

## Therapeutic exercise program to improve physical condition in patients with post-COVID-19 syndrome

### Programa de ejercicio terapéutico para mejorar la condición física en pacientes con síndrome post-COVID-19

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#### Abstract

Background: Post-COVID syndrome is a set of symptoms that persist for up to 3 weeks and even 3 months after the resolution of an acute process, which include predominantly fatigue and dyspnea, this greatly hinders the return to their activities of the people who suffer from it. Objective: To propose a therapeutic exercise program that includes evaluation criteria aimed at improving physical condition in patients with post-COVID 19 syndrome. Methods: The analysis of original articles and systematic reviews that included information in relation to Post-COVID-19 Syndrome, functional evaluation and treatments on Post-COVID-19 Syndrome, which included Therapeutic Exercise, Respiratory Physiotherapy and the evaluation of the post-COVID 19 patient, and bibliographic review as keywords that include physiotherapeutic intervention based on therapeutic exercise. Conclusion: Respiratory rehabilitation aims, in the short term, to relieve dyspnea and anxiety, while, in the long term, it is to recover the maximum functionality of the patient, improving their quality of life and facilitating their integration into society.

**Post COVID-19 Syndrome, Therapeutic Exercise, Physical Therapy in Post COVID-19 Syndrom**

#### Resumen

Fundamento: El síndrome post-COVID es un conjunto de síntomas que persisten hasta 3 semanas e incluso 3 meses tras la resolución de un proceso agudo, que incluyen predominio la fatiga y la disnea, esto dificulta en gran medida el regreso a sus actividades de las personas que lo padecen. Objetivo: Proponer un programa de ejercicios terapéuticos que incluya criterios de evaluación que tengan como propósito la mejora de la condición física en pacientes con síndrome post-COVID-19. Métodos: Se ejecutó el análisis de artículos originales y revisiones sistemáticas que incluían información en relación con el Síndrome post- COVID-19, la evaluación funcional y los tratamientos sobre el Síndrome Post-COVID 19, que incluyeran el Ejercicio Terapéutico, Fisioterapia Respiratoria y la evaluación del paciente post-COVID-19, mediante la búsqueda de palabras claves que incluyeran intervención fisioterapéutica a base de ejercicio terapéutico. Conclusión: La rehabilitación respiratoria tiene como objetivo, a corto plazo, aliviar la disnea y la ansiedad, mientras que, a largo plazo, es recuperar la máxima funcionalidad del paciente, mejorando su calidad de vida y facilitando su integración en la sociedad.

**Síndrome Post COVID-19, Ejercicio Terapéutico, Fisioterapia en COVID-19**

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## Introduction

The pandemic caused by the SARS-CoV-2 virus, named COVID-19 by the OMS, presents manifestations with different clinical responses in each human being, which may be asymptomatic, mild, moderate or severe (1). A significant proportion of infected persons report a series of objective and subjective clinical features, among which fatigue and dyspnea stand out.

The post-COVID syndrome is a set of symptoms that persist up to 3 weeks or even 3 months (2) after the resolution of an acute process, which predominantly include fatigue and dyspnea (3,4) together with other manifestations such as chest tightness and muscle pain, the latter without an established sequential pattern, but of variable intensity.

A post-COVID patient is the final stage or cure of the acute phase, in which the existence of organic damage may or may not be present, which in part may be influenced by the type of hospital treatment received or by the infection itself. In 2020, a study was carried out on 179 patients, of which 87.4% maintained the presence, particularly fatigue and dyspnea (5) after the acute stage.

In another study applied to 50 patients in a third level hospital in Puebla, 84% had persistent symptoms among the main ones were fatigue, tiredness and weakness, chest tightness and dyspnea (6).

With respect to residual dyspnea it may be due to residual pulmonary fibrotic changes, which may cause a restriction of physical activity due to difficulty in breathing due to decreased pulmonary function, resulting in a lower quality of life, which may occur in the phase following the acute phase as a progressive phase (weeks 2-5) with fibrin deposition and infiltration of inflammatory cells and fibroblasts, with evolution to a final phase (weeks 6-8) in which pulmonary fibrosis consolidates with collagen deposition and cellular proliferation of interstitial spaces (7), so that an intervention based on therapeutic exercises that increase lung capacity would help to reduce the risk of patients with pulmonary fibrosis that aggravates the functional status of post-COVID-19 patients.

## Justification

The most recurrent affections in post-COVID-19 patients on their physical condition are fatigue and dyspnea, in this sense, it was decided to carry out a study on the physiotherapeutic approach through the application of exercise programs for the improvement of physical condition in patients with post-COVID-19 syndrome, since it is essential to evaluate variables on training and knowledge of the physiology of physical activity in this type of population, since they have been determinant during the secondary care to the coronavirus. One of the elements mainly affected by the virus is the respiratory system, due to the appearance of respiratory failure in severe patients, observing the survival of the characteristic signs mentioned.

Aerobic exercise could have a great implication, due to the fact that when applied at medium/high intensities it produces adaptations in pulmonary ventilation and perfusion, as well as in the amount of air volume per breath. This leads us to believe that through therapeutic exercise, maximum oxygen consumption will increase, resulting in greater cost-effectiveness in gas exchange, aspects that may be fundamental for the treatment of fatigue and dyspnea in post-COVID-19 patients, thus favoring physical condition.

## Theoretical framework

At the Technological University of Xicotepec de Juárez during the four-month periods January-April and May-August 2021, a systematic review of the main articles published in English and Spanish by Cuban and foreign authors in journals such as *Revista Cubana de Medicina Física y Rehabilitación*, *Revista Mexicana Medicina Física y Rehabilitación*, *Revista Mexicana Medicina Física y Rehabilitación* and *Revista Chilena Enfermedades Respiratorias* was carried out, *Revista Mexicana Medicina Física y Rehabilitación* and *Revista Chilena de Enfermedades Respiratorias*, in which information was found related to the intervention of post-COVID 19 patients in the last months, produced by the SARS-CoV-2 coronavirus and its relationship with the clinical characteristics of fatigue and dyspnea.

Reija Ares (15) through his bibliographic review describes that many of the patients who suffered the disease point to the deterioration of tolerance to effort and the appearance of dyspnea as the main functional sequelae. The cause is due to respiratory dysfunctions caused by the pathology and prolonged periods of immobilization due to hospital admission.

The physiotherapeutic approach can start from the acute phase to the post COVID phase (16), for the study of this article we will focus on the last phase. The patient with COVID-19 goes through the different stages; since there are no established treatment guidelines for improvement depending on the patient's condition and the magnitude of the sequelae (17). Therefore, the intervention with therapeutic exercise may be maintained until the improvement of the physical condition is achieved.

Udina et al (18) suggest carrying out programs lasting 30 minutes/7 days per week working on: a) muscular endurance (2-4 exercises, 2 sets 8-10 repetitions, 30-80 % Maximum Repetition) through the execution of functional exercises of upper and lower limbs; b) cardiovascular endurance training (5-15 minutes with low intensity aerobic exercises such as cycloergometers); c) balance work (2 exercises, static/dynamic work, with the help of stable/unstable surfaces or functional exercises) and d) others (respiratory exercises). It should be noted that the authors propose to carry out each program individually, taking into account the patient's physical condition.

Arbillaga et al (19) recommend for patients who had a respiratory process secondary to mild-moderate COVID 19, the performance of aerobic exercise to recover the exercise capacity prior to hospital admission. In the case of patients who had a severe/critical process, they suggest: a) Aerobic training: low intensity and duration and gradually increase, 20-30 minutes of session duration, 3-5 sessions/week, always monitoring the patient's fatigue and/or dyspnea condition and b) Progressive strength training: work 1-3 muscle groups with a load of 8-12 repetitions, with training intervals of 2 minutes. The recommended frequency is 2-3 sessions/week for a minimum period of 6 weeks, increasing the load/week by 5-10%.

## General Objective

In this sense, the objective of this review is to propose a therapeutic exercise program aimed at improving physical fitness in patients with post-COVID-19 syndrome, through the following specific objectives:

## Specific Objectives

- To determine the clinical characteristics of post COVID-19 syndrome.
- To establish evaluation criteria for the post-COVID-19 patient.
- To propose a series of exercises that contribute to the improvement of the physical condition of the patient with post-COVID-19 syndrome.

Information reported from the INFOMED network and Medical Publication Journals was used; the analysis of original articles and systematic reviews that included information related to Post COVID-19 Syndrome, functional assessment and physical therapy treatments based on therapeutic exercise was carried out, consulting the databases Pubmed, ELSEVIER, SciELO and Original Publications without date restriction, in Spanish and English on Post COVID-19 Syndrome, Therapeutic Exercise, Respiratory Physiotherapy and the evaluation of the Post COVID-19 patient.

Very brief studies were located, but those that were not relevant to the objective of the review were excluded. In the articles that were used, it was possible to expose the main aspects affected in post COVID-19 patients and the variables of application to which treatments based on physical exercise and Respiratory Physiotherapy were applied, with the objective of offering a theoretical reference in relation to the post COVID-19 syndrome, the evaluation and the most recurrent rehabilitation treatments after the solution of the acute stage of the disease. The Google Scholar search engine was used and the keywords and connectors: Post-COVID syndrome, Post-COVID Physical Therapy and respiratory exercises; data extraction was performed according to a spreadsheet that summarized the questions of interest according to the objective of the review.

Based on the analysis of the aforementioned articles, a therapeutic exercise program including functional aspects for the improvement of physical condition in the patient with post-COVID-19 syndrome is proposed.

The proposed protocol suggests carrying out programs with a duration of 45-60 minutes of 3-5 sessions/week per week working:

- a) Aerobic training: low intensity and low duration and gradually increase, 20-30 minutes session duration (can start with 5-15 minutes with low intensity aerobic exercises such as cycloergometers).
- b) Progressive strength training: work 1-3 muscle groups with a load of 8-12 repetitions, with training intervals of 2 minutes.
- c) Muscular endurance (2-4 exercises, 2 sets 8-10 repetitions, 30-80 % Repetition Maximum) through the execution of functional exercises of upper and lower limbs.
- d) Balance work (2 exercises, static/dynamic work, with the help of stable/unstable surfaces or functional exercises).
- e) Breathing exercises, including the following:
  - Slow, deep and sustained inhalations (with shoulder elevation).
  - Diaphragmatic respirations, exhalations with pursed lips (observing improvement of desaturation).
  - Diaphragmatic training: placing a 1-3kg weight on the abdomen in the supine position and stretching the rib cage.
  - We performed 2 sessions/10min per day/for 6 weeks, instead of one session per day, personalized to the age and greater functional capacity of our patient.

Independent Variable	Dependent Variable	Assessment Method
Therapeutic exercise		Literature review
	Fatigue	Borg / 6 min test
	Dyspnea	Oximetry
	Functionality	Katz index

**Table 1** Variables and units of measurement for the evaluation of the Protocol

Taking into account the authors' recommendations, the usefulness of imaging tests for the diagnosis of the disease is indisputable; since in a previous study it was observed that residual lesions were frequent in chest CT after SARS-CoV-2 pneumonia and could persist up to 4 weeks after the onset of symptoms.

At the end of the program, a pulmonary ultrasound is recommended to observe the previously described alterations. It is expected that with the proposed exercise program an improvement in the 6min gait test, Katz index and pulse oximetry will be observed.

It is important to remember that during the development of any protocol involving physical activity in patients, cardiopulmonary exercise testing should be maintained for a period of two days as it provides an objective measure of exercise intolerance and recovery, as well as being important in the assessment of possible mechanisms of exercise limitation among individuals with Post-COVID syndrome (13-19).

## Conclusion

Respiratory rehabilitation aims, in the short term, to alleviate dyspnea and anxiety, while, in the long term, it is to recover the patient's maximum functionality from a good physical condition, thus improving their quality of life and facilitating their integration into society. It is important that therapeutic exercises and respiratory physiotherapy be indicated on an individualized basis, for which it will be necessary to carry out a prior comprehensive evaluation by means of a 6min gait test, Katz index and pulse oximetry.

Currently, the functional and anatomical sequelae that SARS-CoV-2 infection can cause are unknown. Up to 50 persistent symptoms have been identified at pulmonary, functional and systemic levels, so a correct evaluation of each particular case is recommended before applying physiotherapy techniques and considerations of the reactivation of the acute stage.

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