INTI JOURNAL | Vol.2023:06
eISSN:2600-7320

Ground Walk Training Versus Treadmill Training on Endurance Capacity and Quality of Life in COPD Patients

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Abstract

Pulmonary rehabilitation is mainly fascinated by equipment-dependent training such as treadmill and cycle training. But not all patients are affordable due to its high cost of pay for the entire treatment course which may vary from six to twelve weeks. Ground walk training is the simplicity of performance, and it is easy to monitor the exercise training program. Though, ground walk training is very feasible and easily accessible by the patients, it is still not beenpracticed widely as alternative to the treadmill training in pulmonary rehabilitation. Hence, this study was aimed to compare the effectiveness of ground walk training and treadmill training on improving the endurance capacity and quality of life in COPD patients. A quasiexperimental study was conducted and a total of 30 COPD patients were recruited. Participants with age group between 45-60 years, both gender, stage II to IV (GOLD) and reduced exercise tolerance (Modified Borg Scale – Score > 3) were included into this study. Participants were divided into two groups with 15 in each group (group A and group B). Group A received ground walktraining and group B received treadmill training for a period of 6 weeks, 3days/week, 30-45mins/session. The outcome measures including endurance capacity and quality oflife was assessed using six-minute walk test and chronic respiratory diseasequestionnaire. Independent sample 't' test was used to compare the outcome among group A and B. There was a significant increase in endurance capacity with $p \leq 0.001$ in group A (326.40±3.05) compared to group B (310.80±3.31) with 't' value (9.09). Quality of life showed significantly increased ingroup A (5.77±0.53) compared to group B (5.23±0.66) with 't' value (3.33) and $p \leq 0.001$. Ground walk training showed significant improvement on endurance capacity and quality of life in COPD patients compared to treadmill training.

Keywords

Treadmill Training, Endurance, Quality of Life, COPD

Submission: 10 July 2022; **Acceptance:** 27 February 2023

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Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common pulmonary disease worldwide and is characterized by progressively persistent airflow limitation. The economic and social burden of COPD is substantial and increasing. COPD will be the seventh leading cause of disability-adjusted life years and the fourth leading cause of death in 2030 (Zeng et al., 2018). The prevalence of COPD is constantly increasing, while its incidence is growing in old age. COPD is also a leading cause of morbidity worldwide, particularly in developing countries. Whereas COPD is an obstructive and progressive airway disease, it is also associated with a significant reduction in physical activity, and psychological problems, all of which contribute to the patient's disability and poor quality of life. Recently, emphasis has been placed on questionnaires designed to assess health status and prognosis in COPD (Corhay et al., 2013). The treatment of individuals with lung disease has recently witnessed widespread multidisciplinary application of scientific approaches. A rehabilitation programme has become the norm of care for many patients with crippling chronic pulmonary illness thanks to the discovery of techniques to increase exercise training, lessen dyspnea, and improve living. Despite the fact that the underlying illness is initially limited to the lungs, the physical deconditioning and emotional reactions to chronic respiratory disease have a significant role in the morbidity that results (Hillas et al., 2015).

The apparent paradox is that the pulmonary rehabilitation identifies and treats the systemic effects of COPD, such as peripheral muscle dysfunction resulting from physical inactivity and/or systemic inflammation, muscle wasting, inadequate self-management skills, anxiety, and depression (Agustí et al., 2020). Pulmonary rehabilitation intents to restore patients to an independent, productive and satisfying lifestyle. Patient with moderate to severe chronic obstructive pulmonary disease or asthma who is in a stable condition, but whose debility interferes with the quality of life is the perfect candidate for the rehabilitation program. Exercise intolerance and poor quality of life are commonly addressed issues in COPD (Sanseverino et al., 2018). Pulmonary rehabilitation serves as an important component in the management of COPD by increasing exercise capacity and quality of life (McCarthy et al., 2015). Exercise-based pulmonary rehabilitation improves exercise tolerance and functional capacity, thereby improving occupational work tolerance and quality of life in COPD individuals (Chandrasekaran, & Reddy, 2018). The capacity for increasing access to these programs may be hampered by various factors including cost, accessibility and patient's mobility limitations.

Many trials focused on rehabilitation, including systemic exercise for at least four weeks that was offered to patients with COPD; treated patients being compared with control patients who were offered only conventional community care. The length of the program varies from six to twelve weeks in duration. It leads to substantial improvements in symptoms, (especially dyspnea and fatigue), exercise tolerance, and health-related quality of life. Pulmonary rehabilitation is mainly fascinated by equipment-dependent training such as treadmill and cycle training. But not all patients are affordable due to its high cost of pay for the entire treatment course which may vary from six to twelve weeks. Whereas the advantages of ground walk training are the simplicity of performance and an easy way to implement in monitoring of exercise training program. Though, ground walk training is very feasible and easily accessible by the patients, it is still not been practiced widely as an alternative to treadmill training in pulmonary rehabilitation. Hence, the primary goal of pulmonary rehabilitation emphasizes on increased activity levels through

promoting a healthy lifestyle that are associated with less cost of healthcare utilization and increased long-term survival. Due to the increasing prevalence of COPD, evaluating and comprehending the different type of modes of training that are broadly available and easy to implement should meet the growing demand. If walk training is effective in improving endurance capacity and quality of life in people with COPD, compared to equipment-dependent training such as treadmill training, it would provide an easily available training modality, particularly for those living in places with limited resources such as rural and remote areas. This study aims to evaluate supervised and individually prescribed ground walking as a training modality in people with COPD and to determine the effects of ground walk training on endurance capacity compared to the commonly used treadmill training.

Methodology

A total of 36 patients were sent to the pulmonary rehabilitation by the Physician. Out of which, 33 patients met the inclusion criteria and 3 were excluded. A total of 33 patients participated and were randomized into two groups by systematic sampling method. Initially, Group A (Ground walk training) consisted of 16 patients and Group B (Treadmill training) of 17 patients. Later, one patient was lost to follow up due to exacerbation in Group A and 2 patients discontinued from Group B, one due to exacerbation and the other patient was not willing. Hence, a total of 30 patients, 15 in each group, completed the study. Quasi experimental study design was adopted for the study. In the current study, the pre-test measurement of six-minute walk test and chronic respiratory disease questionnaire were noted before the intervention - ground walk training (for Group A) and treadmill training (for Group B). The post test measurements were taken after the six weeks of treatment duration. The study was approved by PSG Research & Ethical Committee and the study was done in the Department of Pulmonology, PSG Hospitals, Coimbatore. Total study duration was eight months. Group A (n = 15 participants) received ground walk training and Group B (n = 15 participants) received treadmill training. Frequency of the treatment was same for both the groups - 3 days/week for six weeks; 30 - 45mins/session). Individualized walking programme in treadmill training with Modified Bruce Protocol. Only out patients presented with COPD referred from the unit of Pulmonology in PSG hospitals, Coimbatore were chosen as population for this study. A total 30 patients were selected by systematic sampling method. Criteria for inclusion includes COPD stage – II to IV (GOLD) and COPD patients with reduced exercise tolerance (Modified Borg Scale – Score >3). Exclusion criteria include patients with acute exacerbation of COPD within the previous month, significant co-morbidities including cardiovascular disease, malignancy systematic disorders, physical limitations such as orthopedic impairments and patients with walking aid. Endurance capacity was measured using six-minute walk test and quality of life was measured using Chronic Respiratory Disease Questionnaire. Baseline assessment was taken on the first visit for all the 30 participants who met the inclusion criteria. Both pre-test and post-test measurements of six-minute walk test and Chronic Respiratory Disease Questionnaire were noted and SPSS version 18 was used for statistical analysis.

Table1. Demographic Data

Characteristics	Group	N (%)
Age	45 – 60 years	51.46 ± 4.22
Gender	Male	18 (60%)

	Female	12 (40%)
BMI	22 - 26	23.42 ± 1.41
Socio-economic level	Low	4 (13.3%)
	Moderate	18 (60%)
	High	8 (26.7%)

The demographic data of the patients were age, gender, BMI and socio-economic level as shown in Table 1.

Table 2. Endurance Capacity (Using Six-minute walk test in meters)

Groups	Mean Values	n	Mean Difference	SD	t-value	P-value
Group A (Pre test)	255.66	15	70.74	3.05	64.85	<0.001
Group A (Post test)	326.40					
Group B (Pre test)	252.33	15	58.47	3.31	56.74	<0.001
Group B (Post test)	310.80					

The Mean values, mean difference, SD, t-value and P-value of Six minute walk test scores of Group A and Group B are shown in Table 2.

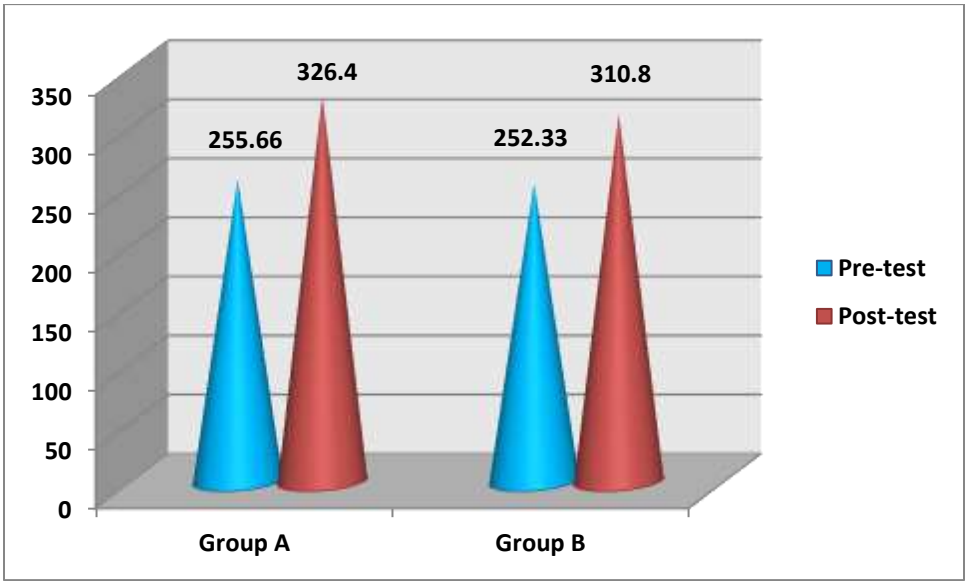


Figure 1. Pre-Test and Post Test Mean Values for Endurance Capacity

Table 3. Quality of Life (Using Chronic Respiratory Disease Questionnaire)

Groups	Mean Values	n	Mean Difference	SD	t-value	P-value
Group A	4.59					

(Pre test)		15	1.18	0.53	13.11	<0.001
Group A (Post test)	5.77					
Group B (Pre test)	4.45	15	0.78	0.66	8.66	<0.001
Group B (Post test)	5.23					

The Mean values, mean difference, SD, t-value and P-value of Chronic Respiratory Disease Questionnaire of Group A and Group B are shown in Table 3.

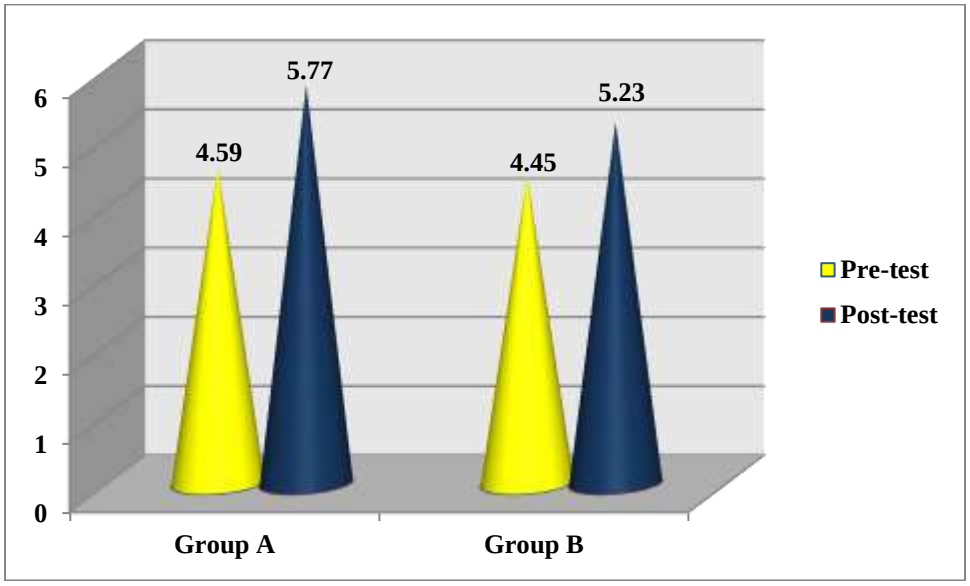


Figure 2. Pre-Test and Post Test Mean Values for Quality of Life

Table 4. Mean Difference Values for Endurance Capacity & Quality of Life of Group A & Group B

Groups	Mean Difference	SD	t-value	p-value
Endurance Capacity	10.87	3.18	9.09	<0.001
Quality of life	0.4	0.34	3.33	<0.001

The Mean difference, SD, t-value and P-value of endurance capacity and quality of life between the Groups are shown in Table 4.

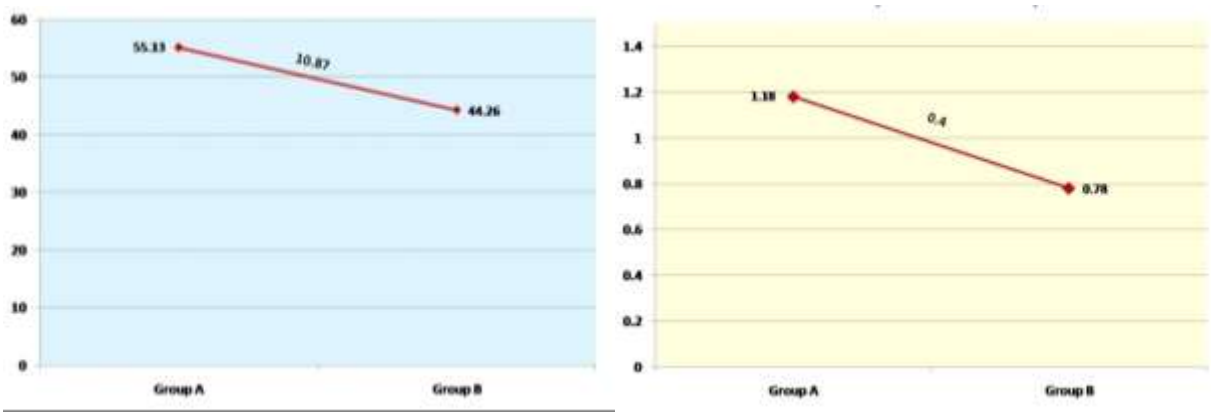


Figure 3. Mean difference values for Endurance Capacity and Quality of Life of Group A and Group B

Results and Discussion

The post intervention values of endurance capacity (mean = 310.80) and quality of life (mean = 5.77) is increased than pre intervention (mean = 255.66; mean = 4.59) in Group A who received ground walk training. The post intervention values of endurance capacity (mean = 326.40) and quality of life (mean = 5.23) is increased than pre intervention (mean=268.80; mean = 4.45) in Group B who received treadmill training. The improvement rate of endurance capacity in Group A (55.13) is higher than Group B (44.26). The improvement rate of quality of life in Group A (1.18) is higher than Group B (0.78). From the above data, the pre-test and post-test mean values for endurance capacity in Figure 1 and the pre-test and post-test mean values for quality of life in Figure 2 shows that patients who received ground walk training in Group A was significantly better than patients who received treadmill training in Group B. Figure 3 shows the mean difference values for Endurance Capacity and Quality of Life between the Groups.

Pulmonary rehabilitation (PR) is now the standard of care for individuals with COPD who remain symptomatic despite bronchodilator therapies (Marciniuk et al., 2010). Exercise training is a cornerstone of pulmonary rehabilitation (PR) and the management of COPD. The evidence on positive effects of exercise training programs with or without other elements of PR on dyspnea, exercise capacity, and health-related quality of life in people with COPD is overwhelming (Frei et al., 2022). Many pulmonary rehabilitation programmes are designed around cycling and treadmill walking as the primary training modalities. There has been a growing interest in the effectiveness of ground-based walking programmes to improve exercise capacity and quality of life, given that ground-based walking training is simple to perform, readily available and easy to administer as it requires no exercise equipment (Wootton et al., 2014). The present study is mainly focused on supervised, progressed ground walk training and has found a significant increase in endurance capacity compared to supervised, progressed treadmill training in COPD patients. Although, ground walk training requires no equipment, it has not been evaluated extensively as a training modality in patients with COPD. Previous studies used treadmill and have examined walk training in COPD. But it showed only a lesser degree of improvement in the endurance level in the walk training group. This is mainly because of the unsupervised or self-monitored training by the patient itself. Few other studies also used unsupervised walking programs that either had a high drop-out

rate (Regina et al., 2010) at the rate of 20% from the rehabilitation group and 23% from the control group. The main reason for dropping out was the difficulty in finding a suitable training site. The two main important finding of this study – ground walk training is more functional and easier to perform compared to treadmill training. And one of the drawbacks of treadmill training was the lack of confidence and fear component that made almost all the participants who underwent treadmill training to feel difficult to walk initially but improved in their walking pace gradually. The results shows that there is a significant increase in the endurance capacity and quality of life in ground walk training group when compared to treadmill training. The two main limitations of this study are - lack of a control group of no exercise training and it was highly impossible to control the normal walk at home for the participants in Ground walk training group. Since, ground walk training is very feasible and cost-effective, it is further recommended to be carried out in community-based levels. Further studies can be done in large samples. Six-minute walk test performed in the Treadmill itself can be taken as an outcome measurement.

Conclusion

In summary, the current study provides an efficient ground walk training programme with good compliance and clinical outcomes in improving endurance capacity and quality of life in patients with Chronic Obstructive Pulmonary Disease. It is simple, easy to perform, requires no equipment, time and cost saving. In conclusion, this study enhances the inclusion of the ground walk training as a substitute to Treadmill training in pulmonary rehabilitation for patients with COPD. Since, treadmill training is not affordable by all the people, ground walk training meets the growing demands of COPD especially in places with limited resources such as rural and remote areas.

Acknowledgement

The authors sincerely thank Prof. Baskaran C, Manipal University, Karnataka, India for his support and logistical help to conduct this research.

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