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A Pilot Study: Effect of Yoga on FEV1, 6-minute walk distance (6-MWD) and quality of

life in patients with COPD group B

Running title: COPD and Yoga

ABSTRACT

Background: Yoga is further used in the treatment of various diseases, including chronic obstructive pulmonary disease (COPD), but no studies have assessed the effect of yoga on COPD patients in Indonesia. The differentiation of this study to other countries is the type and protocol of yoga exercises, demographic characteristics, and methodology as well. This study aims to analyze the effect of yoga on FEV1, 6-minute walk distance (6-MWD), and quality of life in patients with COPD group B in Indonesia.

Methods: This research is an experimental study with a randomized controlled trial pre and post-test control group design. The samples were divided into 2 groups: the treatment group (yoga practice for 1 hour, 2 times a week for 12 weeks) and the control group (untreated with yoga, given lung rehabilitation brochure). Assessment of the effect of yoga exercises on lung function parameters (FEV1), 6-Minute Walk Distance (6-MWD) and quality of life using SGRQ questionnaires in COPD group B.

Results: 33 COPD patients fulfilled the inclusion criteria. 30 patients completed the study. Pre-yoga and post-yoga in the treatment group and the control group was evaluated using statistical tests. There was a significant increase in FEV1, 6-MWD and quality of life using a SGRQ questionnaire after 12 weeks of yoga (p < 0.05) and a significant change in FEV1, 6-MWD and quality of life in the treatment group (p < 0.05) compared with the control group (p > 0.05).

Conclusions: Yoga affects FEV1, 6-MWD, and quality of life in patients with Group B COPD.

Keywords: Yoga, COPD, FEV1, 6-MWD, Quality of Life, SGRQ

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the non-communicable diseases becoming a public health issue in Indonesia. The morbidity and mortality of COPD patients are associated with periodic exacerbations or worsening of symptoms.[1], [2] The more frequent occurrence of exacerbations will lead to severe lung damage, which followed by a worsened of lung function.[3] Problems frequently experienced by COPD patients, especially stages II and III include exercise de-conditioning, muscle wasting, and weight loss, depression, as well as being isolated from the environment. Therefore, it requires comprehensive management of COPD patients to make their life better.[3]

Some COPD patients are pharmacologically and non-pharmacologically managed, such as by smoking cessation and pulmonary rehabilitation.[3], [4] The main purpose of pulmonary rehabilitation is to reduce complaints, improve physical ability to perform daily activities, improve emotions, and improve quality of life.[3], [5]

A couple of studies have shown that exercises such as upper extremity exercises, Tai Chi, and yoga can improve COPD patients' quality of life.[6] Yoga has been included as a recommended exercise component for pulmonary rehabilitation programs and in addition to the treatment of physical therapy in industrial rehabilitation programs and has been proven to improve the coordination of mind and body. Yoga is called a 'low impact' exercise that can be adapted to the needs and abilities of practitioners so that it is suitable for anyone including COPD patients through asana (yoga posture) and pranayama (breathing technique). Short-term studies on yoga practice have reported an increment in pulmonary function parameters, diffusion capacity, improvement in the quality of life, and reduction in asthma-induced stress. Yoga shows its efficacy to coal miners with COPD.[6] Based on the background that has been described above, this research is then conducted.

METHOD

Study Design

This research is an experimental study with a randomized controlled trial pre and post-test control group design. The initial step was made one week before the start of the intervention by performing [CAT score and mmRC score assessments] to ensure that COPD group B was included in this study, then conducting spirometry assessments using the Koko Legend Spirometer (606055 9.A) and assessing 6-MWD. Every result was recalculated according to GLI-2012 and add z-score assessment to the analysis [7]. The follow-up steps

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were carried out one week after completion of the intervention for 12 weeks. Yoga classes were undertaken in one place determined by the researcher by bringing in a certified yoga instructor.

Statistic Analysis

The data normality test was done using the Shapiro-Wilk test. Analysis of variance before and after treatment was carried out using a paired t-test or Wilcoxon Signed Ranks Test. Analysis of variance between yoga groups and controls was made using the independent sample t-test or Mann Whitney test.

Participants

Participants were recruited via clinics and pulmonary rehabilitation centers, or by physician referral. Inclusion criteria include men over the age of 40 years, people witdyh stable COPD category B, willing to follow the research properly and sign informed consent. Exclusion criteria include COPD with other accompanying diseases such as neoplastic or congestive heart failure and asthma. Dropout criteria include subjects who refused to participate in the research, did not undergo the research protocol, and experienced exacerbations more than one time.

Randomization

All participants agreed to be randomized. Stratified randomization was made using baseline measures of spirometry to assure participant balance in disease severity, and they were randomized according to time of attendance, odd dates were included in the yoga group, and even dates were included in the control group. Participants in both groups continued to receive normal care, and those in the yoga group continued to attend the program. All participants were asked to refrain from learning or practicing anything other than what is taught during yoga interventions. Also, participants in the yoga intervention group signed a confidentiality agreement not to discuss class content with fellow participants in the control group.

Intervention

Yoga interventions consisted of two yoga classes for 60 minutes every week for 12 weeks. Meditation instructors must have had formal training. Due to the need for supplemental oxygen and the effectiveness of persons with COPD, the class time was limited to 60 **Commented [RY4]:** In the methodology section there is r description of statistical methods. Please, all detailed description of the ones

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Commented [RY6]: How exactly randomization procedur was performed ? minutes. The program minimized the traditional focus on the breath during the beginning of yoga exercises to address issues related to persons with COPD. The management of non-threatening symptoms focused on awareness of dyspnea was included. Ujjayi, kaphalabati, and sitkari breathing were included. Further, a spiritual focus was introduced to augment a feeling of comfort during meditation. Savasana was chosen as the meditative movement exercise, based on the expertise of the teacher leading the intervention.

RESULTS

Characteristics of research subjects

Table 1 shows the characteristic of this research subjects. The number of all research subjects are 33 people, with male sex. Subjects excluded from the research consist of 3 people, 2 people from the treatment group, and 1 person from the control group. The number of subjects who could take the research until the end is 30 people. Based on COPD degree, in the treatment group including GOLD 2 and GOLD 4 COPD there are 5 people (33.3%) for each group, while in the control group mostly in GOLD 4 obstruction degree there are 6 people (40%).

The results of the normal distribution test using the Shapiro-Wilk test showed that the data on differences in 6-MWD in the yoga and control groups and the impact data of the yoga group were not normally distributed (p < 0.05). Therefore, the paired t-test was used to find out differences in observations before and after treatment given in each group, except for the difference in 6-MWD using the Wilcoxon Signed Rank Test, while the t-test of 2 free samples was used to see the differences in observations between yoga and control groups except for the difference in the impact after treatment using Mann Whitney test.

FEV₁ Change

FEV₁ assessment was carried out in the two groups. Mean FEV₁ in the treatment group before yoga is 1.025 (0.507) L while in the control group is 0.941 (0.488) L. FEV₁ reassessment was carried out after 12 weeks. In the treatment group there was an increase of 1.402 (0.629) L (p= 0.001) while in the control group there was an increase of 1.017 (0.534) L (p= 0.295).

Table 2 shows the results of paired t-test of FEV1 (L) and FEV1 (%) before and after treatment given in each group ant t-test among groups. There were significant differences in

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As can be seen in Table 2, the mean FEV₁ (% prediction) in the treatment group before yoga is 43.53 (20.625) % while in the control group is 40.87 (22.309) %. FEV₁ reassessment was carried out after 12 weeks. In the treatment group there was an increase of 58.93 (22.799) % (p= 0.002) while in the control group there was an increase of 44.60 (22.344) % (p= 0.208). The results of paired t-test showed significant differences in FEV1 (%) before and after treatment in the yoga group (p <0.05), whereas there were no significant differences in the control group (p> 0.05). The results of the t-test of 2 free samples between the yoga and control groups indicated that there were no significant differences in FEV1 (%) both before and after treatment (p> 0.05), but there were significant differences in the value of FEV1 (%) (p < 0.05).

6-MWD Change

As can be seen in Table 3, there was an increase in mean 6-MWD after yoga in the treatment group. Wilcoxon Signed Rank test results in the treatment group showed no significant difference in 6-MWD value between before and after yoga with a p-value of 0.001 <0.05. It can be concluded that patients with COPD treated with yoga have a significantly increased 6-MWD value, whereas in the control group there was a decrease in the mean of 6-MWD after 12 weeks. Wilcoxon Signed Rank test results in the control group showed no significant difference in 6-MWD value between before and after yoga with a p-value of 0.328 \geq 0.05. It can be concluded that COPD patients who did not get yoga treatment have an insignificantly declining 6-MWD value. The 6-MWD change in the yoga group was greater than in the control group. The difference test result using Mann Whitney test showed a significant difference in 6-MWD value change between the two groups with a p-value of 0.016 < 0.05. It can be concluded that patients with COPD treated with yoga have a significantly greater 6-MWD value change compared to patients with COPD not treated with yoga.

The results of the Wilcoxon test showed significant differences in 6-MWD (m) before and after treatment in the yoga group (p <0.05), whereas there was no significant difference (p> 0.05) in the control group. The results of the Mann Whitney test on the difference in the 6-MWD between the yoga and control groups showed significant differences (p <0.05).

Change in quality of life

Table 4 shows the results of symptoms, activity, impact and SGRQ total before and after treatment given in each group. In the treatment group after yoga there was a decrease in the mean value of SGRQ questionnaire. The paired t-test results in the treatment group showed a significant difference in the SGRQ questionnaire value between before and after yoga with a p-value of 0.000 < 0.05. It can be concluded that patients with COPD treated with yoga have a significantly decreased SGRQ questionnaire value, while in the control group there was an insignificantly decreased mean value of SGRQ questionnaire after 12 weeks. The paired t-test result in the control group showed no significant difference in SGRQ questionnaire value in terms of symptom between before and after yoga with a p-value of > 0.05. It can be then concluded that patients with COPD untreated with yoga have an insignificantly decreased SGRQ questionnaire solution after yoga with a p-value of > 0.05. It can be then concluded that patients with COPD untreated with yoga have an insignificantly decreased SGRQ questionnaire solution after yoga with a p-value of > 0.05. It can be then concluded that patients with COPD untreated with yoga have an insignificantly decreased SGRQ questionnaire solution after yoga with a p-value of > 0.05. It can be then concluded that patients with COPD untreated with yoga have an insignificantly decreased SGRQ questionnaire solution after yoga with a p-value of > 0.05. It can be then concluded that patients with COPD untreated with yoga have an insignificantly decreased SGRQ questionnaire value in terms of symptoms.

DISCUSSION

The number of subjects screened was 74 people who are patients with stable outpatient COPD at Asthma-COPD Polyclinics of Dr. Soetomo Hospital Surabaya and Airlangga University Hospital Surabaya, where 24 people were excluded, and 17 people refused to participate in the research. 33 people with male sex were randomly divided into 17 people of the treatment group and 16 people of the control group. Patients who were excluded in this research consist of 2 people from the treatment group because they could not take the exercises regularly according to schedule, while in the control group there was 1 person refused to continue the research. Patients who took the research until it was finished are 30 people.

Our result suggested that FEV_1 change (L) in the treatment group is greater than in the control group. It can be concluded that patients with COPD treated with yoga therapy have a significantly greater change in FEV_1 value (L) compared to COPD patients untreated with yoga therapy. FEV_1 change (% prediction) in the treatment group is greater than in the

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control group. It can be concluded that patients with COPD treated with yoga therapy have a significantly greater change in FEV_1 value (% prediction) compared COPD patients who did not get yoga treatment.

This research is in line with meta-analysis[8] literature by Katiyar[9] and Donesky[10] that there was a significant increase in FEV_1 in patients with COPD treated with yoga exercise for 12 weeks. Madanmohan[11] stated that yoga for 12 weeks would increase the maximum expiratory pressure, maximum inspiratory pressure, time to hold breath during inspiration, time to hold breath during expiration, and grip strength. This result is also in line with the research by Joshi et al. in 1992 which also showed that during 6 weeks of pranayama exercise there was an increase in ventilation function in the form of respiratory rate reduction and increase in FVC, FEV_1 , MVV, ability to hold breath.

The effect of yoga obtained in this research relates to the deep breathing technique (pranayama) and meditation, leading to a respiratory rate reduction. This enables the modulation of airway reactivity, improves breathing sensation through regulating breathing pattern, reduces oxygen consumption, reduces the incidence of hypoxia and hypercapnia, so that blood oxygenation is better without increasing ventilation, improves respiratory resistance and muscle strength then modulate autonomic function with a decrease in heart rate at rest and sympathetic activity.[3], [10]

The result of this research is in line with the result of research by Katiyar[9] and Donesky[10] that there was a significant increase in 6-MWD in COPD group given yoga exercise. Ranjita[12] also gave a similar result that there was a significant increase in COPD patients given yoga exercise for 12 weeks. The increase in 6-MWD is due to the effect of yoga on the musculoskeletal and cardiorespiratory systems, improving cardiovascular efficiency and homeostatic control of the body. Muscle effect during continuous yoga stretch posture helps to increase oxidative capacity and skeletal muscle strength, flexibility, endurance, coordination, power, static and dynamic balance, reduce glycogen utilization that will improve physical performance and improve walking speed and step length. Relaxation technique has been found to increase cardiopulmonary resistance through the body and breath control, which manifests clinically as lung capacity increase, oxygen delivery increase and breathing rate reduction, so overall it can increase exercise capacity at 6-MWD.[12]

Quality of life is assessed by the SGRQ questionnaire which consists of symptoms, activity, impact, and total score of each group. The assessment of quality of life increases when the SGRQ value is decreased. The British Thoracic Society (BTS) recommends using SGRQ as it is more sensitive to assess clinical change. The SGRQ questionnaire can also be

used to detect the response to medical treatment or non-medical treatment such as a lung rehabilitation program. Clinical change is at least significant if the SGRQ value decreases by 4%.[4]

The SGRQ change in the yoga group is greater than in the control group in each component of the SGRQ questionnaire. The difference test result showed a significant difference in the change of SGRQ questionnaire value (symptom, activity, impact, total score) with a p-value of < 0.05. It can be concluded that patients with COPD treated with yoga have a significantly bigger decrease in SGRQ questionnaire value in some components (symptom, activity, impact and total score) compared to patients with COPD untreated with yoga.

This research is in line with several kinds of research as in Fulambarker[13] and Katiyar' s[9] that there was a significant change in the quality of life through the assessment of SGRQ questionnaire for the group given yoga treatment for 12 weeks with 24 meetings. There was a decrease in the mean value of SGRQ in the treatment group for 12 weeks in terms of symptom, activity, impact, and total score. It means that there is an improvement in the quality of life in the treatment group. Lacasse et al. concluded the results of their research by a meta-analysis that pulmonary rehabilitation will reduce shortness of breath symptoms and improve the ability of COPD patient's activity so that the functional capacity and quality of life also increase.[14] Berry et al. explained that pulmonary rehabilitation would increase the maximum oxygen consumption and maximum working capacity, thereby increasing the functional capacity and quality of life.[15]

This study also consistent with Kulpati et al. Patients who received yoga training were seen to have the best maintenance of function, reduction in the respiratory rate (p< 0.001) and heart rate (p< 0.01) compared with a group who received conventional therapy, while a group who received breathing exercise that only intermediate in their response, probably indicated the efficacy of yogasanas.[16]

Yoga exercise will improve the functioning of body systems, namely the nervous system and all the organs of the body. It affects the psychological and spiritual aspects. Yoga exercise is a process of integrating aspects of oneself, including physical, psychological, and spiritual aspects. The optimal integration process enables a person to achieve a quality of life as they expected. A healthy body condition is indicated by the enhancement of psychological well-being (positive psychological conditions improve such as mood and happiness increase, as well as negative psychological symptoms decrease including stress, anxiety, and depression). Such condition also affects spiritual aspects, for example be able to respect

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ourselves, others, and the surrounding environment, be closer to God and have a meaningful life.[17]

This study is consistent with Villien F's research [18], which identified that changes in breathing patterns could be used as a measure of taking meditation interventions. However, it is possible that emotions can mediate the relationship between respiratory rate and level of mindfulness. Respiratory patterns have been demonstrated to be stable over time and fluctuate in a consistent manner during changes in respiratory demand, such as exercise. Despite this stability, respiration patterns have been shown to change at rest in response to meditation practice in persons without pulmonary disease. After attending a meditation intervention using a focus on Ujjayi breathing, it was found that healthy persons demonstrated a decrease in respiratory rate and an increase in expiratory time.[18]

CONCLUSIONS

Yoga has beneficial effects in COPD Group B. FEV1, 6-MWD and the quality of life increase after yoga exercise. Therefore, yoga can be used as an option of pulmonary rehabilitation in patients with COPD category B. The pulmonary rehabilitation program should be given continuously to patients with COPD. However, pulmonary rehabilitation needs to be performed together with the instructor and the exercise schedule to achieve the movements that correspond to the proper procedures.

Ethical Clearance

This study follows the principles of the Declaration of Helsinki. This study has received ethical clearance from Dr. Soetomo General Hospital before the study begins (Ethical Clearance Number 300/Panke.KKE/IV/2017). All subjects gave their informed consent prior to their inclusion in the study. Before signed the informed consent, information for informed consent was given. Details that might disclose the identity of the subjects under study were omitted.

Conflict of interest

All authors declare no conflict of interest

Authors' contributions

MA and RY designed the study. MA and RY collected samples. MA and RY gathered data.

MA and RY analyzed the data. MA and RY made Tables and Figures. MA and RY wrote the

manuscript, and all authors contributed to review and revision and have been approved the

final version.

Acknowledgment

We are truly thankful to patients who participated in the study and the authorities and the

staff of Dr. Soetomo Hospital, Surabaya, Indonesia, who helped and supported us during the

study.

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