

## Application of a therapeutic exercise program to improve physical condition in patients with post-COVID-19 syndrome

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

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#### Abstract

The post-COVID syndrome is a set of signs and symptoms that can persist from 3 weeks to 3 months after the resolution of an acute process, predominantly including fatigue and dyspnea, this makes it very difficult to return to your activities. the daily life of those who suffer from it. The objective of the research is to propose a therapeutic exercise program that improves physical condition in patients with post-COVID 19 syndrome. To meet the objective, a search and analysis of articles that included information related to post-COVID syndrome was carried out. COVID-19, its evaluation and the treatments provided with therapeutic exercise and respiratory physiotherapy. The proposed program was applied to university staff and students who met the inclusion criteria. Two evaluations were carried out, one initial and one final; the results show significant data of improvement in physical condition. Conclusion: The proposed exercise program allows the patient to recover functionality, impacting the physical condition, which as a consequence improves the quality of life and facilitates their integration into society.

**Post COVID-19 syndrome, Therapeutic exercise, Physical therapy in post COVID-19 syndrome**

#### Resumen

El síndrome post-COVID es un conjunto de signos y síntomas que pueden persistir de 3 semanas a 3 meses después de la resolución de un proceso agudo, entre los que predominan la fatiga y la disnea, lo que dificulta mucho la vuelta a sus actividades. la vida cotidiana de quienes lo padecen. El objetivo de la investigación es proponer un programa de ejercicio terapéutico que mejore la condición física de los pacientes con síndrome post-COVID 19. Para cumplir con el objetivo, se realizó una búsqueda y análisis de artículos que incluyeran información relacionada con el síndrome post-COVID COVID-19, su evaluación y los tratamientos realizados con ejercicio terapéutico y fisioterapia respiratoria. El programa propuesto se aplicó al personal universitario y a los estudiantes que cumplían los criterios de inclusión. Se realizaron dos evaluaciones, una inicial y otra final; los resultados muestran datos significativos de mejora de la condición física. Conclusiones: El programa de ejercicios propuesto permite al paciente recuperar la funcionalidad, incidiendo en la condición física, lo que como consecuencia mejora la calidad de vida y facilita su integración en la sociedad.

**Síndrome post COVID-19, Ejercicio terapéutico, Fisioterapia en el síndrome post COVID-19**

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## Introduction

Based on the existing current bibliographic evidence, such as in the article: "Recommendations for physical exercise in a population with a post-COVID-19 diagnosis": The virus responsible for severe acute respiratory syndrome caused by a coronavirus SARS-CoV-2 (COVID-19) has been classified as a global health problem (1).

According to the page of "Our World in data", in the world there have been a total of 612 million confirmed cases, and a death toll of 6.53 million; In Mexico, from the beginning of the pandemic in March 2020 to September 2022, there has been a registered total of 7.07 million confirmed cases, and a figure of 330 thousand deaths as a result (2).

The number of people who, despite having suffered from the SarsCov2 virus disease, have survived is, according to some researchers, around 66% (3).

Among the cases of COVID-19 that have occurred, we find patients who developed severe disabilities using the Intensive Care Units (ICU), as well as other patients who were less severe, and who did not use medical specialties, who only remained in isolation when presenting symptoms; In both types of patients, both severe and acute, we will find functional deterioration as a consequence of the recovery processes. Let us remember that rehabilitation is different in each case from severity to history and many more variables of each individual, it can be from a minimal process to prolonged rehabilitation, especially in those individuals who have had a very important loss of functional activities. . In both cases, rehabilitation is necessary, and to favor the process in patients discharged from a medical service, exercise guided by specialists in the field is of utmost importance and part of the comprehensive treatment in physiotherapy.

## Justification

This research is carried out with the purpose of demonstrating the influence of therapeutic exercises and their contribution to improving the physical condition of post-COVID-19 patients.

Currently, cases of COVID-19 continue to occur, a disease that presents a series of sequelae, including fatigue and dyspnea (which is reflected as shortness of breath when performing simple activities), recurring in the vast majority of patients who have the sequelae of having suffered from the disease, thus affecting their functional status and basic activities such as climbing stairs or walking long distances.

According to the Comprehensive Report on COVID-19 in Mexico, several waves with great impact in the country have been identified; During the development of the variants, various scenarios have been presented for the implementation of organized responses by all the institutions that represent the Health Sector in our country, as well as other government agencies, to meet the demand for clinical care of patients. patients, as a consequence of the different scenarios proposed, the different specialties in the health area have an emphasis on treating the sequelae. With the aforementioned, the Academic Body of Physical Therapy of the Technological University of Xicotepec de Juárez, implemented a study that would allow evaluating the effect of a program that contributes to improving the physical condition and that affects the functionality of the patients and with it impact functionality and quality of life.

The application of the generated program seeks to be a reference for Physical Therapists to consider within their therapeutic exercise programs to integrate warm-up, stretching, coordination, balance and strength; this is transcendental because it seeks to provide tools to other health professionals, for the management of people in whom symptoms such as fatigue, dyspnea and muscle weakness persist, in a way that contributes to the improvement of their physical condition.

## Theoretical framework

Post-COVID-19 syndrome refers to the persistence of signs and symptoms after having suffered from the disease, among which are: dyspnea, fatigue and reduced ability to participate in activities of daily living (4,5,6).

The symptoms and signs can be varied; nevertheless, the two most frequent are fatigue and dyspnea, hence the importance of taking them as a reference for the protocol that is presented (4,5,6).

Currently there is still no specific treatment for this syndrome, despite this, the evidence shows a decrease in symptoms after completing a rehabilitation program. Therefore, the need to generate rehabilitation strategies to help people improve their condition after having suffered from the disease becomes evident (7,8).

Physical exercise is a systematic, planned, structured physical activity with the participation of repetitive movements which involve effort graded by intensity, which has a determined duration and is performed frequently, in order to achieve or maintain physical fitness or other specific objectives. In this regard, the World Health Organization WHO, (2020) recommends exercising or moderate physical activity at least 150 minutes a week, and in case of vigorous intensity, it recommends a total of 75 minutes. In turn, they recommend mixing both intensities and including at least two sessions of strength exercises. On the other hand, there are other recommendations that are specifically aimed at a population due to its particularities, age being a criterion for segmenting said processes. According to Matsudo, (9) stipulates that adults over 60 years of age should perform 180 minutes/day of physical activity with multicomponent exercises, involving cardiorespiratory fitness, muscle strength and balance, or failing that, remain as active as possible (10).

Based on the article "Post-COVID-19 physical rehabilitation in older adults": physical activity in the context of a pandemic can help maintain or improve exercise tolerance, maximum oxygen consumption, functional capacity, cardiovascular health, body composition, muscle strength. Any increase in physical activity can favorably reduce morbidity and the prognosis of various diseases, among other similar aspects (11, 12, 13).

Aerobic training to return to physical exertion should be gradual, individualized and based on subjective tolerance to exertion. The author mentions that patients should follow a regular program of aerobic exercise for 20-30 min, by cycling, walking, brisk walking, jogging, swimming, starting at low intensity and duration and gradually increasing: 20-30 min of exercise is recommended. duration of the session, 3-5 sessions/week, although it will always depend on the feeling of fatigue and/or dyspnea that each patient presents (14).

In progressive strength training: it is recommended to work on 1-3 muscle groups with a load of 8-12 repetitions, with training intervals of 2 minutes. The frequency would be 2-3 sessions/week for a minimum period of 6 weeks, increasing the load by 5-10%/week (14, 11).

After carrying out the reading of different articles, it is observed that several authors mention the performance of low or moderate intensity exercise, and contraindicate vigorous intensity exercise, because if there were an invasion of the myocardium by the COVID-19 virus, 19 could cause myocarditis, making the patient prone to heart failure, stroke or acute myocardial infarction that can cause death (11,12,15).

Let us not forget that some symptoms that may occur in post-COVID-19 patients are fatigue, dyspnea, chest pain, accompanied by a notable reduction in the immune system, which is why the patient is more vulnerable to developing pneumonia (16,17).

Taking into account the existing recommendations for the different populations according to their age, one of the objectives of the study is to establish specific data on physical exercise for those patients who have survived COVID-19 and who are discharged from a hospital environment, posing as a research question the following: what is the exercise that should be indicated to improve physical condition in patients diagnosed with post-COVID-19 syndrome? (18, 19).

Through physiotherapy treatment, fatigue and dyspnea should be addressed, as they are the main factors that generate continuous deconditioning, incidents of long-term cardiopulmonary and musculoskeletal complications (20).

From the respiratory point of view, the goal of physical therapy is to reduce the sensation of dyspnea, preserve lung function, reduce dysfunction, disability, and improve quality of life (11,13).

### General objective

The objective of this research is to generate an exercise program to improve the physical condition of patients with post-COVID-19 syndrome.

### Specific objectives

- Propose a series of exercises that contribute to improving the physical condition of patients with post-COVID 19 syndrome.
- Apply the exercise program integrating warm-up, stretching, resistance exercises and strength exercises.
- Promote muscle balance.
- Promote respiratory capacity.
- Assess the effects of therapeutic exercises.

### Methodology

The present study was of a quasi-experimental quantitative type, a functional evaluation and application of therapeutic exercises was carried out in patients with Post-COVID-19 Syndrome. The inclusion criteria included people between the ages of 18 and 56, a positive COVID test and symptoms such as fatigue and dyspnea after the disease. The exclusion criteria were: patients with uncontrolled chronic health conditions (Systemic Arterial Hypertension, Type II Diabetes Mellitus, among others), acute conditions (respiratory type) that make physical activity impossible, and patients older than 56 years.

Initially, the interview was carried out by filling out an identification form, later tests were applied and anthropometric measurements (height, weight, etc.) were taken to determine functional capacity; Following this, the candidate patients entered the rehabilitation protocol based on physical exercise.

The treatment program consisted of the application of 10 sessions of physical activity, with a frequency of four times a week, the duration of the treatment was 60 to 90 minutes per session. The session was divided into: warm-up; central phase where muscle strength and endurance exercises were worked on; aerobic training; balance exercises, and breathing exercises.

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|---|--------------------|--|
| Independent variable  | Dependent variable | Evaluation method                                      |
| Therapeutic exercise  |                    | Borg / 6 minute walk (6, 21,24)                        |
|   | Fatigue            | Oximetry (22)  |
|   | Dyspnoea           | Barthel (23)   |
|   | Physical condition | Fantastic  |
|   |                    | Fatigue Assessment Scale (FAS)                         |
|   |                    | Modified Medical Research Council Scale ( mMRC ) ( 23) |
|   |                    | Single Breath counting                                 |

**Table 1:** Variables and Units of measurement for the evaluation of the Protocol

Source: Own elaboration

### Results

Five patients participated in the application of the program, the youngest patient was 18 years old, and the oldest patient was 56 years old. Within the treatment protocol, 10 sessions were contemplated; of which the first adaptations occurred even from the first session.

The patients were evaluated in two moments, one at the beginning and one at the end of the application of the exercise program.

In the Fatigue Assessment Scale (FAS), in the initial mental evaluation, the minimum score was 13 and the maximum score was 24; Regarding the physical evaluation, the minimum score was 14 and the maximum score was 20. In the Modified Scale of the Medical Research Council ( mMRC ), only one patient obtained grade 3 in the initial evaluation and the others obtained grade 1. In the Barthel Index all patients obtained a score of 100. In the Fantastic test, one patient obtained a score of 44 in the initial evaluation, being the lowest and the highest score was 94. In the respiratory evaluation or Single Breath Counting the patient with a lower index was 21 words with a single breath with respect to the maximum that was 34 words.

According to the initial aerobic evaluation (6-minute walk), the lowest recorded heart rate was 72 beats per minute ( bpm ) and the maximum was 115 bpm , in oximetry the lowest percentage was 94% and the highest high 96%; Taking into account the BORG dyspnea and fatigue scale, the lowest score obtained was 3, and the highest score was 5. The last aspect evaluated was blood pressure, with the lowest data being 110/50 mmHg and the highest 140/90 mmHg.

Regarding the initial evaluation of strength, the maximum resistance (1RM) of 4 anaerobic exercises was taken into account, which were: bench press, minimum weight 2.3Kg and the highest 7.16Kg; military press, minimum weight 1.3Kg and the highest of 9Kg, in the squat minimum weight 5Kg and the highest was 12.02Kg and the last exercise was deadlift with a minimum weight of 4Kg and the maximum of 12.02Kg.

In the final part of the evaluation, the Berg test was implemented with a minimum score of 46 and a maximum of 56.

Once the treatment protocol was concluded, the reassessment was carried out, obtaining the following:

FAS in the mental reevaluation, the minimum score was 11 and the maximum score was 18; and in the physical evaluation the minimum score was 14 and the maximum score was 20. In the mMRC scale, two patients obtained grade 1 and the rest of the patients obtained grade 0. In the Barthel index, all patients obtained a score of 100 in the reevaluation. In the Fantastic test, the lowest level was 48 and the highest 93. One patient presented a value of 88, decreasing 6 points compared to the initial evaluation. In the Single Breath Counting the patient with a lower index was 21 words with a single breath with respect to the maximum that was 48 words.

Regarding the initial aerobic reassessment (6-minute walk), the lowest recorded heart rate was 75 bpm, and the maximum was 140 bpm. In oximetry, the lowest percentage was 94% and the highest was 98%; Taking into account the BORG scale in dyspnea and fatigue, the lowest score was 2 in both and 4 being the highest score; and in blood pressure, the lowest data recorded was 110/60 mmHg and the highest 110/80 mmHg, both considered within normal ranges.

In the re-evaluation of strength, the following was obtained: bench press, minimum weight of 5.7Kg and the highest of 9.59Kg; in the military press, minimum weight of 6.7Kg and the highest of 11Kg; in the squat, minimum weight of 9.6Kg and the highest was 14.45Kg and the last deadlift exercise, minimum weight 4.8Kg and maximum 12.02Kg.

In the Berg test, a minimum score of 51 and a maximum of 56 was obtained in the reassessment.

### **Analysis of results**

According to the results of the evaluations, we observed that in the mental FAS scale there was a decrease of 3.6 and a decrease of 4.4 in physical FAS, these data represent an improvement in the physical and mental evaluation of the patients. In the mMRC scale, in the initial assessment the mean was 1 grade and only 1 patient obtained grade 3; in the reassessment, the mean was 0 degrees and 2 patients obtained grade 1. That is, a positive decrease of 1 degree was obtained, which translates as beneficial changes in the activities of daily life of the patients, reducing dyspnea.

The results in the Barthel index remained at 100 points, so there were no changes.

Regarding the Fantastic test, in the initial assessment the mean score was 73.4 and in the reassessment, it was 77; the score increased 3.6, this translates into an improvement in lifestyle.

In the respiratory evaluation (Single Breath Counting) the mean of the initial evaluation was 24.2 and in the reassessment 34.4, which shows an increase of 10.2 words with a single breath. These data are significant because they contribute to the improvement of lung capacity, which has an impact on physical condition, only one patient did not show changes.

In the aerobic evaluation (6-minute walk) the mean heart rate in the initial evaluation was 81.2 bpm, in the oximetry the mean was 95.2%, in terms of the results of Borg dyspnea a mean of 4.2 was obtained, in fatigue a mean of 3.6, in blood pressure the mean was 110/80 mmHg; in the reassessment, a mean heart rate of 103.4 bpm was obtained, in the oximetry 96.2%, Borg dyspnea and fatigue the mean remained at 3, the mean blood pressure was 110/80 mmHg. The above shows an increase in heart rate of 22.2 bpm, an increase of 1% in oximetry, in Borg decreased dyspnea 1.2 and fatigue 0.6. Blood pressure was maintained and changes in vital signs after evaluation were satisfactory.

The results of the comparative strength evaluation indicate positive changes, obtaining an increase in the bench press of 2.16kg, in military press 1.88kg, in the squat 2.37kg and in the deadlift 1.24kg. In this category, one patient obtained the lowest results compared to the other patients.

Regarding the Berg scale, the results indicate an increase of 1.2. On this scale, one patient obtained the lowest scores in both evaluations. The remaining patients maintained the same data as at baseline. With the data contained at the moment, the treatment plan can be determined favorably, noting positive changes in the increase in physical condition, data that is evidenced in the independence of the patients.

## Conclusions

Physical activity in the context of a pandemic can help maintain or improve exercise tolerance, maximal oxygen uptake, functional capacity, cardiovascular health, body composition, muscle strength. It is argued that any increase in physical activity can favorably affect the decrease in morbidity and the prognosis of various diseases, among other similar aspects.

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