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Stroke Subjects with Higher Levels of Physical Activity Report Lower Levels of Fatigue

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Abstract

Background: If the associations between levels of physical activity and fatigue were established, specific, directed and more effective interventions could be developed to prevent the onset of fatigue.

Objective: Therefore, the present study aimed to compare the levels of fatigue between subjects with different physical activity levels and to investigate the associations between self-reported levels of fatigue and physical activity of chronic stroke subjects.

Method: This is a cross-sectional study, where 55 participants, with a mean age of 58.8 years and a mean time since the onset of the stroke of 25.5 months, had their fatigue and physical activity levels assessed by the Brazilian versions of the Fatigue Severity Scale (FSS) and the Human Activity Profile (HAP), respectively.

Results: Forty percent of the participants were classified as impaired, 51% as moderately active, and 9% as active. One-way ANOVA revealed significant differences between the groups regarding their fatigue levels (F=9.60, p<0.001). The LSD *post-hoc* analyses revealed that the differences were significant between the impaired and moderately active (p<0.001, 95%CI: 0.57 to 2.19) and between the impaired and active groups (p<0.001, 95%CI: 1.2 to 4.0). No differences were observed between the moderately active and active groups (p=0.08, 95%CI: -0.1 to 2.6). Pearson correlation coefficient showed an inverse and good association between the HAP and the FSS scores (r=-0.60, p<0.001).

Conclusions: Individuals with lower levels of physical activity reported higher levels of self-perceived fatigue, than those of the moderately active and active groups. Additionally, an inverse and good association was found between self reported physical activity and fatigue levels.

Keywords: Fatigue; Motor Activity; Rehabilitation; Stroke

Abbreviations

FSS: Fatigue Severity Scale; HAP: Human Activity Profile; AAS: Adjusted Activity Score

Introduction

Fatigue is a subjective symptom, which is often present and distressing for stroke survivors [1]. Within clinical settings, there is a frequent complaint regarding post-stroke fatigue [2], since it is a potential detrimental factor for physical recovery [3]. It is well known that the stroke subjects have higher levels of fatigue, when compared with community-dwelling, healthy elderly [2]. In a prospective study with 1,080 individuals with stroke, Mead et al. [4] found that fatigue, by itself, was associated with reduced survival.

In general, low levels of physical activity are observed even in stroke subjects with mild motor impairments [5], favoring the onset of deconditioning. Once estabilished, deconditioning after stroke could probably lead to the onset of fatigue [1], and would be explained by the fact that there is a general decrease in the exercise capacity [6] experienced by these individuals. In this sense, a two-year prospective cohort study with more than 3,600 stroke survivors found severe self-reported fatigue to importantly affect functional ability [7]. Additionally, fatigue was observed to be an independent predictor of dependence on the functioning of activities of daily living [7]. Besides, previous studies reported self-perceived fatigue as possibly one of the main causes for stroke survivors not returning to work [8] and it has also been demonstrated that fatigue by itself is associated with increased long-term mortality irrespective of stroke severity [9].

Due to the decline of mortality after stroke [10] and a longer life expectancy observed over the last decades, it is crucial to understand the whole panomara of sequelaes that follow the survivors, to provide the best approach and management methods. Associated with the fact that the improvements of activity levels are crucial concerns during rehabilitation, if the associations between physical activity levels and self-reported fatigue were established, specific, direct, and more effective interventions could be developed to individuals post stroke [1].

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Therefore, the research questions for this study were:

1. Are there significant differences in the levels of self-reported fatigue of chronic stroke individuals with various physical activity levels?

2. Are there significant associations between self-reported fatigue and different physical activity levels in chronic stroke individuals?

Methods

Participants

Individuals with unilateral stroke, who had residual weakness and/or increased tonus of the paretic lower limb muscles, were recruited on a volunteer basis from the general community of Belo Horizonte, Brazil, from August 2013 to August 2014, according to the following criteria: Were older than 20 years; had a time since stroke of at least six months; and showed no cognitive impairments, as determined by the following education-adjusted cut-off scores on the Mini Mental State Examination: 18/19 for the individuals with illiteracy and 24/25 for those with basic education [11]. All participants provided consent, based upon previous approval by the ethical review board from the Universidade Federal de Minas Gerais (CAAE–0254.0.203.000-11).

Instruments and procedures

Initially, the participants underwent a physical examination and an interview for the collection of anthropometric, demographic, and clinical data, such as age, gender, body weight, height, time since the onset of stroke, paretic side and the use of medications. For characterization purposes, their walking speeds were assessed by the 10-meter walking test, following previously recommended procedures [12, 13].

Levels of fatigue

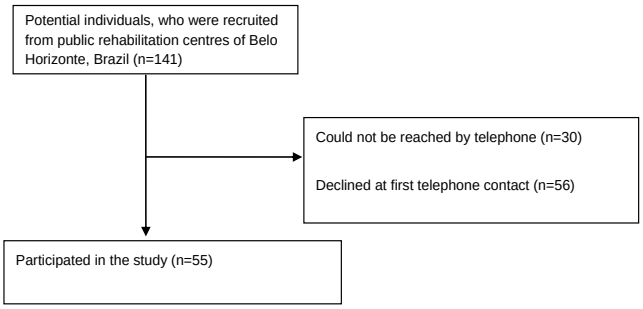
Levels of fatigue were assessed by the Brazilian version of the FSS [14]. The FSS was first developed to be used with multiple sclerosis patients, but it has been frequently used with other neurological conditions, such as Parkinson and stroke [15]. It is a self-reported questionnaire with nine affirmatives, which the individual should score on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) [15, 16]. Mean scores ≥4 were established as indicative of fatigue [15, 16]. The FSS-Brazil showed adequate validity and reliability (ICC= 0.91) for individuals with neurological disorders [14].

Physical activity levels

The Brazilian version of the HAP [17] was employed to determine the participants' physical activity levels. This is a self-report questionnaire, which showed appropriated validity and reliability for the Brazilian population [17]. The HAP adjusted activity scores (AAS) provide information regarding the individuals' current activity levels. The physical activity levels were classified based upon their AAS scores, as impaired (<53), moderately active (53–74), or active (>74) [17, 18]. The HAP showed adequate validity and reliability (ICC=0.89) with stroke subjects [19].

Statistical analyses

Descriptive statistics, tests for normality, and equality of variances were carried out with the SPSS software (release 17.0). One-way analysis of variance (ANOVA), followed by LSD *post-hoc* tests, were employed to investigate differences between the groups (impaired, moderately active, and active) regarding their fatigue levels. Pearson correlation coefficients were calculated to explore the relationships between the fatigue and physical activity levels, which were classified as follows: little or none ($0.00<r<0.25$), fair ($0.25<r<0.50$), moderate to good ($0.50<r<0.75$), and good to excellent ($r>0.75$) [20]. For all analyses, the significance levels was set at 5%.



Box 1: Flow diagram of participants in each phase of the study.

Results

Participants' characteristics

An initial list of subjects enrolled on public rehabilitation centres from Belo Horizonte consisted of 141 participants. However, only 55 individuals with stroke, 33 men, with a mean age of 58.8 (SD 13.5) years and a mean time since the onset of stroke of 25.5 (SD 13.9) months, were evaluated. Box 1 reported the total number of losses and the main reasons for it. About 93% of the participants had ischemic stroke and 61.8% had their right side affected. No significant differences between the three physical activity level groups were observed, regarding the participants' time since the onset of stroke ($F=1.77$, $p=0.18$), number of medications ($F=3.10$, $p=0.06$), body mass index ($F=1.61$, $p=0.21$), and MMSE scores ($F=0.50$, $p=0.61$). The mean walking speed values for the impaired, moderately active, and active groups were respectively 0.69m/s, 0.90m/s, and 1.13m/s. According to their AAS scores, forty percent of the participants were classified as impaired, 51% as moderately active, and 9% as active. The mean FSS-BR for the impaired group was 5.38 (min: 3.56; max:7.00), for the moderately active 3.87 (min:1.67; max:7.00), and for the active group 3.33 (min:1.89; max:5.75).

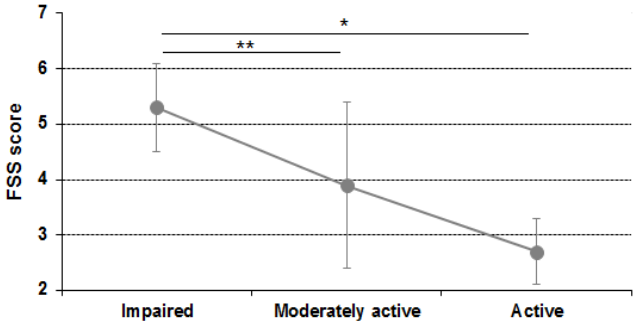


Figure 1: Self-reported fatigue scores, according to the individuals' physical activity levels (n=55).
*$p<0.001$

Table 1: Characteristics of the participants and the results of the comparisons between the physical activity level groups.

Characteristics	Total (n=5)	Between- group comparisons			
		Impaired (n=22)	Moderately active (n=28)	Active (n=5)	F, p
Age (years), mean±SD, (range: min-max)	58.8 ±13.5 (30-84)	58.3±12.5a	62.3±11.9a,c	41.2±15.1b	6.17,<0.01
Time since the onset of stroke (months), mean±SD, (min-max)	25.5 ±13.9 (12-60)	21.7±11.1a	27.2±15.3a	32.8±13.9a	1.77, 0.18
Use of medications (number), mean ± SD	5.1 ±2.6	5.7±2.7a	5.1±2.3a	2.6±2.6a	3.1, 0.06
BMI (kg/m2), mean±SD	26.3±4.7	27.4±5.2a	26±4.6a	23.3±2.8a	1.61, 0.21
Associated diseases (number), mean ± SD	1.8±1	1.90.9a	1.9±0.9a	0.4±0.5b	5.84,<0.01
MMES (score: 0-30), mean ±SD	25.3±2.9	25.2±3.3a	25.2±2.8a	26.6±2.9a	0.50, 0.61
Walking speed (m/s), mean ±SD	0.85±0.3	0.69±0.30a	0.90±0.26b	1.13±0.13b	6.99,<0.01
FSS (score: 0-7), mean±SD, range (min-max)	4.4±1.5	5.38 ± 0.8a (3.56-7.00)	3.87 ± 1.5b (1.67-7.00)	3.33 ± 0.6b (1.89 5.75)	9.6<0.00

SD= Standard deviation; BMI= Body Mass Index; MMES= Mini Mental Examination State.
For each row, different letters represent statistically significant differences between groups.

Comparisons between the groups

ANOVA revealed significant differences between the groups, regarding their fatigue levels (F=9.6, p<0.001) (Table 1). The LSD post-hoc analyses demonstrated that the differences were significant only between the impaired and moderately active (p<0.001, 95%CI: 0.57 to 2.19) and between the impaired and active groups (p<0.001, 95%CI: 1.2 to 4.0), indicating that the impaired group reported higher levels of fatigue (Figure 1). No significant differences were observed between the moderately active and active groups (p=0.08, 95%CI: -0.1 to 2.6). Their characteristics according their physical activity levels are described in Table 1.

Associations between levels of fatigue and physical activity

Pearson correlation coefficient revealed a significant, inverse, and good correlation between the HAP and the FSS scores (*r*=-0.60, p<0.001), showing that lower levels of physical activity were associated with higher levels of fatigue.

Discussion

To the best of our knowledge, this is the first study which examined self-perceived fatigue in individuals with stroke, based upon their self-reported physical activity levels. The results demonstrated that impaired individuals reported higher levels of self-perceived fatigue, than those who were moderately active and active. In addition, a significant, inverse, and good association was found between self-reported physical activity levels and fatigue.

Only 7.4% of the individuals in the present study were classified as active, even though it is well known about the paramount importance of physical activity practice for stroke survivors [21]. Physical activity promotes various benefits for this population, such as, promoting socialization [22] and facilitating the fatigue management [21]. Besides, a reduced physical activity level has been implicated as a risk factor for stroke episodes [23]. Generally, one of the main problems regarding the presence of fatigue in chronic stroke subjects is that once it is estabilished, it is related to mobility deficits [24] leading the individuals to a tendency of avoidance of being active and, consequently, increase even more their fatigue levels, getting into a continuous vicious cycle of fatigue and inactivity [1]. In addition, the lower walking speed values, currently observed in subjects who reported higher levels of fatigue, also reinforced this idea. This fact could possible be explained by increased energy costs during gait, which according to a previous systematic review, could be related to post-stroke fatigue [25]. One hypothesis which could partially explain the presence of this phenomenon is based upon deconditioning, which occurs as a consequence of the sudden decrease of activity levels, resulting from the neurological impairments of stroke [1]. This might be a possible explanation for the current findings, since individuals who reported lower physical activity levels also reported higher levels of fatigue. Concurring with these findings, a longitudinal study conducted for 18 months with 96 acute stroke individuals found fatigue as the best predictor of poor physical health at a 18 month follow-up [26]. Another longitudinal study, which followed-up 165 stroke survivors for two years, found similar findings and reported consistent associations between the presence of fatigue and poor functional status [27].

A possible way to break this vicious cycle is to encourage stroke survivors to become involved in physical activity programs, whenever possible. In this sense, a qualitative study with post-stroke subjects, observed the patients' perspectives regarding fatigue and found that nine out of 15 individuals felt that physical activity helped their fatigue management [28]. The results of the present study agrees with these findings, since there were observed inverse and good associations between levels of self-reported fatigue and physical activity. However, the mean fatigue levels <4 reported by the moderately active and active groups were lower than the cut-off scores for the presence of fatigue.

In the present study, no differences in fatigue levels were found between the moderately active and active group. This overlapping tendency was also observed in a previous study with 98 Brazilian chronic stroke individuals, with the moderately active and active groups showing no differences in the variables related to strength and functional capacity [29]. A possible explanation for this phenomenon might rely on the fact that more active individuals tended to demonstrate lower strength discrepances between the paretic and the non-paretic lower limbs, and higher physical capacities [29], leading them to possibly be more likely to get enrolled in exercise programs, when compared to the impaired group. As a result, subjects from the active and the moderately active groups tended to experience some physical benefits from regular exercise practice, while the impaired group did not.

Considering the questionnaires used in the present study, it is important to point out that the use of self-reported questionnaires is of great value within clinical contexts, considering their low-cost and easy implementation. Even though self-reported questionnaires could lead to some sort of biases because of the subjects' understanding and interpretation abilities, adequate measurement properties of the FSS [14] and HAP [17] were previously reported for individuals with neurological disorders. In addition, reported HAP scores showed strong associations with those observed for stroke subjects [19].

It is important to mention the high number of losses observed in the present study, although the observed power of the findings was consistent (>80). Unfortunatelly, this is a frequent scenario which could impact the findings [30]. It also should be noted that only individuals at the chronic phases after stroke were included in the present study. Therefore, the present findings cannot be generalized to those at the acute or sub-acute stages. Additionally, due to the design of the study, causal relationships cannot be determined. Finally, the fact that the sample size was not uniformly distributed between the physical activity level groups may have influenced the results. However, a previous study that considered post-stroke subjects with different physical activity levels also found similar distribution patterns [29], which are expected behaviors for a population with residual motor deficits. In addition, the group who reported higher fatigue levels in the present study was neither the oldest nor the one with greater number of comorbidities. It is important to point it out that all of the individuals, who were included in the present study, answered both questionnaires. Thus, the observed differences might be considered to be an accurate portrait of the reality of this population, since it included subjects with ages ranging 30 to 84 years.

Conclusion

The present findings demonstrated that impaired individuals reported higher levels of self-perceived fatigue, than those who were moderately active and active. No differences were found between the active and moderately active groups. Additionally, there were found inverse and good associations between levels of self-reported physical activity and self-perceived fatigue. Thus, the present findings reinforces that the physical actvity practice should be encouraged on poststroke survivors.

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