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The level of physical activity among ambulant stroke survivors at one year: a cross sectional study in a tertiary center in Malaysia

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Abstract

Background & Objective: Despite the importance of physical activity, there is lack of evidence measuring the level of activity performed by the stroke survivors. This study aims to determine the level of physical activity amongst ambulant stroke patients in a tertiary centre in Malaysia and to investigate the factors that may impact their physical activity. *Methods:* A cross-sectional study was conducted on ambulant stroke participants at one year post stroke. International Physical Activity Questionnaire (IPAQ) was used to measure the level of physical activity, and 6 Minute Walk Test (6MWT) was recorded to assess the participants functional walking distance and endurance. The participants were categorised into low, moderate, or high physical activity levels. Age-matched healthy controls were recruited form community. Factors including presence of depression were tested in relation to physical activity. P-value of <0.05 was considered statically significant in all statistical analyses. *Results:* There were 45 stroke patients and 30 controls recruited in this study. Participants in the stroke group has significantly lower level of physical activity compared to the control group, especially in the high physical activity level ($p<0.001$); 55.6% reported having moderate, 31.1% low and 13.3% high physical activity level respectively. No significant factors were found to be associated with the physical activity. Only depression was found to have a weak negative correlation with level of physical activity ($p=0.003$).
Conclusion: Stroke survivors have lower level of physical activity at one year post stroke despite having mild physical impairments. Rehabilitation strategies to promote physical activities should be implemented early to take advantage on the benefits of cardiovascular fitness as secondary prevention of stroke.

Keywords: Stroke, exercise, rehabilitation, prevention

INTRODUCTION

Malaysia witnessed a substantial increase in stroke incidence and disability rate post-stroke in the recent years, especially among the younger age group.[1-3] Comprehensive strategies to reduce the burden of stroke disability are warranted, which include implementing secondary prevention guidelines.[3] In numerous studies, physical activity has been shown to be of great importance as primary and secondary prevention of stroke.

Physical activity is defined by World Health Organization (WHO) as 'any bodily movement produced by skeletal muscles that require energy expenditure including activities undertaken while working, playing, carrying out household chores, travelling and engaging in recreational pursuits'. Regular physical activity can prevent the development of other conditions due to sedentary lifestyle following stroke such as obesity, osteoarthritis, osteoporosis, and depression.[4] Among the different types of physical activities, walking is the simplest and most accessible form of physical activity or exercise in the stroke population.[5]

American Heart Association (AHA) recommends stroke survivors to exercise at 40%–70% of peak oxygen consumption or heart rate (HR) reserve, 3–7 days a week, with duration of 20–60 min a day of continuous or accumulated exercise, depending on the patient's level of fitness.[4] Multiple benefits were associated

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with physical activity post stroke, for example, increased social and community participation[5], and improved life satisfaction.[6] However, despite the recommendation, several studies reported low level of physical activity among stroke survivors, even in those with mild stroke who can participate in high level activity.[7] The factors correlated with low physical activity were poor walking ability, specific sensorimotor dysfunction, and low mood.[8]

Studies measuring the level of physical activity of stroke patients are mostly conducted in the developed countries with varying results.[7,9–12] This issue has never been explored in the local population in Malaysia with a different culture and mindset of physical activities. Having a baseline data among ambulant stroke patients is crucial to strategize the comprehensive long term rehabilitation interventions which include the prescription of physical activity and exercise. In this study, we aimed to determine the level of physical activity amongst ambulant stroke patients in a tertiary center in Malaysia and to investigate the factors that influence the physical activity level.

METHODS

This was a cross sectional study conducted in University Malaya Medical Centre (UMMC) via face-to-face interview. This study was approved by the ethics committee of UMMC (MREC ID: 202124-9799).

The inclusion criteria were stroke patients aged 18 years old and above, history of either ischemic or haemorrhagic stroke, duration of stroke of one year duration, Functional Ambulation Category (FAC) score of ≥3, cognitively intact (MMSE ≥ 24) and able to self-administer the questionnaire and attend the rehabilitation clinic follow up in UMMC. Exclusion criteria were non-ambulant stroke patients and those with physical disability prior to stroke or non-related to stroke that limits physical activity. We included healthy controls from the community and match the age group of the stroke patients to confirm that the physical activity of the stroke survivors is most likely due to stroke. Findings from the control group can be regarded as a baseline activity level in the healthy local population and comparison between the two groups can be made. The control group was selected from family members of recruited participants as well as hospital staff that fulfilled the inclusion criteria and all consented to participate in this study.

To capture the physical activity before stroke, a baseline level of physical activity based on the AHA and American College of Sports Medicine classification was used. The pre-stroke activities of the participants were then categorised as low intensity, moderate intensity and high intensity.

Variables in relation to stroke rehabilitation management that may affect ambulation potential such as history of inpatient stroke rehabilitation program, frequency of outpatient physical therapy follow up, presence of lower limb spasticity, history of Botulinum toxin injection and use of lower limb orthoses were also recorded. Presence of depression was measured with Patient Health Quesitonnaire-9 (PHQ-9) to investigate the association of depression and physical activity. PHQ-9 is a self-reported measure consisting of 9 questions designed to screen depressive symptoms.[13]

International Physical Activity Questionnaire (IPAQ)

International Physical Activity Questionnaire (IPAQ) was used to measure the level of physical activity at one year post stroke.[14] IPAQ was developed as an instrument for cross-national monitoring of physical activity and inactivity. It was administered via face-to-face interview in English or the validated Bahasa Malaysia version.[15]

The questionnaire consists of 4 main parts: 1) job related physical activity, 2) transportation physical activity, 3) housework, house maintenance and caring for family and 4) recreation, sports, and leisure time physical activity. It has an additional part which asked about the time spent sitting. The number of days per week and minutes per day that the patient performed performing each specific activity continuously for ≥ 10 minutes in the last 7 days, was recorded.

Using the criteria provided in the IPAQ scoring protocol, total daily physical activity is calculated by adding the product of reported time within each item by a metabolic equivalent (MET) value specific to each category of physical activity using the formulas recommended as follows[16]:

1. Walking MET-minutes/week = x 3.3 x walking minutes x walking days
2. Moderate MET-minutes/week = x 4.0 x moderate intensity activity minute x moderate days
3. Vigorous MET-minutes/week= x 8.0 x vigorous intensity activity minute x vigorous days.
4. The total physical activity MET-minutes/ week = sum of walking + moderate + vigorous MET-minutes /week scores.

From the total score expressed in MET-minutes/ week, the stroke patients were further categorised into three levels of physical activity as proposed by IPAQ group.[16] Those not meeting criteria for either moderate or high physical activity were categorised as low level. Moderate category includes achieving a minimum of at least 600 MET-min/week or 3 or more days vigorous activity of at least 20 minutes per day or 5 or more days of moderate intensity activity or walking of at least 30 minutes every day in a week. High category includes achieving a minimum of at least 3000 MET-minutes/week or vigorous intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/ week.

6 Minute Walk Test (6MWT)

6MWT was recorded to assess participants functional walking capability and distance, as well as to capture participants endurance.[17,18] This test was carried out along the clinic corridor with a walking course of 15m with a specific instruction. The participants were requested to walk straight, turn at the end of the corridor, and return to the starting line. This was repeated continuously for 6 minutes. The participants were allowed to use walking aids and ankle foot orthosis. If needed, participant is allowed to slow down or sit to take rest, but the stopwatch was not stop. The number of meters walked within 6 minutes was recorded. Further distance walked indicated higher walking endurance. The 6MWT has an excellent test-retest reliability (ICC=0.99).[19]

Statistical analysis

Statistical Package for Social Science (IBM SPSS version 27) was used to analyse data. Descriptive analysis was used to describe the study participants. For categorical variables were recorded as frequencies and percentages and continuous variables were expressed in mean and standard deviation.

A normality test was done to compare both age and gender distribution between two groups. In view of both variables were not normally distributed, univariate analysis was carried out to compare 6MWT and generalised linear model analysis for IPAQ score, with both age and gender as co-variates in both analyses.

To study the association between physical activity with demographic characteristics and stroke variables, Pearson-Chi square test or Fisher exact test was done for categorical variables and continuous variables was determined by Spearman correlation analysis. P-value of <0.05 was considered statically significant for all analyses.

RESULTS

A total of 110 stroke patients were screened from 1st March 2021 until 31st March 31, 2022. Forty-five stroke patients fulfilled the criteria and recruited another 30 healthy age-matched people as control. The demographic characteristics and stroke variables for both stroke and control group were summarised in Table 1.

The mean (± SD) age for stroke participants was 54.3±9.5 years with male participants made up of 60% from the participants. Majority of them have the first onset of stroke. There were more stroke participants in the FAC category 5 which are independent ambulators including staircase, compared to FAC category 3 which are ambulators requiring supervision (64.4% vs 26.7%). Pre-stroke more than half of the participants have low activity levels.

Table 2 summarised the findings in outcome measures comparison between stroke group and control group. The level of physical activity among the participants in the control group was significantly higher compared to stroke group ($p<0.001$). One third of the stroke group or 31.1% of participants reported low activity level, compared to only 3.0% in the control group.

The relationship between the level of physical activity and demographic characteristics and stroke variables were summarised in Table 3 and Table 4. There was no statistically significant association noted between the demographic and stroke characteristics with level of physical activity. Similarly, there was no correlation between level of physical activity with age, education or MMSE. However, there was a weak negative correlation between PHQ-9 and level of physical activity ($p=0.003$).

DISCUSSION

This study showed that ambulant stroke patients in our centre have lower level of physical activity compared to healthy adults within the same age matched control. This trend is seen in most studies worldwide, and the reasons are multifactorial for example, probable muscle weakness, incoordination, and sensorimotor deficits.[20-23] Despite the general finding, more than half of the stroke patients in this study who initially reported low level of physical activity prior to stroke, reported a change in their level of physical activities. They began to have a

Table 1: Sociodemographic characteristics and stroke variables

Demographic	Stroke group, (N= 45)	Control group, (N=30)
Age (Mean ± SD)	54.3±9.5	41.8 ± 10.9
Gender, n (%)		
Male	27 (60.0)	9 (30.0)
Female	18 (40.0)	21(70.0)
Marital status, n (%)		
Single	5 (11.1)	4 (13.3)
Married	40 (88.9)	26 (86.7)
Education level, n (%)		
Primary	0 (0)	0 (0)
Secondary	20 (44.4)	1(3.3)
Tertiary	25 (55.6)	29 (96.7)
Years of education (Mean ± SD)	12.60 ± 1.9	15.93 ± 2.6
Employment status, n (%)		
Yes	18 (40.0)	25(83.3)
No	27 (60.0)	5 (16.7)
Types of stroke, n (%)		
Ischemic	34 (75.6)	
Haemorrhagic	11 (24.4)	
Stroke incidence, n (%)		
First onset	41(91.1)	
Recurrent	4 (8.9)	
Lesion side, n (%)		
Right hemisphere	19 (42.2)	
Left hemisphere	21 (46.7)	
Cerebellum / Brain stem	3 (11.1)	
No. of co-morbidities, n (%)		
1	6 (13.3)	
2	19 (42.2)	
≥ 3	20 (44.4)	
Lower limb spasticity, n (%)		
Yes	21 (46.7)	
No	24 (53.3)	
History of lower limb Botulinum injection, n (%)		
Yes	11 (24.4)	
No	34 (75.6)	
Lower limb orthosis Usage, n (%)		
Yes	14 (31.1)	
No	31 (68.9)	
History of inpatient active rehabilitation, n (%)		
Yes	13 (28.9)	
No	32 (71.1)	
Attending outpatient therapy, n(%)		
Yes	35 (77.8)	
No	10 (22.2)	
FAC, n(%)		
3	4 (8.9)	
4	12 (26.7)	
5	29 (64.4)	
Pre-stroke level of activity, n (%)		
Low	28 (62.2)	
Moderate	13 (28.9)	
High	4 (8.9)	
MMSE (Mean ± SD)	28.11 ± 1.570	
PHQ- 9 (Mean ± SD)	3.58 ± 4.256	

Footnotes: FAC = Functional Ambulation Category, MMSE = Mini Mental State Examination, PHQ-9 = Patient Health Quesitonnaire-9

Table 2: Comparison of outcome measures' results between stroke and control groups

Outcome measures	Stroke Group, n=41	Control Group, n=30	p value
6MWT(m)			
Means ±SD	266.91± 89.62	405.57 ± 53.97	p<0.001[a]
Median (Min-Max)	266 (65-492)	400 (291 -502)	
Means*	272.12*	397.75*	
IPAQ score (METs-mins/ week),			
Means ± SD	2006.02 ± 1542.69	3404.63 ± 2421.45	p<0.001[b]
Median (Min-Max)	1793.00(198 -6037)	2463.50 (405-9846)	
Means*	1845.36*	3645.63*	
IPAQ CAT, n (%)			
Low	14 (31.1)	1 (3.3)	
Moderate	25 (55.6)	16 (53.3)	0.001[c]
High	6 (13.3)	13 (43.3)	

Footnotes: 6MWT = 6-Minute Walk Test, IPAQ = International Physical Activity Questionnaire *: Adjusted Means (adjusted for age and gender), p[a]: Univariate analysis, p[b]: Generalised linear model, p[c]: Pearson-Chi Square test

moderate to high level of physical activity after stroke. This may be attributed partly to better knowledge and awareness of the importance of doing regular exercise as part of secondary stroke prevention among the patients. In our centre, the patients were given regular educational sessions by the rehabilitation team including by the rehab nurses and therapists.

Although the stroke participants in this study have lower physical activity than control, more than half of them belonged to the moderate-high physical activity level, thus achieving the required activity time as recommended in most stroke guidelines.[4] The higher proportion of stroke patients who were independent community ambulators (FAC category 5) in this study may have contributed to this result. They also represent the largest proportion of patients in the high physical activity level group. This highlight the importance of rehabilitation goals to achieve community ambulation in patients who are ambulant. However, when we analysed the factors associated with higher level of physical activities, the FAC category was not found to have a significant association. We believe that the small sample size in our study was the reason for the insignificant association found.

Previous recent systematic review by S Thilarajah *et al*. reported multiple factors to be associated with post stroke physical activity, such as age, gender, physical function, depression, fatigue, self-efficacy, and quality of life.[22] In our study, only PHQ-9 score showed a weak negative correlation, with higher PHQ-9 score (stroke patients with higher depressive symptoms) correlated with lower physical activity. This confirms the previous findings of the potential benefits of exercise on mood[24], and higher physical activity is associated with lower depressive symptoms.[25]

We also investigated additional factors that may affect level of physical activity such as presence of lower limb spasticity, usage of lower limb orthosis, and duration of inpatient rehabilitation stay; however, the result was insignificant. There are many possible reasons for the findings. The different lower limb muscles affected, and severity of the spasticity may contribute to the insignificant finding. Spasticity of one muscle group alone, for example the ankle plantar flexors, without any clonus may not affect the gait as much as presence of clonus and concomitant spasticity of another muscle group such as the hamstrings. The usage of lower limb orthosis during walking was also not analysed in detail, for example, the type of orthosis (solid, grand-reaction type or hinged) or duration of the orthotic wear. We believe these factors should be specifically reviewed in greater detail in future studies, to examine its association with the level of physical activity post stroke.

Apart from IPAQ, we also measured the 6MWT scores as this represent the aerobic capacity and walking endurance that the stroke patients can achieve within 6 minutes. A higher 6MWT score can contribute to a higher level of activity. In previous study, the cut-off value of 6MWT for walking independence among stroke patients was stated as 304m.[26] This is much higher than the average 6MWT value for the stroke patients in this study which was 267m. In our study, despite lower value of 6MWT, which represents a slower speed and endurance of walking, most

Table 3: The association between physical activity category and the demographic characteristics and stroke variables among stroke patients

Categorical Variables	IPAQ Category (n=45)			p value[b]
	Low	Moderate	High	
Gender, n (%)				
Male	5(35.7)	17(68.0)	5(83.3)	0.093[b]
Female	9(64.3)	8(32.0)	1(16.7)	
Marital status, n (%)				
Single	2(11.3)	2(8.0)	1(16.7)	0.842[b]
Married	12(85.7)	23(92.0)	5(83.3)	
Employment status, n (%)				
Yes	4(28.6)	10(40.0)	4(66.7)	0.271[b]
No	10(71.4)	15(60.0)	2(33.3)	
Pre stroke level of physical activity, n (%)				
Low	12(85.7)	13(52.0)	3(50.0)	
Moderate	1(7.1)	12(44.0)	1(16.7)	0.021[b]
High	1(7.1)	1(4.0)	2(33.3)	
FAC, n (%)				
FAC 3	1(7.1)	3(12.0)	0(0.0)	
FAC 4	5(35.7)	6(24.0)	1(16.7)	0.774[b]
FAC 5	8(57.1)	16(64.0)	5(83.3)	
Type of stroke, n (%)				
Ischemic	10(71.4)	18(72.0)	6(100.0)	0.395[b]
Haemorrhagic	4(28.6)	7(28.0)	0(0.0)	
Stroke incidence, n (%)				
First onset	13(92.9)	22(88.0)	6(100.0)	0.831[b]
Recurrent	1(7.1)	3(12.0)	0(0.0)	
Lesion side, n (%)				
Right	6(42.9)	12(48.0)	1(16.7)	
Left	7(50.0)	10(40.0)	4(66.7)	0.712[b]
Cerebellum/brainstem	1(7.1)	3(12.0)	1(16.7)	
No. of co-morbidities, n (%)				
1	1(7.1)	5(20.0)	0(0.0)	
2	6(42.9)	9(36.0)	4(66.7)	0.511[b]
≥3	7(50.0)	11(44.0)	2(33.3)	
Presence of lower limb spasticity, n (%)				
Yes	7(50.0)	12(48.0)	2(33.3)	0.836[b]
No	7(50.0)	13(52.0)	4(66.7)	
History of lower limb intramuscular Botulinum injection, n (%)				
Yes	5(35.7)	5(20.0)	1(16.7)	0.553[b]
No	9(64.3)	20(80.0)	5(83.3)	
Usage of lower limb orthosis, n (%)				
Yes	5(35.7)	8(32.0)	1(16.7)	0.816[b]
No	9(64.3)	17(68.0)	5(83.3)	
History of inpatient rehabilitation admission, n (%)				
Yes	6(42.9)	5(20.0)	2(33.3)	0.340[b]
No	8(57.1)	20(80.0)	4(66.7)	
Attending outpatient therapy, n (%)				
Yes	12(85.7)	19(76.0)	4(66.7)	0.688[b]
No	2(14.3)	6(24.0)	2(33.3)	

Footnotes: FAC = Functional Ambulation Category, Pearson-Chi square test, Fisher Exact test: p[b]

Table 4: The correlation between demographic characteristics and stroke variables among stroke patients with physical activity

	IPAQ-LF (n= 45), r	p value[a]
Continuous Variables		
Age (Years)	0.279	0.063[a]
Education (Years)	0.112	0.465[a]
MMSE	0.020	0.899[a]
PHQ-9	-0.427	0.003[a]

Footnote: IPAQ = International Physical Activity Questionnaire, MMSE = Mini Mental State Examination, PHQ-9 = Patient Health Quesitonnaire-9; r, p[a]: Spearman Rho

participants still have moderate to high level of physical activity.

Male participants in the stroke group were also found to be more active than female participants. In a cross-sectional study by Lee *et al*., women have higher prevalence of insufficient physical activity following stroke compared to men (OR=7.32,95% CI:1.89-28.32).[27] An almost 17% stroke risk reduction can be achieved in physically active women.[28] Thus, further research on intervention to promote and raising level of physical activity amongst women need to be carried out as well.

Although not measured quantitatively, during interview with the stroke patients, some of the common barriers that influenced their level of physical activity following stroke were lack of knowledge, fear of falling, no access to facilities such as gym, transportation issue and fatigue. This aligns with a systematic review finding by local authors, Dahlan Tabah *et al*, looking into factors influencing stroke patient adherence to physical activity which were divided into intrapersonal factors, interpersonal factors, and environmental factors.[29]

This study has several limitations. It has a small sample size due to the sudden lockdown in our country when this study was initially started, and it was done in a single centre, so it may not represent the true physical activity of stroke patients in Malaysia. We also measure the level of physical activity via self-reported questionnaire, so overestimation of physical activity may have occurred when compared to objective measurements, like pedometer or accelerometer. However, the reliability and validity of the IPAQ has been demonstrated in numerous studies, and it is cost-effective especially if future study involve a larger sample size.

To our knowledge, this is also the first study in our local settings that explore the level of physical activity among stroke patients, and it can be used as a reference for future studies related to secondary stroke prevention. Future suggestion is to expand on the data collection and include other centres in our country.

In conclusion, stroke survivors have lower level of physical activity compared to healthy controls despite having mild physical impairments. Nevertheless, more than half of the stroke survivors achieved the required activity time as recommended in stroke guidelines. From all the factors examined, higher depressive symptoms are most likely to cause stroke survivors to have lower physical activity.

DISCLOSURE

Conflict of interest: None

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