Functional capacity of post-Covid-19 patients: Impacts of a rehabilitation program

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ABSTRACT
Introduction: COVID-19 is an acute respiratory infection caused by the SARS-CoV-2 coronavirus, potentially serious, highly transmissible and globally distributed. Pulmonary rehabilitation can contribute to the relief of symptoms and the improvement of the functional capacity of patients affected by the infection. Objective: To evaluate the effects of a rehabilitation program on the functional capacity of post-COVID-19 patients. Methods: This is an exploratory, experimental, descriptive research with a quantitative approach. The research took place at the post-COVID-19 Rehabilitation Outpatient Clinic, located at the University of Vale do Taquari - Univates. At the evaluation, the participants performed the following functional tests: the 6-minute walk test (6MWT), the manovacuometry, the 10-meter walk test (10MWT), the digital dynamometry, the Medical Research Council (MRC) dyspnea scale and the Post COVID-19 Functional Status Scale (PCFS). Subsequently, participants underwent a 12-week exercise-based rehabilitation protocol. Quantitative data were analyzed using descriptive statistics and comparisons were performed using the paired t test, considering the significance of p≤005. Results: After complying with the protocol, the patients showed an increase in the distance covered in the 6MWT, higher gait speed in the 10MWT, greater respiratory and peripheral muscle strength, lower dyspnea index and better functional status. Conclusion: The exercise-based outpatient rehabilitation program was able to improve the functional capacity of individuals with post-COVID-19 syndrome.

Keywords: Physical therapy, covid-19, 6-minute walk test, covid-19 pandemic, functional capacity.

1 INTRODUCTION

On March 11, 2020, the World Health Organization (WHO) declared the outbreak caused by the novel coronavirus (SARS-CoV-2), which characterized a Public Health Emergency of International Importance, therefore pandemic, with high transmissibility and rapid lethality on all continents[1–2]. The novel coronavirus is the seventh member of the family of coronaviruses that infect humans and whose disease has been termed COVID-19.

First detected in December 2019 in the city of Wuhan, China, this virus causes a disease whose clinical picture ranges from asymptomatic infections to severe respiratory conditions, called COVID-19.

In Brazil, the first case was reported on February 21, 2020[4]. Worldwide, since the first case revealed in Wuhan, China, at the end of 2019, until June 15, 2020, 7,283,289 cases and 431,541 deaths have been confirmed. In the same period, America occupied the first place in the ranking, with 3,841,609 cases and 203,574 deaths[2–5].

Already looking for more recent data, according to the World Health Organization (WHO) until May 25, 2022, 521,127,460 cases of covid-19 have been confirmed worldwide, of which 30,846,602 in Brazil. Regarding deaths, 6,263,321 were confirmed worldwide, of which 664,872 were confirmed in Brazil.

In Rio Grande do Sul, until the same date, 2,408,431 cases of Covid-19 and 39,472 deaths have been confirmed.

Physical therapy and pulmonary rehabilitation assist patients in recovering from the damage caused by COVID-19, making them return to society more quickly and safely.

According to Lima et al.[8] physiotherapy aims to promote both cardiorespiratory function, which is physical conditioning, which can be stimulated through the use of the exercise bike and the treadmill; and the musculoskeletal aspect, through active activities, which include resistance exercises.

Barker-Davies et al.[9], state that pulmonary rehabilitation (PR) is considered the gold standard for rehabilitation of patients with respiratory diseases, because the method uses physical exercise, education and behavioral modification for physical and psychological improvements.

In this sense, PR is indicated for post-COVID-19 patients, as it is able to reduce symptoms, increase functional capacity and improve quality of life, even for irreversible damage to the lungs.

The goal of pulmonary rehabilitation, in the short term, is to relieve dyspnea and anxiety, which in the long term, improves the patient's quality of life[7-10].

Given the severity of the dysfunction seen in patients with covid-19, rehabilitation is critical to improve physical and cognitive fitness, as well as decrease the risk of disability and morbidity[11].

According to the Cardiopulmonary and Metabolic Rehabilitation Guideline (2006), it is imperative that public health centers have their own places to guide physical exercise, with structure and human resources trained for the care of patients eligible for the extra-hospital phases of Cardiovascular, Pulmonary and Metabolic Rehabilitation (CPMR)[12].

Given the importance of post-COVID-19 functional capacity recovery, rehabilitation in a prepared outpatient setting becomes indispensable.

Thus, it is expected that individuals submitted to a rehabilitation program, with a closed exercise protocol, of time equal to or greater than 12 weeks, achieve important functional recovery.

Therefore, the present study aims to analyze the effects of a rehabilitation program on the functional capacity of patients enrolled in the post-COVID-19 Rehabilitation Outpatient Clinic of Univates.

2 METHODS

This study is an exploratory, experimental, descriptive and quantitative research. The research was conducted at the post-COVID-19 Rehabilitation Outpatient Clinic, located on the premises of the Clinical School of Physical Therapy of the University of Vale do Taquari - UNIVATES, Lajeado-RS.

The population of this study was selected by convenience, composed of individuals of both sexes, over 18 years of age, affected by COVID-19, recruited to participate in the rehabilitation program of the manifested dysfunctions post-COVID-19, directed from the health network of the municipalities of the 16th Regional Health Coordination (CRS) of RS. All participants signed the Free and Informed Consent Form (ICF) (APPENDIX A).

To calculate the sample size, we considered a probability of error ɑ=0.05, effect size of 0.5 and power of analysis of 80%, arriving at the value of 12 patients.

The software used for sample calculation was GPower version 3.1.9.2 for Windows (University of Düsseldorf, Düsseldorf, Germany).

The study's inclusion criteria were individuals with a prior diagnosis of COVID-19; in rehabilitation period of manifested dysfunctions post-COVID-19; individuals with or without hospitalization; of both sexes; aged between 18 and 95 years.

Users who did not present at least three altered conditions in the evaluation process were excluded from the study; who had a previous disease requiring physiotherapeutic care of a specific area; who refused to sign the Free and Informed Consent Form (ICF); and who exceeded the limit of 3 fouls during the service period.

The study consisted of individuals who had contact with the post-COVID-19 Rehabilitation Outpatient Clinic of Univates, located in the Clinical School of Physical Therapy of UNIVATES.

This contact was made via referral from their referral health network, via e-mail, whatsapp, telephone call or in person at the service, referring to having post-COVID-19 dysfunctions.

Data collection was carried out during the months of August, September and October 2022, through the analysis of the medical records of patients previously inserted in the Tasy system, including identification information, disease characteristics, functional assessment and reassessment tests and associated comorbidities.

Initially the individuals were part of a waiting list, and the time to be called varied according to the number of vacancies available at that time.

After having gone through the waiting process, when necessary, the participants were called to the evaluation phase, in which a complete anamnesis was performed, followed by the application of

the functional tests. After 12 weeks, the patients were submitted to the reassessment stage, to compare the results initially obtained in the functional tests.

The research instrument was the application of functional tests at the beginning of the rehabilitation process of patients in the post-COVID-19 Outpatient Clinic and after patients completed the four face-to-face phases of the pre-established exercises of the rehabilitation protocol, totaling at least twelve weeks.

The functional tests established were: the 6-minute walk test (6MWT), manovacuometry, digital dynamometry, the 10-meter walk test (10mMT), THE Medical Research Council (MRC) dyspnea scale and the Post COVID-19 Functional Status Scale (PCFS).

2.1 6-MINUTE WALK TEST – 6MWT

The 6MWT was performed according to the standards of the *American Thoracic Society*[13]. The patients had to travel the longest distance in the period of six minutes, in order to assess functional capacity.

The vital signs monitored, before and immediately after the test, were peripheral oxygen saturation (SpO2), blood pressure (BP), heart rate (HR), sensation of dyspnea and muscle fatigue, using the BORG CR10 scale, modified exertion BORG (06-20) [14].

The 6MWT is performed as follows: in a flat corridor of 30 meters in length, with marks every three meters, the patient is instructed to travel the greatest possible distance in a period of six minutes at his own speed, but trying his best to walk as far as possible in that time.

In this interval, the person can stop if necessary, and should report from the visualization of the Borg Scale, identifying (pointing) the level of discomfort, which will be noted by the researcher (academic), the appearance of chest discomfort, dizziness, severe dyspnea, imbalance, blurred vision, pain in the limbs or back, numbness or tremors, or any other symptom. At the end, the distance covered by each patient [13–15] will be recorded in meters.

2.2 MANOVACUOMETRY

Muscle weakness occurs due to the immobility of the individual in bed; however, hypotrophy is noticeable to a greater extent in the respiratory muscles than in the peripheral ones.

Respiratory muscle strength can be assessed by means of maximal respiratory muscle pressures, measured by means of a manovacuometer. It is a low-cost and easy-to-perform test that measures negative and positive pressures (MIP and MEP) [16].

Maximal expiratory (MEP max) and inspiratory (MIP max) pressures are an estimate of the force produced by the inspiratory and expiratory muscles, respectively.

And to perform such measurements, the manovacuometer is used. The MEP_{max} is the measure of positive pressure generated by the contraction of the expiratory muscles from the total lung capacity, that is, the patient is instructed to perform a maximum inspiration followed by a forced expiration against the buccal of the manovacuometer, thus causing the device to record the value of the maximum expiratory pressure reached by the patient.

The$_{MIP\ max}$ is the measurement of negative pressure obtained through inspiratory effort from the residual volume, that is, the patient is instructed to perform a maximum expiration followed by a maximum inspiration against the buccal of the device, causing the device to record the values referring to MIPax[17].

An MVD 300 Globalmed digital manovacuometer was used. The patient was instructed to perform a maximal inspiration, against an occluded valve, from the residual volume, for the measurement of the $_{MIP}$; for the determination of the $_{MEP}$, the patient will perform a maximum expiration from the total lung capacity, against the referred valve of the manovacuometer, being recorded the peak pressures. For both measurements, three maneuvers will be performed, considering the highest value (cmH$_{,2O}$) and being performed with the individual sitting comfortably, without restrictions to lung expansion, such as tight clothing, among others[18].

2.3 MEDICAL RESEARCH COUNCIL (MRC) DYSPNEA SCALE

The dyspnea scale of the Medical Research Council (MRC) is an instrument that assesses the sensation of dyspnea during the activities of daily living (ADLs) of individuals, and is widely used in the international literature, mainly because it is easy to apply and understand. The scale has been widely used in individuals with sequelae of COVID-19[19]. This scale is composed of five items, and the patient chooses the item that corresponds to how much dyspnea limits their ADLs. Its original version has been described and validated in the English language, as well as the Portuguese[20] version.

2.4 PORTABLE DIGITAL DYNAMOMETRY

The measurement of the maximum voluntary handgrip strength, or simply manual dynamometry (DM), consists of a simple and objective test that has as its principle to estimate the function of skeletal muscle. The internal consistency of the strength measurements exerted by different muscle groups supports the use of DM to characterize the general muscular functional status. It is a test usually performed with a portable device - dynamometer - being a quick and little invasive procedure. It is worth mentioning that its cost, ease of use and size are important factors that justify the present diffusion of the use of the digital dynamometer[21].

Among the portable dynamometers, we highlight as an example the portable pressure dynamometer, from the English *Hand-Held Dynamometry - HHD,* which uses compression to evaluate

the force. For its use, the HHD should be placed between the evaluator's hand and the part of the patient's body being evaluated[22]. Thus, the HHD was used to perform the dynamometry test in the participants, in order to obtain peripheral muscle strength values.

2.5 10 METER WALKING TEST

It consists of the gait speed test. The patient walks for a distance of 14 meters, first at natural speed, using their usual assistive devices, footwear and orthotics. Only the central 10 meters will be used to mark the travel time, since the initial and final two meters will be used for the acceleration and deceleration of the gait. Individuals can be classified as home ambulation (lower 0.4m/s), community ambulation (between 0.4 and 0.8m/s) and complete community ambulation (greater 0.8m/s).

2.6 POST COVID-19 FUNCTIONAL STATUS SCALE - PCFS

The Post-COVID-19 Functional Status Scale (PCFS) was recently translated into the Brazilian Portuguese and has been an excellent strategy to assess limitations after SARS-COv-2 infection.

The PCFS scale covers the full extent of functional outcomes, as it is focused on the limitations of daily tasks/activities at home or at work/school, as well as changes in lifestyle.

This questionnaire can be self-applied, or there is the possibility of a flowchart for application. The scale has 6 possible gradations from 0 (zero: no symptoms), 4 (four: severe functional limitation), to 5 (five: death). It can be applied at hospital discharge and also in outpatient follow-up to assess and monitor functional status[23].

After the evaluation, the selected patients were submitted to a pre-established exercise protocol based on the Brazilian Guidelines for Functional Rehabilitation.

This protocol was divided into 4 phases, presented in Chart 1. After the completion of the exercise protocol, the patients underwent a reassessment process to analyze the effects of the rehabilitation program on patients participating in the post-COVID-19 Rehabilitation Outpatient Clinic.

The demographic data of the study were presented descriptively and the quantitative data were presented as mean and standard deviation (SD), with comparisons performed through the paired Student's t-test and two-way ANOVA. The software used for the analyses was GraphPad version 7.0 for Windows (San Diego, California, USA). $P \leq 0.05$ was considered statistically significant.

3 FINDINGS

Throughout the process of recruitment and application of the protocol, we had some losses and withdrawals on the part of the participants. Initially, a total of 17 patients were evaluated, with 2

dropouts, 1 death and 2 patients who could not finish the protocol due to absences. Thus, we concluded the analyses with the participation of 12 patients, totaling 29.4% of loss.

At the time of the evaluation and anamnesis of the study participants, demographic data were collected and are shown in Table 1. Through the analysis of the results, it was possible to perceive an increase in peripheral and respiratory muscle strength, when comparing the values of the evaluation and reassessment at the end of the protocol, as shown in Table 2.

Regarding functional capacity, we noticed that the patients, after being submitted to the rehabilitation protocol, obtained better performance in the 6-minute walk test (6MWT) and 10-meter walk test (10-meter walk). Data shown in Figure 1.

In addition, we noticed that the patients presented a better functional status and a reduction in the dyspnea index after the protocol (Figure 2).

4 DISCUSSIONS

The present study sought to analyze the effects of a rehabilitation program on the functional capacity of post-COVID-19 patients. The results showed a significant improvement in the functional capacity of all participants who were submitted to the exercise protocol in the period of 12 weeks or more, with improvement evidenced through the increase in the distance covered in the 6MWT and 10mwt, as well as in muscle strength (dynamometry), dyspnea level (MRC) and increased respiratory muscle strength (manovacuometry).

In a study conducted by DAYNES et al[24] (2021) participants underwent a post-COVID-19 rehabilitation program (aerobic training, upper and lower limb strengthening, and home orientations).

These individuals had persistent symptoms of dyspnea, fatigue and reduced exercise capacity. After the completion of the exercise protocol, with a frequency of twice a week, in the period of six weeks, the participants obtained a considerable improvement in functional capacity and in the decrease of fatigue.

These data are similar to the data obtained in the present study, both for the performance of the exercise protocol covering aerobic training and strengthening of upper and lower limbs, and for the frequency of visits being twice a week, in addition to the improvement in the functional capacity of the individuals.

According to the study developed by SILVA, PINA, ORMOND[25] (2021), which is a review of the literature, in the rehabilitation process of post-COVID-19 patients, mediations of aerobic exercises, progressive resistance training for strength gain, balance, diaphragmatic breathing exercises, respiratory muscle training and stretching of the same, involving the intercostal muscles, were recommended, muscles of the abdominal wall and other muscles that aid respiratory function.

Thus, the exercise protocol adopted by this study follows the recommendations found in this literature review, which aimed to offer the participant the opportunity to resume functionality and autonomy.

In a study conducted in Switzerland by BETSCHART *et al*[26] (2021), containing 12 post-COVID-19 patients, it was demonstrated that individuals affected by COVID-19 had decreased functional capacity evidenced through the 6-minute walk test (6MWT), especially patients who developed the severe form of the disease. When these patients were submitted to an outpatient pulmonary rehabilitation program, with physiotherapeutic intervention twice a week, nine of the 12 participants showed clinically significant improvement in the 6MWT results. These data are similar to the findings of our study, in which all participants showed significant improvement in the results of the 6MWT.

In the study by TOZATO *et al*[27] (2021) consisting of 4 case series, participants underwent a post-COVID-19 rehabilitation exercise protocol consisting of aerobic exercise and resistance exercise. The participants obtained important cardiovascular recovery, reduced sensation of dyspnea on exertion, increased peripheral muscle strength and functional independence reported and also observed throughout rehabilitation.

The participants also obtained changes in the distance covered in the 6-minute walk test (6MWT), showing an increase of 16%, 49%, 67% and 94% from Case 1 to Case 4, respectively, thus indicating an increase in functional capacity and improved prognosis, regardless of severity. Similarly, the present study identified an increase in the distance covered by all individuals in the 6MWT, with a high percentage in most cases.

MACHADO et al.[28] 2021, conducted a study in Belgium, validating the PCFS scale, and demonstrated in the course of their study the validity of the application of the PCFS Scale in individuals in the post-COVID-19 period. The fact that the PCFS Scale can be easily used is a great advantage, facilitating its wide implementation.

In the study developed by IMAMURA et al.[29] 2021, composed of a series of retrospective cases, they aimed to describe an outpatient program developed at the Institute of Physical Medicine and Rehabilitation of the Hospital das Clínicas of the Medical School of the University of São Paulo. In their study, it was demonstrated that the PCFS is a tool that can be used as an important outcome variable in the rehabilitation process, in addition to the 10-meter walk test.

A clear trend of improvement of the PCFS and the 10-meter walk test was observed in patients undergoing the rehabilitation process, but there was no significant difference, but the p values obtained indicate that this difference may be a trend, presenting as a limitation the small number of participants. These data are similar when compared to those obtained in the present study, but here it was possible

to observe a significant reduction in the PCFS scale and in the time required to complete the 10-meter walk test.

The reduction in respiratory muscle strength (RMS) was reported in a study by Huang *et al.*[30] (2021), in which approximately 30% of COVID-19 patients were considered severe or critical, and more than half had decreased RMS. According to Nogueira *et al.*[31] (2021) muscle weakness is one of the main complaints of post-COVID patients. In their study, 25% of post-COVID patients had this complaint, which occurs due to the inflammatory response to the virus, related to loss of muscle strength and sarcopenia, as well as malnutrition and prolonged period of immobilization in bed. This pattern was also found in the present study, evidenced by the results of a significant decrease in RMS in nine of the 12 participants.

In the present study, after the patients went through the exercise protocol and performed the respiratory muscle training using PowerBreathe, the participants presented a statistically significant increase in respiratory muscle strength, indicated by the results of manovacuometry, at the time of reassessment. The same occurred in the study by LIU, Kai *et al*.[32] (2020), in which participants, after 6 weeks of respiratory rehabilitation in the intervention group, achieved statistically significant improvements.

Regarding the values obtained through the MRC scale, it was possible to observe that there was a significant reduction in the perception of dyspnea after the participants had completed the rehabilitation protocol. The study by BATISTA *et al.*[33] (2021) presented similar results, in which patients, after undergoing a post-COVID-19 syndrome rehabilitation protocol in primary care, obtained a significant improvement in the sensation of dyspnea (mMRC) and fatigue in performing their ADLs, compared to the period before the disease.

In another literature review study, developed by OLIVEIRA, MACEDO[34] (2021), it is described that functional impairments in critically ill patients are directly related to the length of stay in the ICU and prolonged mechanical ventilation. Seven days of bed rest can already reduce muscle strength by 30%, with an additional 20% loss of remaining strength each week. In the present study, it was possible to observe an important increase in muscle strength after the completion of the rehabilitation protocol. The muscle weakness identified in the evaluation of most participants was also related to the history of hospitalization.

Even with all the important findings, the present study has some limitations, which make it necessary to continue research in the area of rehabilitation of post-COVID-19 patients in order to identify the effects of rehabilitation programs. The main limitation is the small sample size and the high level of losses. Nevertheless, the lack of a control group and the blinding of both the participants and the professionals involved ended up interfering in the quality of the final evaluations. Another

important point was the lack of an evaluation of the levels of anxiety and depression of the participants, remaining as a suggestion for future studies.

5 CONCLUSIONS

The infection caused through COVID-19 generates functional and hemodynamic repercussions to the individual, thus generating significant impairments in functional capacity and, consequently, in activities of daily living and work, negatively impacting the quality of life of the user.

The rehabilitation program consisting of physical exercises, based on principles of cardiovascular and pulmonary rehabilitation showed positive results for all participants, with improvement in functional capacity, even with the variability of the severity of post-COVID-19 cases.

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TABLE AND FIGURES

Table 1. Exposure protocol

REHABILITATION PROTOCOL
Evaluation:
Anamnesis and application of functional tests.

Phase I (attendance 1 to 6)
- Aerobic training (60% of HRmax.): treadmill or stationary bike (20 min, if possible);
- Joint mobilization exercises.

Phase 2 (attendance 7 to 12)
- Aerobic training (70% of HRmax.): treadmill or stationary bike (20 min, if possible);
- Respiratory muscle training (20% to 60% of maximum strength):
- Powerbreathe
- Global muscle strengthening exercises (20% of maximum strength)

Phase 3 (anticipation 13 to 18)
- Aerobic training (80% of HRmax.): treadmill or stationary bike (20 min, if possible);
- Respiratory muscle training (20% to 60% of maximum strength):
- Powerbreathe
- Dynamic exercises of global muscle strengthening (30% of maximum strength):

Phase 4 (attendance 19 to 24)
- Aerobic training (90% of HRmax.): treadmill or stationary bike (20 min, if possible);
- Respiratory muscle training (20% to 60% of maximum strength):
- Powerbreathe (2 sets of 8 to 12 repetitions).
- Dual task and circuit exercises:

STEP 1: Warm-up;
STEP 2: Circuit;
STEP 3: stretching.

Revaluation:
Reapplication of functional tests.

Source: From the author (2022).

Table 1. Sample characteristics

Muscle group	Mean ± SD (%)
Age (years)	61 ± 9.3
Weight (kg)	85 ± 14
Height (m)	1.75 ± 0.14
BMI (kg/m2)	31 ± 7,3
Women, n (%)	7 (63,6)
Men, n (%)	4 (36,4)
Education, n (%)	
Incomplete fundamental	6 (54,5)
Medium	1 (9,1)
Incomplete high school	1 (9,1)
Superior	3 (27,3)
Profession, n (%)	
From home	3 (27,3)
Retired	3 (27,2)
Educator	1 (9,1)
Company Administrator	2 (18,2)
Teacher	1 (9,1)
Shoe reviewer	1 (9,1)
Medications, n (%)	
Yes	10 (90,9)

No	1 (9,1)
Physical Activities, n (%)	
Yes	4 (36,4)
No	7 (63,6)
Smoker, n (%)	
Yes	0 (0)
No	11 (100)
Alcoholic, n (%)	
Yes	0 (0)
No	11 (100)
Associated Diseases, n (%)	
Yes	9 (81,8)
No	2 (18,2)

Source: Study data (2022)

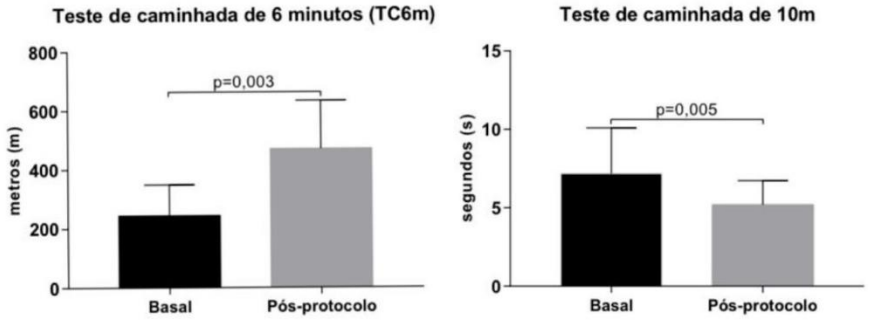
Table 2. Muscle strength – Dynamometry (kgf)

Muscle group	Basal	Post-intervention	*P* (Test t pareado)
Palm grip D	25,4 ± 11,9	33,9 ± 11,7	0,029*
palmar grip E	24,3 ± 10,9	30,8 ± 12,7	0,027*
Elbow flexors D	17,5 ± 6,4	20,8 ± 5,2	0,0006*
Elbow flexors E	17,2 ± 4,9	20,3 ± 4,8	0,004*
Elbow extenders D	12,5 ± 3,2	15,8 ± 5,0	0,0007*
Elbow extenders E	12,5 ± 3,6	14,6 ± 3,7	0,0001*
Rot. Inter. Shoulder D	13,2 ± 4,6	16,0 ± 5,2	0,019*
Rot. Inter. Shoulder E	13,9 ± 4,9	17,2 ± 5,3	0,009*
Rot. Ext. Shoulder D	11,0 ± 3,6	11,8 ± 3,3	0,069
Rot. Ext. Shoulder E	9,7 ± 3,3	12,2 ± 3,8	0,001*
Knee extensors D	17,5 ± 5,2	23,4 ± 7,0	0,0003*
Knee extensors E	17,7 ± 5,4	23,1 ± 7,4	0,0007*
Knee flexors D	13,4 ± 4,1	23,4 ± 7,0	0,0001*
Knee flexors E	13,1 ± 3,3	23,2 ± 7,2	0,0001*
Hip adductors D	9,4 ± 2,7	12,9 ± 3,2	0,0009*
Hip adductors E	10,1 ± 3,1	12,4 ± 3,8	0,012*
Hip abductors D	9,8 ± 2,5	13,9 ± 2,6	0,0001*
Hip abductors E	9,6 ± 2,4	14,5 ± 2,6	0,0001*
PImáx	-80 ± 34,6	-114 ± 41,1	0,007*
PEmáx	68 ± 31,5	94 ± 36,3	0,004*

Source: study data (2022).

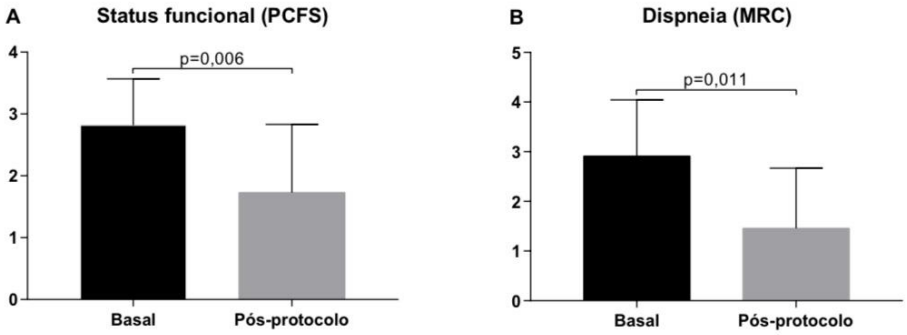
Values presented as mean ± SD. MIP (maximal inspiratory pressure); MEP (maximal expiratory pressure). Paired t-test*.

Figure 1:



Values presented as mean ± SD. Paired t-test.

Figure 2:



Values presented as mean ± SD. Paired t-test.