

ORIGINAL ARTICLE

Balance Exercise on Improvement of Independent Daily Activities Among Stroke Patients

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ABSTRACT

Introduction: The number of stroke cases is increasing in Indonesia and the disability caused by stroke is a burden for the country. The purpose of this study is to determine the effect of balance exercise on the independence of daily activities among stroke patients in Indonesia. **Methods:** The study design used quasi-experiment with pre-test and post-test design with control group sampling techniques. A non-probability sampling method was used through purposive sampling. Independent t test was applied for statistical test. The intervention group was given the balance exercise and routine treatment according to the doctor's program, whereas the control group only received a doctor's therapy program with or without therapy activity besides balance exercise. **Results:** Based on the hypothesis test, there was an effect of the balance exercise on the improvement of patients' independence in performing daily activities, this was evidenced by the results of statistical tests in the control and intervention groups with p value = 0.047. The balance exercise interventions can be given by increasing the physical exercise education ability on both patients and families. **Conclusion:** The use of balance exercise is proven to be able to increase the level of independence of the patient so that this intervention can be given earlier after a stroke to increase muscle strength and cerebral circulation.

Keywords: Balance Exercise, Activity Daily, Stroke

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INTRODUCTION

The number of stroke cases is increasing in Indonesia and the disability caused by stroke is a big burden for the country. The main focus of the physical exercise management of stroke patients is done individually with problem-solving approach to restore patients' independence to attain optimal functional ability.

The loss of central nervous system function causes limited coordination of neuro sensory motor resulting in disruption of physical activity and a decrease in independent activity. The number of patients who have compliance with rehabilitation is only 31.8%. This shows that more than 60% of post-stroke patients do not undergo a rehabilitation program with several factors that should be carried out with further research (1). The novelty of this study is the use of a simple intervention in the form of balance exercise, which is one of the therapies of rehabilitation methods that is easy to carry out either under the guidance of a health professional or carried out independently by the patient under family

supervision. Besides, the results of this study can be used as justification for the management of post-stroke patients in the form of provision of Balance Exercise, so that in the future a Balance Exercise therapy program is mandatory for post-stroke patients. The regularity of undergoing a rehabilitation program can affect the speed at which a patient recovers from disability. The more regularly stroke patients carry out rehabilitation, the more they can prevent and reduce the risk of complications, as well as they can return in normal daily activity.

Body movement exercise of stroke patients is a prerequisite to attain patients' independence. It is because body movement exercise is able to gradually help restore the normal function or approaching normal function of legs and arms and to increase strength of patients to manage their life. Balance exercise is one of rehabilitative actions that aim to improve physical ability in order to recover from the troubles in doing daily activities. The necessity of the effect of balance exercise on patients' independence has been proven in this research. Independence in fulfilling daily activity need is measured by using Barthel index scale. This research is aimed to find out the effect of balance exercise on independence of patient in performing daily activities and independent performance level of post-

stroke patients in doing activities, before and after doing balance exercise treatment.

Balance Exercise can be used to improve postural balance (2). Balance Exercise is also useful to reduce the risk of ageing. Balance Exercise gives the effect of increasing the strength of the lower limb muscles (3). Sports / exercises that involve muscle contraction can increase muscle strength by more than 100%. Decrease in the muscle size with age can be reduced by regular exercise. Research shows that exercise can increase muscle strength (4). Balance training will benefits for the elderly if it is done 1-3 times a week (5). Research has proved that after two weeks exercise muscle contractile proteins (actin and myosin) can be replaced (4).

Disorders due to stroke often cause hemiplegia (paralysis of half the body) and hemiparesis (muscle weakness) which can be a cause of permanent disability and that affect the function in carrying out Activity of Daily Living (ADL). After a stroke, restoring patient's independence in carrying out daily activities must focus on the rehabilitation actions (6). At the time of rehabilitation, the patient can be treated in a hospital, rehabilitation centre, or his own home depending on several factors, including the dependency status of stroke patients. The level of dependence of stroke patients is measured with the Barthel Index (BI) which was formulated by Mahoney and Barthel (7). The results of ADL dependence's measure are total dependence (score 0-20), heavy dependence (25-40), moderate dependence (score 45-55), mild dependence (score 60-95), and independent (score 100) (8).

Stroke patients who will return to home should be motivated to carry out self-care activities as much as they can. The client can do basic ADLs, such as eating, dressing, bathing, going to toilet, continence control, transferring, and mobilization (9). Patients are also advised to use both sides of the body in performing the ADL, for example if the right side is affected, the patient can use his left hand for all activities. Again, the clients are also made sure that the injured hand is included in all activities. The faster patients are allowed to do work by themselves, the faster the patient becomes independent. Activities that can pose a risk of falling or endangering a patient themselves need to be helped by the family (6). The results of this study can be used to describe the regularity/continuity of the respondents in undergoing the therapy program in the form of balance exercise.

MATERIALS AND METHODS

Quasi experimental research design is used for pre-test and post-test with control group. To identify the influence of balance exercise on independence of activities of daily living, these studies select stroke patients for respondents. Respondents were divided into two group namely intervention and control group. The intervention

group received balance exercise treatment and regular treatments according to doctor's program while the control group only got therapeutic program from doctor with or without therapeutic activities besides balance exercise treatment.

In the intervention group, before the intervention of balance exercise was given, the respondents' Activities of Daily Living (ADL) were measured by using the Barthel index scale and after the balance exercise was applied, ADL was measured again. Balance exercise was conducted three times a week for 4 weeks with duration of 15 minutes. In the control group, ADL measurement was carried out at the beginning and at the end of the assessment without balance exercise but still applying other training programs and treatments.

The population in this research were post stroke patients in the Rehabilitation Unit of Hospital in Solo, Indonesia. Sampling was done by non-probability sampling method through purposive sampling. Criteria for the inclusion of samples are: (1) post-stroke patients who are still undergoing treatment (medical stroke), (2) patients having regular control for the last 2 months (March - April 2019), (3) respondents' age >30 years old, (4) patients having *compos mentis* (sanity) who are able to communicate naturally, (5) patients willing to be a respondent. Exclusion criteria could not be included in this study like (1) respondents who resign as respondents, (2) respondents who have a drastic decline in health status. The determination of the number of total samples used. The intervention group samples consisted of 39 people and the control group samples consisted of 38 people.

Data analysis was performed using computerized system program. The data collected were tested for normality in order to obtain the normal results of the distribution of the intervention group and the control group. Based on the normality test, the data processing / analysis then applied the parametric test, namely *independent t-test*.

This study has received ethical clearance and was approved by the health research ethics committee of Dr Moewardi General Hospital/ School of Medicine Sebelas Maret University with a number 579/IV/HREC/2019.

RESULTS

The Characteristics of the Respondents

This study shows that the respondents in the intervention group were mostly male. The group consisted of 23 men (59%) and 16 women (41%). The respondents in the control group consisted of 20 men (52.6%) and 18 women (47.6%). The average age of respondents in the intervention group was 58.9 years old, the youngest age was 31 years old and the oldest was 84 years old. In the control group, the average age of the respondents was 56.7 years old, the age of the youngest participants was

37 years old, and the oldest was 78 years old (Table I).

Table I: Age-based Distribution of Respondent

Age	Mean	SD	Min –Max	N
Intervention	58.9	11.4	31 - 84	39
Control	56.7	9.5	37 - 78	38

The mean Barthel index value before the treatment in the intervention group was 55.97 the highest was 80, and the lowest was 35. In the control group, the mean Barthel index value was 65.42, the highest was 95, and the lowest was 30. The level of patients' independence in the control group and intervention group before the treatment based on Barthel values is shown in Table II.

Table II: The Barthel index-value of Respondents before and after treatment

Barthel Index	Pre-treatment				Post-treatment			
	Mean	SD	Min – Max	N	Mean	SD	Min – Max	N
Intervention group	55.97	12.15	35 - 80	39	62.9	15.76	35 - 90	39
Control Group	65.42	18.90	30 - 95	38	65.42	18.90	30 - 95	38

The mean Barthel index value after the treatment in the intervention group was 62.9, the highest was 90, and the lowest was 35. In the control group, the mean Barthel index value was 65.42 with a standard of deviation (SD) of 18.90, the highest was 95, and the lowest was 30.

In the intervention group, the frequency distribution based on ADL, showed that most respondents consisting of 25 people (64%) had a moderate dependency level, 7 people (17.9%) had a mild dependency level, and 6 people (15.4%) had a heavy dependency level. The characteristics of the respondents' independence based on Barthel values in the intervention group are shown in Table III.

Table III: The Level of Respondents' dependence in the Intervention Group

Level of Dependence	Pre-treatment		Post-treatment	
	N	%	N	%
Heavy	6	15.4	1	2.6
Moderate	25	64.1	11	28.2
Mild	7	17.9	25	64.1
Independent	1	2.6	2	5.1
Total number	39	100	39	100

In the frequency distribution of the respondents in the control group, on the initial assessment of Barthel-value, respondents with heavy dependence consisted of 2 people (5.3%), respondents with moderate dependence consisted of 11 people (28.9 %), and respondents with mild dependence consisted of 18 people (47.4). The characteristics of the respondents' independence based on Barthel values in the control group are shown in Table IV.

Table IV: The level of the Respondents' dependence in the Control Group

Level of Dependence	N	%
Heavy	2	5.3
Moderate	11	28.9
Mild	18	47.4
Independent	7	18.4
Total number	38	100

Note: The measurement of Barthel values in the control group was done 2 months after the first measurement and the group had got pharmacological treatment and ROM exercises as also given to the intervention group.

The research shows that in the intervention group the average duration of stroke was 4 years, the shortest duration was 1 year, and the longest duration was 10 years. In the control group, the average duration of stroke was 3 years, the shortest duration was 1 year, and the longest duration was 14 years (Table V).

Table V: Distribution of the Respondents based on Duration of Stroke

Stroke Duration	Mean	SD	Min-Max	N
Intervention Group	4	2	1-10	39
Control Group	3	3	1-14	38

The Effect of Balance Exercise on the Independence of Post-Stroke Patients

This research shows that the mean Barthel index value before treatment (intervention) was 55.97 and the mean Barthel index value of at post-intervention was 62.90. The statistical test result obtained the value of P which was 0.000. It can be concluded that there is a significant difference between the values of Barthel index before and after the intervention. The analysis result of the dependent t-test shows that there is an increase in the values of Barthel index after the treatment with balance exercise intervention, as shown in details in Table VI.

Table VI: Distribution of Mean Values of Barthel Index before and after Balance Exercise

Barthel Index	Mean	SD	SE	p-Value	N
Before Balance Exercise	55.90	13.022	2.085	0.000	39
After Balance Exercise	66.41	13.715	2.196		

The statistical test results obtained a correlation value (r) of 0.398 and a p- value of 0.013. That means, there is a moderate relationship and a positive pattern, the greater the Barthel Index before the intervention, the greater the Barthel index after being given a balance exercise. Value of coefficient with determination 0.159 means that the regression line equation can explain the post intervention value of Barthel's index by 16%. Then, p -value of 0.013 means that in alpha 5% there is a difference between the values of the Barthel index of the intervention group and the control group (Table VII).

DISCUSSION

The most acute problem experienced and suffered by

Table VII: Correlation and Regression Analysis of Values of Barthel Index after Balance Exercise in the Control Group and Intervention Group

Variable	<i>r</i>	R ²	Regression	<i>p</i> -Value
Barthel Index Pre Treatment	0.398	0.159	Barthel Index Post Intervention = 82.793 – 0.287 * Barthel Index Pre Treatment	0.013

stroke patients is body movement disorders. Patients experience difficulty when walking because they experience disruption in muscle strength, balance, and coordination of movement (10). Stroke patients experience abnormalities of the brain which is a central nervous system that controls and triggers the movement of the neuromusculoskeletal system. Clinically the most common symptom is hemiparesis or hemiplegia, which causes the loss of normal postural reflex mechanisms for balance, body rotation for functional movements in extremities. Functional movement is a movement that must be stimulated repeatedly to make conscious coordinated movements and automatic reflexes based on the skills of daily life activities.

Body movement exercises for stroke patients is a prerequisite for achieving patients' independence because exercise will gradually restore the limb function back to normal or approaching normal, and give strength to patients to control their life. Exercise is adjusted to patients' condition and the main goal is consciousness to make movements that can be controlled properly, not on magnitude of movements (10).

Characteristics of the Respondents

Age is the one risk factor for stroke. Stroke can affect all age groups, but it is more often found in elderly population. The risk of stroke increases after the age of 55, and even doubles every ten years after (11). In this research, the average age of respondents who suffered a stroke was 58.9 years old.

Age factor is the main risk of stroke. According to the research conducted by Lannywati Ghani, et al (2015), the risk of stroke increases with age (12). By considering other factors, respondents aged 55 have 5.8 times the risk of stroke compared to those aged 15 - 44 (12). As people get older, various functions of their bodily system will change or even decline including those in the nervous system, causing several pathological conditions such as sensory motoric disorders, cognitive / memory disorders, and psychiatric or emotional disorders (13). These changes can affect body balance. Body balance can certainly decline with age due to changes in the central or neurological nervous system, sensory systems such as the visual system, vestibular system, and the musculoskeletal system. Sensory motoric disorders after stroke result in impaired balance including muscle weakness, decreased soft tissue flexibility, and impaired motor and sensory control. The lost functions caused by impaired motor control in post-stroke patients result in

loss of coordination and loss of ability to sense body balance and posture (13).

The distribution of respondents in this study showed that there were more males than females. This is in line with a research conducted by American Heart Association (2006) stating that strokes occur more frequently in males than females (14). Another research stated that there is no relationship between stroke and sex difference (15). Sex-specific risk factors in several researches are very diverse, meaning that sex variables are strongly influenced by other variables such as lifestyle like smoking habits, history of alcohol consumption, and medical history on other diseases. One research stated that risk factors for smoking habits and history of alcohol consumption were found mostly in the male respondents and the difference was significant compared to the female respondents (16).

Sacco, et al. (1997) stated that stroke incidence in men was 1.25 times higher than that in women (17). The statement of Sacco, et al. is supported by American Heart Association / AHA (2006) stating that stroke attacks occur more in males than in females as evidenced by the research results showing that the incidence of strokes in males is 81.7 per 100.000 people and in females 71.8 per 100.000 people. This condition is thought to be related to lifestyle and is associated with other risk factors such as smoking, alcohol consumption and dyslipidemia (18).

Balance Exercise Improves Independence in Performing Activities of Daily Living (ADL)

ADL are activities people do in performing daily routines. ADL are basic activities for self-care. ADL include: going to the toilet, self-feeding, dressing (grooming), bathing, and functional mobility (19). ADL are basic skills and occupational tasks that must be mastered by an individual to care for his/her own self independently, daily in fulfilling his/her role as an individual in a family and community (20).

Balance exercise is a special exercise that is intended to help increase the strength of the muscles of the lower limbs and improve the vestibular system / body balance. The organs that have a role in the body's balance system are the organs of balance perception. The exercise is very helpful to keep body stable to prevent falls that often occur in the elderly (21).

Balance exercise activates the voluntary movement system and the body's automatic postural response. When performing ankle, hip, and stepping strategy exercises, the body provides sensory information, through a mechanoreceptor due to a change in sensation of body's position, from the joints to the large myelinated nervous system to be passed into the dorsal column-medial lemniscus system, ending at the postcentral gyrus of the cerebral cortex (somatosensory area I), later

processed in the cerebral cortex.

The creation of body balance, muscle strength and adequate joints will increase the ability of body movement in performing activities such as standing, walking, dressing up, bathing and toilet activities. Independence means performing individual activities without supervision, direction or active personal assistance. Independence means a state or condition of someone who can be independent without depending on others. Independence implies a condition where someone, who has a desire to compete to make progress for his/her own good, is able to make decisions and initiatives to overcome the problems faced, confident in doing his/her tasks, and responsible for what he/she has done. Independence is an attitude in which individuals keep learning to be independent in dealing with various situations in the environment so that they will eventually be able to think and act on their own (13).

This study shows that balance exercise affects the increase in patients' independence ($p=0.047$). Balance exercise is an exercise that can improve coordination and balance function in the brain and can increase muscle strength. According to another research muscle strength is a supporting power for movement to complete tasks in meeting daily routine demands (22). One research stated that physical exercise done regularly, more or less 3-5 times a week, will result in better physical fitness, health, and recovery than that done only once a week. Physical exercise done regularly will lead to increasing strength and improved muscle coordination if done 3-5 times a week for 2-3 weeks (23).

According to another research the increased independence is greatly influenced by family support and compliance in following the rehabilitation therapy program (24). This study did not discuss certain types of rehabilitation therapy programs so that patients and their families may have difficulty doing the exercises independently, meaning that the ability to understand and perform the type of exercise skills is a determining factor. This study provides a solution to the problem faced by stroke patients by examining the effect of the type of balance exercise on the patient's independence. The results of this study can be used as a study material on the importance of balance training as well as the justification for using a balance training model.

CONCLUSION

The level of dependence of post-stroke patient activity before balance exercise is mostly in the medium category at 64.1%. Analysis of 2 populations shows that the population that is given a balance exercise has a value of Barthel greater than that which is not given a balance exercise (or given other types of exercise). Increasing the independence of daily activities in the form of a decrease in dependence from moderate to mild

categories can be achieved after being given a balance exercise intervention (p - value = 0.047).

The management of post-stroke patients must be accompanied by an increase in the ability to educate physical exercise to both patients and families so that balance exercise do not have to be done in hospitals or other rehabilitation units but can be done at home and family as instructors.

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