The impact of post-COVID multicomponent rehabilitation

O impacto da reabilitação com multicomponentes no pós-COVID

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Abstract

Introduction: Post-COVID-19 syndrome is characterized by chronic fatigue and myalgia, among other symptoms, which can limit activities of daily living. Physical therapy protocols with multicomponent exercises combine strength, resistance, balance and gait, producing significant improvements in functional mobility. **Objective:** Evaluate whether multicomponent rehabilitation is effective in improving functional mobility and quality of life in individuals with post-COVID-19 syndrome. **Methods:** Randomized controlled trial with 59 volunteers, divided into an intervention (IG) and control group (CG), all of whom underwent initial assessment (T0). The IG performed 24 sessions over 12 weeks and the CG did not undergo training. Functional mobility was analyzed using the 6-minute walk test (6MWT) and the Berg balance scale, while the SF-36 questionnaire assessed quality of life. **Results:** In the 6MWT, the IG covered 464.40 + 81.26 meters (T0) and 518.60 + 82.68 meters (T4). The IG Berg scale scores were 48.00 + 4.00 (T0) and 51.90 + 4.26 (T4). In terms of quality of life, the IG obtained mean scores of 96.26 + 10.14 (T0) and 102.60 + 5.53 (T4). None of these measures was statistically significant. **Conclusion:** Individuals who underwent the multicomponent physiotherapy protocol showed statistically nonsignificant increases in the variables studied.

Keywords: Active mobility. COVID-19. Physical exercise. Physiotherapy.

Resumo

Introdução: *A síndrome pós-COVID-19 caracteriza-se por fadiga crônica, mialgia, entre outros sintomas que podem causar limitações na realização das atividades de vida diária. Protocolos de fisioterapia com exercício de multicomponentes combinam força, resistência, equi-líbrio e marcha, e produzem melhorias significativas na mobilidade funcional.* ***Objetivo:*** *Avaliar se a reabilitação de multicomponentes é eficaz em promover melhora na mobilidade funcional e qualidade de vida em indivíduos com síndrome pós-COVID-19.* ***Métodos:*** *Ensaio clínico randomizado, controlado, realizado com 59 voluntários, divididos em grupo intervenção (GI) e grupo controle (GC). Todos fizeram avaliação inicial (T0); GI realizou 24 sessões durante 12 semanas e GC não realizou treinamento. A análise da mobilidade funcional foi realizada através do teste de caminhada de 6 minutos (TC6m) e da escala de equilíbrio de Berg. O questionário SF-36 avaliou a qualidade de vida.* ***Resultados:*** *A distância percorrida no TC6m pelo GI foi de 464,40 + 81,26 metros (T0) e de 518,60 + 82,68 metros (T4). A pontuação na escala de Berg do GI foi de 48,00 + 4,00 (T0) e de 51,90 + 4,26 (T4). Na qualidade de vida, GI apresentou escore com média de 96,26 + 10,14 (T0) e 102,60 + 5,53 (T4). Nenhuma destas medidas foram estatisticamente significantes.* ***Conclusão:*** *Os indivíduos que foram submetidos ao protocolo fisioterapêutico de multicomponentes apresentaram incrementos nas variáveis estudadas sem significância estatística.*

Palavras-chave: *Mobilidade ativa. COVID-19. Exercício físico. Fisioterapia.*

Introduction

In 2019, the coronavirus (COVID-19) caused by the SARS-CoV-2 virus originated in Wuhan, China and spread rapidly worldwide.[1,2] On March 11, 2020, The World Health Organization (WHO) declared COVID-19 to be a pandemic.[3,4] In addition to monitoring acute complications, health professionals began to investigate the long-term dysfunctions caused by the disease. Post-COVID-19 syndrome is characterized by chronic fatigue, myalgia, depression, and sleep disorders, among others, which may limit activities of daily living (ADLs).[5] These disorders may persist in individuals with severe and mild symptoms.[6]

Guidelines for COVID-19 patients do not only suggest physical exercise as one of the fundamental pillars in respiratory physiotherapy interventions,[7] but also emphasize that multicomponent exercises, which combine strength, resistance, balance and gait, produce significant improvements in functional mobility,[8] as well as favorable frailty, cognitive state, gait and balance results in older hospitalized patients.[9]

As such, the present study aimed to assess whether multicomponent rehabilitation is effective in improving functional mobility and quality of life in individuals with post-COVID-19 syndrome.

Methods

This is a randomized controlled trial, developed in the Kinesiotherapy and Manual Therapeutic Resources Laboratory (LACIRTEM), of the Federal University of Pernambuco (UFPE), approved by the institutional Research Ethics Committee (protocol 5.236.588) and registered at the Brazilian Registry of Clinical Trials (ReBEC) (RBR-7yh559g).

Data were collected between March and October 2022. A total of 59 individuals of both sexes with post-COVID-19 syndrome, aged between 18 and 70 years, were recruited in Recife, Pernambuco state (PE). Included were sedentary or irregularly active people with laboratory-confirmed COVID-19. Excluded were individuals with COVID-19; neurological or vascular diseases; blindness; foot or spinal deformities; gait devices; uncontrolled hypertension or arrhythmia; active myocarditis; shortness of breath at rest; acute systemic disease or fever; resting heart rate below 50 and above 100 beats per minute; nausea; dizziness; shortness of breath and/or intense fatigue; excessive sweating; bouts of anxiety; palpitations; chest pain or tightness; and those experiencing pain during training. Participants gave their written informed consent.

Procedures

The sample was calculated by a pilot test involving 20 individuals with post-COVID-19 syndrome, using functional mobility and quality of life findings. The number calculated was increased by 30% to compensate for possible losses, using G*Power 3.1 software, α =

0.05 and 80% power. Assuming 30% loss, a total of 24 patients, equally distributed in each group, should be included in the study.

The sample was randomized by a blinded researcher, using Randomization.com. In masking, one researcher was responsible for assessment/reassessment and another for application of the intervention protocol. Participants were randomly distributed into an intervention (IG) and control group (CG). The IG underwent two weekly 60-minute intervention sessions, for 12 weeks. Although the CG did not undergo training, it received educational orientation and performed activities of daily living during the same period and was reassessed at the end of IG training (T).

At initial assessment, all the participants completed a form containing clinical, personal and anthropometric questions. Next, functional mobility (6-minute walk test-6MWT, Berg balance scale) and quality of life (SF-36 questionnaire) were assessed. The IG was reassessed every six sessions, totaling four reassessments, with functional mobility and quality of life tests.

The 6MWT is a safe standardized test that reflects physical activity level and cardiopulmonary capacity, as well as supplying valuable information on blood pressure, heart rate and oxygen saturation (SpO_2).[10-12] The patient is instructed to walk as fast as possible unsupported, under supervision, for 6 minutes on a flat 30-meter-long corridor, with verbal encouragement every minute.[13]

The Berg balance scale,[14] which measures functional balance, consists of 14 items containing activities such as transfers, reaching forward with outstretched arm, turning to look behind, and standing on one foot, rated on a scale from 0 (unable/ insecure) to 4 (independent/ efficient/secure), with high scores indicating greater balance control and low scores a risk of falls. Each item on the scale adapted for Brazil[15] also scores between 0 and 4, with an indeterminate time to perform each task.

The SF-36, a questionnaire that assesses quality of life, contains 36 items that measure physical (10 items) and social functioning (2 items), physically and emotionally-related functional limitations (4 and 3 items, respectively), mental health (5 items), energy and vitality (4 items), pain (2 items) and overall health perception (5 items), in addition to a question on health in the previous year. The scores are coded, summed and transformed into a scale between 0 (worst health status) and 100 (best health status).[16]

Intervention

The protocol adapted from Marques et al.[17] was applied, encompassing twice-weekly 60-minute multi-component exercises, for 12 weeks (Figure 1):

(I) Warm-up (10 minutes): joint mobility, global stretching, breathing techniques such as pursed lips breathing, body positions and diaphragmatic breathing;

(II) Resistance (20 minutes): walking;

(III) Strength (15 minutes): 7 exercises with 2 sets of 10 repetitions for upper and lower limb muscle groups, using elastic bands, free weights and ankle weights, with weight progressively increased according to the participant's ability;

(IV) Balance (5 minutes): postures with a gradual decrease in the support base, dynamic movements that disturb the post-stress center of gravity of muscle groups, dynamic movements when performing secondary tasks individually;

(V) Relaxation (10 minutes).

Data analysis

The categorical variables were expressed as absolute and relative frequency, and their continuous counterparts as mean and standard deviation. The Kolmogorov-Smirnov test was used to determine quantitative data normality and the chi-squared test to compare groups for sociodemographic, anthropometric and comorbidity characterization. Intention-to-treat analysis was applied to compare the 6MWT, Berg balance scale and SF-36, considering all the participants and groups until the end, regardless of their results.[18]

The means were compared before the intervention and one-way ANOVA was conducted to confirm initial homogeneity for the three groups. Statistical analysis was performed using the Statistical Package for the Social Sciences, version 20.0 for Windows (SPSS Inc, Chicago IL, USA), considering a significance level of $p < 0.05$ for all the analyses.

Results

Fifty-nine individuals with post-COVID-19 syndrome were selected, according to the eligibility criteria, in line with the study design and participant allocation, as illustrated in Figure 2.

Figure 1 - Multicomponent physiotherapy protocol stations.

Of the 31 IG participants that underwent initial assessment, 23 completed 6 sessions and were reevaluated once; 17 completed 12 sessions and were reevaluated twice; 13 completed 18 sessions and were reevaluated three times; and 12 completed 24 sessions and were reevaluated 4 times (Figure 2).

Participants were aged between 18 and 70 years (52.32 + 11.87), with an average body mass index (BMI) of 28.98 + 7.86 and 34 (57.6%) were women (Table 1). Of the 59 participants, 36 (61.02%) recovered at home and 23 (38.98%) in the hospital, 16 (51.61%) and 15 (48.38%) in the IG and 20 (71.43%) and 8 (28.57%) in the CG, respectively. The IG improved in all the physical variables examined.

Table 2 shows an intra and intergroup performance comparison after 12 weeks 'follow-up. One-factor ANOVA for the Berg, SF-36 and 6MWT variables was 0.35, 0.93 and 0.38, respectively, demonstrating no statistically significant intergroup differences ($p \geq 0.05$), confirming data normality for the groups and homogeneity of variances.

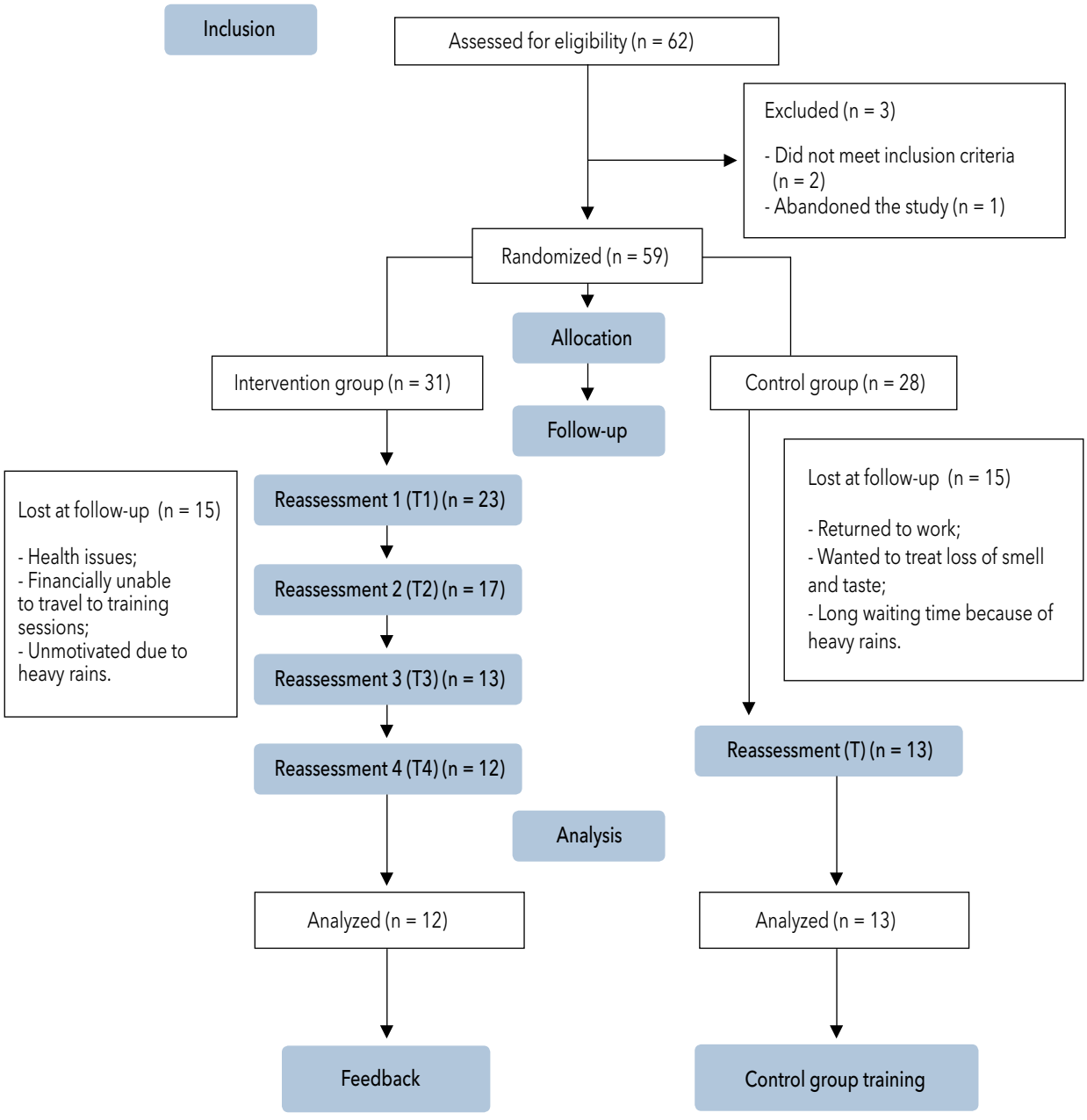

Figure 2 - Study design and participant allocation according to CONSORT guidelines.[19]

Table 1 - Sample characterization of sociodemographic, anthropometric and comorbidity data

Variables	**Total** (n = 59)	**Intervention group** (n = 31)	**Control group** (n = 28)	**p**
Age (years)*	52.32 (11.87)	53.74 (11.21)	50.75 (10.14)	p ≥ 0.05
Height (cm)*	1.65 (0.10)	1.66 (0.09)	1.64 (0.10)	p ≥ 0.05
BMI (cm/kg²)*	28.98 (7.86)	27.53 (4.51)	30.71 (7.22)	p ≥ 0.05
Female, n (%)	34 (57.60)	17 (54.80)	17 (60.70)	p ≥ 0.05
Marital status, n (%)				
Single	16 (27.10)	9 (29.00)	7 (25.00)	p ≤ 0.05
Married	34 (57.60)	17 (54.80)	17 (60.70)	
Other	9 (29.00)	5 (16.20)	4 (14.30)	
Education, n (%)				
Secondary	24 (40.70)	11 (35.50)	13 (46.40)	p ≤ 0.05
University	31 (52.50)	18 (58.10)	13 (46.40)	
Elementary	4 (6.80)	2 (6.50)	2 (7.10)	
Family income, n (%)				
3 to 6 MMW	34 (57.60)	18 (58.10)	16 (57.10)	p ≤ 0.05
1 to 3 MMW	17 (28.80)	8 (25.80)	9 (32.10)	
Up to 1 MMW	8(25.80)	5 (16.10)	3 (10.70)	
Ethnicity, n (%)				
White	21 (35.60)	12(38.70)	9 (32.10)	p ≤ 0.05
Brown	30 (50.80)	15(48.40)	15 (53.60)	
Other	8 (25.80)	4(12.90)	4 (14.30)	
Comorbidities, n (%)				
Hypertension	26 (44.10)	12 (38.70)	14 (50.00)	p ≥ 0.05
Heart disease	8 (13.60)	2 (6.50)	6 (21.40)	p ≤ 0.05
Diabetes mellitus	6 (10.60)	3 (9.70)	3 (10.70)	p ≤ 0.05
Other	19 (31.70)	14 (54.90)	5 (17.90)	p ≥ 0.05

Note: *Mean (standard deviation); BMI = body mass index; MMW = minimum monthly wage (R$1,212.00~USD233.00 in 2022; p = significance value.

Table 2 - Inter and intragroup comparison after 12 weeks

	Intervention group (n = 31)			**Control group** (n = 28)			**p***		**p****
	T0	T4	T4-T0	T0	T	T-T0	GI	GC	
6MWT (m)	464.5 (81.26)	518.6 (82.68)	54.10	441.2 (118.70)	433.9 (111.70)	-7.30	0.55	0.61	0.13
Berg	48.8 (4.00)	51.9 (4.26)	3.10	47.8 (3.96)	47.9 (4.96)	0.10	0.68	0.56	0.87
SF-36	96.3 (10.14)	102.6 (5.53)	6.34	96.4 (8.05)	97.7 (7.74)	1.30	0.05	0.90	0.81

Note: T0 = initial assessment; T4 = final IG reassessment; T4-T0 = mean difference; T = final CG reassessment; T-T0 = mean difference; IG = intervention group; CG = control group; 6MWT = 6-minute walk test; Berg = Berg scale; SF-36 = Quality of Life questionnaire. *Values obtained from the Kolmogorov-Smirnov test of normality; **Values obtained from the Levene test for homogeneity of variance. Data expressed as mean (standard deviation).

Discussion

This study assessed the impact of multicomponent rehabilitation in individuals with post-COVID-19 syndrome. In the population submitted to intervention, positive functional mobility and quality of life results were observed, albeit not statistically significant.

There was a predominance of women (57.6%), corroborating Fortuna et al.,[20] where 55% of cases were women. Mean BMI was 28.98 kg/m^2, not corroborating Eksombatchai et al.,[21] who found a BMI of 23.8 kg/m^2 in 87 individuals with COVID-19. In the present study, the most frequent comorbidities were hypertension (44.1%), heart disease (13.6%) and diabetes (10.6%), differing from the Paraíba State Health Department data,[22] where the three main comorbidities were heart disease (31%), diabetes (30%) and hypertension (13%).

Ferioli et al.[23] showed that the 6MWT is useful in post-COVID follow-up, correlating with the severity of the acute phase and with functional/radiological impairment in the chronic phase, and making it possible to assess improvements in exercise capacity. This corroborates IG performance in the present study, since the 6MWT revealed an increase in the average distance covered from 464.4 (initial assessment) to 518.6 meters (final reassessment). Eksombatchai et al.[21] studied COVID-19 groups with mild symptoms and walking pneumonia and found a decline from 538 ± 56.8 to 527.5 ± 53.5 meters, corroborating the results obtained by the CG of the present study, with an average decrease in distance covered between initial assessment and final reassessment from 441.2 to 433.9 meters.

This study observed that after a 12-week intervention, the average Berg scale score between initial assessment and final reassessment increased from 48 to 51.9, albeit not statistically significant ($p \geq 0.05$). Miyamoto et al.[15] infer that the score for a high risk of falling would be less than 45. Giardini e et al.[24] found a decline in dynamic balance and rise in oscillation during static posture in severely affected patients in the acute phase of COVID-19. However, hospitalization may result in balance problems and muscle weakness that are not necessarily related to COVID-19.

With respect to quality of life, the IG obtained an increase in the average score from 96.3 (initial assessment) to 102.6 (final reassessment), although not statistically significant ($p \geq 0.05$). According to Brazier e et al.[16] a score of 100 represents the best health status. Sousa et al.,[25] found that patients with post-COVID-19 syndrome exhibited worse results on the SF-36.

A limitation of the present study is the fact that collections were suspended due to the heavy rainfalls in May 2022, precluding access to collection sites. A majority of the sample did not engage in physical activity, which may have had a direct impact on the results. IG participants resumed training, but some of the CG were unmotivated to continue.

Conclusion

Multicomponent rehabilitation was not effective in treating post-COVID-19, since the increases in the variables studied were not statistically significant. The changes observed may significantly affect a larger sample. Given the challenges faced when investigating this population, new studies are needed to make a clinical contribution to this disease.

Authors' contributions

KCVO was responsible for collecting and interpreting data and writing the manuscript; APLF for writing, preparing the original draft and editing. JSM, DAS and KVS contributed with the conception, literature review and data collection. LCL was responsible for revision, writing, data analysis and interpretation. MGRA was responsible for the conception, study design and statistical analysis. All the authors approved the final version of the manuscript.

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