The benefit of pulmonary rehabilitation against quality of life alteration and functional capacity of chronic obstructive pulmonary disease (COPD) patient assessed using St George's respiratory questionnaire (SGRQ) and 6 minutes walking distance test (6MWD)

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Abstrak

*Pasien penderita penyakit paru obstruktif kronik (PPOK) tampaknya mendapatkan manfaat dari program rehabilitasi paru. Penelitian ini mengkaji manfaat program rehabilitasi paru pada pasien rawat jalan yang menderita PPOK, dengan menggunakan St George Respiratory Questionnaire (SGRQ) dan six min walking distance test (6MWD), yang mengukur kualiti hidup kesehatan dan toleransi latihan fungsional sebagai hasil pengukuran utama. Penelitian ini merupakan penelitian prospektif, terbuka, acak dengan kelompok kontrol paralel yang diberikan program rehabilitasi pasien rawat jalan pada 56 pasien penderita PPOK (52 orang laki-laki dan 4 orang perempuan). Kelompok aktif (n= 27) diberikan program edukasi dan latihan selama 6 minggu. Kelompok kontrol (n= 29) diperiksa secara rutin sebagai pasien medis rawat jalan. SGRQ dan 6MWD dilakukan pada saat awal penelitian dan setelah 6 minggu. Didapatkan hasil SGRQ dan 6MWD sebelum dan sesudah terapi. Berdasarkan statistik, SGRQ menurun dan skor 6MWD meningkat secara signifikan pada kelompok aktif dibandingkan kelompok kontrol. Disimpulkan bahwa program selama 6 minggu pada pasien rawat jalan ini secara signifikan telah meningkatkan kualiti hidup dan kapasitas fungsional pasien PPOK derajat ringan hingga sedang. (**Med J Indones 2006; 15:165-72**)*

Abstract

*Patients with chronic obstructive pulmonary disease (COPD) have been shown to be benefit from pulmonary rehabilitation programs. We assessed an entirely outpatient-based program of pulmonary rehabilitation in patients with COPD, using the St George's Respiratory Questionnaire (SGRQ) and six minutes walking distance test (6MWD) (which measures health-related quality of life and functional exercise tolerance) as the primary outcome measure. We undertook a randomized, opened, prospective, parallel-group controlled study of outpatient rehabilitation program in 56 patients with COPD (52 men and 4 women). The active group (n=27) took part in a 6-weeks program of education and exercise. The control group (n=29) were reviewed routinely as medical outpatients. The SGRQ and 6MWD were administered at study entry and after 6 weeks. Outcome with SGRQ and 6MWD before and after therapy was performed. Decrease score SGRQ and increase 6MWD in both groups of study, it was analyzed by statistic study and in active group the decrease of SGRQ and the increase of 6MWD was statistically significant. In conclusion 6-weeks outpatient-based program significantly improved quality of life and functional capacity in mild-to-moderate COPD patient. (**Med J Indones 2006; 15:165-72**)*

Keywords: COPD, pulmonary rehabilitation, SGRQ and 6MWD.

In 1995, COPD and asthma were on the 5th rank of death based on House Hold Health Survey, Health Department, Republic of Indonesia (SKRT, Depkes).[1]

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In 1997, Yunus described COPD case pattern with acute exacerbation, which had been hospitalized at Pulmonology Department, Persahabatan Hospital; i.e. 104 cases with COPD diagnosis and there were only 65 cases which were appropriate with the COPD criteria. At the Persahabatan Hospital, as national top referral for pulmonary disease, COPD was on the 5th rank of outpatient and was on the 4th rank of hospitalized patient number.[2]

In 1990, Sherrill et al. indicated that health statistic hardly record the COPD prevalence because of no

standardized definition, lack of recognition and misclassification.[3] In 2000, there were 600,000 COPD patients in the United Kingdom and symptoms appeared after 40 years of age. Male prevalence outnumbered the female and was likely increased about 5 % in 65 – 75 years of age, and about 10 % in the age over 70 years. In developing countries, the COPD prevalence is steadily increased due to increasing of smoking prevalence.[4]

Rehabilitation of COPD patient is a standard management, which is aimed to control, reduce symptoms, and increase the functional capacity optimally. The main objectives is to return the body ability of self-living, which is realized by helping patient to learn about concomitant disease, alternative of therapies and how to manage it. Patient should have active self living and reduce their dependence on health care.[5]

Quality of life is an individual condition level in the extent of ability, boundary, symptoms, and psychosocial characteristics to perform in various expected roles of the community and being satisfied.[6] The concept of quality of life measurement which correlated with health usually refers to minimal one of 4 important domain or component, i.e. somatic sensation, physical function, emotional or psychosocial status and social interaction. General health questionnaire usually is less sensitive about COPD level, therefore specific measurement is applied, such as St George's Respiratory Questionnaire (SGRQ), which is developed by Jones et al.[7]

SGRQ consist of 76 items of questions. It is divided into three components i.e.:[7]

1. Symptoms, associated with short of breath symptom, frequency and severity of symptom
2. Activity, associated with activity that cause short of breath or limited activity because of it.
3. Impact, includes a series of aspect which is correlated to social function and psychological disorder caused by illness.

In the early 1960's, Balke developed a simple test to evaluate functional capacity by measuring walking distance in certain period. Twelve minutes walking distance test was developed to evaluate the exercise outcome of healthy individual and chronic bronchitis patient. Six minutes walking distance test was developed later, and actually the result is as well as the 12 minutes walking distance test, and it is more tolerable by patients and more representing daily activity situation. Main indication of 6 minutes walking distance test is to measure patient's therapeutic response with heart or lungs disorder of mild to severe level. Other indication is to measure patient's functional status and predict disease mortality and morbidity.[8]

The aim of this study is to evaluate the benefit of physical rehabilitation in mild to moderate COPD patients. The specific objectives are to evaluate the quality of life alteration in COPD patients who have medical rehabilitation by using SGRQ and to evaluate the alteration of functional capacity in COPD patients who have medical rehabilitation by using 6 minutes walking distance test.

METHODS

This was an open randomized clinical trial on 56 mild to moderate COPD patients, who came to Asthma Clinic of Department of Pulmonology and Respiratory Medicine Faculty of Medicine, University of Indonesia in Persahabatan Hospital. This trial has been proved by ethical committee of Faculty of Medicine, University of Indonesia. The inclusion criteria were mild to moderate stable COPD patients, male or female of 45 – 75 years old, FEV_1 more than 30% predicted value, $FEV_1/FVC < 70\%$, no exacerbations 4 weeks prior to the study, continue taking medicines for COPD, not enrolled in any physical exercise and gave written agreement to enroll this study. The exclusion criteria were patient who had heart disease, Cor Pulmonale, neurologic disorder and cognitive disorder. The patients were given information about the aim of this study, agreed to enroll until completed, stated orally and signed informed consent paper. Mild to moderate COPD patients, which met with inclusion criteria were performed the following procedures:

1. Anamnesis of history of illness such as duration of illness, last attack period, trigger factor for the attack, attack frequencies, and type and dose of bronchodilator medication
2. Physical examination
3. Determination of body mass index
4. Chest X Ray
5. Lung function test followed by bronchodilator test to evaluate the reversibility of the airway
6. Fill in the SGRQ questionnaire after getting complete information

The patients were divided randomly into two groups. The active group was performed blood gas analysis and ECG examination. Both groups (active and control group) performed six minutes walking test, the distance of test were recorded in meter. Patients might discontinue the test if they felt exhausted or shortness of breath. The active group participated in stationary cycling exercise program three times a week for 6 weeks, while the control group did not participated in this program. The exercise lasted 5 minutes each time, and every week the exercise was extended for 5 minutes. Before they participated in exercise program, they had physiotherapy preparation i.e. education and 3 times chest physiotherapy. After completing every exercise, their symptoms were being evaluated. Patients were dropped from the study if they did not complete stationary cycling exercise program or experienced exacerbation more than 3 times during the study. If exacerbation occurred, exercise was discontinued, they might continue to participate after they reached stable condition. After completing the program, lung function test was performed for both groups. Type and dose of medication before and after study were recorded.

RESULTS

Patients' characteristics

The study group was 60 stable COPD patients. It was divided randomly into active and control groups for 30 patients each. There were 56 patients who had completed the study. Three patients of active group were excluded from the study because they refused to continue the exercise and 1 patient of control group was also excluded because of being hospitalized due to uncontrolled diabetes mellitus type 2. The patients' characteristics for both groups can be seen on table 1 & 2.

Table 1. Patients' characteristics based on gender

Gender	Active group	Control group	p value
Male	25 (92,6%)	27 (96,1%)	0,941 chi square
Female	2 (7,4%)	2 (6,9%)	
Total	27 (100%)	29 (100%)	

Table 2. Patients' characteristics based on COPD severity

Severity	Active group	Control group	p value
Mild	11 (40.7%)	10 (34.5%)	0.629 chi square
Moderate	11 (40.7%)	19 (65.5%)	
Total	27 (100%)	29 (100%)	

The active group consisted of 25 males (92.6%) and 2 females (7.4%), whereas in the control group were 27 males (96.1%) and 2 females (6.9%). Patients distribution based on gender in both group did not indicate any significant difference ($p = 0.941$). Distribution of COPD severity in the active group was 11 patients (40.75%) with mild COPD and 16 patients (59.3%) with moderate COPD. In the control group, there were 10 patients (34.5%) with mild COPD and 19 patients (65.5%) with moderate COPD. There was no statistical difference ($p = 0.629$). Table 3 shows patient's characteristic based on age and body mass index (BMI). The age mean value in the active group was 64.3 years (SD 6.3) and 67.2 years (SD 4.5) in the control group, and there was no statistical difference ($p = 0.085$). BMI mean value in the active group was 19.6 (SD 8.5) and in the control group was 20.2 (SD 6.4), and there was no significant difference between two groups ($p = 0.749$). Table 4 shows the value of blood gas analysis prior to study in active group. The mean value of PO_2 was 78.79 (SD 8.8) and PCO_2 was 33.28 (SD 5.75).

Table 3. Patients' characteristics based on age and body mass index (BMI)

Variable	Active group N = 25			Control group N = 29			p value
	X(SD)	Median	Range	X(SD)	Median	Range	
Age	64.3 (6.3)	64	49-75	67.2 (4.5)	67	62-75	0.085 Mann Whitney U
BMI	19.7 (8.5)	21.6	17-34.8	20.2 (6.4)	20.9	17-31.2	0.749 Mann Whitney U

Table 4. Patients' characteristics of PO_2 and PCO_2 values in active group

	Active group		
	Mean	SD	Range
PO_2 initial	78.79	8.80	94.20 – 55.90
PCO_2 initial	33.28	5.75	48.10 – 18.60

Initial values of FEV$_1$, 6 meters walking distance, VO$_2$ max and St George's Respiratory Questionnaire (SGRQ)

Table 5 shows the initial value of FEV_1 in the active group was 1218 ml (SD 512) and in the control group 1140 ml (SD 290). Statistically, there was no significant difference ($p = 0.492$). The mean value of 6 minutes walking distance in the active group was 414 meters (SD 51), whereas in the control group was 366 meters (SD 51), and statistically it did not indicate any significant difference ($p = 0.064$). Mean value of VO_2 max in the active group was 15.52 (SD 0.99), and in the control group was 14.58 (SD 1.00). The difference was statistically also not significant ($p = 0.277$). The values of SGRQ were divided into 4 items namely symptom, activity, impact and total mean value. The mean value of symptom SGRQ of active group was 41.3 (SD 17.7), whereas in control

group was 36.9 (SD 13.5), and statistically it did not indicated significant difference ($p = 0.421$). Mean value of SGRQ activity in active group was 47.9 (SD 18.7), while in control group was 51.2 (SD 16.7) which statistically did not indicate any significant difference ($p = 0.496$). The mean value of impact SGRQ in active group was 29.8 (SD 15.5), while in control group was 32.5 (SD 13.2) which statistically did not indicate any significant difference ($p = 0.366$). Total mean value of SGRQ in active group was 36.7 (SD 14.5) and 38.4 in control group (SD 12.3), there was no significant difference ($p = 0.637$).
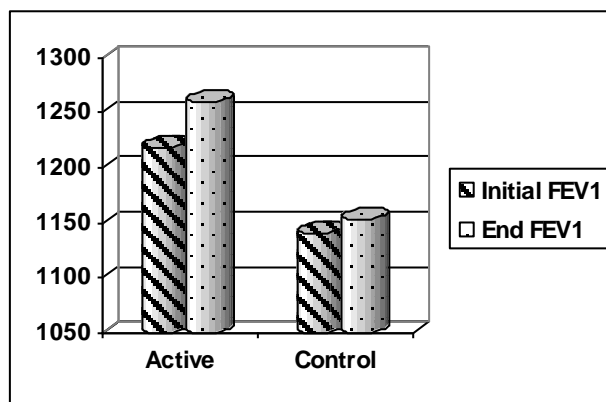

Figure 1. Alteration FEV$_1$ values between two groups

Table 5. Initial values of FEV$_1$, 6 minutes walking distance, VO$_2$ max and SGRQ

Variable	Active group N = 25			Control group N = 29			p value
	X(SD)	Median	Range	X(SD)	Median	Range	
FEV$_1$	1218 (512)	1150	580-2270	1140 (290)	1040	740-1850	0.993 t-test
Walking distance	414 (51)	420	300-510	366 (51)	368	270-45	0,064 Pillai's Trace
VO$_2$ max	15.52 (0.99)	15.65	13.29-17.42	14.58 (1.00)	14.61	12.69-16.29	0.277 Pillai's Trace
SGRQ symptom	41.3 (17,7)	41.1	11.9-76.3	36.9 (13,5)	38.5	11.1-60.5	0.421 Mann-Whitney U
Activity	47.9 (18.7)	47,2	17.6-79.9	51.2 (16,7)	47.6	11.2-79.1	0.496 Mann-Whitney U
Impact	29.8 (15.5)	28.3	3.6-67.8	32.5 (13,2)	33.8	11-64.3	0.366 t test
Total	36.7 (14.5)	37.2	12.6-68.6	38.4 (12.3)	37.8	18.6-64.4	0.637 t test

Changing of FEV$_1$, 6 minutes walking distance, VO$_2$ max and St George's Respiratory Questionnaire values

On table 6 and Figure 1, the changing value of FEV$_1$ in the active group was 41 ml (SD 163), while in the control group was 13 ml (SD 175) from initial value, which statistically no difference ($p = 0.421$). Changing value of 6 minutes walking distance in the active group was 50 (SD 15), while in the control group was 7.9 (SD 22) from initial value (see Figure 2). There was significant difference in distance between two groups ($p = 0.000$). Figure 3 shows changing value of VO$_2$ max in both groups was statistically significant ($p = 0.000$). Changing SGRQ value of symptom in the active group was −21.3 (SD 11.2), while in the control group was 0.2 (SD 4.2) which statistically indicated significant difference ($p = 0.000$). Changing SGRQ value of impact in the active group was −13.9 (SD 9.9), while in the control group was −3.5 (SD 7.9) which statistically indicated significant difference ($p = 0.000$). Changing total SGRQ value in the active group was −15.1 (SD 8.7), while in control group was −2.2 (SD 3.9) which statistically indicated significant difference ($p = 0.000$) (see Figure 4).
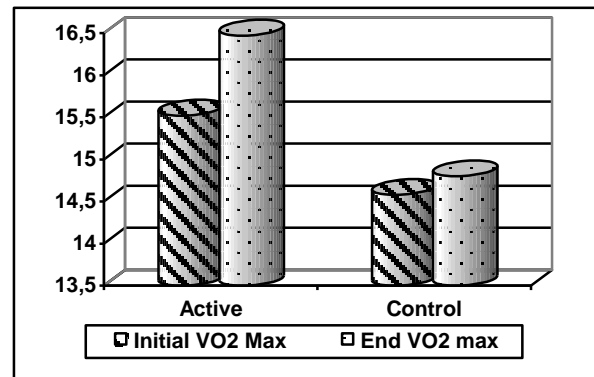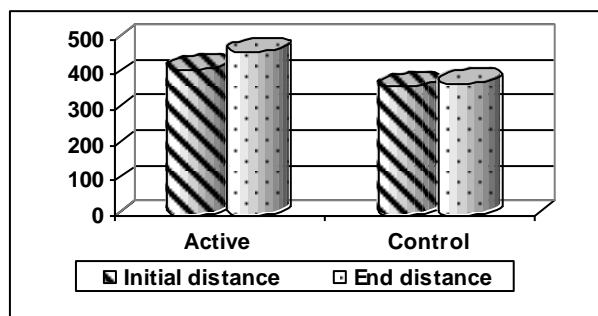

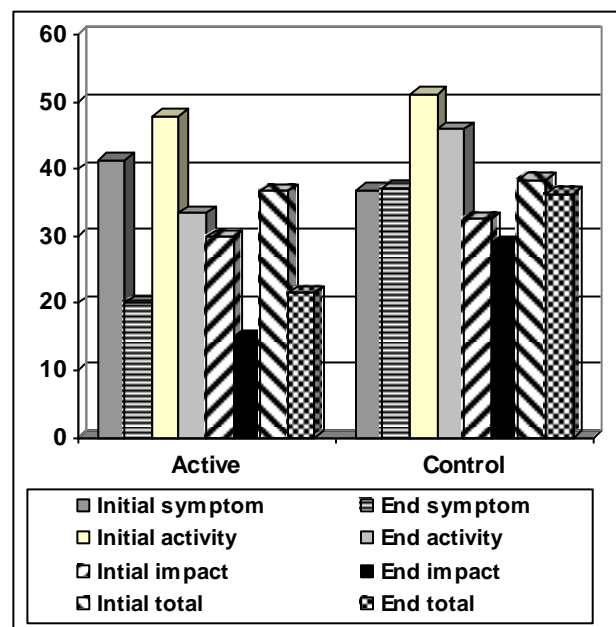*Figure 3. Alteration of VO$_2$ max (ml/Kg/minute)*

Figure 4. Alteration symptom, activity, impact and SGRQ total values (%)

Figure 2. Alteration of 6 minutes walking distance

Table 6. Changing of FEV$_1$, 6 minutes walking distance, VO$_2$ max and SGRQ values

Variable	Active group			Control group			p value
	X(SD)	Median	Range	X(SD)	Median	Range	
Δ FEV$_1$	41 (163)	30	−240 - 420	13 (175)	20	−380 - 350	0.421 Mann-Whitney U
Δ distance	50 (15)	52.5	22.5 - 87.5	7.8 (22)	10	−30 - 60	0.000 Mann-Whitney U
Δ VO$_2$ max	0.95 (0.45)	1.08	1.73 - −0.59	0.22 (0.50)	0.29	1.59- −0.59	0.000 T-test
Δ SGRQ symptom	−21.3 (11,2)	−17.4	−48 - −8.1	0.2 (4,2)	0	−11 – 14.4	0.000 Mann-Whitney U
Activity	−14.5 (10)	−12.2	−32 - 0.0	−5.3 (6,8)	6.8	−26.0 - 5.4	0.000 Mann-Whitney U
Impact	−13.9 (10)	−11.4	−36.4 – 0.9	−3.5 (7.9)	−3.4	−30.6 - 8.3	0.000 Mann-Whitney U
Total	−15.1 (8.7)	−14.1	−32.8 - 2.4	−2.2 (3.9)	−2.3	−11.6 - 8.1	0.000 Mann-Whitney U

Unexpected condition

There were unexpected conditions during the 6 weeks study in the active and control groups such as exacerbation occurred during exercise and exercise complication. Other unexpected conditions were not found.

Medication administered before and after study

Medications administered before and after study were similar in most of patients. This condition indicated that there was no exacerbation, or patients were at stable condition.

DISCUSSION

Subjects characteristics

There were 60 subjects, consists of 2 groups, namely 30 subjects of mild to moderate COPD who had pulmonary rehabilitation and 30 subjects of mild to moderate COPD without pulmonary rehabilitation. There were 56 subjects who have completed the present study, whereas 3 subjects of the active group and 1 subject of the control group were excluded. There was no significant difference in subject gender and was greater amount of male than female. This fact was in accordance with Yunus study in Persahabatan Hospital, which indicated greater amount of male (86.2%) than female (13.6%).[2]

Wihastuti et al. found 95% of male and 5% of female in study about correlation of pulmonary physiologic value and quality of life in COPD.[9] Subject distribution of age indicated no significant difference between the active group (64.3 years) and the control group (67.2 years). This was in keeping with Yunus study, which found greatest age at 61-80 years old.[2] Wihastuti et al. found mean age of COPD patients was 65.4 years old.[9] Subject distribution of COPD severity indicated no significant difference between these two groups. Subject distribution of BMI also indicated no significant difference between the active and control group. Harik-Khan et al. found that the lower BMI value, the greater COPD risk.[10]

PO_2 characteristic of the active group was 78.79 mmHg (SD 8.8) and PCO_2 was 33.28 (SD 5.75) mmHg. The present study showed no exacerbation condition in the active group. Ortega et al. conducted study on COPD patient and they found strength and endurance training for 12 weeks. The PO_2 characteristics

was 71 ± 7 mmHg and PCO_2 was 44 ± 7 mm Hg for strength, PO_2 65 ± 10 mmHg and PCO_2 45 ± 7 mmHg for endurance, PO_2 73 ± 9 mmHg and PCO_2 44 ± 6 mmHg for both. They found 4 subjects being hospitalized because of exacerbation.[11] Spruit et al. compared resistance and endurance training with PO_2 characteristic was 63 ± 14 mmHg and PCO_2 characteristic was 42 ± 9 mmHg for resistance, PO_2 70 ± 20 mmHg and PCO_2 43 ± 8 mmHg for endurance.[12] In this study there were 7 exacerbations of 24 resistance group and 5 exacerbations of 24 endurance group.

Pulmonary physiologic changes

There was no significant difference of pulmonary function before study in the active and control group. In the active and control group after study, there was an increase of FEV_1 value, but statistically was not significant. Wijkstra et al. studied about FEV_1 changes of patients who had home rehabilitation for 12 weeks. They found no changes of FEV_1 value in the active group and significant decrease of FEV_1 value about 200 ml ($p < 0.05$) in the control group. Wijkstra could not explain about FEV_1 decrease in the control group even though they recognize that FEV_1 value of COPD decreases about 50 ml/year.[13] Berry et al studied FEV_1 changes in patients who had exercise program for 12 weeks. They found no significant results.[14] Giiell et al. studied about benefits of long-term rehabilitation in COPD patients. They found significant result of Forced Vital Capacity (FVC) increase and no significant value of FEV_1 changes. Those were caused by breathing technique exercise and physiotheraphy that would produce increase flexibility of chest wall and respiratory muscles strength. Giiell stated that the strength of respiratory muscle only affect the FVC value.[15] Wouters explained about 3 types of COPD patients' muscles, namely myosin heavy chain-1 (MHC-1), MHC-2A and MHC-2B. Muscle type of MHC-2B mostly was found in COPD than other muscles. In their study, there were no significant correlation between MHC-2B and FEV_1 value level ($p = 0.38$) and significant correlation between MHC-2A and FEV_1 ($p= 0.05$). These explain that COPD patient without rehabilitation will not have significant changes of FEV_1.[16] Ries et al. studied on COPD patient who had exercise program of upper-extremities. They found improvement in residual volume (RV), total pulmonary capacity (TPC), functional residual capacity (FRC), FVC but no improvement in FEV_1. These was because of exercise program that would

improve ventilation muscles function, so it might reduce pulmonary hyperinflation.[17]

Alteration of 6 minutes walking distance

Before study the value of six minutes walking distance between the active group and the control group had no significant difference. Alteration of walking distance after study in the active group was 50 meters and in the control group was 7.8 meters. The comparison of walking distance between two groups indicated statistically significant difference (*p* = 0.000). Bendstrup et al. studied on patients with exercise, education, occupational therapy and stop-smoking program for 12 weeks. They found increased 6 minutes walking distance which was significantly different between the active and control group. After 6 weeks, they found increase walking distance by 79.8 meters in the active group and 21.6 meters in the control group. This was caused by exercise program which increased anaerobic threshold and maximal oxygen consumption.[18]

Finenerty et al. studied on patients with 6 weeks exercise program. They found significant increase between the active and control group. In the active group, they found increase walking distance after 12 weeks of 51 meters. In such study, an exercise monitoring 1 hour/week was continued to home exercise program. Finenerty concluded that those exercises would improve dyspnea so it would increase the exercise tolerance and walking distance.[19] Wijkstra et al. studied on patients with 12 weeks home exercise program. They found significant difference in 6 minutes distance between the active and control group. Exercise is the best intervention, psychologically and physiologically for dyspnea. Exercise tolerance and adaptation is the best mechanism to reduce dyspnea although generally the lungs and heart functions remain.[13]

Berry et al. studied on patients with 12 week exercise program. They found increase walking distance, which significantly different on mild COPD group (*p* < 0.01), moderate COPD group (*p* < 0.0001) and severe COPD group (*p* < 0.01).[14] Lacasse et al. conducted meta-analysis about COPD rehabilitation. They found mean value of 6 minutes walking distance increase by 55.7 meters. They concluded that minimum clinically important difference (MCID) was 50 meters. Minimum clinically important difference (MCID) is the shortest distance that should be attained in order to have significant clinical improvement.[20] British Thoracic Society (BTS) recommended significant clinical improvement of minimum distance was 54 meters.[4] Redelmeier et al. conducted meta-analysis and stated that 6 minutes walking distance clinically significant at 54 meters.[21] Weiner et al. studied patients with long-acting bronchodilator and exercise program. They found significant increase of 6 minutes walking distance by 50 meters.[22] Ortega et al. compared the benefit of strength, endurance training and both combination. Strength training is an exercise with various techniques to strengthen the respiratory muscles, whereas endurance is persisting exercise on a certain technique. Ortega concluded that the best result was obtained with combination of both techniques. This was caused by dynamic hyper-ventilation occurred in COPD that reduce the tidal volume during exercise, which cause dyspnea and reduce exercise tolerance. Combination of both techniques will improve ventilation, reduce end expiration volume, and dyspnea.[11] Marin et al. described that there was strong correlation between reduced dynamic hyper-ventilation and increased 6 minutes walking distance.[23]

Alteration of VO_2 max

Alteration of VO_2 max in the active group was 0.95 (SD 0.45) and in the control group was 0.22 (SD 0.50). The comparison of VO_2 max value of both groups statistically indicated significant difference (*p* = 0.000). Wijkstra et al. studied on COPD patient with home rehabilitation for 12 weeks. They found significant increase of VO_2 max in the active group. The increase of VO_2 max was also followed by significant reduces of lactate, dyspnea and increase of work performance.[13] Spruit et al. found increased VO_2 max in the resistance training group. Resistance training will cause increase component of oxygen transportation (increase amount of capillary and oxidative enzyme), increase density volume of mitochondria and increase speed of phosphocreatine recovery, so that finally causes VO_2 max increase.[12]

Alteration of St. George's Respiratory Questionnaire (SGRQ)

There was no significant difference before study between the active and control group. Alteration of SGRQ value after study indicated significant difference between the active and control group. Alteration of symptom, activity, impact and total value were

significantly different between two groups (p = 0.000). Finnerty et al. studied on patient with 6 weeks exercise and education program. They found significant difference between the active and control group ($p < 0.001$). In the active group, there was decreased symptom value by 20.5, activity value by 12.1, impact value by 9.6 and total value by 12.5. In control group, there was decreased symptom value by 4, impact value by 0.7, total value by 0.8 and increased activity value by 0.7. They concluded that there was alteration of SGRQ value, which was significantly different between the active and control group. Those values indicate that the lesser SGRQ value, the better quality of life. Significant minimal alteration was if there was 4% decreased of SGRQ value (minimally clinically significant change).[19] British Thoracic Societies recommended utilization of SGRQ because it is more sensitive to evaluate clinical changes.[4] Wijkstra et al. studied on patients with 12 weeks home exercise program. They found significant different changes for quality of life in the active and control group ($p < 0.001$).[13] Berry explained that rehabilitation would cause increase maximum oxygen consumption and maximum work capacity, therefore it would increase functional capacity and quality of life.[14] Lacasse et al. described that by meta-analysis, pulmonary rehabilitation would improve dyspnea and increase the patient's ability. Therefore, functional capacity and quality of life will increase.[20]

CONCLUSIONS

1. Pulmonary rehabilitation in COPD patient may improve quality of life, namely by improving symptom, activity, impact and total SGRQ value
2. Pulmonary rehabilitation of COPD patient will increase the functional capacity, namely by significant increase of 6 minutes walking distance

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