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Biopsychosocial factors and falls among older adults during the COVID-19 pandemic: a longitudinal study

Fatores Biopsicossociais e quedas em idosos durante a pandemia de covid-19: um estudo longitudinal

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ABSTRACT

The restrictions imposed by the COVID-19 pandemic impacted the older adult population. Therefore, this study aimed to investigate the difference between timeline changes (baseline vs. final assessment) of the biopsychosocial factors and fall prevalence during the pandemic; the differences between infected and non-infected older adults regarding the biopsychosocial approach; and to describe the characteristics of post-COVID falls. Thirty-one community-dwelling older adults (70.9 ± 5.6 years, ♀20) were evaluated twice in one year. The variables tested were based on the biopsychosocial approach: diseases and COVID-19 infection (Health Conditions), body mass index, cognition, and depression (Body Functions and Structures), physical activity, sedentary behavior (SB), and functional capacity (Activity), health-related quality of life (HRQoL, Participation), medications (Environmental), falls history and fear of falling (Personal). Cohen's effect size (*d*) was used in data analysis. Comparing the timeline changes (baseline vs. final assessment) the biopsychosocial factors were worst in Activities (SB, *d* = 0.70) and Personal Factors (Fear of falling, *d* = 4.06). The infected older adults showed worst scores in Body Functions and Structures (Cognition, *d* = 0.77), Activity (SB, *d* = 0.55), Participation (HRQoL domains, *d* = from 0.31 to 0.78), and Personal Factors (Fear of falling, *d* = 0.54). Falls prevalence enhanced between the evaluations (12.9%) and was higher in infected older adults compared to not infected (63.6% vs. 25%). Older adults showed negative changes during the pandemic in most biopsychosocial domains, especially in older adults with COVID infection and in aspects related to falls, SB, and HRQoL compared to their counterparts without COVID infection.

Keywords: Accidental falls; Aging health; Older people; Biopsychosocial.

RESUMO

As restrições impostas pela pandemia de covid-19 impactaram a vida da população idosa. Sendo assim, o presente estudo teve como objetivo investigar a diferença entre mudanças ao longo do tempo (avaliação inicial vs. final) dos fatores biopsicossociais e prevalência de quedas durante a pandemia; as diferenças entre idosos infectados e não infectados considerando a abordagem biopsicossocial; e descrever as características das quedas pós-covid. O estudo teve como objetivo investigar os fatores biopsicossociais e a prevalência de quedas durante a pandemia de covid-19. Trinta e um idosos da comunidade (70,9 ± 5,6 anos, ♀20) foram avaliados duas vezes em um ano. As variáveis testadas foram baseadas na abordagem biopsicossocial: doenças e covid-19 (Condições de Saúde), índice de massa corporal, cognição e depressão (Funções e Estruturas do Corpo), atividade física, comportamento sedentário (CS) e capacidade funcional (Atividade), qualidade de vida relacionada à saúde (QVRS, Participação), medicamentos (Ambiente), histórico e medo de cair (Pessoais). O tamanho de efeito de Cohen (d) foi usado na análise dos dados. Comparando os momentos de avaliação (Inicial vs. Final) os fatores biopsicossociais foram piores em Atividades (CS, d = 0,70) e Fatores Pessoais (Medo de cair, d = 4,06). Os idosos infectados apresentaram escores piores em Funções e Estruturas do Corpo (Cognição, d = 0,77), Atividades (CS, d = 0,55), Participação (domínios da QVRS, d = de 0,31 a 0,78) e Fatores Pessoais (Medo de cair, d = 0,54). A prevalência de quedas aumentou entre as avaliações (12,9%) e foi maior entre os idosos infectados (63,6% vs. 25%). Os idosos apresentaram mudanças negativas durante a pandemia na maioria dos domínios biopsicossociais, especialmente nos idosos com histórico de covid-19 e nos aspectos relacionados a quedas, CS e QVRS, em comparação com seus pares sem infecção por COVID.

Palavras-chave: *Quedas acidentais; Envelhecimento; Idosos; Biopsicossocial.*

Introduction

The coronavirus disease (COVID-19) pandemic has been a significant worldwide infectious disorder burden in recent history. One of the first actions to mini-

mize its effects was to impose social distancing, which significantly impacted several aspects of the older adult population. For example, social distancing may have affected older adults' health care[1], reduced social interactions, and increased the risk of mental disorders[2]. Furthermore, it has been suggested that the performance of daily activities and the engagement in regular physical were reduced[3], which may cause a decline in mobility and physical performance. Such changes may have impacted the quality of life[4] and increased the risk of disabilities and falls[1].

Falls are one of the major causes of unintentional injury and mortality, and the risk of falls increases according to age, functional capacity, physical activity (PA) level, and fall risk awareness[5]. Additionally, the importance of the biopsychosocial perspective has been identified in predicting falls[6]. The biopsychosocial model is defined by a functional and a disease status contemplated through the dynamic interplay of contextual and environmental health conditions, activities, and the individual's ability to perform their function and social roles[7]. According to the International Classification of Functioning, Disability, and Health, the biopsychosocial model is based on the functioning that is determined by the interactions between the components of Body Functions and Structures, Activity, Participation, as well as by the influence of Contextual Factors, including Health Condition, Environmental and Personal factors. Therefore, the model recognizes that functioning and disability can be affected by external and internal factors[8].

Although health and falls among older adults are well documented in the literature, a biopsychosocial approach including falls in the actual scenario is necessary. Furthermore, the pandemic consequences require special attention, given all the changes observed in daily activities, especially among vulnerable groups, such as older adults. Therefore, during the pandemic, little is known about the burden of biopsychosocial aspects among older adults. In addition, the results of previous studies may not reflect the pandemic's impact on the biopsychosocial aspects of older adults infected by COVID-19, as they are more prone to be more impacted than their non-infected peers.

Thus, the present study aimed to investigate: a) the difference between timeline changes (baseline vs. final assessment) of the biopsychosocial factors and fall prevalence during the pandemic; b) the differences between infected and non-infected older adults regarding the biopsychosocial approach; and c) to describe the characteristics of post-COVID falls (place, circumstances, and consequences). It was hypothesized that the pandemic had a negative impact on biopsychosocial aspects, and the non-infected older adults presented better scores compared to their COVID-19-infected counterparts.

Methods

Participants

This longitudinal study was performed in Curitiba – Brazil, where 11% of the population is aged ≥ 60 years. Participants living independently in the community were invited through social media. The sample size estimates were performed in the statistical software G*Power (University of Düsseldorf, Dusseldorf, Germany). Given the study design (Wilcoxon test), an a priori power analysis was conducted with the following criteria: effect size 0.50, an alpha error <.05, and the desired power (1 – β error) = 0.80, resulting in a minimum sample size of 28 participants.

The eligibility criteria were: (1) over 65 years of age and (2) accepting the researcher's face-to-face visit to evaluate the functional capacity and cognition. Individuals with cognitive impairment assessed by Montreal Cognitive Assessment (MoCA) adjusted by the educational profile and suffering from neurological or musculoskeletal problems that limited their accomplishment in all procedures, and those unable to participate in all evaluations were not included. Initially, 90 older adults from the local community were recruited. After the first contact, 54 declined or refused to participate, resulting in 42 older adults for the first evaluation. After applying the eligibility criteria, 31 older adults were included in the study. The significant sample loss may be associated with increased mortality rates of COVID-19 and related sequelae. Initially, the participants were grouped for the analysis according to the evaluation time (Baseline vs. Final Assessment, n = 31). Then, the Final Assessment data were allocated according to the COVID-19 infection (Infected [n = 11] vs. non-infected [n = 20]). All participants signed a consent form approved by the Ethics and Research Committee of the Federal University of Parana (CAAE: 39004420.0.0000.0102, number of the ethical report 4.817.680).

Procedures

The baseline assessments were conducted between April and July 2021, and then individuals were re-evaluated between April and July 2022, totaling one year of

difference between the two assessments (baseline and final assessment). All assessments were face-to-face interviews, with an interval of a year between them, at the participants' residences. Individuals who expressed interest in participating in the study were required to have a suitable space within their residence where functional tests could be administered. This space was required to be on a flat surface with regular flooring. The functional tests followed a standardized order of administration, which included the following sequence: firstly, the static balance test, followed by the 4-meter walk test, the Five Times Sit-to-Stand Test, and finally, the Timed Up and Go test. This standardized order was employed to ensure consistency in the assessments. The biopsychosocial model is based on the descriptions of health domains present in the International Classification of Functioning, Disability and Health classification [8]. The variables were categorized into the following categories: a) Body Functions and Structures (body mass index; cognition; depression); b) Activity (PA levels; Sedentary Behavior [SB]; Functional capacity); c) Participation (Health-related Quality of Life [HRQol] domains); and d) Contextual Factors (Environmental [Medications] and Personal Factors [Falls history and fear of falling] and Health Conditions [Chronic diseases; COVID-19 infection]). All interviewers were trained and received a qualification program to standardize all procedures.

Body functions and structures

The cognitive function was assessed by the MoCA. The maximal test scored is 30 points (a correction of 1 point is added for people with > 12 years of education), with a cutoff of 26 points for cognitive impairment. In addition, body stature and mass were measured, and body mass index was calculated using standard procedures. Depression was assessed using the Geriatric Depression Scale (short version), formed by 15 questions. The greater the score, the greater the depression state (0-5 points - normal condition; 6-10 points - mild depression and >10 - severe depression).

Activity

PA level was assessed by the Minnesota Leisure Time Activities Questionnaire. The weekly volume of physical activities was classified as: insufficiently active (< 150 min*week^{-1}) and sufficiently active (≥150 min*week^{-1}) . SB was evaluated through two questions of the International Physical Activity Questionnaire and considered the time spent, in hours, in routine activities on weekdays and weekends. The SB was classified as: low (≤ 360 min*day^{-1}) and high (> 360 min*day^{-1}).

The Short Physical Performance Battery (SPPB) was used to determine the functional capacity. It consisted of a static balance test (balance), a 4-meter walk test (gait speed), and the Five Times Sit-to-Stand Test (muscle power). In addition, the Timed Up and Go was used to assess the functional mobility.

Participation

The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) was used to assess the HRQoL. The instrument has 36 questions that include eight domains: functional capacity, physical aspects, pain, general health status, vitality, social factors, emotional aspects, and mental health. A final score from 0 to 100 was presented, in which 0 corresponds to the worst and 100 to the best HRQoL.

Contextual factors

The environmental factors and health conditions were evaluated by self-reported information about the use of medications (environmental factors), chronic disease diagnoses, and COVID-19 infection (health conditions). The Personal Factors included the fall history and the fear of falling.

Fall history was evaluated through the question, "Did you have a fall episode in the last 12 months"? A fall was defined as an unintended event that resulted in the individual's position changing to a lower level concerning his/her initial position. The older adults who reported a fall episode in the last 12 months were deemed fallers, irrespective of the number of falls. Furthermore, participants who reported falls were asked about fall location, fall circumstances, and fall consequences. Fall incidents were evaluated both at the baseline and in the final assessment.

The Falls Efficacy Scale-International is an instrument to assess the fear of falling during the performance of activities of daily living, external activities, and social gatherings. The scale has 16 activities, with scores from one to four in each item. The total score ranges from 16 (no concern about falling) to 64 points (extreme concern about falling).

Data analysis

Descriptive statistics (mean, standard deviation, frequency, and percentages) were performed to charac-

terize the participants. The Wilcoxon (for continuous data) and Chi-square test (for categorical data) were used to verify the time effect on the biopsychosocial factors on the total sample (baseline vs. final assessment, n = 31). The Mann-Whitney test was used for group comparisons (infected [n = 11] vs. non-infected [n = 20]). Finally, Cohen's effect size (*d*) was calculated to check the magnitude of the observed results. A small effect (*d* < 0.40), medium effect (0.40 to 0.75), large effect (0.75 to 1.10), and substantial effect (*d* >1.10) were assumed. The fall prevalence was evaluated by frequency and percentages. The significance level was set at p<0.05, and all statistical procedures were performed using SPSS (version 22) statistical package.

Results

The final analysis included 31 older adults who completed all assessments. They were aged between 65-86 years (70.9 ± 5.6 years). A detailed description is shown in Table 1.

Table 1 – Characteristics of the total sample and by gender at baseline.

Variables	Overall (n = 31)	Female (n = 20)	Male (n = 11)
	n (%)	n (%)	n (%)
Education level			
< 8 years	11 (35.5)	8 (40.0)	3 (27.3)
> 8 years	20 (64.5)	12 (60.0)	8 (72.7)
Occupation			
Retired	27 (87.1)	16 (80.0)	11 (100.0)
Employee	2 (6.5)	2 (10.0)	0 (0.0)
Housekeeper	2 (6.5)	2 (10.0)	0 (0.0)
Marital status			
Married	15 (48.4)	9 (45.0)	6 (54.5)
Divorced or single	9 (29.0)	5 (25.0)	4 (36.4)
Widowed	7 (22.6)	6 (30.0)	1 (9.1)
Chronic diseases			
Cardiovascular	14 (45.2)	10 (50.0)	4 (36.4)
Diabetes mellitus	9 (29.0)	6 (30.0)	3 (27.3)
Orthopedics	6 (19.4)	3 (15.0)	3 (27.3)
Respiratory	1 (3.2)	0 (0.0)	1 (9.1)
Cancer	1 (3.2)	1 (5.0)	0 (0.0)

The comparison between timeline changes on the total sample (baseline vs. final assessment, n = 31) indicated that there was an increased SB (p = 0.036) and fear of falling (p = 0.019). There was also an increase in COVID-19 infection prevalence of (32.3%), a growth in SB (12.9%), and fall rates (12.9%). The biopsychosocial domains also differed regarding COVID-19 infection status comparison (infected [n = 11] vs. non-infected [n = 20]) older adults), in which infected older adults presented the worst scores in Body Functions and Structures (cognition, *d* = 0.77, p = 0.038), Activities (SB, *d* = 0.55, p = 0.046), and Personal Factors (fear of falling and falls, *d* = 0.54, p = 0.014) compared to their non-infected counterparts. The fall prevalence increased and was higher in the infected than in the non-infected older adults (p < 0.05) (Table 2).

The fall characteristics are shown in Table 3 according to the baseline (fallers in the total sample) and the final assessment (infected fallers and non-infected fallers). The most frequently reported site where a fall occurred was inside the residence (baseline and infected). On the other hand, most falls occurred outdoors for the non-infected group. The circumstances and consequences associated with falls varied widely between groups.

The comparison of the HRQoL domains indicated a reduction in Vitality (67 vs. 56 points; p = 0.029, *d* = 0.48), Social functioning (84 vs. 76; p = 0.017, *d* = 0.43), Role-emotional (77 vs. 71; p = 0.024, *d* = 0.33), and Mental health (61 vs. 55 points; p = 0.022, *d* = 0.31) (Figure 1A). The older adults COVID-19-infected showed lower scores in Bodily pain (53 vs. 71 points, p = 0.033 *d* = 0.78), Vitality (52 vs. 63 points, p = 0.040, *d* = 0.49), Social Functioning (71 vs. 82 points, p = 0.042, *d* = 0.48), and Role-Emotional (61 vs. 77 points, p = 0.024, *d* = 0.70) (Figure 1B). The other domains showed no difference between assessments (p > 0.05).

Discussion

There are scarce reports regarding the burden of biopsychosocial factors and falls among older adults during the pandemic. The results indicate a worsening in several aspects of the biopsychosocial factors, especially in those infected with COVID-19 compared to their uninfected peers.

PA level was relatively unaffected in both assessments (i.e., baseline and final). However, it was noticed that most participants were above the recommendations for the health benefit maintenance of 150 minutes per week of PA. This may explain the functional capacity stability across assessments, as PA and functional capacity have been demonstrated as positively correlated field[5]. A recent study supported that it is more challenging to promote changes in very active than in older adults with insufficient PA levels[10].

Table 2 – Comparison between timeline changes of biopsychosocial domains of the total sample and according to COVID-19 infection (n = 31).

Variables	Total sample				Final assessment COVID-19 infection			
	Baseline* (n = 31)	Final assessment* (n = 31)			Infected (n = 11)	Non-infected (n = 20)		
Biopsychosocial Domains Continuous data	Mean ± SD	Mean ± SD	d	p	Mean ± SD	Mean ± SD	d	p
Body function & structure								
Body mass index (kg/m2)	27.6 ± 4.6	28.1 ± 4.4	0.10	0.332	27.9 ± 4.0	28.1 ± 4.8	0.03	0.924
Cognition (points)	22.9 ± 2.6	21.70 ± 2.1	0.51	0.132	20.9 ± 4.0c	23.7 ± 3.5	0.77	0.038
Depression (points)	2.8 ± 2.8	3.19 ± 2.1	0.17	0.288	3.8 ± 3.2	2.9 ± 2.9	0.28	0.858
Activity								
Physical activity (min/week)	244.5 ± 226.5	228.9 ± 215.4	0.07	0.714	182.0 ± 145.2	320.0 ± 259.8	0.44	0.217
Sedentary behavior (min/day)	507.7 ± 108.2	581.4 ± 106.8a	0.70	0.036	625.5 ± 192.9c	574.6 ± 199.0	0.55	0.046
Functional Capacity								
Balance (points)	3.7 ± 0.6	3.8 ± 0.6	0.05	0.831	3.7 ± 0.7	3.8 ± 0.5	0.15	0.921
Gait speed (s)	3.7 ± 1.1	3.8 ± 0.7	0.02	0.324	3.8 ± 0.8	3.5 ± 0.7	0.38	0.649
Muscle power (s)	17.0 ± 3.9	17.1 ± 4.5	0.01	0.835	17.7 ± 3.0	16.2 ± 4.8	0.37	0.395
SPPB Score (points)	9.4 ± 1.4	9.6 ± 1.0	0.17	0.194	9.2 ± 1.2	9.9 ± 1.6	0.50	0.517
Functional mobility (s)	10.8 ± 2.7	11.0 ± 2.5	0.10	0.453	11.3 ± 3.3	10.9 ± 2.5	0.15	0.476
Contextual environmental								
Medications (n)	2.1 ± 1.4	2.1 ± 1.4	0.02	0.856	2.2 ± 1.3	2.1 ± 1.5	0.06	0.985
Fear of falling (points)	24.4 ± 1.4	31.8 ± 2.2a	4.06	0.019	35.8 ± 11.7c	30.6 ± 13.4	0.54	0.014
Categorical data	n (%)	n (%)		p	n (%)	n (%)		p
Activity								
Physical activity level								
Insufficiently active	13 (41.9)	14 (45.2)		0.119	5 (45.5)	9 (45.0)		0.981
Sufficiently active	18 (58.1)	17 (54.8)			6 (54.5)	11 (55.0)		
Sedentary behavior								
High	20 (64.5)	24 (77.4)b		0.024	9 (81.8)e	15 (75.0)		0.043
Low	11 (35.5)	7 (22.6)			2 (18.2)	5 (25.0)		
Contextual & personal								
Falls								
Yes	8 (25.8)	12 (38.7)b		0.032	7 (63.6)e	5 (25.0)		0.035
No	23 (74.2)	19 (61.3)			4 (36.4)	15 (75.0)		
Contextual & health								
COVID-19 infection								
Infected	2 (6.5)	11 (35.5)b		0.043	-	-		-
Non-infected	29 (93.5)	20 (64.5)			-	-		-

Legend: *12-month interval between Baseline and Final Assessment; SD = Standard deviation; SPPB = Short physical performance battery; a = Differ from the baseline (Baseline vs. Final Assessment), Wilcoxon test; b = Differ from the baseline (Baseline vs. Final Assessment), Chi-square test; c = Differ from the Non-infected (Final Assessment), Wilcoxon test; e = Differ from the Non-infected (Final Assessment), Chi-square test.

On the other hand, infected individuals presented the lowest PA level than their peers, which may derive from physical deficits (fatigue, dyspnea, and musculoskeletal pain) and emotional distress (anxiety, depression, social isolation). Therefore, a decline in PA levels and increased SB[1] may have played a relevant role. The SB and low levels of PA combined with social isolation can cause severe health and psychophysiological problems[11], reinforcing the importance of attention to these aspects in the older adult population.

Previous studies showed that older adults had increased SB during the pandemic[12], which is evidenced mainly in those infected by COVID-19[1]. SB is a well-known factor, and higher levels of SB can increase the risk of numerous chronic diseases[13] and impact on physical, mental, and social aspects. A systematic re-

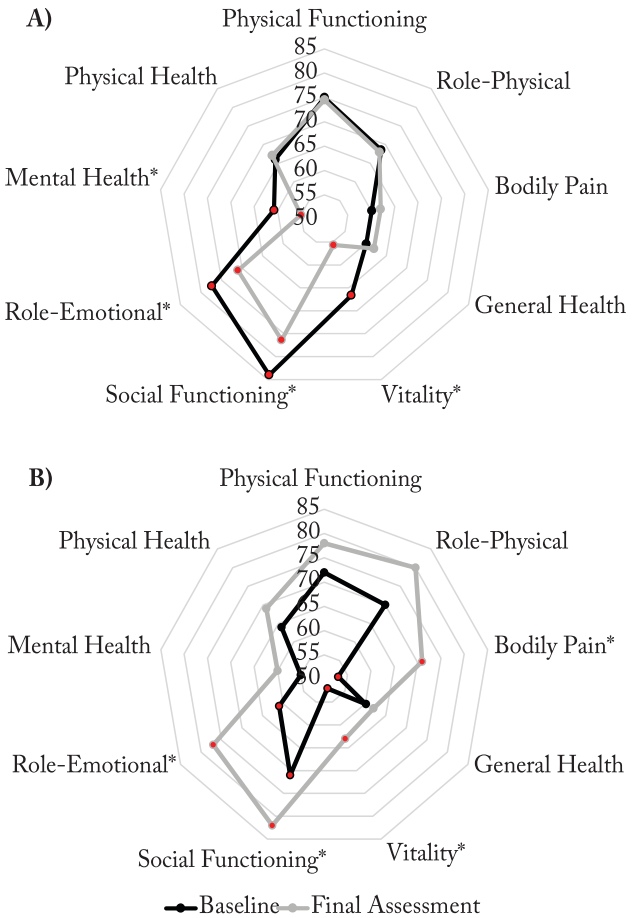

Figure 1 – Comparison between changes in health-related quality of life of participants at baseline and the final assessment (Figure A), and according to COVID-19 infection (Figure B). The red dots and the "*" indicate significant differences ($p < 0.05$).

Table 3 – Number of participants that have fallen and its characteristics at baseline and final assessment according to COVID-19 infection.

Fall characteristics	Baseline*	Final Assessment*	
	Total sample (n = 8)	Infected (n = 7)	Non-infected (n = 5)
Fall location	n (%)	n (%)	n (%)
Outside home	3 (37.5)	2 (28.6)	2 (40.0)
Inside home	3 (37.5)	3 (42.9)	0 (0.0)
Outdoor	2 (25.0)	2 (28.6)	3 (60.0)
Fall circumstances			
Slipped	6 (75.0)	2 (28.6)	2 (40.0)
Tripping	2 (25.0)	2 (28.6)	3 (60.0)
Dizziness	0 (0.0)	3 (42.9)	0 (0.0)
Fall consequences			
None	2 (25.0)	4 (57.1)	2 (40.0)
Hematoma	5 (62.5)	2 (28.6)	2 (40.0)
Hospitalization	1 (12.5)	1 (14.3)	1 (20.0)

Legend: *12-month interval between Baseline and Final Assessment.

view brought findings that SB may be associated with depressive factors[14]. Additionally, it may be directly associated with declines in participation (HRQoL domains: Mental, Role-Emotional, Social Functioning, and Vitality domains), which is a life quality proxy[15]. Indeed, COVID-19 caused a significant impact on the HRQoL[16] .These results corroborate with a recent meta-analysis (n = 4,828), in which individuals infected by COVID-19 had pain (41.5%), anxiety and depression (37.5%), mobility difficulties (36.0%), issues with usual activities (28.0%), and with self-care problems (8.0%).

It has been demonstrated that poor HRQoL poses challenges to the population, healthcare suppliers, and public health specialist. It has been reported that decreases in social activity contribute to isolation and loneliness. The lower HRQoL can also be related to the financial impact due to COVID-19 infection[16]. Chopra et al.[17] reported that nearly 10% of those infected used all their savings on home care, and medications, and also needed to help their family members financially[18]. The combination of these factors may have an additive effect, significantly impacting several aspects of life, from physical to emotional[16]. Although the main consequences of COVID-19 infection are related to the respiratory and musculoskeletal systems, other impacts are not fully understood. It has been suggested that other organ systems may also be impacted[19] and contribute to a more extensive influence on body functions and structures. Indeed, cognition was lower in those infected by COVID-19. Previous studies reported that COVID-19 may affect cognition domains such as executive function attention[20], memory, and verbal memory, which consequently may affect language, concentration[21], and quality of life[22].

The present study demonstrated that the fear of falling and falls prevalence increased, and those infected presented higher scores than their counterparts. Fear of falling has been associated with age, depression[23], cognitive impairment[24], limitations in daily living activities[23], social isolation[25] and activity restriction[26], situations experienced by older adults during the pandemic. The social isolation of older adults may have created a fear of leaving the house, which has been reported as the most critical barrier to the practice of PA, and consequently, the increase in SB and falls risk[25]. The combination of these aspects may have initiated a vicious cycle of fear, isolation, and inactivity[19].

Increased SB in older adults may indicate less time spent in PA, which leads to reduced muscle strength,

balance, gait function, posture control and, consequently, increased falls risk[27]. The falls risk can be increased by stress, anxiety, depression, and fear caused by the pandemic[28]. Nguyen et al[1] observed an increase in the falls episodes during the pandemic, and similar results were found in the present study. However, the circumstances and consequences of falls varied between groups (infected vs. uninfected). The infected group had a higher prevalence of falls indoors (at home), and these findings can be explained by the mandatory need for isolation and social distancing[29], in addition to higher exposure to potential hazards found in homes (e.g., carpets, slippery surfaces, and obstructed walkways)[30]. The non-infected group, on the other hand, had a higher number of falls in outdoor environments, probably due to activities with a higher risk (e.g., walking on uneven surfaces, gardening and shopping).

The findings presented in the present study may aid in the development of a better management plan for the general population of older adults and post-recovery from COVID-19 infection. In addition, it is believed that future investigations should reinforce the importance of the biopsychosocial approach, so that they can strengthen intervention strategies. The strengths of our study include the study design (longitudinal), which allows verifying the relationship between COVID-19 and the other variables, in addition to the comparison between infected and non-infected individuals. However, our study also has limitations. The self-report method to determine the PA level, SB and falls may present memory bias, however, this limitation can be minimized when using widely used questionnaires. In addition, the low number of study participants, mainly individuals infected with COVID-19, can also be considered a limitation.

Conclusions

According to the findings of the present study, during the pandemic, the biopsychosocial factors showed adverse changes in Body Functions and Structures (Cognition), Activities (Sedentary behavior), Participation (HRQoL), and Personal Factors domains (Fear of falling and falls), especially in infected older adults. Furthermore, the post-COVID falls variated between groups, with most falls at home in infected older adults. These results indicate that future health programs need to promote engagement in physical activities and reduce SB in older adults to positively impact biopsychosocial factors, prevent falls, and improve quality of life. Finally, older adults infected by COVID-19 need special attention to reduce the biopsychosocial burden, enhancing healthy and promoting a healthy lifestyle.

Conflicts of interest

The authors declare no conflict of interest

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Author's contributions

Grando RZ: Conceptualization; Methodology; Software; Validation; Formal analysis; Investigation; Resources; Data curation; Supervision; Project administration; Visualization; Funding acquisition; Writing – original draft; Approval of the final version. Cutisque LP: Methodology; Software; Validation; Formal analysis; Investigation; Data curation; Project administration; Funding acquisition; Writing – original draft; Writing – review & editing; Approval of the final version. Elias ACO: Investigation; Visualization; Funding acquisition; Writing – original draft; Approval of the final version. Rodacki ALF: Visualization; Funding acquisition; Writing – original draft; Writing – review & editing; Approval of the final version. Moreira NB: Conceptualization; Methodology; Software; Validation; Formal analysis; Investigation; Resources; Data curation; Supervision; Project administration; Visualization; Funding acquisition; Writing – original draft; Writing – review & editing; Approval of the final version.

Declaration regarding the use of artificial intelligence tools in the article writing process

The manuscript did not use artificial intelligence tools for its preparation.

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The data of this study is available on demand from referees.

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Reviewers' assessment

The reviews of this article were originally conducted in Portuguese. This version has been translated using ChatGPT and subsequently reviewed by the Chief Editors.

Reviewer A

- Did not authorize the publication of the review

Reviewer B

Anonymous

Format

- Does the article comply with the guidelines for manuscript preparation for submission to the Revista Brasileira de Atividade Física & Saúde?
  Yes
- Is the manuscript well-structured, including the sections: Introduction, Methods, Results, and Discussion (with the Conclusion as part of the Discussion)?
  Yes
- Is the title concise, specific, and descriptive of the study (up to 100 characters)?
  Yes
- Is the language appropriate, and is the text clear, precise, and objective?
  Yes
- Were any indications of plagiarism observed in the manuscript?
  No
- **Suggestions/comments:**
  No suggestions or comments.

Abstract

- Are the abstract and resumo adequate (including: objective, study participants, variables studied, main results, and conclusion) and representative of the manuscript's content?
  Yes
- **Suggestions/comments**:
- The abstract is concise and objective, effectively summarizing the article.

Introduction

- Is the research problem clearly stated and defined?
  Partially
- Is the research problem adequately contextualized within existing knowledge, progressing from general to specific?
  Partially
- Are the reasons justifying the study (including the authors' assumptions about the problem) well-established?
  Yes
- Are the references used to support the research problem current and relevant to the topic?
  Yes
- Is the objective clearly presented?
  Yes
- **Suggestions/comments:**
- Although the problem statement could be improved—particularly in linking COVID-19 infection, biopsychosocial factors, and the number of falls—the introduction fulfills its purpose, especially regarding the objectives. However, it lacks a stronger argument to convince readers why investigating the relationship between COVID-19 infection and biopsychosocial factors is relevant to fall incidents in older adults.

Methods

- Are the methodological procedures generally appropriate for the research problem?
  Partially
- Are the methodological procedures sufficiently detailed?
  Partially
- Is the recruitment or selection procedure for participants appropriate and adequately described?
  Partially
- Are details provided about the instruments used for data collection, their psychometric properties (e.g., reproducibility, internal consistency, validity), and, where relevant, the operational definitions of variables?
  Partially
- Is the data analysis plan appropriate and adequately described?
  Partially
- Are the inclusion and/or exclusion criteria for participants described and appropriate for the study?
  Yes
- Have the authors provided clarification on the eth-

ical procedures followed in the research?
Yes

- **Suggestions/comments:**
Important points to review:
- Sample size calculation: Why was a one-tailed hypothesis used for the a priori calculation? What led the authors to believe the difference would only occur in one direction? This should be clarified, as this choice influences the calculated sample size.
- Analysis: While non-parametric tests were used to compare groups, there was no mention of whether normality testing was performed.

Results

- Are the use of tables and figures appropriate, facilitating the proper presentation of the study's results?
Yes
- Is the number of illustrations in the article consistent with the journal's submission guidelines?
Yes
- Are the number of participants at each stage of the study, as well as the reasons for losses and refusals, presented in the manuscript?
Yes
- Are the characteristics of participants presented and sufficient?
Yes
- Are the results appropriately presented, emphasizing key findings and avoiding unnecessary repetition?
Yes
- **Suggestions/comments:**
No suggestions.

Discussion

- Are the study's key findings presented?
Partially
- Are the study's limitations and strengths presented and discussed?
Partially
- Are the results discussed in light of the study's limitations and existing knowledge on the subject?
Partially
- Are the potential contributions of the study's findings to scientific development, innovation, or real-world interventions discussed?
Partially
- **Suggestions/comments:**
- The discussion requires better structuring, highlighting the findings at the beginning of each paragraph and then comparing them to the literature. Even though this is at the authors' discretion, it would enhance the discussion.
- Additionally, some paragraphs refer to results not found in the study. For instance, the paragraph starting on line 8, page 10, includes the statement: "On the other hand, infected individuals presented the lowest physical activity level than their peers...". However, the results do not indicate this difference, as it was not statistically significant.
- Regarding the limitations section, variables not collected but potentially influential on the outcomes should be mentioned, such as COVID-19 severity indicators (e.g., hospitalization, oxygen use, ICU admission), symptom duration, and time since infection.
- I recommend reviewing all paragraphs in the discussion.

Conclusion

- Is the conclusion presented appropriately and consistent with the study's objective?
Partially
- Is the conclusion original?
Yes
- **Suggestions/comments:**
- The conclusion emphasizes the importance of promoting physical activity engagement and reducing sedentary time. However, the study only found significant differences in sedentary time. Although encouraging physical activity engagement is a relevant recommendation, it should not be included in the conclusion unless supported by the study's findings.

References

- Are the references current and sufficient?
Yes
- Are most references original articles?
Yes
- Do the references comply with the journal's guidelines (quantity and format)?
Yes
- Are citations in the text appropriate, substantiating the statements made?
Yes
- **Suggestions/comments:**
No suggestions or comments.

Comments to the Author

- It is a pleasure to contribute to such a relevant study. The article addresses an important topic, especially considering the limited knowledge about the effects of the COVID-19 pandemic.
- Overall, I recommend greater care in writing the discussion. Some articles can be very helpful in making this process more technical (e.g., https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1005619). Nonetheless, this is a good article—easy to read and in need of adjustments but promising.

Final Decision (Recommendation)

Rejected [with the possibility of resubmission]