

# The effects of 6 weeks home rehabilitation program for non-ventilated COVID-19 patients after discharge: A case report

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## Abstract

COVID-19 disease is a pandemic that affects the cardio-respiratory system and causes other systemic problems. The effect of pulmonary rehabilitation (PR) programs for COVID-19 disease sequelae is not clear. The aim of this study was to investigate the effects of PR on COVID-19 sequelae. A 52-year-old patient was hospitalized for 8 days, and the complaints of fatigue and dyspnea continued after being discharged. For this reason, an exercise program was recommended. The patient underwent a 6-week PR that consisted of breathing, aerobic, and resistance exercises under supervision. After 6 weeks of the PR, complaints of dyspnea and fatigue decreased. There were also improvements in aerobic capacity and quality of life scores. The PR caused improvements in cardiorespiratory system complaints on a non-ventilated COVID-19 patient.

**Keywords:** Coronavirus, COVID-19, Pulmonary rehabilitation, Dyspnea, Aerobic capacity

## Introduction

Coronavirus disease 2019 (COVID-19) has entered the world's agenda from Wuhan city in December 2019. The disease was noticed rapidly after increased unknown pneumonia complaints [1]. Today, it has become a pandemic and spread all over the world. The total number of cases in the world had approached 7 million in June 2020. On the same date, the official number of cases in Turkey was 169K. While worldwide death rate was 5.90%, it was 2.75% in Turkey.

COVID-19 is transmitted from person to person through secretions and has a broad-spectrum chain of symptoms after transmission [2]. Some of these symptoms include dyspnea, headache, weakness, fatigue, shortness of breath, dry cough, chills, fever, myalgia, anosmia, and diarrhea [3]. The most prominent symptom which causes mortality is dyspnea. Also, respiratory capacity loss, seen in diseases such as pneumonia and acute respiratory distress syndrome, can be observed in COVID-19 patients [4].

Reducing the symptoms of the respiratory system and strengthening the immune system is possible with physiotherapy and rehabilitation programs [2, 4]. Especially aerobic and respiratory exercise programs are recommended because of the healing and protective effect of exercise against COVID-19 comorbidity and risk factors [5]. However, the long-term effects of COVID-19 pandemic are not clear. For this reason, there are no specific pulmonary rehabilitation protocols for COVID-19 disease.

The purpose of this case study is to examine the effects of pulmonary rehabilitation programs on non-ventilated COVID-19 patients' symptoms and compliance.

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## Informed Consent

The authors stated that the written consent was obtained from the patient presented with images in the study.

## Conflict of Interest

No conflict of interest was declared by the authors.

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## Case presentation

The patient was informed about the rehabilitation program, and he agreed to participate in the study. Written consent was obtained.

The participant was a 52-year-old male patient diagnosed with COVID-19. He was admitted to the hospital with fever, shortness of breath, dry cough, anorexia, and fatigue symptoms and diagnosed with COVID-19. He was hospitalized for 8 days at the ward, and administered anti-malaria, anti-influenza drugs, antibiotics, antipyretics, and gastroprotective medication during hospitalization. After the symptoms decreased and the diagnostic test result was negative, discharge procedures were started. Azithromycin dehydrates and terbutaline sulfate agents were prescribed to protect against upper respiratory tract infections and relax the bronchial muscles during discharge. The internal medicine specialist recommended the patient to exercise at a level that would not increase shortness of breath to improve the cardiorespiratory situation.

Rehabilitation phases were divided into two main parts, as respiratory exercise that consisted of thoracic expansion exercise (5 min/day), diaphragmatic breathing, pursed-lip breathing, coughing training and general exercise that consisted of aerobic and resistance training. Breathing exercises were supervised by the physiotherapist with 10 repetitions and 3 sets performed every day for six weeks. We used a 6-minute walking test for aerobic capacity estimation.

Aerobic exercise was performed with 50-60% HR<sub>max</sub>. HR<sub>max</sub> was calculated with the Karvonen formula. For resistance training, the patient used a yellow iso flex band with bare hands for upper and lower extremity big muscle groups for 10 min/day. Also, the patient performed mini-squats (10x3 repetition) and sit-to-stands for 30 sec/day. All these exercises were performed at home under the supervision of a physiotherapist for 6 weeks. Approval was obtained from the patient for the presentation of this case.

The demographics, weight, comorbidity, the presence of other illnesses during the last 6 months, onset complaints of disease, the existing complaints before the exercise program and the hospital process of the patient was questioned. 6-Minute-Walking Test (6-MWT), EuroQol (EQ-5D), sit to stand test, chest circumference length test (CCLT) and Breathing Frequency (BF) were performed.

During his hospitalization period, the patient, who is military personnel, lost 3 kilograms of weight, and his BMI decreased from 24.17 to 23.17. He had no chronic illness and no history of any diseases such as the flu, colds, chronic cough, fever, or others in the past 6 months. Before a hospitalization, he had weakness, fatigue, shortness of breath, anorexia, dry cough, and sore throat complaints. His anorexia, and runny nose complaints continued after discharge, but had completely regressed at the end of the exercise program. No adverse effects were observed throughout the exercise program.

Dyspnea and fatigue were evaluated on a 10-category scale. The results of dyspnea and fatigue scores before the exercise program were 4/10 and 5/10, respectively. Both scores decreased to 1/10 after the intervention. The patient increased the walking distance by 189 meters in 6 minutes and increased

repetition of the sit-to-stand test by 8 cycles compared to baseline. Also, quality of life scores improved 3 points, and the result of the patient's self-reported general health status reached 80% of the pre-disease normal. Other results are shown in Table 1.

Table 1: All Assessment Results of the COVID-19 Patient

Parameter	Subtitle	Before	After
		Intervention	Intervention
Dyspnea		4	1
Fatigue		5	1
6-MWT	Distance (m)	390	579
EQ-5D	Total	8	5
	General Health Status	50	80
STS		9	17
BF		26	19
CCLT	Inspiration (cm)	94	101
	Expiration (cm)	85	78

6-MWT: 6-minutes walking test, EQ-5D: EuroQol-5D, STS: Sit-to-Stand test, BF: Breathing Frequency, CCLT: Chest circumference length test

## Discussion

COVID-19, which starts with atypical pneumonia, mostly affects the respiratory and cardiac systems. PR has great importance for multi-systemic disease. In this study, PR caused improvements in dyspnea, aerobic capacity, muscle endurance, and quality of life scores.

Physiotherapy programs should be administered both during hospitalization after the patient has stabilized and after discharge to compensate for multi-systemic losses. However, according to some studies, the PR process should not start very early. Deep and slow breathing, thoracic expansion, diaphragmatic breathing, airway cleaning techniques, sitting up, active extremity exercises, walking, and cycling exercises should be started to the COVID-19 patients in the post-acute phase [6].

While the aim of short-term PR in COVID-19 should be to reduce dyspnea as much as possible, the long-term goal is to increase functions. The rehabilitation programs should be organized for these purposes.

The main aim of the PR for the non-ventilated and discharged COVID-19 patients is to reduce dyspnea and disability, as well as improve pulmonary capacity, and quality of life [7]. Especially patients with dyspnea should be carefully examined before the exercise program because the results of studies on rehabilitation practices in COVID-19 disease are not clear yet.

EQ-5D is one of the quality-of-life questionnaires used in lung diseases. Meta-analysis revealed that PR has the same positive effect in patients with idiopathic pulmonary fibrosis and chronic obstructive pulmonary disease (COPD) in terms of dyspnea and quality of life parameters. Also, it was highlighted that breathing exercises added to aerobic programs are a complementary method to improve dyspnea [8]. The pulmonary rehabilitation programs are an effective treatment method for improving the cardiorespiratory functions and quality of life in moderate to severe COPD [9]. The 4-month aerobic and breathing exercise program administered to COPD patients resulted in both statistically and clinically significant improvements in aerobic capacity and quality of life [10].

COPD is a common disease affecting many people all over the world. It is also commonly characterized by dyspnea and a decrease in quality of life. PR is widely used in the

treatment of COPD as it is an effective non-pharmacological treatment for dyspnea. A study showed that PR caused an improvement in dyspnea, tidal volumes, and quality of life. It has been reported that this increase in tidal volume contributes to the improvement of the respiratory pattern and improves dyspnea and quality of life [11].

Reduced exercise capacity and fatigue are two of the main physiological symptoms of sarcoidosis. Improvements can be seen in these two main symptoms with a 4-week PR [12]. Another study showed that 8-week respiratory rehabilitation improves dyspnea, exercise tolerance, and quality of life parameters [13].

A study found no difference in terms of aerobic capacity and quality of life between an 8-week home-based and hospital-based PR program. The lack of a significant difference in aerobic capacity was attributed to the fact that the 6-minute walk test was insufficient to evaluate the patients. However, in almost all respiratory system studies, 6 MWT was used to assess exercise capacity without disadvantages [14].

Postural, motor, and cardiorespiratory losses can be observed due to long-term rest during COVID-19 disease. PR applied to prevent these adverse effects improves exercise tolerance, respiratory muscle functions, and skeletal muscle functions in chronic pulmonary disease patients. A total of 2504 patients with COPD were included in a study and muscle strength, mass, and endurance of the patients increased after the exercise program. The mechanism of action of training in the rehabilitation of diseases with an obstructive pattern is based on the increase in ventilation and gas exchange, and cardiovascular, and limb muscle functions [15]. We think that the likely reason for the decrease in dyspnea is due to the improvements in the cardiorespiratory system.

The new type of coronavirus involves respiratory epithelial cells, leading to respiratory system problems. The 6-week pulmonary rehabilitation program administered to prevent respiratory involvement increased the quality of life of patients. In this study, the exercise program consisted of breathing, stretching, and home exercise programs performed two days a week, and a significant increase was noted in the quality of life of patients [15]. Many studies in the literature report that PR increases the quality of life in lung diseases. Similarly, in our study, the quality of life of the patient increased. We think that the psychological effect of exercise, decreased dyspnea, and increased aerobic capacity makes the patient more active in daily life activities.

### Conclusion

Our pulmonary rehabilitation program improved dyspnea, fatigue, aerobic and functional capacity, quality of life, and respiratory parameters in non-ventilated COVID-19 patients. The pulmonary rehabilitation program is used in cardiorespiratory system diseases and related complications as an evidence-based intervention. However, its effects on COVID-19 disease are still under investigation. We examined the effect of an exercise program administered to a clinically stable non-ventilated COVID-19 patient in this study. We know that COVID-19 disease adversely affects different systems of the body, especially the respiratory system. Supervised and planned exercise is an effective treatment method that can eliminate these

negative effects. Therefore, pulmonary rehabilitation has had positive effects on the parameters mentioned above.

This was a case report; hence, our results cannot be generalized to the public. There is a need for more randomized controlled studies with large samples to prove the effect of pulmonary rehabilitation in both discharged and inpatient COVID-19 patients, like those performed in other respiratory system diseases. In addition, evaluating the patients with more objective assessment methods is important to prove the effect of the treatment program. This study can be a reference to future studies and can serve as an example for both the clinicians and academicians.

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