Physical activity level of post-stroke individuals that use the Brazilian public health system

Nível de atividade física de indivíduos pós-AVC usuários do sistema público de saúde brasileiro

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Abstract

Introduction: According to studies from developed countries, post-stroke individuals commonly have a low level of physical activity. Considering the benefits of maintaining a good level of physical activity in these subjects, it is important to provide specific and complete information, based on the assessment of all dimensions of physical activity, which supports interventions. **Objective:** To compare the physical activity levels between individuals with stroke and matched healthy individuals that use the public health system in Brazil considering the different dimensions of physical activity. **Methods:** Individuals with stroke (n = 11) and matched healthy individuals (n = 11) were assessed. Physical activity levels, considering all dimensions -duration (> 3 MET), frequency (number of steps) and intensity (mean total energy expenditure per day) - were assessed using SenseWear® monitor for seven days. Descriptive statistics and between-groups comparisons were performed (α = 0.05). **Results:** The physical activity levels were significantly lower in individuals with stroke when compared to matched healthy individuals, considering all dimensions. The between-group differences in activity duration, frequency, and intensity were 74 minutes/day, 5,274 steps/day, and 2,134kJ/day, respectively. **Conclusion:** Individuals with stroke users of the Brazilian public health system have lower physical activity levels in different dimensions of physical activity than matched healthy individuals. The assessment of the physical activity level of post-stroke individuals is important for decision making in public health programs.

Keywords: Delivery of health care. Physical activity. Rehabilitation. Stroke.

Resumo

Introdução: *De acordo com os estudos realizados em países desenvolvidos, indivíduos pós-acidente vascular cerebral (AVC) comumente apresentam baixo nível de atividade física. Considerando os benefícios desses indivíduos manterem um bom nível de atividade física, é importante fornecer informações específicas e completas a partir da avaliação de todas as dimensões da atividade física que guiem as intervenções.* ***Objetivo:*** *Comparar o nível de atividade física de indivíduos pós-AVC e saudáveis pareados, usuários do sistema público de saúde brasileiro, considerando as diferentes dimensões da atividade física.* ***Métodos:*** *Foram avaliados indivíduos pós-AVC (n = 11) e seus pares saudáveis (n = 11). O nível de atividade física, considerando as diferentes dimensões - duração (> 3 equivalentes metabólicos), frequência (número de passos) e intensidade (média do gasto energético total por dia) -, foi avaliado com o monitor SenseWear® por sete dias. Foram utilizadas estatísticas descritivas e comparações entre os grupos (α = 0,05).* ***Resultados:*** *O nível de atividade física foi significativamente menor nos indivíduos pós-AVC comparados aos seus pares saudáveis, considerando todas as dimensões. A diferença entre os grupos na duração, frequência e intensidade da atividade foi de 74 minutos/dia, 5274 passos/dia e 2134 kJ/dia, respectivamente.* ***Conclusão:*** *Indivíduos pós-AVC usuários do sistema público de saúde brasileiro têm menor nível de atividade física nas diferentes dimensões da atividade quando comparados aos seus pares saudáveis. A avaliação do nível de atividade física em indivíduos pós-AVC é importante para a tomada de decisões em programas de saúde pública.*

Palavras-chave: *Sistemas integrados de cuidados de saúde. Exercício físico. Reabilitação. Acidente vascular cerebral.*

Introduction

The common disabilities of individuals with stroke are usually associated with low physical activity levels.[1-3] Maintaining a good physical activity level after experiencing a stroke has the potential to improve general health and function,[2-4] with a reduction of the risk factors for stroke, such as hypertension and lipid dysfunction, and in the likelihood of recurrent stroke.[4,5]

Several studies have highlighted the importance of assessing and increasing the physical activity level of individuals affected by stroke as a secondary preventive strategy.[3,4,6] Previous studies performed in developed countries, such as England,[7] Australia[8,9] and Canada,[10] compared the physical activity level between individuals with stroke and healthy individuals. According to the results of these studies, individuals with stroke have lower physical activity level than matched healthy individuals. Despite the important information provided by these studies, they were performed in developed countries, which have different socioeconomic, cultural and health system characteristics from that observed in developing countries.[11] According to our knowledge, there is a lack of studies that compared the physical activity level between individuals with stroke and healthy individuals from developing countries, such as Brazil. According to Moore et al.,[7] physical activity levels are determined by environmental factors. Therefore, it is important to investigate the physical activity levels of subjects from a specific region to provide information to guide clinical decision making.

In Brazil, an important developing country, the public health system is the only one available for three-quarters of the country's population.[12,13] Therefore, the assessment of the physical activity level of post-stroke individuals that use the Brazilian public health system is important to guide decision making of public health programs. Considering the benefits of maintaining a good level of physical activity in this population,[2-5] it is important to provide information that supports interventions to increase the level of physical activity.

A variety of assessment tools used to measure physical activity level in individuals with stroke are available. These tools can be classified as indirect (i.e., questionnaires and diaries) or direct (i.e., pedometers, accelerometers, and physical activity monitors) instruments.[14,15] Although the instruments used for direct evaluation are expensive and have less clinical applicability than the indirect (self-report) instruments,[6,14,15] they provide a more objective and reliable measure of the physical activity levels of individuals with stroke.[6]

Directly measuring a patient's physical activity level can provide information on the different dimensions related to this variable, such as activity type or mode, duration, frequency, and intensity.[16] Some authors have recommended the use of different dimensions of physical activity to understand this outcome better.[15,17,18] An individual scoring highly in one particular dimension will not necessarily score well in another dimension.[7,17] Therefore, complete information on the physical activity

level can only be obtained if the different dimensions of this outcome are measured.

Only two previous studies with the aim to compare the physical activity level between individuals with stroke and healthy individuals assessed this outcome considering the different dimensions of activity.[7,8] Moore et al.[7] assessed individuals over time following stroke (acute, subacute and chronic phases) and found differences between subjects in all dimensions. English et al.[8] assessed individuals in the chronic phase of stroke and found differences between subjects only in the duration and frequency dimensions. These results indicate the need for further studies assessing the physical activity level in the different dimensions.

Therefore, the aim of this study was to compare the physical activity level between individuals with chronic stroke and matched healthy individuals, users of the Brazilian public health system, considering three dimensions of physical activity: duration, frequency, and intensity. We hypothesize that individuals with stroke have lower physical activity levels than matched healthy individuals, considering the different dimensions of physical activity.

Methods

This was an exploratory cross-sectional study approved by the Ethical Committee of the Universidade Federal de Minas Gerais (#51453995.1.0000.5149).

Sample

Individuals with stroke and healthy individuals living in the city of Belo Horizonte, Minas Gerais, were recruited from two Brazilian health centers and the surrounding community via advertisements. They were informed of the objectives and procedures adopted for the development of the study, and those who fulfilled the eligibility criteria and signed the informed consent form were included.

Individuals who had a clinical diagnosis of stroke for more than 6 months, were older than 19 years, and were capable of walking more than 10 meters independently with or without gait aid were included.[19] Individuals with cognitive impairment assessed using the Mini-Mental State Examination,[20] comprehension aphasia, and other neurological or orthopedic conditions that could interfere with physical activity performance were excluded. Healthy individuals, matched with the individuals with stroke in terms of age, sex, and region of residence, were also included.

The sample size was estimated on the basis of data from a previous study[7] that compared the total activity time (minute/day), measured using the SenseWear® Pro3, between individuals with stroke (28 ± 32 minutes/day) and matched healthy individuals (98 ± 63 minutes/day), and found a significant difference between them ($p < 0.001$). For the analysis, the total activity time of each group[7] (means and standard deviations) was recorded in the G*Power 3 program[21] to calculate the effect size ($d = 1.4$). Subsequently, for the sample size calculation, an effect size of 1.4, a power of 80%, and a significance level of $\alpha = 0.05$ were considered. The optimal sample size was determined to be 20 individuals (10 in each group).

Procedures

All data were collected by a single examiner previously trained in all procedures, aided by another examiner, also previously trained. Initially the examiners checked the eligibility criteria and, subsequently, the clinicodemographic data were evaluated for the characterization of the individuals with stroke: age, sex, clinical data, level of physical exercise,[22] motor impairment,[23] and gait speed.[24,25] Healthy individuals also had their clinicodemographic data collected. All participants were assessed using the SenseWear® monitor.[26]

The SenseWear® monitor (Body Media, Pittsburgh, PA, USA, version 8.1) was used to assess the physical activity level, considering activity duration, frequency, and intensity. It is a multi-sensor tool, which, when in contact with the skin, captures the number of steps, body temperature, heat flow, and galvanic skin response of the subject; these data are integrated with clinical characteristics (age, height, body mass index, sex, and smoking habits) into an algorithm to provide the estimation of the physical activity levels.[6,27] It is an easy-to-use tool for both the examiner and the examinee because it is lightweight (45.4 g), small, has a durable lithium battery (5-7-day charge), and has large capacity memory for data storage (28 days); moreover, the results are easily accessed through the software.[26] This tool is valid and reliable in measuring the physical activity levels in individuals with stroke.[26] In the present study,

the SenseWear® monitor was positioned on the back of the non-paretic arm of the individuals with stroke and the non-dominant arm of the healthy individuals.[8] It was adjusted by a Velcro cuff between the elbow and shoulder (in the triceps), placing the sensors in contact with the skin.[27] The subjects were instructed to use the equipment for seven days continuously, removing it only when bathing or when engaging in water activities.[26] During this period, they were encouraged to maintain their regular daily activities and record daily bedtime and wake-up hours and the hours the equipment was removed.

The physical activity level was reported considering the duration (mean total time spent on activities with more than three metabolic equivalents of task [MET] per day), frequency (mean number of steps per day), and intensity (mean total energy expenditure per day) dimensions.[7,16] The data used for the analysis were obtained from a report generated by the manufacturer's software.

Statistical analysis

Descriptive analysis was performed for all study variables, and normality test (Shapiro-Wilk) was performed for the quantitative variables. Mean and standard deviation were used for the quantitative variable with normal distribution, whereas median and interquartile range for quantitative variables without normal distribution. For categorical variables, absolute frequency (%) was determined. Independent Student`s T test (age), Chi-square (sex), and Mann-Whitney tests (total time spent on activities with more than three MET per day, number of steps per day, and total energy expenditure per day) were used for between groups comparisons. All statistical analyses were performed using the SPSS® for Windows (Version 17.0, SPSS Inc., Chicago, Illinois, USA), and the significance level was set at $\alpha = 0,05$.

Results

Eleven individuals in each group were evaluated. The mean age of post-stroke individuals was 64 ± 8 years and the mean stroke duration was 72 ± 60 months. The mean age of healthy individuals was 64 ± 9 years. There was no significant difference between individuals with stroke and healthy individuals regarding the matching variables: age ($p = 0.858$) and sex ($p = 0.394$). All the participants lived in the same neighborhood, as planned. The clinicodemographic characteristics of the participants are shown in Table 1.

There was a significant difference between individuals with stroke and matched healthy individuals in the three dimensions of physical activity, indicating a lower physical activity level in individuals with stroke. Individuals with stroke spent 87% (74 minutes/day) less time engaging in activities, took 70% (5,274 steps/day) less steps per day, and spent 25% (2,134 KJ/day) less total energy expenditure than matched healthy individuals. The descriptive and between groups comparison statistics regarding the physical activity level in the three dimensions are presented in Table 2.

Table 1 - Clinicodemographic characteristics of the participants

Characteristics	**Stroke (n = 11)**	**Healthy (n = 11)**
Age - mean ± SD (years)	64 ± 8	64 ± 9
Sex (Woman) - n (%)	6 (54%)	6 (54%)
BMI - mean ± SD (kg/m^2)	25 ± 5	27 ± 4
Natural gait speed - mean ± SD (m/s)	1.0 ± 0.3	1.3 ± 0.2
Level of physical exercise[22]		
Inactive	8 (73%)	4 (36%)
Insufficient	2 (18%)	1 (9%)
Moderate	0	1 (9%)
Vigorous	1 (9%)	5 (46%)
Time since the onset of stroke - mean ± SD (months)	72 ± 60	-
Hemiparesis (Right) - n (%)	7 (64%)	-
Type of stroke - n (%)		
Ischemic	6 (55%)	-
Hemorrhagic	4 (36%)	-
Not defined	1 (9%)	-
Motor impairment[23] - n (%)		
Severe (< 50 points)	1 (9%)	-
Moderately severe (50 - 84 points)	1 (9%)	-
Moderate (85 - 95 points)	8 (73%)	-
No impairment (100 points)	1 (9%)	-

Note: SD = standard deviation; BMI = body mass index.

Table 2 - Descriptive (median ± interquartile range) and inferential statistical results of the physical activity level of subjects with stroke and healthy subjects

Dimensions of the activity	Stroke (n = 11)	Healthy (n = 11)	p*
Duration (min)[1]	11 ± 43	85 ± 108	0.004
Frequency (n)[2]	2,218 ± 4,319	7,492 ± 5,900	0.009
Intensity (kJ)[3]	6,280 ± 2,592	8,414 ± 2,260	0.0023

Note: [1]Total time in activities per day; [2]Number os steps per day; [3]Total energy expenditure per day; *α = 0.05 (Mann-Whitney test).

Discussion

The present study demonstrated that individuals with chronic stroke living in Brazil had a lower physical activity level than matched healthy individuals in all the three dimensions: duration, frequency, and intensity. This is the first study that compared the physical activity level between individuals in the chronic phase of stroke and healthy individuals, users of the Brazilian public health system, considering these dimensions of activity.

We observed that individuals with stroke spent 87% less time engaging in activities, took 70% less steps per day, and spent 25% less total energy expenditure than the matched healthy individuals. These data are similar to that of previous studies from developed countries that compared the physical activity level between individuals with stroke and healthy individuals.[7-10] The low level of physical activity can be explained, at least in part, by the impairments caused by the stroke since the participants had moderate to severe motor impairments. Although all participants were able to walk independently, there was great variability in their gait speed (range from 0.4 to 1.5 m/s). Thilarajah et al.[28] showed that physical function was associated with physical activity level of individual with stroke ($0.68 \leq r \leq 0.73$; $p < 0.001$).

The results of the present study showed that the differences between individuals with chronic stroke and matched healthy individuals living in Brazil were higher than that observed in previous studies.[7,8] Moore et al.[7] assessed the physical activity level with the SenseWear® monitor, considering different dimensions of activity over time following stroke, and compared with a healthy control group. The authors showed that individuals in the chronic phase of stroke spent 33% (32 minutes/day) less time engaging in activities, took 34% (2,963 steps/day) less steps per day, and spent 5% (120 kcal) less total energy expenditure than the matched healthy individuals. English et al.[8] assessed the physical activity level with different instruments, considering different dimensions of activity in the chronic phase of stroke, and compared with a healthy control group. The authors showed that individuals in the chronic phase of stroke spent 87% (33 minutes/day) less time engaging in activities and took 55% (2,903 steps/day) less steps per day than the matched healthy individuals. The authors found no significant difference in the total energy expenditure ($p = 0.060$) between groups. Differences in the degrees of motor impairments of the subjects with stroke was also pointed out as a possible explanation for these results. In these previous studies,[7,8] individuals with stroke had mild motor impairments.

Low level of physical activity cannot be solely attributed to impairment caused by stroke. Moore et al.[7] pointed out that physical activity levels may not be fixed but are determined by environmental factors. Brazil is a developing country and despite having public policies that emphasize the need to remain physically active, they are often not put into practice. That possibly happens as a result of lack of financial or human resources for the topic, due to social or physical barriers that do not allow that the individual arrives at the place destined for the practice of physical activity, among others.[29,30] Thus, the result of this study can also be explained by the socioeconomic characteristics of the country where they live, and not only by the impairments imposed by their own health condition.

It is important to emphasize that contextual factors, both environmental and personal, can vary according to the region studied and can be barriers to the practice of physical activities. For example, a region with steeper streets, existence of public or private places for physical activity and access to them, among others, may impact in the level of physical activity of the people who live around. However, there is still a gap in the literature about this topic. In the present study, such barriers were similar for both groups, as the individuals included were residents of the same neighborhood, users of Brazilian public health system, and present a level of physical activity below that recommended by the guidelines.[31] Based on the territorialization of the public health guideline,[32] which emphasizes that basic health units must know the profile of their users, recognize the barriers and accessibility to health services, and know

the infrastructure and resources available in the region, it makes necessary that more studies similar to this one are developed considering different areas of the city of Belo Horizonte, Minas Gerais, Brazil, to assess the real effect of physical and social barriers in the level of physical activity of these individuals.

According to the results of the present study, most individuals with stroke and matched healthy individuals do not follow the recommendations established by the World Health Organization and American College of Sports Medicine (ACSM) to maintain an adequate physical activity level.[31] Regarding activity duration, the worldwide-used ACSM guideline recommends the practice of at least 150 minutes/week of moderate physical activity or 20 minutes of vigorous physical activity at least three days/week, in addition to basic activities of daily living.[31] Regarding activity frequency, a literature review pointed out 10,000 steps/day as an indicator of good health.[31] It is difficult to guarantee that individuals with stroke have a low number of steps because of the impairments left by the stroke or if they already had this habit prior to the stroke.[7] It is worth mentioning that the literature already reported that this goal of 10,000 steps/day might not be sustainable for some populations, especially among elderly individuals with chronic diseases,[33] as individuals post-stroke.

Some limitations of this study should be considered. The SenseWear® monitor is not able to provide information on four dimensions of physical activity. This method is limited in its ability to detect different types of activity. Furthermore, the activity frequency was only defined for the walking activity (total number of steps). Most individuals with stroke had a moderate motor impairment (according to the Fugl-Meyer classification) and independent ambulation. Therefore, the results of the present study cannot be extrapolated to individuals with more severe motor impairment and slower gait speed. Such individuals may present worse results than the subjects in this study. Another limitation was the non-matching of the individuals' type of occupation, since most healthy individuals (n = 7; 64%) still performed work activity, different from post-stroke individuals (only one performed work activity (n = 1; 9%), which may have influenced the results. However, it is important to note that only two studies[8,27] with a similar objective to the present study matched occupations. All matching parameters employed by previous studies with similar objectives were adopted, including age and sex.

Conclusion

Individuals with stroke have lower physical activity level in different dimensions than matched healthy individuals, both users of the public health system in Brazil, matched by age, sex, and region of residence. The assessment of the physical activity level of post-stroke individuals is important to guide decision making of public health programs. Considering the benefits of maintaining a good level of physical activity in this population, strategies must be created to increase the level of physical activity.

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Authors´ contributions

All authors were responsible for the conception, analysis and interpretation of data, and writing of the manuscript. CLGM, DSF and DRS were involved in the data collection. JCM, MV and CDCMF, in the revision of the manuscript and final approval.

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