). Research before the pandemic conducted by Wu et al., (2018) also showed that there was an increase in the respiratory muscles of Chronic Obstructive Pulmonary Disease (COPD) patients after three months of Liuzijue exercise.

b. Breathing Exercise

Senthil & Sivabackiya, (2020) explained the case report of a 72 year old male with Covid-19 and diabetes mellitus who complained of difficulty breathing even while sleeping. In this research, these patients agreed and follow the intervention consisting of percussion technique on pulmonary, deep breathing and thorax mobility exercises that were performed for 30 minutes every two times a week. This breathing exercise is implemented out for three weeks. This exercise consists of pulmonary percussion with shaking and vibration manually by the physiotherapist for 10 minutes and then followed by deep breathing exercises, thorax mobility and incentive spirometry exercises. This breathing exercise evaluation was carried out every one week by documenting the measurement of oxygen saturation with pulse oxymetry for each pre and post exercise. For three weeks the exercise was carried out and showed an increase in oxygen saturation from 88% to 97% when the saturation measurement was relaxed. During this rehabilitation process, the patient is monitored through tele-counseling which is carried out for 15 minutes with the aim of improving the mental status of the patient. This breathing exercise intervention has shown significant results in the restoration of lung ability

The effectiveness of breathing exercises has also been proven from research conducted by Liu et al., (2020) with a randomized controlled trial design. This study was conducted to identify the effects of respiratory rehabilitation, activity daily living (ADL), Quality of Live (QoL), and psychological status in elderly patients with COVID-19 after

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being discharged from hospital. The rehabilitation program consists of a respiratory rehabilitation (2 sessions per week for 6 weeks), once a day for 10 minutes. The intervention include respiratory muscle training, cough exercise, diaphragmatic training, stretching exercise and home exercise. Breathing muscle exercises are performed for three sets with 10 times breaths in each set using a commercial hand-held device, parameters were set at 60% of the individual's maximal expiratory mouth pressure, with a rest period of 1 min between the two sets. This is followed by 10 times effective cough exercises. Diaphragmatic breathing training is performed by placing a weight of 1 - 3 kg above the abdominal surface and then the patient inspires and expires so that the diaphragm muscles expand. Ubolnuar et al., (2019) stated in their study that diaphragm breathing exercise or abdominal breathing coupled with other breathing exercises such as pursed-lip breathing had a positive effect on the lungs of COPD patients ($P \leq 0.001$) compared to the control group.

c. Physical Exercise

Apart from breathing exercises, physical exercise also has an important role in the post-Covid-19 rehabilitation process. Ferraro et al., (2021) conducted a case study of seven Post Covid-19 patients. All patients underwent the intervention 1-2 sessions per day per day for 30 minutes each session for 6 days / week. This exercise consists of a) changing positions to improve the oxygenation system, namely the prone position, sitting or semi-orthopneic position, b) breathing control exercises with a diaphragm or breathing exercise, c) passive mobilization of upper and lower limbs, d) passive muscle stretching, e) muscle strengthening exercises of upper and lower limbs, trunk, and gluteus muscles, aimed at reaching the control of sitting position and standing; f) balance and coordination exercises. Each patient will then be evaluated using the Borg category ratio 10 (CR10) measurement scale to measure the level of fatigue; hand grip strength test to measure muscle strength; 6-minute walking test (6MWT) to measure physical performance and Barthel Index (BI) to measure dyspnea in ADL. The result was that 85.7% of patients showed a feeling of severe fatigue before the rehabilitation intervention. After the patients did physical exercise, 71.4% stated that there was no fatigue, and 29.6% stated that only mild fatigue was felt after routine physical exercise. Literature reviews from many research also state that early mobilization and physical exercise have benefits for Covid-19 patients (Wittmer et al., 2021).

Other physical exercise procedures that are useful for post Covid-19 patients are also described in the study of Modified Rehabilitation Exercise (MRE) for mild Covid-19 (Zha et al., 2020). This physical exercise was carried out for four weeks on 60 mild Covid-19 patients, with an average age of 54 years. The patient expressed symptoms of dry cough, productive cough, difficulty expectoration to shortness of breath, finally reduced after regularly participating in MRE physical exercises. The procedure in MRE is 1) overhead chest and shoulder stretch (1 set of 2 repetitions): namely doing the inspiration and expiration maximally until the breathing muscles expand widely, 2) standing heel raises and upper body acupressure (2 sets of 12 repetitions) : namely standing heel raises while applying upper body acupressure by patting the Yunmen acupoint (located on the infraclavicular), 3) upper body rotation (1 set of 4 repetitions), namely upper body rotation while patting the lateral side of the Thoracic cavity and do percussion on the lung, 4) hand acupressure massage (3 sets of 12 repetitions), namely pressing the acupressure point on the posterior to the thumb nail, metacarpal, and fossa superior to the styloid of the radius. During one month, participants showed a reduction

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in dry cough symptoms from 41.7% to 11.7%, productive cough from 43.3% to 11.7%, difficulty expelling phlegm from 35% to 8.3% and shortness of breath from 50% to only 15%

Breathing exercise and physical exercise after Covid-19 are part of the Pulmonary Rehabilitation (PR) or Respiratory Rehabilitation Program (RRP) which has been shown to have a positive impact on repairing lung damage due to lung disease or the installation of mechanical ventilation devices (Chou et al., n.d.). Before carrying out the PR and RRP program, the client must first measure the ability of lung function and the ability to do activities by walking. Al Chikhanie et al., (2021) conducted a study on 21 Covid-19 Post ICU patients and 21 Non-Covid-19 Post ICU patients in pulmonary rehabilitation centers, all patients had at least one comorbid disease: cardiovascular, respiratory, diabetes and others. Each patient in both groups performed breathing exercises, muscle strengthening, balance and walking, cycling and gymnastics according to American Thoracic Society guidelines. This prospective cohort study evaluated lung capacity and physical activity ability after participating in a pulmonary rehabilitation program. The measurement of lung capacity is carried out by spirometry, namely measuring the Forced Vital Capacity (FVC): the volume of air that is exhaled after maximum inspiration without applying force, and measuring the Force Expiratory Volume 1 (FEV1): the volume of air that can be exhaled in the first second when performing FVC. The result was an increase in FEV1 and FVC, from 66.7 ± 16.0 and 59.1 ± 15.2 to 81.2 ± 14.2 and 72.9 ± 15.2. Post Covid-19 patients who underwent Pulmonary Rehabilitation were also assessed for their physical activity ability with a 6 minute walking test (6MWT). After strengthening and walking exercises for approximately 5 weeks, the results showed that there was an increase in the walking distance or 6 minute walking distance (6MWD) of Covid-19 Post ICU patients from 138.7 ± 144.4 to 343.4 ± 139.6 meters. Whereas in Non-Covid-19 Post ICU patients the increasee in 6MWD was not as significant as Covid-19 patients, the increase was from 136.6 ± 151.9 to 223.2 ± 170.5 meters. However, after the patient was declared discharged, the patient still experienced respiratory problems and physical performance had not fully recovered due to lack of monitoring. Follow-up monitoring should be carried out by the community nurse when the patient begins to be able to carry out normal activities and is no longer under the supervision of the health team at the rehabilitation center.

Wootton et al., (2020) stated that to do breathing exercises and physical exercises in the post-Covid-19 rehabilitation process, patients must undergo pre intervention, monitoring and post intervention. The current condition of a pandemic can indeed be an obstacle and one of the risks if monitoring must be done face-to-face. Monitoring programs such as telehealth rehabilitation can assist in the process of monitoring the rehabilitation of Post Covid-19 patients. Monitoring is carried out by trained medical personnel who have understood the breathing exercise procedures and physical exercises according to the patient's needs during the initial 4-6 weeks post discharge from hospital. Community health nursing has a role and responsibility to improve public health status and prevent injuries after hospitalization (Anderson & McFarlane, 2014). For Covid-19 Post ICU patients, monitoring should be done more intensely and face-to-face (Hosey & Needham, 2020).

CONCLUSION

Symptoms of Covid-19 such as dry cough, fever, shortness of breath, and decreased quality of life are still felt by Post Covid-19 patients even after they are declared cured of

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corona virus infection. Breathing exercises and physical exercises for patients have a positive impact in reducing the 'Long Covid' symptoms that are felt. Breathing exercises and physical exercises are carried out according to the needs of the patient, therefore the initial assessment is very important before doing breathing exercises and physical exercises. Various literature has shown the positive effect of breathing exercises and physical exercise in reducing persistent symptoms of Covid-19. Persistent symptoms that have been shown to reduce are fatigue, breathlessness, and dry cough, as well as an increase in lung capacity which can be seen from an increase in the patient's oxygen saturation. Monitoring the effect of this breathing exercise can be done for at least 4-6 weeks. Medical personnel, especially nurses in Indonesia, should learn more about breathing and physical training procedures for post-Covid-19 rehabilitation patients, first the incidence of Covid-19 in Indonesia is quite high and the rehabilitation phase is the role and responsibility of a nurse.

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