Original Article

Correlation between sitting time and lower limb motor impairment in post-stroke patients: a cross-sectional study

Correlação entre tempo sentado e comprometimento motor de membros inferiores em pacientes pós-AVC: um estudo transversal

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ABSTRACT | INTRODUCTION: The physical deficiencies caused by stroke can encourage patients to maintain a low physical condition and become increasingly sedentary. Sedentary behavior has harmful health effects, including an increased risk of cardiovascular disease. **OBJECTIVE:** To verify whether there is a relationship between daily sitting time and lower limb motor impairment in post-stroke patients. **METHODS:** This is an observational, cross-sectional study, in patients with clinical diagnosis of stroke in the chronic phase, of both genders. Sitting time was analyzed using the 5th section of the International Physical Activity Questionnaire (IPAQ) and the motor function using the Fugl-Meyer Scale - lower limbs (LL) subsection. Participants were evaluated in a single session, with an average duration of 1 hour. **RESULTS:** The correlation by Spearman's ρ coefficient between the Fugl-Meyer Scale subsection for lower limbs and IPAQ weekdays sitting time was -0.639 (p=0.008) and IPAQ weekend days sitting time -0.603* (p= 0.013). Patients spend 11.59 hours/day on weekdays and 12.15 hours/day on weekends in the sitting position. **CONCLUSION:** The results show a negative relationship between the variables studied, suggesting that the greater the lower limb motor impairment, the greater the average sitting time of the individual after the stroke.

KEYWORDS: Stroke. Sedentary Behavior. Physical Functional Performance.

RESUMO | INTRODUÇÃO: As deficiências físicas ocasionadas pelo Acidente Vascular Cerebral (AVC) podem estimular os pacientes a manterem um baixo condicionamento físico e a se tornarem cada vez mais sedentários. O comportamento sedentário tem efeitos prejudiciais à saúde, incluindo um maior risco de incidência de doenças cardiovasculares. **OBJETIVO:** Verificar se existe correlação entre o tempo sentado e o comprometimento motor de membros inferiores em pacientes pós-AVC. **MÉTODOS:** Trata-se de um estudo observacional, de caráter transversal, onde foram analisados pacientes com diagnóstico clínico de AVC na fase crônica, de ambos os sexos. O tempo sentado foi analisado por meio da seção 5 do Questionário Internacional de Atividade Física (IPAQ) e a função motora por meio da Escala de Fugl-Meyer - subseção de membros inferiores. Os participantes foram avaliados em uma única sessão, com duração média de 1 hora. **RESULTADOS:** A correlação pelo coeficiente ρ de Spearman entre a Escala Fugl-Meyer- subseção de membros inferiores (MMII) e IPAQ-tempo sentado durante a semana foi de r= -0,639 (p=0,008) e IPAQ-tempo sentado durante final de semana foi de r= -0,603 (p=0,013). Os pacientes passam 11,59 horas/dia durante a semana e 12,15 horas/dia durante o final de semana na posição sentada. **CONCLUSÃO:** Os resultados mostram uma relação negativa entre as variáveis estudadas, sugerindo que quanto maior o comprometimento motor dos MMII, maior será a média de tempo sentado do indivíduo após AVC.

PALAVRAS-CHAVE: Acidente Vascular Cerebral. Comportamento Sedentário. Desempenho Físico Funcional.

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Introduction

Stroke is one of the main causes of death in the world, occupying the second position, and is the third leading cause of disability.[1] After the first event, there is a 10.4% chance of a subsequent episode within one year and a 12.9% risk over the next 5 years.[2] Recent research provides evidence that excessive sedentary behavior, such as sitting or lying down for a long time, has harmful health effects, including an increased risk of cardiovascular disease.[3] Any waking behavior with an energy expenditure equal to or less than 1.5 METS (Metabolic Equivalents) in a sitting, lying or reclining position is characterized as sedentary behavior.[4]

Regular physical activity of moderate intensity is known to decrease the risk of stroke and the risk of cardiovascular disease.[5] The reduction in the practice of physical activity after a stroke event can cause a deficit in cardiovascular conditioning and other negative effects on the health of the affected patient.[6] Regarding exercise and physical activity recommendations for stroke survivors, the focus is on secondary prevention strategies, including a decrease in sedentary behavior, low-to-moderate intensity physical activity, and resistance exercise.[7] Habits of sedentary behavior for long periods and insufficient practice of physical activity are harmfully associated to negative effects on the health of the general population and in individuals with motor impairment.[8]

Post-stroke survivors do not meet these expectations of physical activity after the hospital rehabilitation period.[9] This is worsened by sedentary behavior during other periods of the day, which may increase cardiometabolic risk factors linked to a recurrent stroke episode.[10] In addition, there is evidence from studies that people with stroke may take an average of 5.535 steps per day in the subacute phase and 4.078 steps per day in the chronic phase, limiting opportunities for functional recovery.[11] According to this fact, new strategies highlight, such as interrupting long sedentary periods with light physical activities (involving energy expenditure between 1.5 and 6.0 METS). Research has shown an association of these practices with a decrease in waist circumference, body mass index (BMI) reduction, improvement in quality of life and normalization of glucose and insulin levels.[12]

There are barriers that difficult the adequate levels of physical activity in post stroke patients, such as reduced strength in the lower limbs.[6] The rehabilitation of lower limb function is a major challenge and approximately 30% of post-stroke survivors in the chronic stage exhibit persistent difficulties in independent ambulation.[13] The ability to walk can be used as an indicator of impaired mobility and disability after a stroke.[14] The level of gait recovery may be associated with both the initial impairment in walking ability and the severity of sequelae in the lower limbs.[12,13] To minimize functional damage, early physical therapy intervention is recommended, aiming to restore independent walking to improve motor function and reduce disability.[14] It is interesting to highlight the factors related to sedentary behavior, seeking to reduce the harmful effects of this behavior.

The present study aims to verify the existence of a correlation between sitting time and motor impairment of the lower limbs in post-stroke patients.

Methods

This research is an observational cross-sectional study of an analytical nature. The research was developed at the Clínica Escola de Fisioterapia da Faculdade de Ciências da Saúde do Trairi - FACISA (Clinical School of Physiotherapy of the Faculty of Health Science at Trairi), Specialized Academic Unit of Universidade Federal do Rio Grande do Norte – UFRN (Federal University of Rio Grande Norte). The study was approved by the Research Ethics Committe - FACISA/UFRN (CAAE: 10651319.5.0000.5568). The collection period started in August 2019 and ended in December 2019. The convenience sample, with patients who had a clinical diagnosis of stroke in the chronic phase, who were being treated or who had already been discharged from the outpatient service.

Patients over 18 years of age, of both genders, with a single unilateral stroke, of ischemic or hemorrhagic type, and who were in good cognitive status were included. The clinical diagnosis of stroke was determined through medical reports presented by the patient during the initial screening procedure.

Those with severe cognitive impairment assessed by the Mini Mental State Examination (MMSE)[15] were excluded. This instrument is composed of 7 categories: temporal orientation, spatial orientation, immediate memory, calculation, attention, language, evocation memory, and visual constructive capacity. Scores range from 0 to 30 where lower scores indicate more severe cognitive impairment. The cutoff points are 13 for illiterates, 18 for low and medium and 26 for high schooling.[15]

Participants diagnosed with other neurological diseases, who had a clinical history of dementia or other neurodegenerative disorders (e.g., Alzheimer's), visual neglected (assessed by the clock drawing test), visual agnosia (analyzed during the application of the MMSE), auditory or visual alterations (as long as they were not corrected), aphasia of comprehension, bedridden, lower limb amputees, who had exacerbated Chronic Obstructive Pulmonary Disease (COPD), severe cardiorespiratory conditions or who had been discouraged to carry out any physical or work activity by the physician were also excluded. Volunteers who did not complete the application of the assessment scales were also discontinued from the study.

Assessment instruments

The volunteers were evaluated using the instruments mentioned below. The evaluations were carried out by a physiotherapist and physiotherapy students previously trained in the use of the evaluation instruments of this research. The evaluation procedure was performed during two sessions on alternate days depending on the patient's schedule, with a maximum duration of 60 minutes in each evaluation session.

Modified Rankin Scale (mRankin)

The mRankin evaluates the level of functional independence scored from 0 (zero) - without disability to level 5 - (severe disability) and 6 - (death).[16]

Fugl-Meyer Rating Scale (FMS)

Motor function was assessed by the lower limb subsection of the Fugl-Meyer Scale, which includes: reflex activity, active motor skills within synergies, combined synergistic movements, movement with mild or no synergy, coordination and speed, scored 34 points (lower scores indicate greater motor impairment).[17]

International Physical Activity Questionnaire (IPAQ)

The section 5 - IPAQ was used to measure the sitting time after the injury. The questions referes to the last week and quantify the time (in hours and minutes) that the subject spends sitting during a weekday and during a weekend day. The IPAQ is an instrument for measuring the level of physical activity at an international level, which allows estimating the weekly time spent in physical activities of moderate and vigorous intensity, in different day-to-day situations, such as: transportation, household chores, work and leisure, and also the time spent in passive activities and the time spent per week in the sitting position.[18]

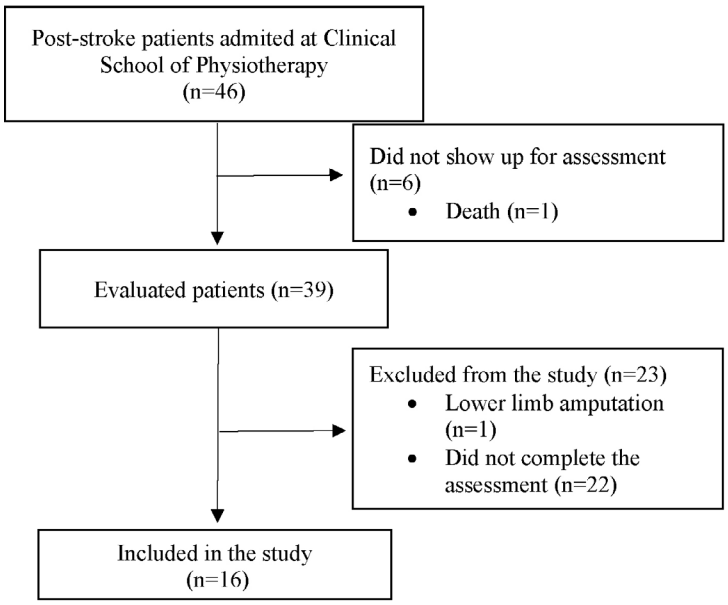
Statistical analysis

For the statistical analysis, the Statistical Package for the Social Sciences (SPSS) software (version 20.0) was used. The assumption of normality was verified using the Shapiro-Wilk test. For the correlation analysis between the variables, the Spearman test was applied considering the following estimates of the correlation strength, where 0 (no correlation), 1 (perfect correlation).[19] A significance level of 5% was adopted.

Results

A total of 46 patients with a clinical diagnosis of stroke were initially contacted, of which only 39 agreed to participate in the evaluation procedure, totaling 39 patients who passed the inclusion and exclusion criteria, making up 16 volunteers included in the analysis, as shown in (Figure 1).

Figure 1. Flowchart with the selection of participants



Source: The authors (2023).

The demographic and clinical data to characterize the sample are described in Table 1.

Table 1. Sample characterization

Variables *(n=16)*	**Results**
Demographics	
Gender/ F:M (%)	7:9 (43.8%: 56.3%)
Age/years (mean±sd)	61.62 ± 12.8
Clinics	
Injury time/months (median [Q1:Q3])	42 [24:60]
Affected side/ R: L (%)	5:11 (31.3%: 68.8%)
MMSE (mean±sd)	18.87±5.7
Rankin (median [Q1:Q3])	2.50 [2.0: 4.0]
IPAQ Sitting weekdays hours (mean±sd)	11.59 ± 4.03
IPAQ Sitting weekend/hours (mean±sd)	12.15 ± 4.02
Fugl-Meyer LL (mean±sd)	16.06 ± 10.02

Note: F = Female, M = Male, sd = standard deviation, MMSE = Mini Mental State Examination, IPAQ = International physical activity questionnaire, LL= lower limbs.

Source: The authors (2023).

The results indicated a moderate and negative (inverse) correlation between the Fugl-Meyer scale - subsection for lower limbs and sitting time verified by the IPAQ, as shown in Table 2.

Table 2. Correlation analysis by Spearman's ρ coefficient between sitting time verified in the IPAQ and Fugl-Meyer Scale subsection of lower limbs

Variables *(n=16)*	Results
	Fugl-Meyer LL
IPAQ Sitting/Weekdays	-0.639 (p=0.008)
IPAQ Sitting/Weekend	-0.603 (p=0.013)

Note: IPAQ = International physical activity questionnaire, LL= lower limbs.

Source: The authors (2023).

Discussion

The results obtained in this study demonstrate that there is an inverse correlation between sitting time and the results of the Fugl-Meyer scale for the lower limbs, suggesting that the increase in sitting time is directly related to the worst result for motor impairment.

People affected by stroke remain with sedentary lifestyle up to a year after the event, and even if they restore their functionality, there is an increase in uninterrupted sedentary events with periods greater than 1 hour and a half.[6] Our study observed that stroke patients tend to spend more time sitting (about 11.59 hours/day during the weekdays and 12.15 hours/day during the weekend), corroborating with other studies that identified that stroke survivors spent much more time sitting during the day, particularly for prolonged periods of time compared to age-matched healthy ones, and spent less time in activities that involved standing. These people spend most of their time sitting down, usually in silence, watching television and much less time in more cognitively demanding tasks, such as work, study and reading.[20]

Ezeugwu and Manns observed in their study that 34 post-stroke patients, at baseline, spent 908.1 minutes/day awake, spending 673.7 minutes/day sitting, which is equivalent to 11.23 hours/day, 74.3% of waking time was spent sitting; monitored through a 24-hour protocol for 7 days, using the activity monitor activPAL, fixed to the anterior part of the thigh, of the non-hemiparetic limb that was not removed during the monitoring period.[20] English *et al* observed in their study with 39 participants in the post-stroke group that patients accumulated 10.9 hours/day sitting; with a percentage of waking hours sitting equal to 78.4%; measured by an activity monitor activePAL3 (PAL Technologies Ltd) attached to the anterior part of the non-paretic thigh of the participants, during 24 hours for 7 days.[21] Inferring that the average sleep time is 8 hours, a person spends 16 hours/day awake, considering the sitting time identified in our study, patients spent an average of 75% of the time awake in a sitting position, corroborating with the previously mentioned studies. We consider this time to be quite high, drawing attention once again to the need for intervention in this population, focused on reducing sitting time.

The degree of motor impairment of the lower limbs in individuals with stroke significantly affects activities involving these extremities, resulting in a reduction in the acceptable performance to perform some movements such as getting up from a chair and walking.[22] Post-stroke survivors do not manage to modify the synergistic pattern of extension in lower limbs, because they have difficulty in selecting the musculature to achieve a normal synergy, developing biomechanics that makes weight bearing and walking difficult.[23] They use, most of the time, compensatory movement strategies, to be able to carry out the daily tasks. Those who have a more pronounced motor impairment and are unable to develop these strategies have a greater need and consequent dependence on their caregivers.[24]

Previous studies have already observed the relationship between motor impairment and balance, where survivors use compensatory strategies to maintain balance, but this is impaired and is more affected the more serious the motor deficit. In this way, it is evident the difficulty in fragmenting the movements and dissociating the balance strategies and, consequently, the independent locomotion.[25]

It was observed in the study that the motor impairment of the lower limbs has been shown to be related to the increase in sitting time. Many physical therapists focus on assessing the structure, but if they do not develop a global view, such as that based on the International Classification of Functioning, Disability and Health (ICF)[26], they may underestimate the impact and development of sedentary behavior habits in post-stroke survivors. And such facts may increase the risk of a recurrent stroke, as they will have greater difficulty in modifying periods of sedentary behavior and, in most cases, do not meet the recommendations for levels of physical activity practice of the American College of Sports Medicine and the American Heart Association.[27] Therefore, it becomes extremely necessary to develop strategies to change sedentary behavior, such as encouraging the performance of low to moderate intensity physical activity, such as energy expenditure greater than 1.5 METs, walking slowly around the house, washing dishes, ironing clothing, which has an energy expenditure of 2.0 to 2.5 MET.[28]

Some limitations need to be recognized in this study. First, the impossibility of performing a multivariate analysis is highlighted, considering potential confounding factors. Second, the lack of knowledge about the physical activity level of the analyzed sample and its heterogeneity, since the participants included in this research had different types of stroke and variability in the time of brain injury of the participants. Another limitation was the failure to insert relevant clinical data such as education, stroke severity, type of stroke (ischemic or hemorrhagic), affected regions or affected vascular territory, dominance, types of medications used or number of medications (polypharmacy). For future studies, we suggest the use of an activity monitor, associated with the use of an activity diary to monitor sedentary time and the use of a specific scale to verify the level of physical activity such as the Human Activity Profile (HAP).

Conclusion

This study found a negative and inverse correlation between the increase in sitting time and lower limb motor impairment in post-stroke patients, inferring that the greater the motor impairment, the greater the sitting time of this individual. Post-stroke patients tend to sit for an average of 75% of the time they should be active, drawing attention to this point, demonstrating the need to seek strategies to modify sedentary behavior in this population, since most of them are unable to achieve a satisfactory level of physical activity.

Author's contributions

Brito AGS participated in the design of the research question, methodological design, search and statistical analysis of research data, interpretation of results, writing of the scientific article. Carvalho AA participated in the design of the research question, methodological design and data collection. Souza JVA participated in data collection. Pereira NKF, Carvalho ABC and Cacho RO participated in the writing and review of the scientific article. All authors reviewed and approved the final version and agreed with its publication.

Conflicts of interest

No financial, legal or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to, grants and funding, participation in advisory boards, study design, preparation manuscript, statistical analysis, etc.).

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