

Physical activity in stroke patients: A scoping review

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ABSTRACT Stroke is the second leading cause of disability and death worldwide with 5.9 million deaths annually. Stroke can be followed by various clinical problems. Impaired motoric function of the extremities is the most severe post stroke disorder experienced and impacts on limitations of daily activities. The main treatment is by doing regular physical activity exercises. This review was conducted to identify physical activities that can be performed by stroke patients. This scoping review was compiled using Arksey and O'Malley's five-stage framework. A total of three databases (i.e., Pubmed, Proquest, and DOAJ) was searched with relevant keyword "physical activity OR exercise AND stroke". The articles selected are published in the last 5 years, in English, and in full text. The literature search retrieved 164 studies to be screened based on the exclusion-inclusion criteria which finally resulted in the 11 studies included in the review. The remaining 11 studies were fully read and data were extracted regarding the type of physical activity, goals, settings and outcomes. Qualitative (i.e., theme analysis) methods have been used to synthesis the data. Based on the results of the review, there are several physical activities that stroke patients can do, such as progressive resistance and balance (PRB) exercises, locomotors exercises: (walking on a treadmill with body weight support and walking on the ground), selective movements of the upper and lower trunk body in the Supine and sit using a stable support / pad or unstable support (Swiss ball), core stability training, aerobic (AT) and resistance training (RT), aerobic training, walking exercises, and task-oriented training. Several physical exercises have been identified where each of these exercises has a purpose and benefit in the recovery of physical functional stroke patients. Physical activity should be done regularly and take into account the duration, intensity, and frequency of the exercise based on patient's ability and stamina.

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1. Introduction

Stroke is the second leading cause of disability and death worldwide with 5.9 million deaths annually^{1,2}. Stroke can be followed by various clinical problems. However, impaired motor function of the extremities is a major problem that is often found among sufferers. As much as 50% of stroke survivors experience hemiplegic and hemi paresis, fatigue, and instability of posture and balance that cause difficulty in walking and carrying out daily activities^{3,4}. Six months after stroke, the problems can persist and result in long-term disability^{4,5}.

The main handling of motor function disorders of the extremities can be through routine physical activity, both light to moderate physical activity.

Physical activity exercise increases muscle strength, functional capacity, ability to perform daily activities, gait, balance, improved cardiorespiratory measures and quality of life, and prevents cerebrovascular-related risks⁶⁻¹¹. Accordingly, post stroke patients are required to perform routine physical activity exercises in the rehabilitation phase so that the decrease in motor function of the extremities does not lead to long-term disability.

Stroke sufferers with low physical activity (less than four hours per week) have a 91% chance of experiencing secondary complications such as disability, pressure ulcer, pneumonia, and heart problems^{6,12}. Low physical activity / sedentary behavior also has the potential to trigger complications of diabetes mellitus, repeated strokes and death¹³⁻¹⁶. Improving the stationary time (*sedentary lifestyle*) by 25-30 minutes per day can lower the risk of cardiovascular disease by 1%

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^{15,16}. Therefore, stroke sufferers are advised to start physical activity exercise as soon as possible when the post stroke condition has stabilized. Thus, this review was conducted to identify various forms of physical activity for stroke patients. The results can be used to establish evidence-based, valid and reliable information concerning rehabilitation through physical exercise for stroke patients.

2. Method

This scoping review was compiled using Arksey and O'Malley's five-stage framework ¹⁷. More details on our research protocol can be found below. In this section, we provide an overview of the steps.

2.1 Identifying the research question

Based on the purpose of this review, the formulation of this research question was: what physical activity can stroke patients do.

2.2 Identifying studies

Literature search was performed on the PubMed,

Proquest, and DOAJ databases using the keywords: "physical activity OR exercise AND stroke". The articles selected are: (a) articles published in the last 5 years (2015-2020), (b) in English, and (c) in full text. The articles that were excluded were articles that were not in accordance with the objectives of the scoping review and articles in the form of a review.

2.3 Selecting studies

Researchers independently screened the published papers, first using the title and abstract approaches. Titles and abstracts were checked and then articles within the last 5 years of publication were scanned. Articles were also screened by excluding duplicate articles. To avoid duplication, all articles detected during the search were entered in the Mendeley application to detect duplicated articles. The screening results then were screened according to the inclusion and exclusion criteria

2.4 Charting the data

Data extraction for each included article was in the form of a matrix (table). The articles that have

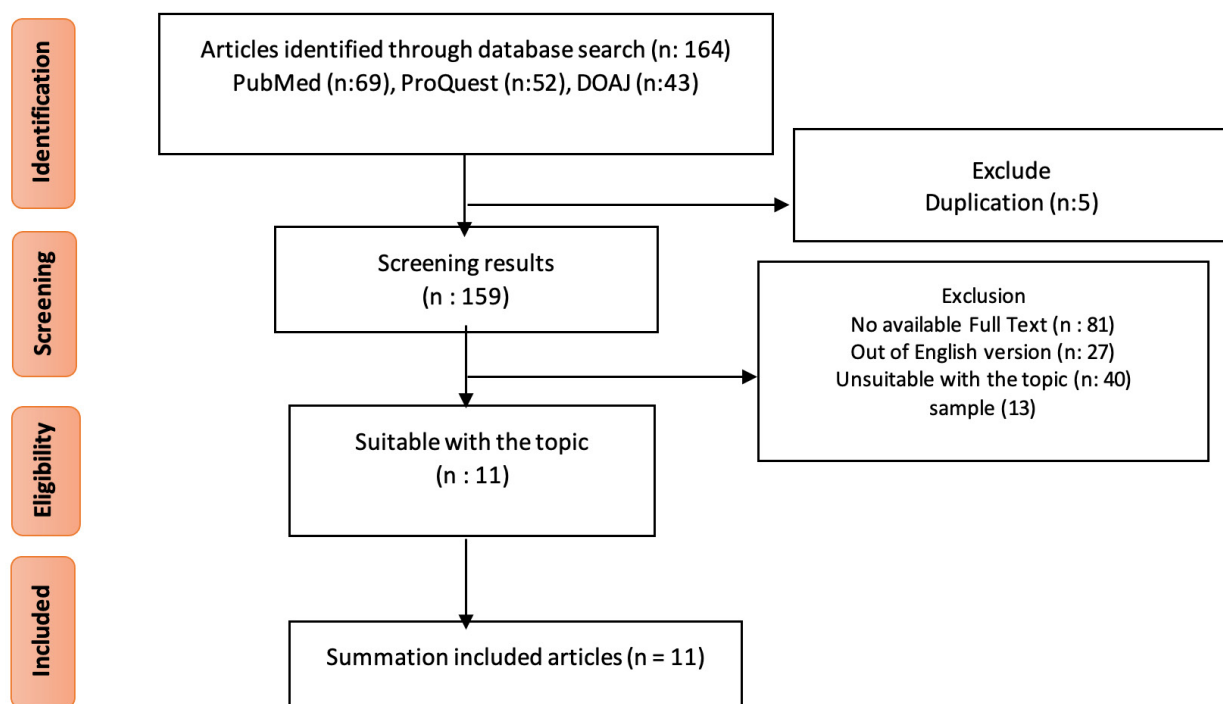


Figure 1. Study selection flowchart

been included were then extracted based on the details of publication and research, the author, year of publication, exercise/physical activity, setting, and results. The data obtained were analyzed and arranged systematically.

2.5 Collating, summarizing, and reporting results

Descriptive qualitative content analysis methods were used to synthesis and analysis the data

3. Result

3.1 Search Result

Based on predetermined keywords, there were 164 identified articles. After the inclusion criteria were applied, the duplication of articles screened and their suitability for the purpose of writing this literature review, 11 articles were selected to be included in this literature review.

3.2 Physical activity of stroke patients

Based on the results of the analysis (Table 1), the authors identified physical activity / physical exercise that can be performed by stroke patients including progressive resistance and balance (PRB) training^{18,19}, locomotors training: (walking on a treadmill with body weight support and walking on the ground)¹⁸, selective movements of the upper and lower trunk of the body in a supine position and sitting using a stable support / base or unstable support (Swiss ball)²⁰, core stability training^{21,22}, aerobic (AT) and resistance training (RT)^{23,24}, aerobic training²⁵, walking exercises²⁶, and task-oriented training^{27,28}.

4. Discussion

Physical activity that can be performed by stroke patients consists of several types, including balance exercises (i.e., core stability training, progressive resistance and balance (PRB) training, selective movements of the upper and lower trunk of the body in a supine position and sitting using a stable support / base or unstable support (Swiss ball)), walking exercises (i.e., locomotors training: (walking on a treadmill with body weight support and walking on the ground) and walking exercises), physical fitness training (i.e., aerobic training, aerobic (AT) and

resistance training (RT), and exercise modification in the form of daily activities, namely task-oriented training.

Physical activity is an important part of the rehabilitation phase for stroke patients. Full family or caregiver assistance predisposes the patient to immobility. As a result, the body, especially the limbs, becomes weaker, gets tired easily and feels heavy movement. This sedentary pattern in turn increases the risk of recurrent stroke and secondary complications²⁵.

Physical activity is the main health behavior for stroke sufferers as a form of health management and maintenance. Physical activity with certain modifications can reduce the risk of cardiovascular disease and protect the incidence of stroke recurrence. Modifications can be made in the form of basic activities such as daily activities at home^{29,30}. Physical activity programs are structured based on the basic principles of motor learning such as intensive, specific tasks, included challenges and exercises³¹.

The duration, intensity, and frequency of exercise are also the main things to consider in order obtaining the best exercise outcome. Based on this literature review, it can be stated that almost all physical activity is done with duration of 30 minutes - 1 hour for approximately 2-3 times a week. The core stability training is carried out with a relatively shorter duration of 15-20 minutes but the frequency is increased up to 5 times a week. This schedule is in accordance with the basic principles of an exercise program including specificity, repetition, meaningful movements, and intensity³². In fact, physiological exercise will activate the stimulus signal to increase protein synthesis of actin fibers and muscle myosin. Therefore, with intense exercise, the amount of actin protein and muscle myosin will increase progressively and will increase muscle energy and strength, ultimately developing better coordination, so that the patient can support the body and perform movements^{33,34}.

Thus, the results of this review can be used as a supporting guideline for determining exercises/ physical activities that can be recommended to stroke rehabilitation patients so that the patient's

Table 1. Physical activity of stroke patients

Physical activity	Author, year, design	Purpose	Setting	Outcomes
Progressive resistance and balance (PRB) exercise	Vahlberg et al., 2017, RCT	To evaluate the effects of progressive balance and resistance training (PRB) on physical and psychological functioning post stroke patients	- Exercises combined with motivational discussion - Frequency: 2-3 times / week for 3 months. - Duration: Warm-up session which includes stationary cycling or walking (10 minutes), circuit class (approx. 45 minutes) and motivation session related to physical activity (20 minutes).	Significant balance improvement. effect size [ES]: 0.72; ($p < 0.01$) comfortable walking speed (MD 0.04 versus -0.05 m / s; ES, 0.68; ($p: 0.01$))
1. Locomotors exercise: (walking on a treadmill with body weight support and walking on the ground) 2. Strength and balance exercise	Rose et al., 2017, cohort + RCT	To determine the effect of 2 locomotors exercise interventions and strength and balance training on post stroke recovery.	- Frequency: 36 sessions (3 times / week for 3 months) - Exercise duration is 90 minutes	The walking speed increased significantly, value ($p: 0.003$).
Selective movement of the upper and lower trunk body in a supine and seated position using a stable support / base or unstable support (Swiss ball)	Karthikbabu et al., 2018, RCT	to test the effectiveness of Swiss ball support plinths and trunk exercises on balance, mobility, physical functioning and community reintegration	1 hour per exercise session, 3 sessions / week for 6 weeks	Significant mean change in outcome measures: trunk impairment scale 2.0 (3.6; 4.1 points), Brunel Balance Assessment (1-level), Tinetti scale (5; 5.2 points), walking speed (.06; .08m / s) , Punch Impact Scale 16 (8.7; 7.2 points), and community reintegration (7.6; 8.8 points). $p < 0.05$.
Core stability training	Cabanas-Valdés et al., 2016, RCT	To test the effect of core stability training on torso control, dynamic sitting and standing balance, gait, and daily activities in subacute stroke patients.	15 minutes long a day with a frequency of five days / week for five weeks	differences were statistically significant for all total scale scores ($p < 0.05$), except for the sitting portion of the Brunel Balance Ratings.
	Haruyama et al., 2016, RCT	To determine the effectiveness of core stability training on rod function, standing balance, and mobility in stroke patients	20 minutes Duration a day, with a frequency of 5 days / week for 4 weeks	Effective on dynamic balance subscales and Trunk Impairment Scale / TIS total scores ($p = 0.002$ and $P < 0.001$, respectively), active range of motion of the pelvis ($p < 0.001$), Brief-BESTest ($p < 0.001$), Timed Up-and-Go test / TUG ($p = .008$), and Functional Ambulation Categories / FAC ($p = .022$)
Aerobic (AT) and resistance training (RT)	Marzolini et al., 2018, RCT	To examine the effect of aerobic and resistance training (AT and RT) on the physiological outcomes of chronic stroke patients with motor impairments.	Aerobic exercise 3 days / week Resistance exercise 2 days / week AT + RT for 6 months and doing the exercise at home / community	A Similar and significant improvements in 6MWD ($p = 0.8$), VO 2peak ($p = 0.9$), sitting-standing time ($p = 0.05$), stair climbing performance ($p = 0.97$).), T + RT resulted in greater improvements in total lean body mass ($p = .039$), limbs of the affected side ($p = 0.04$), and muscle strength of the upper and lower extremities. ($p < 0.03$)

Table 1. (Continued)

Physical activity	Author, year, design	Purpose	Setting	Outcomes
Aerobic (AT) and resistance training (RT)	Lund et al., 2018, RCT	To investigate the effect of different types of physical exercise on balance performance and whether improved balance correlates with improved walking performance	Resistance and aerobic exercise is carried out 3 days / week for 3 months.	the AT group increased peak oxygen absorption by 15.5 (6.0–25.0)%, the RT group increased the non-paretic knee extensor strength by 35.1 (18.3–51.9)% All groups improved balance (6, 0 (95% CI: 3.2–8.8)%), maximum walking speed (10.2 (6.5–14.0)%), and 6 minutes walking (12.4 (8.8 -15.9)%) Physical exercise improves balance and walking performance
Aerobic training	Mansfield et al., 2016, cohort	to evaluate the effect of exercise programs and self-management on participation in independent physical activity	-Combined aerobic exercise with a self-management program -Training sessions: warm up 3–5 minutes, cool down with low intensity training, and 20–30 minutes of aerobic exercise -Frequency: 3 times a week for 6 weeks	expected higher outcomes for sport, less resistance to physical activity, and higher participation in physical activity
Walking exercise	Andreasen et al., 2020, quasi RCT	to examine patterns of post-stroke physical activity and the relationship of these patterns to parameters	30 minutes duration and frequency 6-7 times per week for 3 months	Step count and regularity were linearly correlated ($p < 0.001$). The measures and their associated complexity were squared ($r^2 = 0.70$ for mean, 0.64 for daily values). The complexity is affected by the seasons between spring and winter ($p = 0.019$). Season has no effect on steps or structure. Rainfall has no effect on steps or complexity.
Task-Oriented training (Reaching, grasping, manipulating an object): - Brushing teeth - Hand writing - Holds the spoon - Drink Open a book page	Israely et al., 2017, case report	Seeing the effect of task-oriented training on hand and arm function	One exercise session of two minutes (the task is repeated 8-15 times). Each set of exercises can be repeated 4-5 times.	Significant improvement in hand function in proximal and distal skills. emphasized the importance of intensive task-oriented training during the first 3 months after stroke to support natural healing of the lesion area.
Task-oriented training: - drink water from a glass - lifting a glass of water to 90 ° shoulder flexion - move 5 crystals from table to box - wiping the table with a towel with elbows extended - grasps and releases a 6 cm diameter tennis ball comb the hair	Thant.A.A et al., 2019, RCT	To determine the effect of task-oriented training on the functional performance of the upper extremities paretics in patients with subacute stroke	-Practicing 3 out of 6 functional tasks selected according to his wishes -1 session for 1 hour, warm up for 10 minutes, practice the task for 50 minutes. -Every 15 minutes of walking exercise given a 2.5 minute rest period then resumed. -Exercise is done 5 sessions / week for 4 weeks -Prior to training, the task is demonstrated to participants with reference to their unaffected Upper Extremity	-All participants complete their training program. -Much more significant improvements to the Wolf Motor Function Test, motor portion of the Fugl-Meyer assessment of upper extremity, and the hand function domain of the Stroke Impact Scale. -No serious side effects were observed during or after training

functional recovery, especially physical function, can be achieved according to the patient's rehabilitation target.

5. Conclusion

Through this review, empirical evidence identified findings regarding physical activity in stroke patients which provides the basis for routine implementation. Several physical activity exercises were identified to be the exercises that stroke patients can perform with each of them having goals and benefits in the physical functional recovery of stroke patients. Physical activity should be done regularly and take into account the duration, intensity, and frequency of the exercise in relation to a patient's ability and stamina. This review reveals how physical activity plays an important role in the physical improvement of stroke patients.

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Conflict of interests

There is no conflict of interest.

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