



## THE CORRELATION BETWEEN PHYSICAL REHABILITATION COMPLIANCE AND MUSCLE STRENGTH IN POST-STROKE PATIENTS WITH HEMIPLEGIA

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### ABSTRACT

Post-stroke patients will experience weakness, paralysis, or disability as a result of the stroke attack, thus requiring rehabilitation. The rehabilitation results will be more optimal if supported by the compliance of post-stroke patients in following the rehabilitation program. The purpose of this study was to determine the correlation between physical rehabilitation compliance and muscle strength in post-stroke patients with hemiplegia. The type of research used in this study is using a cross-sectional analytic approach. The study population was post-stroke patients undergoing physical rehabilitation at Ir. Soekarno Sukoharjo Hospital with an average of 73 patients using the Slovin formula. The inclusion criteria in this study were patients who performed physical rehabilitation regularly for 1 month, and patients willing to become respondents in the study by signing a consent form. Exclusion criteria in this study were patients who suddenly re-entered the inpatient clinic, patients who had repeated stroke attacks, and patients who suddenly moved to hospital locations. Collection of rehabilitation compliance data according to the rehabilitation compliance questionnaire. Collection of muscle strength data by existing muscle strength measurements. The results of the Spearman Rho correlation obtained a significance value (p-value) of 0.001 ( $p < 0.05$ ), the majority of respondents were in the age range of 60-74 years, most of the respondents were male, most of the respondents were married, most had undergone rehabilitation for 3 months, and the majority were first stroke patients. This study concludes that there is a correlation between physical rehabilitation compliance and muscle strength of post-stroke patients with hemiplegia at Ir. Soekarno Sukoharjo Hospital.

Keywords: hemiplegia; muscle strength; non-hemorrhagic stroke; physical rehabilitation

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### INTRODUCTION

Data obtained from the World Stroke Organisation (WSO) (2019), shows that there are new cases of stroke every year and more than 101 million people living with the disease (Lindsay et al., al 2019). The data shows that around 6.5 million people die each year from stroke and more than 143 million people suffer from stroke-related disability (Feigin et al., 2022). Indonesia itself for stroke prevalence based on National Basic Health Research (RISKEDAS) data in 2018 was 10.9% or around 2,120,362 people. The Central Java Health Office reported in 2018, the number of stroke cases in Central Java was 2.1% or around 31,871 cases (Central Java Provincial Health Office, 2018). Stroke causes health problems that can lead to death and serious disability worldwide every year (Gonzalez et al., 2023). According to the Global Burden of Disease (GBD) (2019), stroke is the second leading cause of death and the third leading cause of disability worldwide. Oxygen deprivation occurs when blood flow to the brain is cut off due to occlusion or rupture of an artery to the brain, leading to death in stroke patients (Owolabi et al., 2022). Non-traumatic cerebral circulation disorders that occur suddenly, rapidly, and progressively can cause paralysis of the face and limbs, changes in consciousness, slurred or slurred speech, and visual disturbances (Ministry of Health, 2019). Stroke is one of the causes of functional disabilities such as hemiplegia, loss of sensation in

the face, arm, or leg on one side of the body, difficulty speaking and understanding, difficulty swallowing, and loss of vision on one side of the body (Agustyaningsih et al., 2020).

Appropriate and high-quality physical rehabilitation increases the likelihood of recovery after a stroke. Stroke rehabilitation includes physical therapy, occupational therapy, speech therapy, and cognitive therapy (Kuriakose & Xiao, 2020). Post-stroke rehabilitation aims to maximize the functional independence of patients with various stroke disorders (Marliana, 2023). The main goal of post-stroke rehabilitation is to help stroke patients return to normal pre-motor or pre-stroke function, whether in the home environment, social environment, or even the workplace (Whitehead & Baalbergen, 2019). A comprehensive rehabilitation program for stroke patients begins in the hospital and includes Range Of Motion (ROM), mirror therapy, and music therapy (Harmayetty, Ni'mah, Firdaus, 2020). Currently, patient non-adherence to rehabilitation programs remains a serious problem for medical providers (Nadila, Syahrul, Suherman, Mamfaluti & Firdausa, 2021). The healing and rehabilitation process that takes a long time sometimes makes stroke patients feel lazy in carrying out rehabilitation. Research conducted by Pishkhani, Dalvandi, Ebadi, and Hosseini (2019) states that only 50% of stroke patients are compliant in carrying out rehabilitation. The effect of non-compliance with physical rehabilitation for post-stroke patients is that it can increase the risk of higher complications, impaired balance risk of falls, and decreased quality of life.

Based on the results of research conducted by Nanda (2021), the results of research on the effect of passive Range Of Motion (ROM) exercises on muscle strength and range of motion of extremity joints in post-stroke patients show that there is an effect of passive ROM exercises on muscle strength. Based on the results of research by Rofina (2020), the results of research on the effect of mirror therapy on the muscle strength of patients with impaired physical mobility due to stroke showed that most respondents experienced an increase in muscle strength after the mirror therapy intervention. Furthermore, based on research by Yuliyani (2023) it is found that rubber ball grasping therapy shows that grasping rubber balls can increase the muscle strength of limbs that experience weakness. Based on the results of medical records of stroke patients who underwent outpatient care at Ir. Soekarno Sukoharjo Hospital June to August 2024, there were 196 new cases of stroke and 605 visits of stroke patients. Based on the results of interviews with 10 post-stroke patients at the Outpatient Installation of Ir. Soekarno Sukoharjo Hospital 2024, shows that 5 out of 10 post-stroke patients said they routinely followed the rehabilitation program. This shows that there is still a lack of compliance among post-stroke patients in following the rehabilitation program regularly.

Until now there are still few literature reviews or systematic reviews that report on the effectiveness of physical rehabilitation on muscle strength of post-stroke patients. Advances in the medical management of stroke patients over the past decade have achieved significant reductions in mortality, yet the prevalence of stroke and the number of patients living with its consequences continues to increase. Stroke disease poses substantial mortality and morbidity risks to individuals with increased economic costs to society. Therefore, more efficient stroke rehabilitation strategies such as physical exercise and physical activity are needed. Based on the above reasons, the authors are interested in knowing the effect of physical rehabilitation on the muscle strength of patients after stroke treatment. This study was conducted to determine the correlation between physical rehabilitation compliance to muscle strength of post-stroke patients with hemiplegia.

## **METHOD**

The type of research used in this study is using a cross-sectional analytic approach. This study was conducted to determine the correlation between physical rehabilitation compliance to muscle strength of post-stroke patients with hemiplegia. The research was conducted at the outpatient installation of the Ir. Soekarno Sukoharjo Hospital in August-September 2024. The sample was taken by purposive sampling using the Slovin formula and obtained a research sample of 73 post-stroke patients. The inclusion criteria in this study were patients who performed physical rehabilitation regularly for 1 month, patients aged  $\geq 15$  years and  $< 70$  years, and patients willing to become respondents in the study by signing a consent form. Exclusion criteria in this study were patients who suddenly re-entered the inpatient clinic, patients who had repeated stroke attacks, patients who suddenly moved to hospital locations, and patients who had mental disorders and dementia.

Data were collected by collecting patient demographic data, physical rehabilitation compliance questionnaire, and measurement of muscle strength gain. The physical rehabilitation compliance questionnaire used a modified Morinsky Medication Adherence Scale (MMAS) questionnaire which was translated into Indonesian. The measurement method of this instrument is by choosing one of the two answers provided. The results of the adherence scoring were categorized into high adherence if the total score was 8, moderate adherence if the total score was 6 -  $< 8$ , and low adherence if the total score was  $< 6$ . The validity test has been carried out and the results of the calculated r-value are between 0.706-0.852 so that the rehabilitation compliance instrument consisting of eight questions can be said to be valid with the results of  $r_{\text{count}} \geq r_{\text{table}}$  (0.602) (Kurniawan, 2017). To measure the increase in muscle strength using existing measurements, namely by assessing muscle strength 0 is paralysis / no muscle contraction at all, 1 is visible or palpable vibration of muscle contraction but no movement at all, 2 can move limbs without gravity, 3 can move limbs to withstand weight (gravity), 4 can move joints actively and against minimal resistance, 5 can move joints actively and against maximum / full resistance (normal strength).

Univariate analysis was conducted by researchers to determine demographic characteristics (age, gender, education, marital status, length of rehabilitation, stroke history, muscle strength before, and muscle strength after stroke) rehabilitation compliance questionnaire data. The analysis of this study used the Spearman correlation test to analyze the effect between two variables. The results of the analysis test were assessed by looking at the significance value if  $p < 0.05$  which means  $H_0$  is accepted. This research has obtained ethical permission from the Health Research Ethics Commission (KEPK) FK Muhammadiyah University Surakarta with No. 5317/B.1/KEPK-FIKSUMS/IX/2024.

## **RESULT**

The characteristics of the study subjects were patients with a medical diagnosis of stroke who underwent outpatient care at Ir. Soekarno Sukoharjo Hospital in August-September 2024.

The majority of respondents were in the age range of 60-74 years as many as 38 people (52.1%). Of the 73 respondents, 44 were male (60.3%), and the rest were female. Respondents had various educational backgrounds, with most of them completing junior high school (23 people or 31.5%). Most respondents were married (53 people or 72.6%). In terms of rehabilitation duration, 43 respondents (58.9%) had undergone rehabilitation for 3 months. The majority were first-time stroke survivors (78.1%), while the rest had recurrent stroke. Most of the subjects were at level 2 muscle strength (56.2%). After rehabilitation, the majority of subjects improved to level 4 muscle strength (53.4%) (table 1).

Table 1.  
Frequency Distribution of Respondents Based on Age, Gender, Education, Marital Status, Length of Rehabilitation, History of stroke, Pre muscle strength, Post muscle strength (n=73)

Respondent characteristics	f	%
Age (years)		
45-59	32	43,8
60-74	38	52,1
>74	3	4,1
Gender		
Male	44	60,3
Female	29	39,7
Education		
Elementary school	18	24,7
Junior high school	23	31,5
Senior high school	19	26,0
S1	13	17,8
Marital status		
Married	53	72,6
Widow	7	9,6
Widower	13	17,8
Length of Rehabilitation (month)		
2	30	41,1
3	43	58,9
History of stroke		
First	57	78,1
Recurrent	16	21,9
Pre muscle strength		
2	41	56,2
3	29	39,7
4	3	4,1
Post muscle strength		
2	4	5,5
3	26	35,6
4	39	53,4
5	4	5,5

Table 2.  
Frequency Distribution of Respondents Based on Physical Rehabilitation Compliance and Muscle Strength (n=73)

Respondent characteristics	f	%
Physical Rehabilitation Compliance		
Low	14	19,2
Medium	13	17,8
High	46	63,0
Increase in Muscle Strength		
None	13	17,8
1	43	58,9
2	14	19,2
3	3	4,1

Most subjects had a high level of compliance (64.4%). A total of 58.9% of subjects experienced a 1-level increase in muscle strength, followed by a 2-level increase (19.2%), no increase (17.8%), and a 3-level increase (4.1%) (table 2). Table 3 shows that there is a correlation between physical rehabilitation compliance and muscle strength of post-stroke patients with muscle weakness at Ir. Soekarno Sukoharjo Hospital. The results of the Spearman Rho correlation obtained a significance value (p-value) of 0.001 ( $p < 0.05$ ) and a coefficient value (r) of 0.391, this value indicates a moderate positive relationship between rehabilitation compliance and muscle strength, which means that the higher the physical rehabilitation compliance, the higher the increase in muscle strength of post-stroke patients, although this relationship is not too strong (table 3).

Table 3.  
Analysis of the Relationship between Physical Rehabilitation Adherence and Muscle Strength in Post-Stroke Patients with Muscle Weakness (n=73)

Physical Rehabilitation Compliance	Increase in Muscle Strength								Total	r	p	
	None		1		2		3					
	f	%	f	%	f	%	f	%				
Low	6	46,2	7	16,3	1	7,1	0	0,0	14	19,2	0.391	0,001
Medium	2	15,4	11	25,6	0	0,0	0	0,0	13	17,8		
High	5	38,5	25	58,1	13	92,9	3	100,0	46	63,0		

## DISCUSSION

Based on the results of the analysis, it was found that there was a correlation between physical rehabilitation compliance and muscle strength of post-stroke patients with hemiplegia at Ir. Soekarno Sukoharjo Hospital. The data shows that patients with a high level of compliance tend to achieve better muscle strength. The results of this study are in line with previous research by Taher (2018) at Labuang Baji Makassar Hospital, which showed that post-stroke patients were compliant with the rehabilitation program. This finding is consistent with previous research which shows that adherence to rehabilitation programs is very influential in improving motor function and post-stroke muscle strength (Harmayetty et al., 2020). Compliance in undergoing rehabilitation greatly affects the motor function of the patient where it is found that motor function has increased significantly after patients follow rehabilitation regularly and regularly (Safei et al., 2021). The more consistent the patient is in following rehabilitation, the greater the chance of restoring muscle ability and preventing atrophy (Lad et al., 2020).

The majority of patients in this study were in the elderly age range. In line with research by Pamungkasty and Dewi (2020), the average age of patients with stroke is > 65 years. According to Vargas-Escobar et al. (2022), which states that patients aged ≤ 68 years show a better level of compliance compared to older patients. Pishkhani et al. (2019) also highlighted that older individuals often face obstacles such as age-related pain, fatigue, and disability, which limit their participation in rehabilitation programs and decrease adherence to medical instructions and family recommendations. According to Harmayetty et al. (2020) confirmed that the younger a person is, the higher the level of compliance in undergoing rehabilitation. Based on gender, it is known that men are more susceptible to stroke due to lifestyle. In line with Laily's research (2017) found that men are more at risk of stroke than women in early adulthood, with a ratio of 2:1. Lifestyle factors such as smoking, lack of physical activity, and alcohol consumption increase this risk. Meanwhile, Cheiloudaki and Alexopoulos (2019) reported that male patients tend to be less compliant in following rehabilitation than females. This may be related to the caregiving role more often held by women, which increases their involvement in treatment and recovery programs.

Most respondents had a history of education in secondary school. Sinuraya et al. (2018) stated that individuals with higher education tend to be more compliant than those with low education. An individual's education plays a role in how their knowledge is related to health, where a low level of education will lead to a lack of health information that he will get and result in a person becoming indifferent to the health conditions that are being disturbed (Taher, 2018). Conversely, people with higher education more easily understand medical information and the importance of therapy. According to Harmayetty et al. (2020), this understanding encourages stroke patients to consistently follow rehabilitation programs to accelerate recovery. Most of the respondents were married. According to Setyoadi et al. (2017), married status provides an advantage for the recovery of stroke patients because life partners play an important role in emotional support, help with problem-solving, and provide

financial and caregiving support. Utama & Nainggolan (2022) added that patients who have a partner tend to be more optimistic about undergoing treatment and post-stroke life. Spouses help remind drug or therapy schedules and accompany during rehabilitation, increasing patient compliance. In addition, the role of the family in motivating and caring for patients is very influential in the success of recovery (Okwari et al., 2017).

Most respondents had undergone rehabilitation for 3 months. The length of time for medical rehabilitation itself depends on how diligent the patient is in following this rehabilitation. Purwati, Christina, and Harlyanti (2022) stated that the length of following rehabilitation also has an important role in increasing the independence of stroke patients, where rehabilitation therapy carried out for more than 4 weeks has a more positive effect on the level of independence of stroke patients. Nadila et al. (2021) in their research showed that the insurance company limits the number of visits to  $\geq 7$  times per month for economic reasons and is considered sufficient to support the patient's recovery. Based on stroke history some respondents had a stroke for the first time. Research by Fadlilah et al. (2019) supports this finding, suggesting that one way to prevent recurrent stroke is to modify lifestyle and undergo therapy. In addition, Rahmawati, Kurniawan, and Hartati (2019) stated that non-compliance with rehabilitation and poor dietary management can increase the risk of recurrent stroke and other advanced complications. According to Andriyani and Hudiyawati (2017), physical exercise and position changes have been proven effective for improving physical mobility and muscle strength in post-stroke patients.

In the study, Vargas-Escobar et al. (2022) emphasized that family support and patients' understanding of the importance of rehabilitation influenced their adherence to therapy. This suggests that in addition to internal factors, external factors such as social support and motivation from family play an important role in the success of rehabilitation programs. In other words, rehabilitation adherence is not only related to physical strength but also to the psychological and social aspects of the patient. Adherent patients have a positive mindset towards recovery, fuelled by family support and an understanding of the importance of rehabilitation. These results emphasize the importance of continuous education and family involvement in the rehabilitation process to improve the effectiveness of therapy and accelerate patient recovery. This study has several limitations that need to be considered. Firstly, the sample size used is relatively small and only includes respondents from one particular area, so the results may not be generalizable to a wider population. Secondly, this study uses a survey method with a questionnaire, which risks respondent bias, especially if answers are given based on subjective perceptions. Thirdly, time constraints meant that the data was collected over some time, which may not reflect changes that may have occurred over a longer period of time. These limitations are expected to be taken into consideration for future research to expand the coverage area, increase the number of samples, and consider a longitudinal approach to gain more comprehensive insights.

## **CONCLUSION**

Based on the results of this study, there is a significant correlation between compliance in physical rehabilitation with muscle strength of post-stroke patients at Ir. Soekarno Sukoharjo Hospital. Patients with a high level of compliance are more likely to experience an increase in muscle strength. Of the compliant respondents, 46 (63%) respondents experienced an increase in muscle strength. It is hoped that future research can be conducted with a larger sample and over a longer period to validate these findings. It is recommended to examine additional factors such as psychological and economic conditions that affect patient compliance in rehabilitation.

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