

# The Effectiveness of Home Based Pulmonary Rehabilitation in Elderly Patients with COVID 19 Infection

COVID 19 Geçirmiş Geriatrik Hastalarda Ev Temelli Pulmoner Rehabilitasyonun Etkinliği

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## Abstract

While Coronavirus disease-2019 (COVID-19) affects the whole world, most affected group is geriatric individuals. There is a need for strategies for geriatric individuals returning to society and their social life. The aim of this study is to investigate the effect of an 8-week home-based Pulmonary Rehabilitation program on quality of life, depression, anxiety and functional capacity in geriatric individuals with COVID-19. Twenty-five patients were included in this prospective study. Patients over 65 years of age with COVID-19 were evaluated. Physical capacity with the 6-minute walking test (6MWT), dyspnea status with the Medical Research Council Dyspnea Scale, quality of life with the Short Form-36 (SF-36), depression and anxiety with the Hospital Anxiety and Depression Scale were evaluated. The mean age of the patients included in the study was  $68.9 \pm 6.4$  years. 56% of the patients were men and 44% were women. When pre-treatment and post-treatment values were compared, a significant improvement was found in the 6MWT, dyspnea scores, SF-36 and all subgroups, anxiety and depression scores ( $p < 0.05$ ). This study shows that the home-based Pulmonary Rehabilitation program is an effective method on parameters such as quality of life, depression and physical capacity in geriatric individuals with COVID-19. Prospective large-scale studies are needed to validate our current results.

**Keywords:** Covid-19; pulmonary rehabilitation; quality of life

## Özet

Coronavirüs hastalığı-2019 (COVID-19) tüm dünyayı etkilerken en çok etkilenen grup geriatrik bireylerdir. Geriatrik bireylerin topluma ve sosyal yaşamlarına dönmeleri için bazı stratejilere ihtiyaç vardır. Bu çalışmanın amacı, COVID-19'lu geriatrik bireylerde 8 haftalık ev temelli Pulmoner Rehabilitasyon programının yaşam kalitesi, depresyon, anksiyete ve fonksiyonel kapasite üzerine etkisini araştırmaktır. Bu prospektif çalışmaya 25 hasta dahil edildi. COVID-19 geçirmiş 65 yaş üstü hastalar değerlendirildi. Fiziksel kapasite 6 dakikalık yürüme testi (6DYT) ile, dispne durumları Medical Research Council Dispne Skalası ile, yaşam kalitesi Kısa Form-36 (KF-36) ile, depresyon ve anksiyete durumları ise Hastane Anksiyete ve Depresyon Ölçeği ile değerlendirildi. Çalışmaya dahil edilen hastaların ortalama yaşı  $68.9 \pm 6.4$  idi. Hastaların % 56'sı erkek, % 44'ü kadındı. Tedavi öncesi ve tedavi sonrası değerler karşılaştırıldığında 6DYT, dispne skorları, SF-36, anksiyete ve depresyon skorlarında anlamlı iyileşme saptandı ( $p < 0.05$ ). Bu çalışma, ev tabanlı Pulmoner Rehabilitasyon programının COVID-19'lu geriatrik bireylerde yaşam kalitesi, depresyon ve fiziksel kapasite gibi parametreler üzerinde etkili bir yöntem olduğunu göstermektedir. Mevcut sonuçlarımızı doğrulamak için ileriye dönük büyük örneklem büyüklüğüne sahip çalışmalara ihtiyaç vardır.

**Anahtar Kelimeler:** Covid-19; pulmoner rehabilitasyon; yaşam kalitesi

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## 1. Introduction

Coronavirus Disease 2019 (COVID-19) is an infectious disease that was identified in Wuhan, China in late December 2019. This disease has affected many countries and millions of people with high infectiousness rates (1). Although many people with COVID-19 undergo the disease mildly and without complications, approximately 5% of patients are admitted to Intensive Care Units (2). COVID-19 mainly affects the respiratory system; however, it can also cause physical, psychological, and systemic involvements. Although COVID-19 is a threat to the general population, it is also known to affect the elderly more in particular (3). It is considered to be more mortal in people with underlying diabetes, hypertension, cardiovascular disease and cerebrovascular disease (4, 5). It is already known that elderly and people with comorbidities have higher morbidity and mortality; however, there are not enough data on how the return to the society and integration of the survivors will be. It is considered that supportive rehabilitation programs can be used during this period.

The purpose of Pulmonary Rehabilitation (PR) is to reduce the physical and psychological symptoms of individuals with pulmonary disease-related disabilities, improve their quality of life, and ensure that they return to the highest functional capacity possible (6,7). Most PR programs are performed under the supervision of a healthcare professional. Home-based PR has been proposed as an alternative to hospital-based programs.

PR is important as COVID-19 is a respiratory infection. Many experts recommend PR programs to improve respiratory, physical and psychological impairments in COVID-19 patients (8, 9) While COVID-19 continues to affect the whole world, online exercise programs and home-based exercise programs are becoming more preferable as access to health resources can be restricted (10). There are not adequate data on the effectiveness of PR in patients with COVID-19. In this study, our purpose is to examine the effect of home-based PR program on quality of life,

depression, anxiety, functional capacity in geriatric patients with past COVID-19.

## 2. Patients and Methods

Geriatric patients with COVID-19 infection who were admitted to our clinic PR Unit were included in this study. The criteria for being included in the study were as follows; 1) Being diagnosed with COVID-19, 2) being 65 years of age or older, 3) having a mini-mental status score of >21, 4) not having any other chronic respiratory disease (such as COPD), 5) not having moderate or severe heart disease, 6) not having a condition that would prevent participating in the rehabilitation program (psychiatric, neurological). Before the study was initiated, approval was obtained from the local ethics committee (approval number 2021/08), and the study was conducted according to the Helsinki Declaration. Written informed consent was obtained from all participants included in the study.

### *Participants*

At first, 36 patients were included in the present study. A total of 11 patients did not meet the inclusion criteria. Six patients did not meet the inclusion criteria, 5 patients did not give consent to participate in the study.

### *Assesment*

The socio-demographic and clinical data of the patients were obtained from patient files. The clinical data of the patients before and after the treatment were recorded from patient files. The patients were taken to an 8-week home-based PR program. All patients were given detailed information on the PR Program, and informed consent forms were obtained. Weekly phone calls were made to increase the exercise compliance of the patients. Physical examinations and clinical evaluation scales of all patients were done by the same doctor before and after the rehabilitation program (in the 8thweek).

### ***Evaluation of Physical Capacity***

The exercise capacity measurement of the patients was done with a 6-Minute Walking Test (6MWT). Patients, who rested for 10 minutes before the test, walked on a specially marked 20-meter corridor. At the end of 6 minutes, the distance was recorded in meters (11).

### ***Evaluation of Dyspnea Status***

The dyspnea status was recorded from patient files and were then evaluated with medical research council dyspnea scale (MRC) measured scores. The MRC is a scale in which patients choose the expression that best describes their dyspnea levels, out of five statements on dyspnea status. High scores in MRC show higher dyspnea perception (12).

### ***Evaluation of Depression and Anxiety Status***

Hospital Anxiety and Depression Scale (HADS) scores, which are used to evaluate the anxiety and depression levels of patients, were recorded from patient files. HADS consists of a total of 14 items, each of which is scored in the range of 0-3 points. High scores show the presence of more severe anxiety and depression (13).

### ***Evaluation of Quality of Life***

Quality of life was evaluated with Short Form-36 (SF-36). The SF-36 consists of 8 different sub-scales, which are; physical function, social function, pain, restriction due to emotional problems, mental health, general health perception, energy/fatigue and physical problems (14). Each subscale is scored between 0 and 100, and the height of the score shows better quality of life.

### ***PR Program***

Participants underwent a home-based respiratory rehabilitation program 3 days a week for 8 weeks in addition to clinical treatment and recommendations related to COVID-19. Before the respiratory rehabilitation program started, patients were informed about general precautions, such as exercise habits and smoking. All patients were given a standard exercise program by the

same doctor. Also, all patients were given a brochure and video recording containing the exercise program by the same doctor. The same doctor made weekly phone calls for 8 weeks to provide standardization and identify problems. Exercise program consisted of pursed lip breathing, bending forward posture, diaphragmatic breathing (abdominal breathing), relaxation exercises, upper extremity-shoulder girdle exercises, and endurance exercises.

In pursed lip respiration, the patient breathes from his/her mouth for a few seconds, and then gradually exhales from his/her mouth in whispering position. S/he then sits in forward-leaning posture (a forward tilt position of 20-45 degrees according to the vertical axis), and in this way, does pursed lip respiration.

In the diaphragmatic breathing technique, the patient lying in the supine position puts the dominant hand on the upper-middle of the abdomen and non-dominant hand on the anterior-upper of chest area. S/he then breathes through the nose, gradually exhales with pursed lip respiration. During this procedure, while the hand on the chest does not move as much as possible, the diaphragm is moved to the abdomen as loose as possible. During inspiration, the patient feels that the abdomen rises despite the motionless status of the rib cage. The patients were told about the exercise program consisting of breathing muscles exercises, upper extremity-shoulder girdle exercises and endurance (resistant aerobic) exercises. They were also told to do gravity resistance exercises with 1-2kg weights for upper extremity-shoulder girdle muscles (subclavius, pectoralis major and minor, serratus anterior, trapezius upper and lower part, latissimus dorsi, sternocleidomastoid muscles) to be performed 3 times a week.

### ***Statistical analysis***

When the findings of the study were evaluated, the Statistical Package for Social Sciences (SPSS, Inc.; Chicago, IL, USA) for Windows 15.0 Program was used for statistical analyses. Clinical parameters were evaluated twice, before and after the treatment. "One Samples T test" was used to

calculate group averages, and “Paired Sample T Test” was used to compare pre- and post-treatment data. The data was expressed as mean ± standard deviation from the average data. Statistical significance level was considered to be  $p < 0.05$ .

### 3. Results

The mean age of the 25 patients who were included in the study was  $68.9 \pm 6.4$  years.

Among the patients, 14 were male and 11 were female; the sociodemographic data are shown in Table 1.

When the pre- and post-treatment values were compared, significant improvements were detected in anxiety and depression scores, 6MWT, dyspnea, SF-36 and all sub-groups ( $p < 0.05$ ). Pre- and post-treatment values are shown in Table 2.

**Table 1.** Sociodemographic data of the patients

Age (years) (Mean±SD †)	68.9 ± 6.4
Body Mass Index (kg/cm <sup>2</sup> )	26.8 ± 3.9
Marital Status	
Married (n/%)	16/ 64
Single (n/%)	9/ 36
Gender	
Male (n/%)	14/56
Female (n/%)	11/44
Smoking	
Yes (n/%)	3/12
No (n/%)	22/88
Comorbidity	
Hypertension (n/%)	11/44
Diabetes Mellitus (n/%)	8/32
Osteoporosis (n/%)	6/24

†: Standard Deviation

**Table 2.** Comparison of pre- and post-treatment values

	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	P
MRC †	3.1 ± 0.9	1.9 ± 0.3	< 0.001
6MWT ‡	112.7 ± 61.0	183.3 ± 72.1	< 0.001
SF-36 §-physical health	58.4 ± 6.2	72.6 ± 5.9	< 0.001
SF-36 §-social function	56.0 ± 4.2	74.2 ± 3.8	< 0.001
SF-36 §-pain	59.2 ± 6.4	78.7 ± 5.8	< 0.001
SF-36 §-emotional function	59.5 ± 3.3	72.7 ± 7.2	< 0.001
SF-36 §-mental health	61.7 ± 6.8	76.5 ± 7.9	< 0.001
SF-36 §-energy	62.8 ± 4.3	79.2 ± 3.6	< 0.001
SF-36 §-general health status	63.2 ± 6.4	73.9 ± 5.7	< 0.001
Anxiety score	54.7 ± 7.3	43.4 ± 7.9	< 0.001
Depression score	55.8 ± 5.2	41.5 ± 9.2	< 0.001

†: Medical Research Council Dyspnea Scale, ‡: 6 Minute Walking Test, §: Short Form-36

### 4. Discussion

According to our present data, this study is the first to show the effectiveness of the home-based exercise program in geriatric individuals who underwent COVID-19. We

found significant improvements in physical capacity, anxiety, depression, dyspnea and quality of life scores with the 8-week home-based PR program.

It is not clear whether permanent lung and/or physical damage will prevail in people with COVID-19 pneumonia. However, in those who are particularly elderly and who need intensive care hospitalization, limitations may occur in terms of respiratory functions and gas exchange (15). It is considered that this disorder in respiratory function may be because of some residual fibrotic lesions (16). In this context, many people who have COVID-19 will need PR programs.

PR programs are used as part of the treatment programs in many respiratory system diseases, especially in Chronic Obstructive Pulmonary Disease (COPD). There are no adequate data on PR practices in people who have COVID-19. Liu et al. applied a hospital-based PR program for 6 weeks in geriatric individuals with COVID-19. At the end of 6 weeks, they found significant improvements in pulmonary functions and physical capacities of their patients (17). Similarly, in our study, we also found significant improvements in physical capacity. Long-term inactivity and muscle pain are the most important problems in people with COVID-19. Similarly, the most important factors that limit physical capacity in COPD patients were shown to be muscle fatigue rather than dyspnea (18). In cases of immobilization such as bed rest in the skeletal muscle, motor loss, decrease in muscle mass, and in physical capacity occur (19). Reidy et al. (20) found that even a decrease in the number of daily steps in geriatric individuals was associated with muscle strength. Isolation, quarantine and subsequent muscle pains in people with COVID-19 might be the factors reducing muscle strength. Replacing this decreased muscle strength is very important for increasing physical capacity and ensuring quality of life. The present study showed that physical capacity and quality of life increased with home-based PR program. The effect of PR on increased physical capacity and improvements in quality of life is related to the changes in gas exchange, ventilation, cardiovascular function, and skeletal muscles.

The COVID-19 pandemic continues to have effects both in psychological and physical terms. As with SARS and MERS viruses, viral infections and subsequent quarantine period may result in depression and anxiety disorder (21). Covid-19 patients who have psychiatric comorbidities have longer hospitalization periods and difficulty in healthcare services with increased medical costs (22). The positive effect of PR programs on anxiety and depression scores is known (23, 24). In our study, anxiety and depression scores decreased at significant levels with PR. Similarly, Liu et al. found significant decreases with PR in depression and anxiety scores (17). This improvement is very important for people to return to normal lives and for their motivations.

Although most PR applications are performed under the supervision of a healthcare professional in a hospital setting, home-based exercise programs are used less frequently (25). Difficulty in accessing PR programs is an important factor in less use of this intervention (26). As the COVID-19 pandemic continues in full speed, we believe that it may be more possible to spread home-based exercise programs and PR programs. Although no economic analyses have been done so far, it is clear that home-based PR programs will be cheaper than hospital-based PR programs. As the number of people affected by the pandemic increases, we believe that home-based PR programs might be more appropriate to relieve the demand for healthcare and related costs.

There are some limitations in this study. The number of patients was relatively small, and there were no long-term follow-ups. In addition, the clinical characteristics of the patients, such as disease severity, were not questioned. Long-term follow-up studies with larger number of patients are needed in future studies.

As a conclusion, home-based PR programs have positive effects on physical capacity, quality of life, anxiety, and depression in elderly individuals with COVID-19.

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