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The effect of a six-week home physiotherapy program on symptoms and activities of daily living in post-COVID-19 patients following hospital discharge

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ABSTRACT

Introduction: Patients following the acute stage of Severe Acute Respiratory Syndrome Coronavirus 2 were shown to present with persisting symptoms including fatigue, dyspnea, joint pain, and chest pain. The aim of this study was to investigate the effect of a 6-week home physiotherapy program on the psychological and physical symptoms, as well as the physical abilities to perform activities of daily living in post-COVID-19 patients.

Methods: The subjects were 39 adult patients who had been diagnosed with COVID-19 and had been hospitalized at the University Clinical Center of Kosovo. Patients initially underwent a physiotherapy assessment 2-3 weeks after discharge from the hospital, including sociodemographic data, psychological and physical symptoms, and functional performance in daily activities using the Patient-Specific Functional Scale (PSFS). Based on their functional capacity, the patients received two types of brochures for a home physiotherapy program that was carried out over the next 6 weeks. Upon the completion of the physiotherapy program, 23 patients reported for the second physiotherapy assessment. The Mann–Whitney Wilcoxon test was used for comparison of the variables obtained during the first and second assessments.

Results: Pre–post analysis showed that the symptoms including excessive fatigue, difficulty breathing, and insomnia were significantly less present following the home physiotherapy program ($p = 0.005$; $p = 0.008$; $p = 0.034$). On the PSFS scale, the mean score increased from 5.2 (2.1) to 7.8 (0.5) for stair climbing, from 5.5 (1.8) to 8.8 (1.6) for walking longer distances, and from 3.7 (3.2) to 4.0 (5.6) for running.

Conclusion: Although limited by the absence of a control group, the findings from this study indicate that home physiotherapy intervention can be feasible and effective in enhancing psychological and physical symptoms, as well as activities of daily living in post-COVID-19 patients following hospitalization.

Keywords: COVID-19; physiotherapy; rehabilitation; symptoms; activities of daily living

INTRODUCTION

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) appeared in 2019 and caused Coronavirus Disease 2019 (COVID-19) (1). COVID-19 was declared a global pandemic on March 11th, 2020 (1). As of October 22nd, 2023, the number of confirmed cases of COVID-19 had surpassed 770 million worldwide (2). Existing reports on its clinical presentation estimate that 80% of cases are asymptomatic or mild, 15% are serious cases (requiring additional oxygen), and 5% are critical necessitating ventilation and life support (1). The symptoms identified as persisting following the acute stage of COVID-19 are fatigue, dyspnea, joint pain, and chest pain (3), which are especially associated with prolonged hospitalization (4-7). Physiotherapy is considered vital after hospitalization, including early mobilization and exercise with the active participation of a physiotherapist (8).

The Global Alliance for Rehabilitation believes that rehabilitation is an integral part of the response to the COVID-19 pandemic (9). Early physical rehabilitation for critically ill patients plays an important role in respiratory weaning from mechanical ventilation, the improvement

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of functional outcomes, and the enhancement of quality of life (10). Given the possibility of long-term disability, outpatient post-discharge respiratory rehabilitation can be applied to all hospitalized patients with COVID-19 (4).

It has been implied that it is necessary to establish appropriate measures for successful implementation of rehabilitation, including assessment of the physical, functional, cognitive, and emotional conditions of patients who survived COVID-19 (11). In addition to thorough assessment, rehabilitation professionals are described as playing a key role in establishing an individualized, progressive treatment plan for recovery from COVID-19 consequences (12,13). The role of the physiotherapist, as rehabilitation professional, includes assessing patients, setting goals, and prescribing treatments to increase respiratory capacity and mobility, as well as exercise and functionality, to enable early discharge and return to normal activities (8).

The improvement of symptoms caused by COVID-19 is expected after 6 weeks, but in certain persons, the symptoms may last longer (14). Rehabilitation interventions have been mainly focused on the treatment of patients in acute care institutions, while less attention has been dedicated to the rehabilitation of patients following the infection with COVID-19, i.e., after discharge from the hospital and return home. The need for additional high-quality studies on physiotherapy in the rehabilitation of discharged patients with COVID-19 has been emphasized (15). The aim of this study was to investigate the effect of a 6-week home physiotherapy program on the psychological and physical symptoms, as well as physical limitations in performing activities of daily living, in post-COVID-19 patients.

METHODS

The research was designed as a prospective, interventional, and experimental study. The Improving the Reporting of Therapeutic Exercise Interventions in Rehabilitation Research Guidelines (16) were followed in this study.

Subjects in the research were adult male and female patients over 18 years of age who had been diagnosed with COVID-19 (positive polymerase chain reaction test) and had been hospitalized in the Clinic for Infectious Diseases at the University Clinical Center of Kosovo (UKCK). Permission for the conduction of the research was obtained from the Ethics Committee of UKCK, protocol no. 1233. The study included patients discharged from the Clinic for Infectious Diseases at the UKCK during the period from August 30, 2021, to December 3, 2021. In total, 377 patients were hospitalized in the Clinic for Infectious Diseases, of whom 93 passed away; 4 were transferred to other departments of the UKCK or out of the country; and a total of 280 patients were discharged from the clinic. The exclusion criteria were moderate or severe heart disease (III or IV degree, according to the functional classification by the New York Heart Association), chronic lung disease, chronic neurological diseases, renal insufficiency, cognitive deficit, acute diseases and injuries of the musculoskeletal system, including the acute phase of rheumatological conditions and abnormalities of the spinal disc. Based on data from the patient's history, 107 patients met the inclusion criteria and were contacted by phone to report to the outpatient clinic for physical medicine and rehabilitation at UKCK 2-3 weeks after discharge from the hospital. Out of the total number of invited patients, 39 responded for the first assessment, of whom 23 also responded for the second assessment after the completion of the home physiotherapy program. Patients included in this study were informed about the complete protection of their identities and gave written consent to participate in the study.

All patients underwent physiotherapy assessment in the presence of a physical medicine and rehabilitation physician, which included the collection of sociodemographic data, the evaluation of psychological and physical symptoms, and the assessment of functional performance in daily activities using the Patient-Specific Functional Scale (PSFS) (17). The PSFS is a valid and reliable self-reported measure (18) designed to determine observed physical limitations in performing activities of daily living. The patients were asked to identify up to five important activities that they had difficulty with or were unable to perform and to grade them from 0 to 10 points, where a score of 0 represents the inability to perform the activity, while 10 represents the ability to perform the activity at the same level as before the problem occurred. Patients were also asked to identify the presence or absence of nine physical and psychological symptoms described in the literature to be most commonly present following the infection with SARS-CoV-2 (19).

Following the physical therapy assessment and based on functional capacity, the subjects were divided into two groups: Study Group 1: patients with major limitations in performing daily activities, with a high degree of fatigue during physical activity and a very low level of exercise tolerance and Study Group 2: patients with minor limitations in performing daily activities, with a lower degree of fatigue during physical activity and an increased level of exercise tolerance. The allocation of patients to the study groups was based on the Royal Dutch Society for Physical Therapy (KNGF) guidelines regarding physiotherapy approaches with post-COVID-19 patients with varying levels of exercise tolerance (20).

The patients were given two types of brochures with different sets of exercises, depending on the group they were initially assigned to. The brochures contained written instructions and picture illustrations for the purpose of successful execution of the home physiotherapy program that was carried out over the next 6 weeks. The brochure for patients assigned to Study Group 1 contained ergonomic instructions for correct body positioning, breathing exercises, relaxation exercises, exercises for improvement of activities of daily living, strengthening exercises for the muscles of the upper extremities (using body weight as resistance), and exercises for improvement of balance in a sitting position. The brochure for patients assigned to Study Group 2 contained the same instructions and exercises as the brochure for patients in Study Group 1, with the additional option to use weights for strengthening exercises for the muscles of the upper extremities, the strengthening exercises for the muscles of the lower extremities (using body weight as resistance), as well as exercises for improvement of balance in a standing position. The home physiotherapy program is thoroughly described in Table 1. The brochures also

TABLE 1. Home physiotherapy program

Respiratory exercises	1. Breathing control 2. Deep breathing (diaphragmatic breathing) 3. Blowing exercises 4. Exercises for ACBT 5. Exercises for expectoration
Relaxation exercises	The progressive relaxation technique is used to relax the muscles through a two-step process. First, certain groups of body muscles are tensed for 5 s, then the muscles are stretched and relaxed, and attention should be paid to the relaxing sensation in the muscles. It should be stayed in this relaxed state at least 15 s. This technique is applied to muscle groups, starting from the distal to proximal segments: - Lower extremities (feet and legs), - Belly and chest, - Upper extremities (arms and shoulders), - Neck and face.
Exercises for gradual improvement in activities of daily living	1. Getting up from a chair 2. Walking inside the home (using a walking aid if necessary) 3. Climbing up several stairs 4. Walking a short distance or using a stationary bicycle with low resistance 5. Outdoor activities, such as grocery shopping (outdoor activities are applied only in the patients of the Study group 2)
Muscle strength exercises	
Exercises for gradual strengthening of upper extremity muscles in a sitting position and with optional use of weights as resistance (the use of weights applied only for the patients of the Study group 2)	1. Abduction of the shoulder joint 2. External rotation of the shoulder joint 3. Elevation of the shoulder joint 4. Extension of the elbow joint
Exercises for gradual strengthening of lower extremity muscles using body weight as resistance (applied only for the patients of the Study group 2)	1. Extension of the hip joint in the supine position (bridging exercise) 2. Abduction of the hip joint in the side-lying position 3. Flexion of the hip joint in the supine position 4. Extension of the hip joint in a standing position 5. Abduction of the hip joint in a standing position 6. Flexion of the hip joint in a standing position
Exercises for gradual improvement of balance in a sitting position	1. Keeping the back in an upright position, shifting the body weight to one side of the pelvis, holding for a few seconds, returning to the neutral position, and then transferring the body weight to the other side pelvis and holding again for a few seconds. 2. Keeping the hands clasped in front of the body, stretching the arms straight forward and leaning the body forward as far as possible while being cautious of the danger of falling. Staying in this position for 5 s, then returning back to neutral position.
Exercises for gradual improvement of balance in a standing position (applied only for the patients of the Study group 2)	1. Standing and holding onto the back of a stable, sturdy chair, raising the right leg and balancing on the left leg. Holding the position as long as possible and then repeating the same with the other leg. 2. Standing behind a stable, sturdy chair, straightening the arms forward, lifting the body on the toes as high as possible, and then lowering the body slowly without leaning too much forward onto the chair.

ACBT: Active cycle of breathing techniques; s: seconds

contained a table that served as a daily diary for the patients to document the exercises they performed or were unable to do. The physiotherapy program used in this study is based on the brochure of the United Kingdom National Health System (NHS): post-COVID-19 physiotherapy advice and exercise program (14) and KNGF recommendations for physiotherapy in patients with COVID-19 (20). Upon the completion of the home physiotherapy program, the patients again underwent a physiotherapy assessment.

All the exercises were explained and demonstrated to the patients by a physiotherapist with the purpose of being able to perform them at home. Each patient was informed about the correct positioning during exercise. The patients were instructed to perform the breathing exercises, relaxation exercises, and exercises for improvement of activities of daily living every day for 5-20 min, while doing muscle strength exercises for upper and lower extremities, as well as exercises for improvement of balance in a sitting and standing position 2-3 times a week, in 2-5 sets of 8-15 repetitions, with at least 2 min of rest between the sets and an exercise duration of 5-20 min. The number of repetitions of all exercises could be increased or decreased, depending on the patients' abilities; however, they were instructed to try to increase the number of repetitions each week. It was explained to the patients that fatigue during the exercises in the first 4 weeks should correspond to degree 4, and for the last 2 weeks to degree 6 of the Borg scale CR10 (21). The patients were also instructed to monitor blood oxygen saturation and heart rate at rest, during and after exercises, and to use 90% as the lower limit of transcutaneous blood oxygen saturation at rest, with an absolute minimum of 85% during physical exertion.

The time frame of 6 weeks for physiotherapy intervention program duration was determined based on existing scientific data that implementing a program of breathing exercises and respiratory rehabilitation during a period of

6 weeks improves lung function, cardiopulmonary capacity, functional capacity, and quality of life in persons who have recovered from COVID-19 and other persons with similar respiratory difficulties caused by COVID-19 (22-26). Furthermore, the NHS stated in its post-COVID-19 physiotherapy advice and exercise program that improvement in symptoms caused by COVID-19 is expected after 6 weeks, but that symptoms in certain people may last even longer (14). Moreover, this time period reduces the risk of patients' dropping out of the physiotherapy program.

The software IBM-SPSS Statistics 24 was used to perform the statistical analysis. Descriptive statistics were used for all investigated variables, including the arithmetic mean, standard deviation, standard error, 95% confidence interval for the arithmetic mean, and minimum and maximum values. The variables obtained during the first and second assessments were compared using the Mann–Whitney Wilcoxon test. The confidence level was 95% (0.05), and the significance level was set at $p < 0.05$ for all analyses.

RESULTS

Table 2 shows patients' demographic data for the entire sample of patients who underwent the first assessment (n = 39). The patients underwent the first and second assessments 16.6 (standard deviation [SD] = 3.3) and 65.5 (SD = 8.2) days after discharge from the hospital. One-quarter (25%) of the patients were prescribed medications for chronic diseases after discharge from the hospital, of which 10% were for hypertension, 5% for diabetes, and 10% medications for problems with the thyroid gland (Table 2). Patients' complete demographic data for the entire sample of patients who underwent the first assessment (n = 39) were previously published in the study by Qorolli et al. (27).

From the total number of patients who underwent the first assessment (n = 39), 7.7% did not have any psychological or physical symptoms, 10.2% reported one, 12.8% reported two, and 69.2% reported three or more psychological or physical symptoms (Figure 1). Among the patients who reported for the second assessment (n = 23), 13.0% did not have any psychological or physical symptoms, 8.7% reported one, 26.1% reported two, whereas 47.8% reported three or more psychological or physical symptoms (Figure 2).

Table 3 shows the frequencies of psychological and physical symptoms of subjects who underwent both the first and second assessments (n = 23). The non-parametric Wilcoxon matched-pair signed rank test was used to compare the presence of variables at the first and second assessments.

Excessive fatigue was reported by significantly fewer patients at the second assessment (n = 11) compared to the first assessment (n = 19) ($p = 0.005$). Half as many patients who reported difficulty breathing at the first assessment (n = 14) continued to have the same symptom at the second assessment (n = 7) ($p = 0.008$). Chest pain was not significantly changed (n = 11 vs. n = 8) ($p = 0.180$), nor were memory difficulties given that the same number of patients continued to have these problems at the second assessment (n = 12) ($p = 1.00$). Insomnia significantly improved following the physiotherapy program (n = 11 vs. n = 5) ($p = 0.034$). The presence of palpitations was reported by almost the same number of patients at the first (n = 8) and second (n = 7) assessments ($p = 0.655$). An interesting finding is that many more patients had problems with dizziness at the second assessment (n = 8) compared to the first (n = 3) ($p = 0.059$). Almost the same number of patients who complained about joint pain before the beginning of the physiotherapy program (n = 12) continued to have this symptom after the end of the program (n = 11) ($p = 0.705$). Feelings of depression and anxiety reported at the first assessment (n = 6) showed a somewhat decreased prevalence at the second assessment (n = 4) ($p = 0.414$) (Table 3).

Figure 3 shows the frequency of physical limitations in

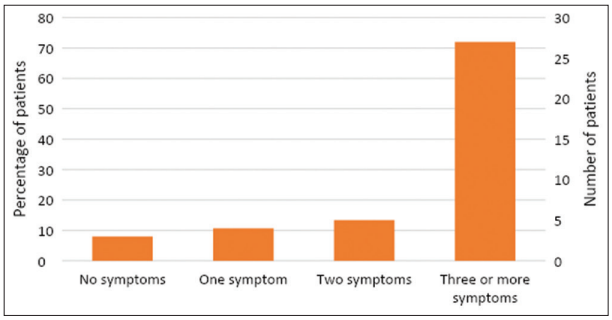

FIGURE 1. Frequencies of different psychological and physical symptoms at the first assessment (n = 39).

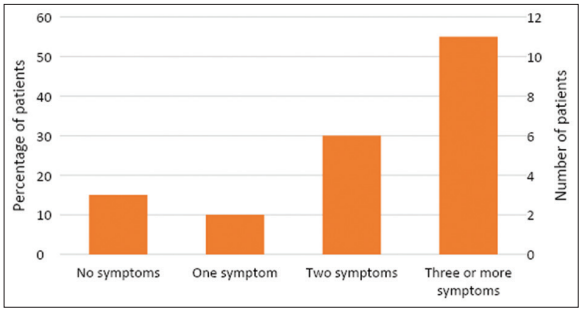

FIGURE 2. Frequencies of different psychological and physical symptoms at the second assessment (n = 23).

TABLE 2. Demographic data (n=39)

Variable	Mean	STD	STE	95% CI	Min.	Max.
Period between hospital discharge and first assessment (days)	16.6	3.3	0.5	1.1	14	23
Period between hospital discharge and second assessment (days) (n=23)	65.5	8.2	1.7	3.6	54	88
		n			%	
Medical therapy for chronic diseases						
High blood pressure		4			10	
Diabetes		2			5	
Problems with thyroid gland		4			10	

STD: Standard deviation, STE: Standard error, CI: Confidence interval, Min.: Minimum, Max.: Maximum

TABLE 3. Psychological and physical symptoms in patients at the first and second assessment (n=23)

Variable	First assessment (I) Second assessment (II)	n	%	*p*-value
Excessive tiredness	I	19	82.6	0.005
	II	11	47.8	
Difficulty breathing	I	14	60.9	0.008
	II	7	30.4	
Chest pain	I	11	47.8	0.180
	II	8	34.7	
Memory difficulties	I	12	52.2	1.00
	II	12	52.2	
Insomnia	I	11	47.8	0.034
	II	5	21.7	
Palpitations	I	8	34.7	0.655
	II	7	30.4	
Dizziness	I	3	13.0	0.059
	II	8	34.7	
Joint pain	I	12	52.2	0.705
	II	11	47.8	
Depression and anxiety	I	6	26.1	0.414
	II	4	17.4	

performing activities of daily living measured at first assessment using the PSFS scale in post-COVID-19 patients following the discharge from the hospital (n = 39). Patients reported a total of 17 activities they encountered difficulty with. The most frequently reported activity was stair climbing (66.7%), followed by walking longer distances (23.1%), brisk walking (7.7%), and running (7.7%). It can be observed that patients were unable to perform some activities following COVID-19, such as gardening, livestock breeding, milking, and wood carving (Figure 3).

On the PSFS scale, stair climbing ability had a mean score of 5.2 (SD = 2.1) at the first assessment, which increased to 7.8 (SD = 0.5) at the second assessment. Also, the ability to walk longer distances increased from 5.5 (SD = 1.8) to 8.8 (SD = 1.6), running from 3.7 (SD = 3.2) to 4.0 (SD = 5.6), while brisk walking had the same score at both assessments, 6.0 (SD = 1.0) and 6.0 (SD = 1.4), respectively (Figure 4).

DISCUSSION

This study aimed to investigate the effect of a 6-week home physiotherapy program on the psychological and physical symptoms, as well as on performance in activities of daily living in post-COVID-19 patients. Based on the findings from this study, it can be derived that the home physiotherapy program can positively affect the improvement of psychological and physical symptoms, as well as activities of daily living in post-COVID-19 patients following hospitalization.

When designing a rehabilitation program separately for each patient, many authors believe that it is necessary to take comorbidities and age into account (28-30). The existing studies examining the effect of physiotherapy in post-COVID-19 patients after hospitalization identified the degree of presence of different comorbidities in patients upon admission to intervention programs. In summary, the prevalence of comorbidities ranged from 21% to 62% for arterial hypertension, 5-28% for diabetes, 5-48% for

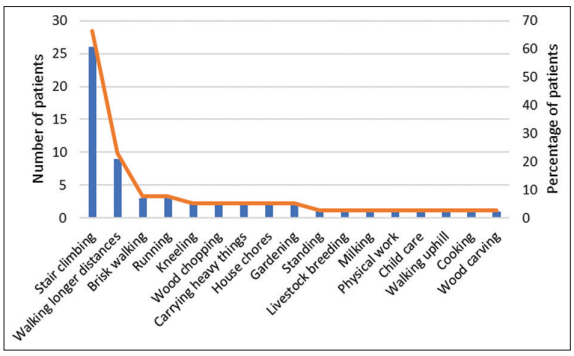

FIGURE 3. Frequency of reported physical limitations in performing activities of daily living measured at the first assessment using the PSFS scale (n = 39). PSFS: Patient-Specific Functional Scale.

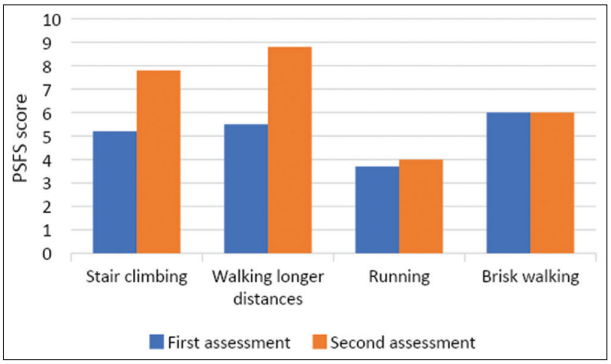

FIGURE 4. Intensity of physical limitations in performance of four different activities of daily living measured at the first and second assessment using the PSFS scale (n = 23). 0: Inability to perform the activity, 10: Ability to perform the activity on the same level as before COVID-19. PSFS: Patient-Specific Functional Scale.

established coronary artery disease, 22-30% for previously diagnosed lung disease, while the prevalence for active smoking reached 12.5-41.7% (31-35). The presence of comorbidities for which the patients in our study were prescribed medication, i.e. hypertension (10%) and diabetes (5%), correlate with the comorbidities found in the above studies. However, problems with the thyroid gland identified in our study were not found in the investigated studies. Regarding the smoking status, it can be depicted that the percentage of patients in our study who consumed tobacco was lower than the percentage of those in the existing research. Given the rigorous exclusion criteria, the sample of our study had a quite homogeneous structure with a predictable low presence of comorbidities.

It can be conveyed from our findings that more than 80% of our patients had at least one physical or psychological symptom, which is in agreement with the systematic review study of Nasserie et al. who reported that 72.5% of post-hospitalized patients due to COVID-19 presented with at least one persistent symptom (36). On the contrary to our findings, in a prospective cohort study by Tleyjeh *et al.* (37) involving patients with COVID-19 after discharge from hospital, symptoms were reported by 56.3% of patients with only 29.7% of the sample describing symptoms to be lasting longer than 21 days. This discrepancy can be accounted for the longer period of assessment following the hospital discharge (6 weeks to 6 months) in the latter study.

Although significantly improved following the home

physiotherapy program, the symptoms found to still persist in our patients were excessive tiredness, difficulty breathing, and insomnia. Similar profound difficulties, lasting more than 2 months, were also reported in numerous other studies, including fatigue and dyspnea (7, 36-39), cough (37-39), insomnia (36), chest pain (38,39), as well as psychological stress (7) and poor concentration (39). Correspondingly, chest pain, depression, and anxiety were also found to persist at the second assessment in our study.

The patients in our study reported various limitations they encountered while carrying out daily activities, including also the activities they were not able to perform at all. The most frequent and challenging activities were described to be stair climbing, walking longer distances, running, and brisk walking. Following the home physiotherapy program, the stair climbing and walking longer distances improved, whereas performing the latter two activities remained equally difficult.

While we haven't found studies that used the PSFS scale to investigate the level of functional capacity in post-COVID-19 patients after hospitalization, the positive effect of rehabilitation programs on functional improvement has been reported in several existing studies that employed other evaluation instruments. Udina et al. (40), Zampogna et al. (41), and Puchner et al. (34) used the Barthel Index (BI) to assess the ability to perform daily activities, such as personal hygiene, dressing, and walking. Similar to our findings, they reported statistically significant improvement in performance of daily activities.

Other scales found in the literature to be used for the purpose of identification of changes in patients' functional status as a result of a rehabilitation program in post-COVID-19 patients following hospitalization are functional independence measure (FIM) and the feeling thermometer (FT), a type of subjective visual analog scale used to measure the effect of a disease. Spielmanns et al. found in both of their studies a significant improvement in the overall FIM score and FT after the intervention program compared to the initial score (33,35). Likewise, the FT was also employed in the study by Hermann et al. (31) who observed a significant improvement in the total sample of the study after the intervention program, without significant differences between ventilated and non-ventilated patients during the COVID-19 disease. The results of our study are in agreement with the findings from the studies discussed above regarding the improvement of functional abilities in post-COVID-19 patients who underwent rehabilitation programs following hospitalization.

It is important to emphasize that although the PSFS used in our study is not specific to the COVID-19 condition, it is quick and relatively easy for patients to complete, providing a faster reflection of functional status in comparison to the previously discussed instruments. While BI and FIM provide a more comprehensive assessment of pre-specified activities of daily living, the PSFS scale allows for subjective identification of functional difficulties specific to an individual.

The current study has several limitations. Even though it could be conveyed from the findings that home physiotherapy intervention induces improvement in psychological and physical symptoms, as well as the ability to perform activities of daily living in post-COVID-19 patients after hospitalization, it should be taken into consideration that patients could have also improved with time. Also, during the 6-week home physiotherapy program, patients were not supervised, the patients documented the exercises they performed in the daily diary, which could have been confounded by the patients' subjective understanding of adherence to the program. Therefore, we suggest that future studies include a control group and supervised physiotherapy programs for the purpose of a deeper understanding of its effects on symptoms and daily performance in the post-hospitalized COVID-19 patients.

CONCLUSION

Although limited by the absence of a control group, the findings from this study indicate that home physiotherapy interventions can be feasible and effective in enhancing psychological and physical symptoms, as well as activities of daily living, in post-COVID-19 patients following hospitalization.

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DECLARATION OF INTERESTS

Authors declare no conflict of interest.

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