ORIGINAL RESEARCH

Changes in Physical Functioning and Fall-Related Factors in Older Adults Due to COVID-19 Social Isolation

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ABSTRACT

Background

Social isolation has been one of the main measures for the prevention of COVID-19. It's possible that, in addition to the natural aging-related deficits, social isolation has accelerated the decline of the different components of physical and mental capacity in older adults. This study aimed to compare the functional capacity and concern about falling in older adults before and during COVID-19 social isolation.

Method

This observational longitudinal study was carried out with 45 community dwelling older adults (mean age 65.6 ± 4.6 years, 88.8% women). Functional capacity and concerns about falling assessments were carried out before the COVID-19 pandemic, and between the 16th and 18th week of social isolation. All testes were face-to-face, except the second FES-I assessment, which took place via telephone call in order to minimize a prolonged person-to-person contact. Muscle strength, muscle power, functional mobility, functional muscle fitness, upper and lower body flexibility, dynamic balance, and Efficacy Scale were assessments.

Results

Regarding functional capacity, there was 14% decline in muscle strength ($p<.001$), 7% in power ($p=.001$), 11% in functional mobility ($p=.001$), 20% in functional muscle fitness ($p=.001$), and 60% in upper body flexibility ($p=.001$) and 33% lower body flexibility ($p=.003$). The dynamic balance and the concern about falling showed no statistically significant differences.

Conclusion

Thus, it can be concluded that there was a decline in older adults' functional capacity during COVID-19 social isolation.

Key words: COVID-19, social isolation, older adults, functional capacity, concern about falling

INTRODUCTION

Effective public health strategies to control the spread of coronavirus are utmost and include stay-at-home orders aimed at self-isolation and physical distancing whereby movement behaviors within a community are contained or limited.(1,2) Although the implementation of such restrictions is desirable to control the pandemic, reduction in levels of physical activity and increasing sedentary time(3) ultimately may lead to adverse health-related consequences, particularly in older adults—a population at risk of having severe infection,(4,5) as well as ICU admission and death.(6)

Mostly in Brazil there was not a full quarantine regime, but measures such as the suspension of events, school closures, and partial economic lockdown.(7) However, for those considered as a risk group, there was a greater restriction of mobility and social interaction.(7) Data from a systematic review and meta-analysis emphasize that this social isolation contributed to a decrease in physical activity levels during this period.(8)

Movement restriction and step-reduction approaches (e.g., inactivity due immobilization, bed rest or surgery) negatively impact neuromuscular system by leading to transient muscle atrophy, faster progression to sarcopenia phenotype, as well as multimorbidity.[9,10] Studies also have been shown the psychological impact of activity-related restrictions after fall episode; older adults often report increasing levels of concern of a recurrent fall episode.[11,12] In this sense, the potential physical and psychological burden associated with prolonged periods of movement restraints as happened during COVID-19 outbreaks could potentially contribute for poor health prognosis, lost of autonomy to perform activities of daily living, as well as poor quality of life and well-being.[13]

Understanding the potential effects of stay-at-home orders in the context of aging is relevant and may shed light on local and global public health strategies to counteract negative outcomes imposed by COVID-19 and promote healthy aging. Thereby, we aimed to compare the physical functioning and fall-related psychological consequences of social isolation in community-dwelling older adults.

METHODS

Experimental Design

The study was approved by the Federal University of Pernambuco's Ethics Committee (protocol no. 14788819.7.0000.5208). Participants agreed with all terms involved with study and signed the Consent Form prior to baseline assessments. Additionally, outcomes of interest were gathered between February 18 and July 23, 2020, in Recife, Pernambuco, Brazil. We reported the main components of the study and key findings following the recommendations of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE).[14]

Baseline assessments were completed before COVID-19 closures on March 16, 2020 (first wave). These data were gathered from a previous clinical trial which primarily looked at the effects of exercise training on functional mobility in older adults but had to be suspended due to the COVID-19 pandemic. Follow-up assessments (physical functioning, flexibility, and dynamic balance) were conducted 16 to18 weeks after the first closures restrictions, using a home-delivered approach with all participants who agreed to receive the researcher in their homes. All physical functioning assessments were delivered in outdoor spaces, and a trained research staff used protective equipment including mask, face shield, gloves, and 70% Ethyl Alcohol Gel Hand Sanitizer as recommended by the WHO[15] as well as the local healthy authorities. The self-efficacy follow-up measure was delivered remotely thought a phone call. The final assessment was due on July 23, 2020. Figure 1 shows the experimental design of the study.

Participants, Eligibility Criteria, Recruitment, Sample Size

We included older adults ≥ 60 years living independently in their own homes and community if they met the following criteria: 1) not be engaged regularly in an exercise training program (e.g., walking training) in the previous six months; 2) have no restriction regarding musculoskeletal (e.g., severe osteoarthritis), neurological, cardiometabolic disorders, or other relevant health concern/condition; 3) be able to attend all scheduled appointments (e.g., baseline visits), and other study procedures; 4) agree and sign the consent form. Participants who did not complete follow-up assessments were excluded.

Participants' recruitment was performed through general newspaper advertisements, social media, wait list of previous research, and verbal invitation (e.g., word of mouth).

Outcomes

Lower Limb Muscle Strength

We determined the lower limb muscle strength through the 30-Second Sit to Stand (STS) test, which is part of the well-known Fullerton Functional Fitness Test Battery,[16,17] and showed excellent reliability [intra-class coefficient (ICC)= 0.87]. Briefly, the 30-Second STS test assessing the completed number of sit-stand-sit cycles for 30 sec. At the beginning of test, participants remain seated, back straight on a folding chair without arms and at a height of 43.2 cm. The participant's arms should be crossed at the wrists and held against the chest. Additionally, feet should be apart and placed on the floor. After a previous familiarization procedure (one or two repetition practice), they are encouraged to complete as many full stands as possible within 30 sec,[18] where higher values reflect better performance.

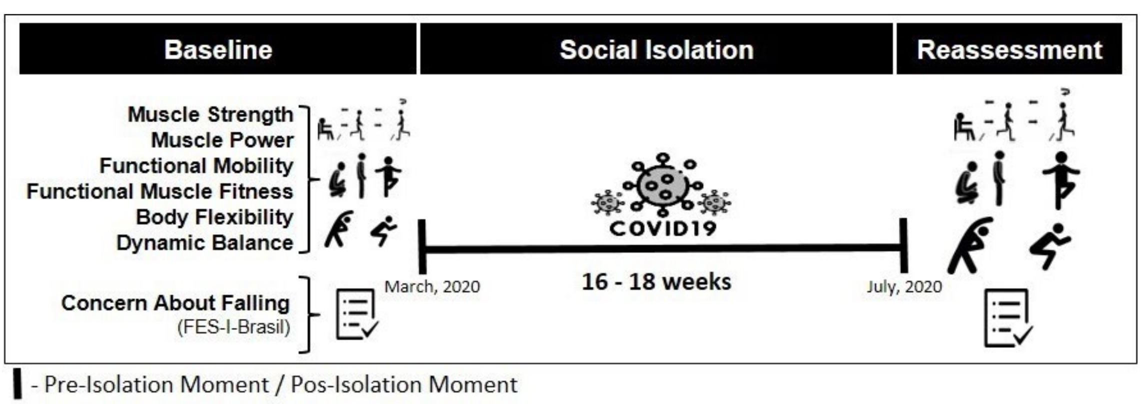

FIGURE 1. The experimental design of the study

Lower Limb Muscle Power

The lower limb muscle power was computed using a previous predictive equation estimation[19] using the number of repetitions successfully performed during the first 20 sec of the STS test and the body weight (in kg) of the participants as follow: Average Power (watts) = -504.845 + 10.793 (body weight) + 21.603 (no. of chair rises in the first 20 sec). The reliability index for that measure was excellent [intra-class coefficient (ICC)= 0.98].

Functional Mobility

We assessed the functional mobility by the Timed Up and Go (TUG),[20] which measures the time (in seconds) that the participant takes to get up from a chair, walk to a line at 3 meters distance, walk around it, and return and sit back down in the chair. Data were recorded using a stopwatch, and a shorter time taken to complete each test indicated better functional mobility performance. TUG is a valid tool, widely used in the context of geriatric care, and the reliability index was excellent [intra-class coefficient (ICC)= 0.93].

Functional Muscle Fitness

Functional muscle fitness was assessed thought the Sitting–Rising Test (SRT), which measures the participant's ability to sit and rise from the floor by means of counting the number of supports (hands and/or knees or even the hands under the knees or legs) that a individual needed to successfully complete both steps: 1) to sit, and 2) rising from the floor.[21] In each step, partial scores ranging from 0 (poor) to 5 (good) were assigned (total score 0 to 10 points). One point was deducted for any support used (hands or elbows to sit or stand) or 0.5 for any observed imbalance. If the participant could not perform the steps without help of another person or a wall, or even needed more than four supports, a minimum score was assigned (zero). We used a composite score from the sum of sitting and rising partial scores, which ranged from 0 (poor functional muscle fitness) to 10 (better functional muscle fitness). The reliability index was excellent [intra-class coefficient (ICC)= 0.87].

Flexibility

To assess the upper body flexibility, the Apley's ScratchTest was used, which aims to assess the flexibility of the scapular waist muscles.[22] The subject attempts to touch or overlap the fingers of both hands when trying to reach the lower back with one arm placed over the shoulder, and the other arm behind the back, close to the waist. When the fingertips touch, the score is zero. If they do not touch, the score is negative, and the distance between the fingertips is measured in centimeters. If they overlap, the score is positive, and how far the tip of a middle finger has exceeded the other is measured in centimeters.

As for the assessment of lower body flexibility, the chair sit and reach test was used, in which the subject is invited to sit at the front edge of the chair, with one leg bent and the other one extended forward, with the heel on the floor and the toe pointed upwards.[23] Thus, the subject attempts to reach forward toward the toes by bending at the hip, with one hand on top of the other. If the fingertips touch the toes, the score is zero, just like the Apley's test. If the subject's fingertips do not touch the toes, the score is negative, and if they overlap, the score is positive.

Dynamic Balance

We assessed the dynamic balance by means of the Brazilian version of the Berg Balance Scale (BBS).[24] BBS is a validated, reliable and gold standard measure for functional balance tests.[25] The administration of BBS takes roughly 15 to 20 min and encompasses a set of 14 balance-related tasks ranging from simple skills (i.e., transfers, standing unsupported) to difficult motor skills (i.e., 360° rotation, tandem standing position). The degree of success in achieving each task receives a score from zero (not capable) to four (independent). The sum of the scores obtained in each one of the tasks ranged from 0 to 56 points (higher scores indicate better dynamic balance).

Concerns About Falling

We assessed the concerns about falling as an index of self-efficacy—a fall-related psychological risk factor—through a cross-culturally adapted, translated, validated, and reliable[26] version of the Falls Efficacy Scale (FES-I-Brazil). This 16-item instrument encompasses questions about the different concerns when performing activities basic and instrumental to daily living, socialization, and postural stability activities such as "house cleaning", "taking a shower", and "walking under uneven ground surfaces conditions". Each question had scores ranging from one to four ('1' = not at all concerned; '4' = high concern). We used the sum of scores in each question to compute an overall measure of concern about falling that ranged from 16 (without concern) to 64 (extreme concern).

Statistical Analysis

All analysis was performed using the Statistical Package for the Social Sciences (SPSS for Windows, Version 20.0; IBM SPSS Statistics, Armonk, NY). Normality of data was checked using the Shapiro-Wilk test. We compared the changes in each outcome assessed though a paired sample *t*-test or the Wilcoxon test, accordingly. A descriptive summary and the main results are presented as mean and standard deviation (SD) (parametric data), median and interquartile range (non-parametric data), or relative frequencies (categorical data). Statistical significance was set as $p<.05$. The MCID (minimal clinically important difference) was estimated by distribution-based estimates including one-half standard deviation (SD × 0.5), effect size (mean change/baseline SD), standard error of measurement and minimal detectable change (1.96 × 2 × standard error of measurement).

RESULTS

Figure 2 shows the study flowchart. Out of 71 participants screened for eligibility, six individuals did not meet the inclusion criteria. Of the 65 individuals who met the inclusion

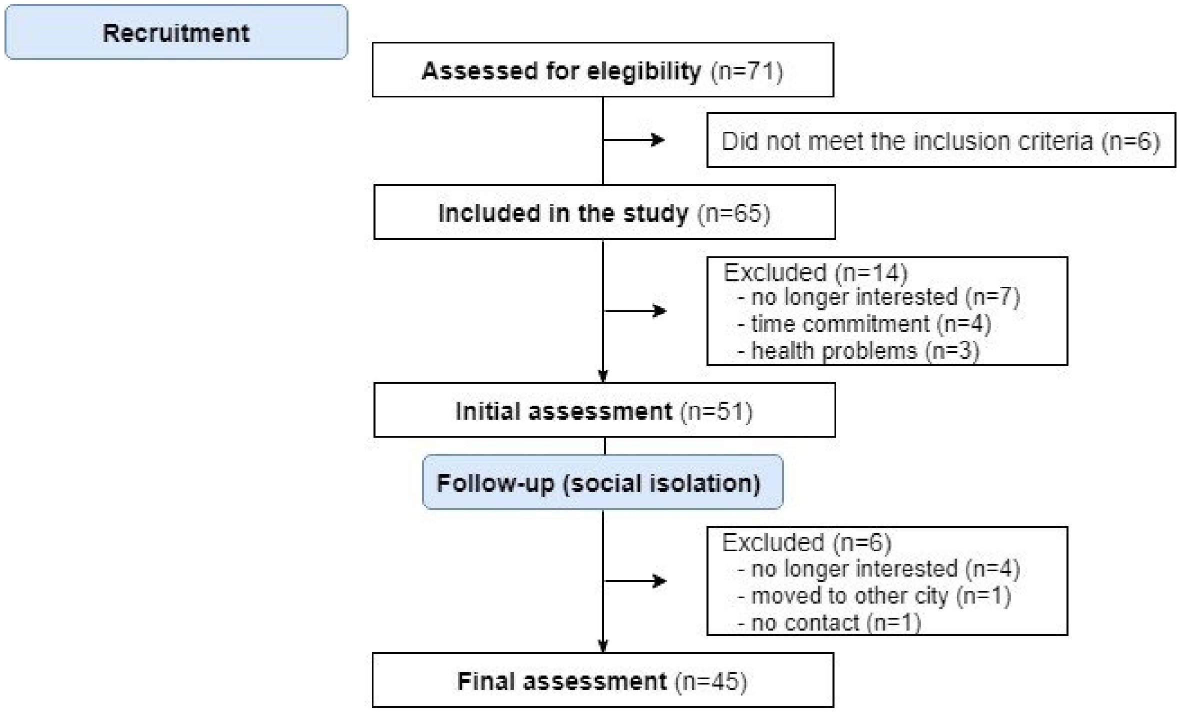

FIGURE 2. Study flowchart

criteria, however, 14 dropped out due lack of time, personal reasons, and health-related issues. Thus, 51 participants completed the baseline assessments in which six participants did not complete outcome assessments at follow-up and 45 participants were included in the present study.

Table 1 shows the participant characteristics. The mean of age was 65.3 (SD=4.1) years, and majority were women (89%) and were overweight (BMI= 28.7 kg.m^{-2}, SD=4.0). Most prevalent comorbidity was hypertension (69%) and the less prevalent was osteoarthritis (13%).

As displayed in Table 2, compared with baseline values, participants experienced a detrimental reduction on several physical functioning (p<.05 for all) including lower limb muscle strength (14%; MCID=0,38 reps) and power (7%; MCID=6,18 watts), functional mobility (11%; MCID=0.21 sec), functional muscle fitness (20%; MCID=0.15 pts), upper (60%; MCID=0.44 cm) and lower (33%; MCID=0.12 cm) body flexibility at completion of follow-up. Conversely, there were no substantial impact of social isolation on dynamic balance (p=.782; MCID=0.009 pts) as well as self-efficacy (p=.261; MCID=0.32 pts).

No participant reported being infected with Sars-CoV-2 throughout the study.

DISCUSSION

The present study examined the effect of social isolation caused by the COVID-19 pandemic on the functional capacity and fear of falling in an elderly community-dwelling population. Our key findings indicated that 16 to 18 weeks of social isolation promoted a significant decline on muscle strength and power, functional mobility, functional muscle fitness, and flexibility in community-dwelling older adults.

The decrease in the levels of strength and power identified during the period of social isolation can be justified in an integrated way, given the natural relationship between these variables, since power is the product of force by speed.[27] The decline of both aspects can be discussed from the perspective of the natural losses of aging, the difference between the findings and the normative values for the age group studied, and the decrease in the levels of physical activity during the period of social isolation.

Strength and power losses were 14% and 7%, respectively. Naturally, the aging process is accompanied by a lower capacity to produce strength and power, both by the increase

TABLE 1.
Overall characteristics of participants included in the study

Variables	*Values*[a]
Sex (% women)	89
Age (yrs)	65.3 (4.1)
Height (m)	1.56 (0.07)
Body mass (kg)	70.1 (11.1)
BMI (kg.m^{-2})	28.7 (3.98)
Hypertension (%)	68.8
Diabetes (%)	20
Osteoarthritis (%)	13.3

[a]Values are presented in mean (SD) or %.

TABLE 2.
Median (interquartile range)/mean (SD), significance of *p* value (*p*) and power (β-1) of the comparison between the measurements of the variables in the pre- and post-isolation moments

	Pre	*Post*	*Δ%*	*p*	*β-1*
Functional Component					
Muscle Strength[a] (repetitions)	14 (2)	12 (2.50)	-14%	.000[c]	0.99
Muscle Power[b] (w)	459.2 (123.60)	428 (121.40)	-7%	.001[c]	0.50
Functional Mobility[b] (sec)	9.48 (1.09)	10.55 (1.22)	11%	.000[c]	0.99
Functional Muscle Fitness[a] (score)	5 (2.75)	4 (3.50)	-20%	.001[c]	0.94
Lower Body Flexibility[a] (cm)	-5 (13.75)	-8 (16)	-60%	.001[c]	0.93
Upper Body Flexibility[a] (cm)	3 (4)	2 (3.50)	-33%	.003[c]	0.87
Dynamic Balance[a] (score)	54 (3)	53 (3)	-2%	.782	0.08
Concern About Falling[a] (score)	23 (12.50)	27 (13.5)	17%	.261	0.26

[a]Median and interquartile range.
[b]Mean and SD.
[c]Statistically significant values.
Δ% = percentage difference between the measurements of the variables in the pre- and post-isolation moments.

in neural transmission instability and by the morphological aspects of the motor units.[28,29,30] Losses associated with decreased levels of physical activity during social isolation[3] may also have impacted other factors related to functionality.[28,31,32,33]

With regard to strength specifically, from the clinical point of view, the elderly in the present study presented a lower-than-expected strength performance for their age group. It is expected that, in order to maintain physical independence, individuals between 65 and 69 years of age perform 15 repetitions.[34] However, after the period of isolation, the elderly further reduced performance from 14 to 12 repetitions. The result obtained after isolation corresponds to the normative value for maintaining the physical independence of elderly older than 80 years. This is a considerable reduction for a short period, which can be justified by the additional effects generated by social isolation.[35]

Another relevant aspect related to the functional capacity in older adults is the functional mobility, which was assessed by the TUG test in the present study.[20] The performance in the TUG test is a moderate predictor of falls in older adults who are considered healthy.[36] It has been suggested that individuals who have a TUG test score greater than 8.4 sec have already experienced a fall or are more prone to falling.[37] After 18 weeks of social isolation, a 11% decline in the performance was observed, with the same task being performed with an additional 1.07 sec. According to Schoene *et al*.,[36] at each 0.6 sec increase in the TUG test, the risk of falls in healthy older adults also increases, although no cutoff point is recommended.

Functional muscle fitness is a capacity that encompasses different components, and is measured by a simple method that assesses the ability to sit and rise from the floor, which requires strength, balance, joint flexibility, and motor coordination.[21] It is noteworthy that the sit and rise test is a predictor for all causes of death in people aged 51 to 80 years, and each unit increase in the score causes a 21% reduction in the risk of death. However, no studies were found to allow comparisons with our experimental design, from a clinical point of view.[38] In the present study, even considering a short period, the older adults had, on average, a reduction of one point in the score, which increases the risk of death.

Another important functional component affected by social isolation was upper and lower body flexibility. Clinically, values up to 25% below the cutoff point are considered normal and acceptable, while greater losses already point to a considerable impairment for body flexibility and, consequently, for the autonomy of this older adult.[39] In the present study, there was a 60% reduction in upper body flexibility and a 33% reduction in lower body flexibility.

Dynamic balance was the only functional component that did not show significant differences. In a systematic review, Downs *et al*.[40] pointed out that the assessment of the performance of a healthy dynamic balance seems to be more appropriate for samples of older adults aged 70 years and over, even though the Berg Balance Scale is a widely used instrument for the population of older adults.

Regarding concerns about falling by the elderly, in fact, no significant differences were found between the assessments; however, the increase in concern about falling became a borderline score between the classification groups of "moderate concern" and "high concern" about falling.[41] An analysis to be performed is based on the tasks that compose the Falls Efficacy Scale,[26] but it is important to note that this scale was not validated for a pandemic context where there is social isolation. In the current scenario, six of the 16 actions addressed on the scale have not been experienced in the pandemic moment, such as: "going shopping", "walking in crowded places" or "going up and down hills", a fact that may have underestimated the results of the scale.

It is important to note that this study has some limitations, such as the lack of control for intervening factors. Among them, the record of physical activities performed at home during the isolation period and the level of compliance with these measures during that same period. Another limitation of the study was the absence of an instrument capable of measuring cognitive aspects, and the inability to respond to the Falls Efficacy Scale in an autonomous way, despite the volunteers having met the inclusion criteria, declaring themselves capable of understanding and committing to the study steps. The impossibility of maintaining a group without social isolation in times of pandemic in order to have a comparison between two different groups was also a limitation of the study, in addition to the sample size that was compromised in the face of the pandemic scenario.

On the other hand, as strengths of the study, we can highlight the use of specific, validated, and sensitive instruments for older adult population, applied directly and longitudinally, which allowed the dimension of the impacts resulting from social isolation to be assessed, unlike the studies included in systematic review conducted by Chtourou *et al.*,[42] who assessed the impacts via online questionnaires, using a cross-sectional design. All this in addition to allowing the identification of the most affected variables during the isolation period and providing subsidies to define the best strategies to minimize these impacts.

Finally, it is important to highlight that the changes between the first and second measures for all tests were above the minimal clinically important difference (MCID), even for the non-significant ones. Additionally, the results showed large (muscle strength, mobility, muscle fitness, lower and upper body flexibility) or moderate (muscle power) power effects for all significant tests. The nonsignificant tests were also those with low power. Therefore, all tested functional capabilities should be considered in a clinical context of older peoples' social isolation.

In view of the above, it is relevant to highlight the impacts of social isolation caused by the COVID-19 on the lifestyle of older adults in general, and the functional and psychological damages produced by the decrease in the levels of physical activity during the pandemic. Therefore, it is suggested to health professionals in different contexts—rehabilitation and/or physical conditioning—that protective measures to maintain functional capacity and reduce the concern about falling should be adopted when performing home-based exercises.

CONCLUSION

This premilinary study provided evidence of physical functioning impairment through 16 to 18 weeks of social isolation during the first wave of COVID-19 in community-dwelling older adults. Most domains affected lower limb muscle strength and power, functional mobility, functional muscle fitness, and flexibility levels. Conversely, the stay-to-home order restrictions did not promote significant changes on dynamic balance and self-efficacy.

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Not applicable.

CONFLICT OF INTEREST DISCLOSURES

We have read and understood the Canadian Geriatrics Journal's policy on conflicts of interest disclosure and declare there are no conflicts of interest.

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