
EDUCAÇÃO FÍSICA

THIAGO MARTINS SIRICO

**THE EFFECTS OF SOCIAL ISOLATION ON GAIT
PARAMETERS OF OLDER PEOPLE WITH
PARKINSON'S DISEASE**

**OS EFEITOS DO ISOLAMENTO SOCIAL NOS
PARÂMETROS DO ANDAR DE IDOSOS COM
DOENÇA DE PARKINSON**



Rio Claro - SP
2023

THIAGO MARTINS SIRICO

**THE EFFECTS OF SOCIAL ISOLATION ON GAIT PARAMETERS OF
OLDER PEOPLE WITH PARKINSON'S DISEASE**

**OS EFEITOS DO ISOLAMENTO SOCIAL NOS PARÂMETROS DO
ANDAR DE IDOSOS COM DOENÇA DE PARKINSON**

Trabalho de Conclusão de Curso apresentado ao Instituto de Biociências – Câmpus de Rio Claro, da Universidade Estadual Paulista “Júlio de Mesquita Filho”, para obtenção do grau de Bacharel em Educação Física

Orientador: Prof. Dr. Diego Orcioli-Silva

Coorientador: Prof. Me. Vinicius Cavassano Zampier

Supervisor: Prof. Dr. Eduardo Kokubun

Rio Claro - SP
2023

S619e Sirico, Thiago Martins
The effects of social isolation on gait parameters of older people with Parkinson's disease / Thiago Martins Sirico. -- Rio Claro, 2023
23 f. : il., tabs.

Trabalho de conclusão de curso (Bacharelado - Educação Física) -
Universidade Estadual Paulista (Unesp), Instituto de Biociências, Rio Claro
Orientador: Diego Orcioli-Silva
Coorientador: Vinicius Cavassano Zampier

1. Neurociências. 2. Desordens do movimento. 3. Doença neurodegenerativa. 4. Doença de Parkinson. 5. COVID-19 (doença). I. Título.

Sistema de geração automática de fichas catalográficas da Unesp. Biblioteca do Instituto de Biociências, Rio Claro. Dados fornecidos pelo autor(a).

Essa ficha não pode ser modificada.

THIAGO MARTINS SIRICO

**THE EFFECTS OF SOCIAL ISOLATION ON GAIT PARAMETERS OF
OLDER PEOPLE WITH PARKINSON'S DISEASE**

**OS EFEITOS DO ISOLAMENTO SOCIAL NOS PARÂMETROS DO
ANDAR DE IDOSOS COM DOENÇA DE PARKINSON**

Trabalho de Conclusão de Curso apresentado ao Instituto de Biociências – Câmpus de Rio Claro, da Universidade Estadual Paulista “Júlio de Mesquita Filho”, para obtenção do grau de Bacharel em Educação Física

BANCA EXAMINADORA:

Prof. Dr. Diego Orcioli-Silva

Prof. Me. Vinicius Cavassano Zampier

Prof. Dr. Eduardo Kokubun

Profa. Dra. Gabriella Andreetta Figueiredo

Aprovado em: 10 de novembro de 2023

DISCENTE



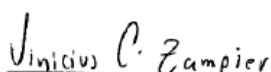
Thiago Martins Sirico

ORIENTADOR



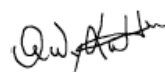
Prof. Dr. Diego Orcioli-Silva

COORIENTADOR



Prof. Me. Vinicius Cavassano Zampier

SUPERVISOR



Prof. Dr. Eduardo Kokubun

AGRADECIMENTOS

Agradeço, primeiramente, aos meus pais e irmão, Ricardo, Cátia e Lucas, pelo apoio oferecido nesse período e ao longo da vida, assim como pelos aprendizados que ganhei com cada um.

À minha amiga Kátia, por todo o amor oferecido há mais de dez anos, sem o qual esse processo teria se feito mais árduo.

Aos meus amigos Ana, Beatriz, Emerson e Gabriel, pelo companheirismo e pelas risadas, pelos momentos fáceis compartilhados nesses últimos anos.

À minha orientadora, Profa. Lilian Teresa Bucken Gobbi, por todo o apoio, cuidado e inspiração oferecidos enquanto conosco. Que sua memória permaneça em frutos como esse e em próximas conquistas de cada orientando seu.

Aos meus amigos, Prof. Diego Orcioli-Silva, Prof. Vinicius Cavassano Zampier e Prof. Eduardo Kokubun, pela coorientação e inspiração, pela amizade e momentos de grande aprendizado.

Ainda, ao Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) e à Pró-Reitoria de Pesquisa (PROPe) da Universidade do Estado de São Paulo (Unesp), Rio Claro, pelo apoio financeiro (processo nº 165572/2021-3).

ABSTRACT

The COVID-19 disease acquired pandemic proportions in 2020. To deal with the scenario, social isolation (SI) was adopted, which configures a lack of contact with people and places. The impediments of this measure, however, can bring risks to older people with Parkinson's disease (PD), such as impairments in gait parameters. Therefore, the aim of this study was to verify the effects of SI on gait parameters in people with Parkinson's disease. Thirty-three people with PD were recruited. Gait assessment was conducted in two periods: February 2020 and March 2022 (before and after the SI, respectively). For that, participants were invited to walk on a 5.74m mat with pressure sensors under two conditions: preferred walking speed and fast walking speed. Three trials were performed for each condition. The gait parameters analyzed were stride length, stride time, double support time, stride velocity, stride width, and cadence. Statistical analysis was performed by paired t-tests for the comparison of gait parameters between moments (pre and post-SI). In the preferred walking speed condition, the participants reduced their stride length ($t_{15} = 3.88$, $p = 0.001$) and stride velocity ($t_{15} = 3.63$, $p = 0.002$) in the post-si period. In the fast-walking speed condition, the participants also reduced their stride length ($t_{15} = 3.73$, $p = 0.002$) and stride velocity ($t_{15} = 2.86$, $p = 0.012$) in the post-SI period. Therefore, the SI period caused by the COVID-19 pandemic negatively affected the mobility of people with PD, reducing stride length and stride velocity.

Keywords: Walking; COVID-19; Neurodegenerative disease.

RESUMO

A COVID-19 adquiriu proporções pandêmicas em 2020. Para lidar com tal cenário, o isolamento social (IS), que configura uma perda de contato com pessoas e lugares, foi adotado. Contudo, os impedimentos causados por esta medida podem trazer riscos para idosos com doença de Parkinson (PD), como déficits nos parâmetros do andar. Assim, o objetivo deste estudo foi verificar os efeitos do IS nos parâmetros do andar de idosos com doença de Parkinson. Trinta e três pessoas com PD foram recrutadas. A avaliação do andar aconteceu em dois períodos: Fevereiro de 2020 e Março de 2022 (antes e depois do IS, respectivamente). Para isso, os participantes foram convidados a caminhar sobre tapete de 5.74m, com sensores de pressão, em duas condições: velocidade preferida e velocidade rápida. Três tentativas foram realizadas para cada condição. Os parâmetros do andar analisados foram comprimento da passada, tempo da passada, tempo em duplo suporte, velocidade da passada, largura da passada e cadência. A análise estatística foi realizada por meio de testes t pareados para a comparação dos parâmetros do andar (pré e pós IS). Na condição andar em velocidade preferida, os participantes reduziram o comprimento ($t_{15} = 3,88$, $p = 0,001$) e a velocidade da passada ($t_{15} = 3,63$, $p = 0,002$) no período pós IS comparado ao pré. Na condição andar em velocidade rápida, os participantes também reduziram o comprimento ($t_{15} = 3,73$, $p = 0,002$) e a velocidade da passada ($t_{15} = 2,86$, $p = 0,012$) no período pós IS comparado ao pré. Portanto, o período de IS causado pela pandemia de COVID-19 afetou negativamente a mobilidade das pessoas com DP, reduzindo o comprimento e a velocidade da passada.

Palavras-chave: Andar; COVID-19; Doença neurodegenerativa.

CONTENTS

| | | |
|-----|---|----|
| 1 | INTRODUCTION..... | 08 |
| 2 | METHODS..... | 10 |
| 2.1 | Participants..... | 10 |
| 2.2 | Experimental procedures..... | 10 |
| 2.3 | Clinical, cognitive, and physical activity level assessments..... | 11 |
| 2.4 | Gait evaluation..... | 11 |
| 2.5 | Statistical analysis..... | 11 |
| 3 | RESULTS..... | 13 |
| 4 | DISCUSSION..... | 16 |
| 5 | CONCLUSION..... | 19 |
| | REFERENCES..... | 20 |

1 INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus that took pandemic proportions in 2020. COVID-19 led to more than 761 million cases of infection, which resulted in ~6.8 million deaths worldwide until March 2023 (WHO Coronavirus (COVID-19) Dashboard, 2023). COVID-19 primarily affects the respiratory system, causing symptoms such as breathing difficulties, headaches, dry cough, and fever (SHI et al., 2020). At the moment, several vaccines have been approved by the World Health Organization (WHO) and regulatory agencies; moreover, the vaccination process is ongoing in several countries, thus, helping to prevent more infections as well as the aggravation (ZHENG et al., 2022) of symptoms. However, at the beginning of the pandemic, when vaccines were not available and COVID-19 spread rapidly in many countries, public health measures, such as social isolation (SI), had to be adopted in 2020.

The SI is an imposing measure generally implemented to stop certain threats to the population, such as the virus responsible for COVID-19 (MALAY, 2020). This type of isolation is defined as a state in which an individual refrains from being in any social group and certain places, regarding proximity or physical contact. Therefore, SI leads to difficulties in maintaining several activities as well as quality relationships (NICHOLSON, 2012). Despite being an effective measure against the SARS-CoV-2 virus spread, the SI presents some risks, especially in older populations (ENG et al., 2002; NICHOLSON, 2012), such as the decline in motor function (PELICIONI et al., 2021) and an increase of mortality (ENG et al., 2002), dementia (FRATIGLIONI et al., 2000), gait impairments (WOLFF et al., 2023), and in the number of falls (FAULKNER et al., 2003). Although several studies have verified the effects of SI on physical health components of older people (SEPÚLVEDA-LOYOLA et al., 2020b), studies that focus on the effects of SI on gait parameters, especially in populations such as older people who have mobility impairments (e.g., people with Parkinson's disease - PD), are still necessary.

PD is the second most common neurodegenerative disease in the world (BARBOSA et al., 2006), ranging from 57 (0.057%) to 230 (0.23%) cases for each group of 100,000 people (MUANGPAISAN et al., 2011), mainly affecting the population over 50 years of age. PD is a pathology that affects the central nervous system (CNS), caused by progressive and asymmetrical degeneration of dopaminergic

neurons in the substantia nigra pars compacta (KALIA; LANG, 2015). These neurons are responsible for the production of dopamine – a neurotransmitter that regulates cortex activity (KANDEL et al., 2014). Such degeneration causes abnormalities in the neurotransmission from the basal ganglia to the different cortical and subcortical areas, such as the motor cortex (BLANDINI et al., 2000). As a result, people with Parkinson's Disease (PwPD) present motor symptoms, which include tremor, rigidity, bradykinesia, hypometria, and postural instability (LEWEK et al., 2010). In addition, previous studies have reported gait impairments in PwPD – for example, a decrease in step length and gait speed, and a longer double support time (MIRELMAN et al., 2019; ORCIOLI-SILVA et al., 2017, 2021; SOFUWA et al., 2005).

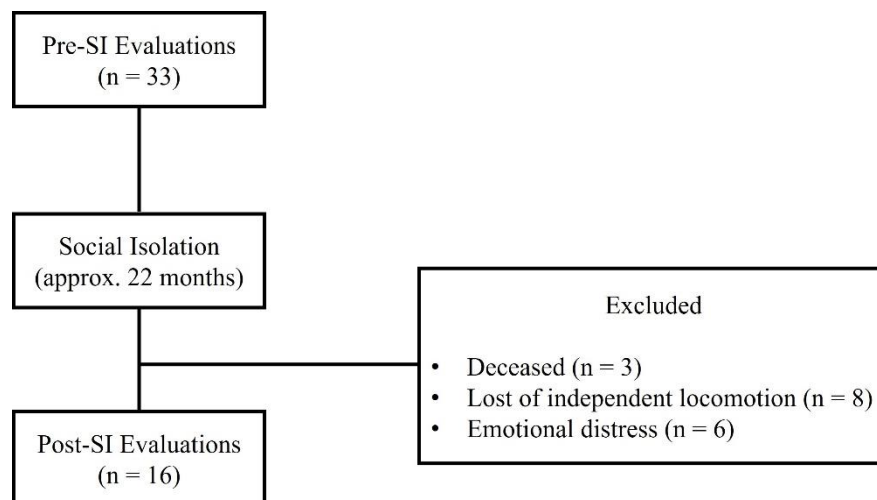
Due to the progressive nature of the disease, it is expected that walking impairments in PwPD become worse over time. Although SI was necessary as a public health measure, this may reduce the physical activity level in PwPD, which may contribute to the disease progression and lead to negative motor behavior outcomes, including in the gait parameters. In fact, previous studies have revealed that physical inactivity/sedentary behavior are associated with slower gait speed (BUSCH et al., 2015; WILLEY et al., 2017). In addition, the analysis of walking under different conditions has shown promising results. For example, an analysis of preferred walking speed may estimate physical function, risk for adverse events (e.g., hospitalization, falls, fractures, or death), and chronic diseases (KIM et al., 2016; STUDENSKI, 2011; WHITE et al., 2013), while an analysis of fast walking speed may estimate the individual's overall health, skeletal muscle mass quantity, and risk of falls (KIM et al., 2016). Thus, studies that verify the effects of SI on the gait parameters, especially under different conditions, are necessary to deepen the knowledge of this type of situation (lockdown) and to prevent the worsening of some motor deficits. In this context, the present study aimed at analyzing the effect of SI on the gait parameters during preferred and fast walking speed in PwPD. Furthermore, in order to identify the factors such as clinical/cognitive characteristics and physical activity levels that may influence the decline in gait parameters, we also investigated the association between the change in gait parameters and clinical, cognitive, and physical activity levels characteristics of PwPD. We expected that PwPD with worse clinical and cognitive characteristics as well as a lower level of physical activity would present a higher decline in gait parameters.

2 METHODS

2.1 Participants

Thirty-three individuals diagnosed with PD who regularly attended the Physical Activity Program for Patients with Parkinson's Disease (PROPARKI) prior to the COVID-19 pandemic were selected for this study. For inclusion criteria, the individuals should have a PD diagnosis based on UK Brain Bank criteria, be of age >50 years, take their PD medication, and have independent locomotion. The exclusion criteria were: to present musculoskeletal, vestibular, or visual impairments that could affect the performance in the experimental protocol; to present a score above III in the adapted Hoehn & Yahr scale (H&Y); and cognitive decline indicated by a score <24 in Mini-Mental State Examination (MMSE) (FOLSTEIN; FOLSTEIN; MCHUGH, 1975). Seventeen PwPD did not participate in the experimental protocol after the SI. Thus, 16 participants were analyzed before and after SI (Figure 1). Study approval was obtained from the research ethics committee at São Paulo State University (n. 3936). All participants gave their signed informed consent before their participation.

Figure 1. Study flowchart



Source: Research data (2023)

2.2 Experimental procedures

All experimental procedures were performed at the Posture and Gait Studies Laboratory (LEPLO), Sao Paulo State University (Unesp), Rio Claro. Clinical,

cognitive, and gait assessments were performed before (i.e., February 2020) and after SI (i.e., March 2022). In addition, the physical activity level was measured at the post-SI moment. Participants were tested during the 'ON' state of dopaminergic medication in both periods.

2.3 Clinical, cognitive, and physical activity level assessment

Firstly, the participants answered an anamnesis, and anthropometric data was obtained for characterization. An experienced researcher assessed the motor severity and the stage of PD using the motor section of the Movement Disorder Society Unified Parkinson's Disease Rating Scale (MDS-UPDRS III) and the adapted Hoehn and Yahr scale, respectively. The MMSE was used as a screening tool for cognitive assessment. To evaluate the physical activity levels of the participants during SI, the Modified Baecke Questionnaire (BAECKE; BUREMA; FRIJTERS, 1982) was applied in the post-SI period. This questionnaire considered the habitual physical activity in the last 12 months in three dimensions: occupational physical activity, physical exercises/sports in leisure, and leisure and commuting activities.

2.4 Gait evaluation

Each individual was asked to walk 8m in a straight line in two conditions: (i) preferred and (ii) fast walking speed. Three trials were performed for each condition. A 5.74m long carpet with pressure sensors (GAITRite®, CIR Systems Inc., Sparta, USA), with a sampling frequency of 200 Hz, was placed in the middle of the straight line to record the gait parameters. All steps recorded by the system were considered for the calculation of the dependent variables, which included stride length, stride time, double support time, stride velocity, stride width, and cadence.

2.5 Statistical analysis

SPSS 26.0 (SPSS, Inc) was used for statistical analysis. The level of significance was set at $p < 0.05$ for all analyses. The Shapiro-Wilk and Levene's tests were applied to verify the normality and homogeneity of the data, respectively. Paired

t-tests were used for the gait parameters comparison between moments (pre vs. post-SI). Cohen's d statistic provided estimates of the effect sizes for the t-test (d: 0.2 = small, 0.5 = moderate, 0.8 = large) (COHEN, 1988). Pearson's correlation coefficient was used between gait parameters (considering the difference between post- and pre-SI; Δ) and the scores from MDS-UPDRS III, MMSE, and The Modified Baecke Questionnaire to verify if there were significant relations between gait parameters and clinical, cognitive, and physical activity level data.

3 RESULTS

The demographics and clinical characteristics of the participants are shown in Table 1.

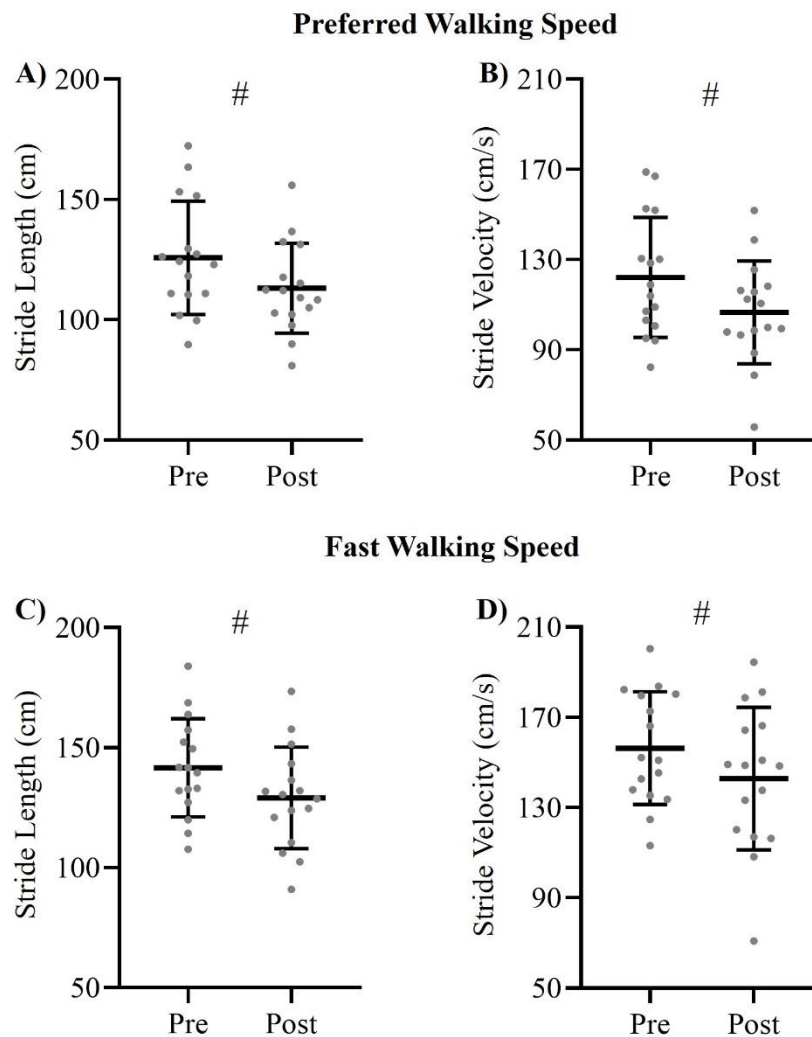
Table 1. Participants characteristics. The parametric variables are shown as mean and standard deviations, and the non-parametric variables as medians and 25-75 percentile.

| Sample size = 16 | |
|--------------------------------------|--------------------|
| Age (years) | 69.37±7.79 |
| Weight (kg) | 72.46±12.10 |
| Height (cm) | 165.02±7.35 |
| MDS-UPDRS III (0-132) | 33.5 (26.75-40.25) |
| H&Y stage (1/1.5/2/2.5/3) | 0/0/9/4/3 |
| MMSE (0-30) | 28 (25.00-29.00) |
| Baecke (score) | 7.66 (6.41-10.12) |

MDS-UPDRS III: Movement Disorder Society Unified Parkinson's Disease Rating Scale part III; H&Y: Hoehn & Yahr Scale; MMSE: Mini-Mental State Examination.

In the Preferred Walking Speed condition, the t-test revealed that the participants decreased stride length ($t_{15} = 3.88$, $p = 0.001$, $d = 0.614$; Figure 2A) and stride velocity ($t_{15} = 3.63$, $p = 0.002$, $d = 0.647$; Figure 2B) after the SI. No significant statistic was shown for stride time ($t_{15} = -1.61$, $p = 0.128$), double support time ($t_{15} = -1.49$, $p = 0.156$), stride width ($t_{15} = -1.46$, $p = 0.166$) or cadence ($t_{15} = 1.9$, $p = 0.077$) (Table 2).

Figure 2. Mean, standard deviations, and individuals data of stride length and stride velocity in pre and post-SI in both preferred and fast walking speed conditions.



Source: Research data (2023)

Table 2. Mean and standard deviations of gait parameters during Preferred Walking Speed condition.

| Preferred Walking Speed | | | |
|---------------------------|---------------|----------------|------------------|
| | Pre-SI | Post-SI | Cohen's <i>d</i> |
| Stride Time (s) | 1.04 ± 0.07 | 1.08 ± 0.12 | 0.348 |
| Double Support (%) | 30 ± 5.23 | 31.8 ± 5.38 | 0.373 |
| Stride Width (cm) | 11.92 ± 2.66 | 12.73 ± 3.7 | 0.252 |
| Cadence (step/min) | 115.99 ± 7.68 | 112.31 ± 11.15 | 0.384 |

SI: Social Isolation.

In the Fast-Walking Speed condition, the t-test revealed that the participants also decreased stride length ($t_{15} = 3.74$, $p = 0.002$, $d = 0.624$; Figure 2C) and stride velocity ($t_{15} = 2.87$, $p = 0.012$, $d = 0.489$; Figure 2D) after the SI period. No significant statistic was shown for stride time ($t_{15} = 0.29$, $p = 0.775$), double support time ($t_{15} = -2.01$, $p = 0.062$), stride width ($t_{15} = -1.38$, $p = 0.189$) or cadence ($t_{15} = 0.36$, $p = 0.727$) (Table 3).

Table 3. Mean and standard deviations of gait parameters during Fast Walking Speed condition.

| Fast Walking Speed | | | |
|---------------------------|---------------|----------------|-------------------------|
| | Pre-SI | Post-SI | Cohen's <i>d</i> |
| Stride Time (s) | 0.92 ± 0.09 | 0.92 ± 0.13 | 0.050 |
| Double Support (%) | 25.3 ± 3.86 | 27.6 ± 5.27 | 0.364 |
| Stride Width (cm) | 12.1 ± 2.94 | 12.77 ± 3.63 | 0.202 |
| Cadence (step/min) | 131.21 ± 13.8 | 132.12 ± 16.98 | 0.059 |

SI: Social Isolation.

There were no correlations between the delta (Post – Pre-SI) of gait parameters in both preferred and fast walking speed conditions and the scores of MDS-UPDRS III, MMSE, and The Modified Baecke Questionnaire (Table 4).

Table 4. Correlations between gait parameters and clinical, cognitive, and physical activity level.

| Gait Parameters | MDS-UPDRSIII | MMSE | Baecke |
|---------------------------------------|----------------------------|----------------------------|---------------------------|
| <i>Preferred Walking Speed</i> | | | |
| ΔStride Length | $r = -0.010$; $p = 0.971$ | $r = -0.126$; $p = 0.641$ | $r = 0.015$; $p = 0.956$ |
| ΔStride Velocity | $r = -0.037$; $p = 0.893$ | $r = -0.102$; $p = 0.708$ | $r = 0.011$; $p = 0.967$ |
| <i>Fast Walking Speed</i> | | | |
| ΔStride Length | $r = -0.152$; $p = 0.575$ | $r = 0.141$; $p = 0.603$ | $r = 0.157$; $p = 0.562$ |
| ΔStride Velocity | $r = -0.217$; $p = 0.420$ | $r = 0.324$; $p = 0.221$ | $r = 0.016$; $p = 0.953$ |

Δ: post – pre-Social Isolation; MDS-UPDRS III: Movement Disorder Society Unified Parkinson's Disease Rating Scale part III; MMSE: Mini-Mental State Examination; Baecke: The Modified Baecke Questionnaire.

4 DISCUSSION

We aimed at verifying the effects of SI as a public safety measure on the gait parameters of PwPD. Our findings revealed that the participants presented a decrease of 10% and 8.8% in stride length and 12.7% and 8.6% in stride velocity during Preferred and Fast Walking Speed, respectively, after approx. 22 months of SI (Figures 2A-2D). This impairment of gait parameters in PwPD by SI is relevant, as walking can be a predictor of loss of functionality and of an increase in the number of falls, hospitalizations, and deaths (MIDDLETON; FRITZ; LUSARDI, 2015; PELICIONI et al., 2021). However, changes in gait parameters were not associated with participant characteristics.

Our results corroborate previous studies that have shown a decrease in functionality of older adults after a period of SI (PELICIONI et al., 2021; SEPÚLVEDA-LOYOLA et al., 2020b). A study by Fastame et al. (2021) assessed functional components (e.g., gait parameters) of older people with and without cognitive decline before and past two months of lockdown. This study demonstrates a decrease in stride length and walking speed after the SI in people with preserved cognition, who were also more physically active prior to the lockdown 32. With regard to PwPD, previous studies have also demonstrated similar effects of the SI on the mobility of this specific group (HERTOGH et al., 2008; WOLFF et al., 2023). A study conducted by Wolff et al. (2023) verified the effects of the COVID-19 pandemic on parkinsonian symptoms of 342 PwPD through online, nationwide surveys. In addition, the number of individuals reporting worsening of symptoms or the development of new ones has increased during the pandemic, and the most commonly affected symptoms were rigidity, gait impairments, and bradykinesia (WOLFF et al., 2023).

A possible explanation for the decrease in stride length and stride velocity shown in this study is the relationship between SI and physical activity. Older adults tend to increase the time in sedentary behavior when they are deprived of access to places that stimulate the practice of physical activity (e.g., gym, parks, and clubs), as well as the support of people working as mediators of this practice (FASTAME et al., 2021; MORATELLI et al., 2022; PELICIONI et al., 2020). This corroborates The Modified Baecke Questionnaire scores of this study's sample, which ranged from low to moderate levels of physical activity (HERTOGH et al., 2008). This period of low or even inexistent practice of physical activity may bring negative consequences, such as

loss of muscle mass and muscle strength (MORO; PAOLI, 2020; PELICIONI et al., 2020, 2021), lack of joint mobility (MORATELLI et al., 2022), loss of dynamic balance (SEPÚLVEDA-LOYOLA et al., 2020), and worse neuromuscular performance, contributing to the observed deficits in such gait parameters (FASTAME et al., 2021; TEIXEIRA-SALMELA et al., 2005). Thus, the adoption of interventions that contribute to an improvement of gait parameters of PwPD is important even in the SI context. Actions that overcome the lack of access of these individuals to certain places, such as the adoption of digital tools, and the use of a training program for a wide range of motor and non-motor components (e.g., muscle strength, balance, coordination, executive function, and attention), can be beneficial for PwPD (HORBINSKI et al., 2021; MIAN et al., 2007; PELICIONI et al., 2021).

We can also speculate that the SI fragmentation of social relationships may increase the symptoms of depression (PELICIONI et al., 2021), which impact the mobility of PwPD (BRANDLER et al., 2012). Higher levels of depression are associated with poor practice of physical activity (PÉREZ et al., 2021), and they also produce a feeling of insecurity, leading to changes in motor behavior, characterized by a slower walking speed and a shorter step length. In cognition, depression levels may cause attention and executive function deficits, which are also factors intrinsically linked to gait parameters (AMANZIO et al., 2021; BRANDLER et al., 2012). In PwPD who already have a depletion of neurotransmitters, such as dopamine and serotonin, the increase in depression levels may be more pronounced (FASTAME et al., 2021; PELICIONI et al., 2020), thus, affecting the gait parameters. Therefore, the association of a training program with greater social support, such as dance, not only increases physical activity levels, which is beneficial for motor impairments, but also can better handle depression levels linked to SI as well, contributing to the health of PwPD in general (CRAFT; PERNA, 2004; MORATELLI et al., 2022).

It is also worth mentioning that, despite not having participated in the second part of the research, 17 eligible individuals from the pre-SI period were found in negative situations such as loss of independent locomotion or death, making it impossible to continue in the present study. This could indicate a worsening of some motor deficits due to the SI impediments.

Unexpectedly, the declined gait parameters were not associated with participant characteristics. Although previous studies have demonstrated the role of physical activity level and cognition/clinical features for gait parameters (MORRIS et al., 2016),

our results showed that the gait progression was not related to these variables. Gait is a complex task, which depends on several factors, not only cognition, clinical features, and physical activity level. There are several studies that found an association between gait parameters and depression, anxiety, PD medication, atrophy/loss of muscle strength, and sensorial functions, among other factors (BRANDLER et al., 2012). Therefore, further studies should consider such factors to understand which variables are associated with changes in gait parameters.

The current findings should be carefully interpreted, as this study presented some limitations, such as a great loss of participants during the pandemic and a limited number of non-motor parameters. Despite the small sample size, this study moves towards a better understanding of the SI as a protective measure in public health, considering its risks to more vulnerable populations such as those with gait impairments, in order to collaborate on the creation of appropriate interventions to deal with this scenario.

5 CONCLUSION

The SI period caused by the COVID-19 pandemic negatively affected the mobility of PwPD, reducing stride length and stride velocity.

Published article:

SIRICO, T.M.; ORCIOLI-SILVA, D.; ZAMPIER, V. C.; MORACA, G. A. G.; SANTOS, E. F. O.; BERETTA, V. S.; GOBBI, L. T. B. The effects of social isolation on gait parameters of older people with Parkinson's disease. **Brazilian Journal of Motor Behavior**, v. 17, n. 4, p. 118-125, 2023.

REFERENCES

- AMANZIO, M. et al. Lockdown Effects on Healthy Cognitive Aging During the COVID-19 Pandemic: A Longitudinal Study. **Frontiers in Psychology**, v. 12, 24 maio 2021.
- BAECKE, J.; BUREMA, J.; FRIJTERS, J. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. **The American Journal of Clinical Nutrition**, v. 36, n. 5, p. 936–942, nov. 1982.
- BARBOSA, M. T. et al. Parkinsonism and Parkinson's disease in the elderly: A community-based survey in Brazil (the Bambuí study). **Movement Disorders**, v. 21, n. 6, p. 800–808, 6 jun. 2006.
- BLANDINI, F. et al. Functional changes of the basal ganglia circuitry in Parkinson's disease. **Progress in Neurobiology**, v. 62, n. 1, p. 63–88, set. 2000.
- BRANDLER, T. C. et al. Depressive Symptoms and Gait Dysfunction in the Elderly. **The American Journal of Geriatric Psychiatry**, v. 20, n. 5, p. 425–432, maio 2012.
- BUSCH, T. DE A. et al. Factors associated with lower gait speed among the elderly living in a developing country: a cross-sectional population-based study. **BMC Geriatrics**, v. 15, n. 1, p. 35, 1 dez. 2015.
- COHEN, J. **Statistical Power Analysis for the Behavioral Sciences**. 2. ed. [s.l.] Routledge, 1988.
- CRAFT, L. L.; PERNA, F. M. The Benefits of Exercise for the Clinically Depressed. **The Primary Care Companion For CNS Disorders**, v. 6, n. 3, 1 jun. 2004.
- ENG, P. M. et al. Social Ties and Change in Social Ties in Relation to Subsequent Total and Cause-specific Mortality and Coronary Heart Disease Incidence in Men. **American Journal of Epidemiology**, v. 155, n. 8, p. 700–709, 15 abr. 2002.
- FASTAME, M. C. et al. The Impact of SARS-CoV-2 (COVID-19) and its Lockdown Measures on the Mental and Functional Health of Older Individuals. **Psychiatric Quarterly**, v. 92, n. 4, p. 1759–1769, 20 dez. 2021.
- FAULKNER, K. A. et al. Is Social Integration Associated With the Risk of Falling in Older Community-Dwelling Women? **The Journals of Gerontology Series A: Biological Sciences and Medical Sciences**, v. 58, n. 10, p. M954–M959, 1 out. 2003.
- FOLSTEIN, M. F.; FOLSTEIN, S. E.; MCHUGH, P. R. "Mini-mental state". **Journal of Psychiatric Research**, v. 12, n. 3, p. 189–198, nov. 1975.
- FRATIGLIONI, L. et al. Influence of social network on occurrence of dementia: a community-based longitudinal study. **The Lancet**, v. 355, n. 9212, p. 1315–1319, abr. 2000.
- HERTOGH, E. M. et al. Validity of the Modified Baecke Questionnaire: comparison with energy expenditure according to the doubly labeled water method. **International**

Journal of Behavioral Nutrition and Physical Activity, v. 5, n. 1, p. 30, 27 dez. 2008.

HORBINSKI, C. et al. Longitudinal observational study of boxing therapy in Parkinson's disease, including adverse impacts of the COVID-19 lockdown. **BMC Neurology**, v. 21, n. 1, p. 326, 24 dez. 2021.

KALIA, L. V; LANG, A. E. Parkinson's disease. **The Lancet**, v. 386, n. 9996, p. 896–912, ago. 2015.

KANDEL, E. et al. The Basal Ganglia. Em: **Principles of Neural Science**. 5. ed. [s.l.] McGraw Hill, 2014.

KIM, H. et al. The reliability and validity of gait speed with different walking pace and distances against general health, physical function, and chronic disease in aged adults. **Journal of Exercise Nutrition & Biochemistry**, v. 20, n. 3, p. 46–50, set. 2016.

LEWEK, M. D. et al. Arm swing magnitude and asymmetry during gait in the early stages of Parkinson's disease. **Gait & Posture**, v. 31, n. 2, p. 256–260, fev. 2010.

MALAY, D. S. COVID-19, Pandemic, and Social Distancing. **The Journal of Foot and Ankle Surgery**, v. 59, n. 3, p. 447–448, maio 2020.

MIAN, O. S. et al. The Impact of Physical Training on Locomotor Function in Older People. **Sports Medicine**, v. 37, n. 8, p. 683–701, 2007.

MIDDLETON, A.; FRITZ, S. L.; LUSARDI, M. Walking Speed: The Functional Vital Sign. **Journal of Aging and Physical Activity**, v. 23, n. 2, p. 314–322, abr. 2015.

MIRELMAN, A. et al. Gait impairments in Parkinson's disease. **The Lancet Neurology**, v. 18, n. 7, p. 697–708, jul. 2019.

MORATELLI, J. A. et al. Physical activity of individuals with Parkinson's in social isolation before and during the pandemic COVID-19. **Revista Brasileira de Atividade Física & Saúde**, v. 26, p. 1–8, 14 jan. 2022.

MORO, T.; PAOLI, A. When COVID-19 affects muscle: effects of quarantine in older adults. **European journal of translational myology**, v. 30, n. 2, p. 219–222, 2020.

MORRIS, R. et al. Gait and cognition: Mapping the global and discrete relationships in ageing and neurodegenerative disease. **Neuroscience & Biobehavioral Reviews**, v. 64, p. 326–345, maio 2016.

MUANGPAISAN, W. et al. A systematic review of the worldwide prevalence and incidence of Parkinson's disease. **Journal of the Medical Association of Thailand = Chotmaihet thangphaet**, v. 94, n. 6, p. 749–55, jun. 2011.

NICHOLSON, N. R. A Review of Social Isolation: An Important but Underassessed Condition in Older Adults. **The Journal of Primary Prevention**, v. 33, n. 2–3, p. 137–152, 6 jun. 2012.

ORCIOLI-SILVA, D. et al. Walking behavior over multiple obstacles in people with Parkinson's disease. **Gait & Posture**, v. 58, p. 510–515, out. 2017.

ORCIOLI-SILVA, D. et al. Cortical Activity Underlying Gait Improvements Achieved With Dopaminergic Medication During Usual Walking and Obstacle Avoidance in Parkinson Disease. **Neurorehabilitation and Neural Repair**, v. 35, n. 5, p. 406–418, 23 maio 2021.

PELICIONI, P. H. S. et al. Lockdown During COVID-19 and the Increase of Frailty in People With Neurological Conditions. **Frontiers in Neurology**, v. 11, 16 nov. 2020.

PELICIONI, P. H. S. et al. COVID-19 and its impact on human motor control. **Brazilian Journal of Motor Behavior**, v. 15, n. 1, p. 9–19, 1 mar. 2021.

PÉREZ, L. M. et al. Depressive Symptoms, Fatigue and Social Relationships Influenced Physical Activity in Frail Older Community-Dwellers during the Spanish Lockdown due to the COVID-19 Pandemic. **International Journal of Environmental Research and Public Health**, v. 18, n. 2, p. 808, 19 jan. 2021.

SEPÚLVEDA-LOYOLA, W. et al. Social participation is associated with better functionality, health status and educational level in elderly women. **Brazilian Journal of Development**, v. 6, n. 4, p. 20690–20701, 2020.

SEPÚLVEDA-LOYOLA, W. et al. Impact of Social Isolation Due to COVID-19 on Health in Older People: Mental and Physical Effects and Recommendations. **The journal of nutrition, health & aging**, 25 set. 2020.

SHI, H. et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. **The Lancet Infectious Diseases**, v. 20, n. 4, p. 425–434, abr. 2020.

SOFUWA, O. et al. Quantitative Gait Analysis in Parkinson's Disease: Comparison With a Healthy Control Group. **Archives of Physical Medicine and Rehabilitation**, v. 86, n. 5, p. 1007–1013, maio 2005.

STUDENSKI, S. Gait Speed and Survival in Older Adults. **JAMA**, v. 305, n. 1, p. 50, 5 jan. 2011.

TEIXEIRA-SALMELA, L. F. et al. Functional performance and quality of life related to training and detraining of community-dwelling elderly. **Disability and Rehabilitation**, v. 27, n. 17, p. 1007–1012, 2 set. 2005.

WHITE, D. K. et al. Trajectories of Gait Speed Predict Mortality in Well-Functioning Older Adults: The Health, Aging and Body Composition Study. **The Journals of Gerontology Series A: Biological Sciences and Medical Sciences**, v. 68, n. 4, p. 456–464, 1 abr. 2013.


WHO Coronavirus (COVID-19) Dashboard | WHO Coronavirus (COVID-19) Dashboard With Vaccination Data. Disponível em: <<https://covid19.who.int/>>. Acesso em: 01 mar. 2023.

WILLEY, J. Z. et al. Physical Inactivity Predicts Slow Gait Speed in an Elderly Multi-Ethnic Cohort Study: The Northern Manhattan Study. **Neuroepidemiology**, v. 49, n. 1–2, p. 24–30, 2017.

WOLFF, A. W. et al. Long-Lasting Impact of the <scp>COVID</scp> -19 Pandemic on Patients with Parkinson's Disease and Their Relatives. **Movement Disorders Clinical Practice**, v. 10, n. 5, p. 819–823, 12 maio 2023.

ZHENG, C. et al. Real-world effectiveness of COVID-19 vaccines: a literature review and meta-analysis. **International Journal of Infectious Diseases**, v. 114, p. 252–260, jan. 2022.

ORIENTADOR



Prof. Dr. Diego Orcioli-Silva

COORIENTADOR

Vinicius C. Zampier

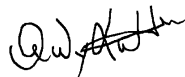
Prof. Me. Vinicius Cavassano Zampier

DISCENTE

Thiago Martins Sirico

Thiago Martins Sirico

SUPERVISOR



Prof. Dr. Eduardo Kokubun