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## The Effectiveness of Range of Motion (ROM) on Increasing Muscle Strength in Stroke Patients: Literature Review

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### ABSTRACT

Stroke is one of the health problems that cause movement disorders in sufferers due to decreased loss or decreased muscle function. Range of motion exercise is thought to improve movement function in stroke patients. The purpose of this study was to determine the effectiveness of a range of motion (ROM) on muscle strength in stroke patients. Thus, the authors discussed the literature review on the effectiveness of ROM on muscle strength in stroke patients. A systematic search was conducted in the following three databases: PUBMED, PLOS ONE, EBSCO, and GOOGLE SCHOLAR using the keywords "Stroke" AND "Range Of Motion" AND "Muscle Strength". There are 417 articles in the Pubmed, Plos One, Ebsco, and Google Scholar databases, but only eight articles meet all criteria. The results of statistical tests in eight literature show that most of the effects of a ROM exercises on increasing muscle strength in stroke patients are carried out 1-2 times a day, and the duration of each extremity is 15-20 minutes per session, performed two times a day for six days. Performing ROM exercises for stroke patients must be adjusted to the recommendations for both the type and time of implementation. It aims to maintain or increase muscle mass and muscle tone of patients with stroke who have decreased muscle strength. ROM exercise affects increasing muscle strength in patients with stroke. Recommendations for nurses in clinics that active and passive ROM exercises can give to increase muscle strength in the care of stroke patients effectively.

Keywords: Stroke, Range of Motion, Muscle Strength

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### INTRODUCTION

A stroke is a circulatory disorder in the brain that causes diseases in other limbs. Non-hemorrhagic stroke causes delays in movement due to muscle weakness. In Indonesia, the death rate due to stroke occupies the first position in Southeast Asia. Who says 328,524 Indonesians have died of a stroke (Helen, et al., 2021).

Stroke is one of the leading causes of death and occupies the third position in the world after andgerous diseases and cancer. Stroke is one of the main causes of death in Indonesia in cerebrovascular disease (Handayani, et al., 2018). A blood stroke is an attack that occurs in the brain and occurs in a way that can cause partial or complete disruption of brain function as a result of disturbances that can cause the rupture of certain blood vessels in the brain caused by blockage of flow. This can cause a lack of oxygen; the cells in the brain are deprived of blood and nutrients and eventually can cause the death of these cells in a short time (Agusrianto et al., 2020). Patients with stroke will experience weakness and paralyze the limbs suddenly until the patient is discharged from the hospital. As a result of this weakness and paralysis, it can cause impaired physical mobility in carrying out daily activities (Nurshiyam et al., 2020).

Stroke is the second leading cause of death and the sixth most common cause of general disability. About 15 million people have a stroke (3.1 million men and 3.5 million women), accounting for a third of cases or about 6.6 million deaths. According to data from the World Health Organization (2016), every year, there are 13.7 million new cases of stroke, or a quarter of people over 25 years old have a stroke. New cases of non-hemorrhagic stroke are more than 9.7 million cases. Strokes that occur every year in individuals under the age of 70 are around 60% (Nurshiyam et al., 2020). Based on gender, data from Riskesdes (Kemenkes RI, 2018) shows the prevalence of stroke in Indonesia is 11.0% for men and 10.9% for women. Stroke is also a major cause of dysfunction, where 3% of survivors still need to be treated at a medical institution after three months, while 15-30% of patients experience permanent disability. In Indonesia, 55-60% of patients with stroke symptoms experience mild to severe disability, 25% die, and 10-15% survive. As a result of this dysfunction, stroke survivors lose productivity and have to spend a lot of money on rehabilitation treatments (Bariroh et al., 2016).

Most stroke patients will experience limitations in carrying out activities, causing a decrease in muscle and joint strength. The number of hemiparesis incidence is increasing along with the increasing incidence of stroke. Every year the increase in stroke patients continues to occur, not only affecting old age, people with a young and productive age can have a stroke (Oktraningsih, 2017). Movement disorders are problems that are often experienced by stroke patients. Movement disorders occur due to a decrease in extremity muscle strength as a result of lesions in the motor cortex. Disorders of muscle strength and body balance result in disturbances or difficulties when walking and doing activities and can occur in patients who have had a stroke (Oktraningsih, 2017). Weakness on one side of the body in stroke patients occurs due to a decrease in the ability to move the muscles in their limbs.

The increase in the incidence of stroke and disability continues to occur in stroke patients, so it is necessary to provide non-pharmacological therapy. One of the non-pharmacological therapies that can be given physical therapy is the Range of Motion (ROM) exercise (Susanti et al., 2019). In the Range of Motion (ROM) exercise, we move the joints actively or passively with the aim of maintaining joint mobility and training the motor skills of stroke patients. If ROM exercises are not carried out as early as possible, muscle atrophy, contractures, pressure sores, and decreased muscle strength can occur (Oktraningsih, 2017). Range of Motion (ROM) exercise is aimed at maintaining or increasing the level of perfect ability to move muscles normally and completely to increase muscle mass and tone. In semi-coma and comatose patients, passive ROM exercises are usually performed. Patients with a limited range of motion are unable to perform some or all of their range of motion independently, the patient is completely at rest, or the patient is lying in bed with total limb paralysis. Active ROM exercises are performed by the patient independently without assistance from others. This exercise aims to maintain joint mobility, stimulate blood circulation, prevent deformity and maintain muscle strength (Agusrianto, et al., 2020).

Assessment of muscle strength to examine patients who experience paralysis uses a measuring scale. Assessment of muscle strength is also used to see if there is progress or worsening obtained during treatment. Conceptually, preventing muscle stiffness can be done by providing ROM training (Agusrianto, et al., 2020). In a study conducted by Nurtanti and Ningrum (Nurtanti, et al., 2019) on two-stroke patients in Dusun Jaten Kedunggupit, active ROM was carried out for one month with a duration of 20 minutes every morning and evening. ROM exercise in stroke patients increases muscle strength to a scale of 3, which is able to move muscles with minimal resistance previously from a scale of 2, which is unable to move weak muscle parts according to orders (Nurtanti, et al., 2019). In another study by Susanti and Bistara (Susanti et al., 2019), in patients with ischemic stroke, ROM exercises were given two times a day in order to increase muscle ability rather than once a day (Susanti et al., 2019).

Based on some of the descriptions above, the authors are interested in researching journals about the effectiveness of a range of motion (ROM) on muscle strength in stroke patients. The purpose of this study was to determine the effectiveness of a range of motion (ROM) on muscle strength in stroke patients. Thus, the authors discussed the literature review on the effectiveness of a range of motion (ROM) on muscle strength in stroke patients.

## METHOD

A systematic search was conducted in the following three databases: PUBMED, PLOS ONE, EBSCO, and GOOGLE SCHOLAR using the keywords "Stroke" AND "Range Of Motion" AND "Muscle Strength." The search results found 417 journal articles with the following distribution: PUBMED found 82 articles, PLOS ONE found 65 articles, EBSCO found 25 articles, and GOOGLE SCHOLER found 245 articles. The articles found were then selected using the following inclusion criteria: 1) original research with quantitative and qualitative designs; 2) articles are accessible and full-text; 3) articles published in 2016-February 2021; 4) articles published in English or Indonesian; 5) the article is declared eligible based on the results of the critical appraisal. The article selection process is as listed in figure 1. The results of the selection of 417 articles obtained eight articles that deserve to be reviewed as listed in table 1.



Table 1. Selected Article For Review

Author	Year	Title	Design	Sample
Agriani, Nurul Aini and Sulaiman	2020	The Effectiveness of Range of Motion Exercises in Stroke Patients at Siti Hajar Hospital	One group pre-post test	20 Respondents
Agusrianto and Nirva Rantesigi	2020	Application of Passive Range of Motion (ROM) Exercises to Increase Extremity Muscle Strength in Patients with Stroke Cases	Case studys	1 partisipant
Chandra Irawan, Mardiyono, Suharto, Aris Santjaka	2018	Combination Of Hypnosis Therapy And Range Of Motion Exercise On Upper-Extremity Muscle Strength In Patients With Non-Hemorrhagic Stroke	Quasi Experimental with pre-post-test control design	32 respondents have been divided into 16 respondents, including the treatment group and 16 respondents including the control group
Donghwan Park, Heon-Seock Cynn, Chungwi Yi, Woochol Joseph Choi, Jae Hun Shim, Duck-Won Oh	2019	Four-week training involving self-ankle mobilization with movement versus calf muscle stretching in patients with chronic stroke: a randomized controlled study	A Randomized Controlled Study	38 respondents had divided into 19 respondents included in the self-ankle mobilization with movement (S-MWM) group and 19 respondents included in calf muscle stretching (CMS)
Helleana Eschmann, Martin E. Héroux, James H. Cheetham, Stephanie Potts, Joanna Diong	2019	Thumb And Finger Movement Is Reduced After Stroke: An Observational Study	Cross-Sectional Study	15 respondents
Shindi Hapsari, Sonhaji, Nindya Nurulia	2020	Effectiveness of Range of Motion (ROM) Fingers and Spherical grip to Extremity Strength in Non Hemorrhagic Stroke Patients	Quasi experimental with a control group	32 respondents have been divided into 16 respondents, including the treatment group and 16 respondents including the control group
Susana Nurtanti and Widya Ningrum	2019	The Effectiveness of Active Range Of Motion (ROM) To Increase Muscle Strength In Stroke Patients	Case study	2 Partisipant
Susanti and Difran Nobel Bistara	2019	Effect of Range of Motion on Muscle Strength in Stroke Patients	Pra-Eksperimental One-Group Pre-Post-Test Design	32 partisipant

## RESULT

The results of the eight articles are presented in the following table:

### Duration of Range of Motion (ROM) Exercises

Distribution of implementation in ROM exercises based on the duration of implementation as listed in table 2 and table 3.

Table 2. Distribution of Range of Motion (ROM) Exercises per Session

ROM Training Length per Session	Number of articles	Percentage
10-15 minutes/session	2	12.5
15-20 minutes/session	4	50.0
30 minutes	1	12.5
Not known	1	25.0
<b>Total</b>	<b>8</b>	<b>100.0</b>

Table 3. Distribution of Implementation Time (ROM)

NO	Author	ROM Exercise Implementation Time		
		Minutes/Session	Sessions/Day	Day
1	Agriani, Nurul Aini, Sulaiman	10-15	2	6
2	Agusrianto and Nirva Rantesigi	15-20	2	6
3	Chandra Irawan, Mardiyono, Suharto, Aris Santjaka	30	2	3
4	Donghwan Park, Heon-Seock Cynn, Chunghwi Yi, Woochol Joseph Choi, Jae Hun Shim, Duck-Won Oh	10-15	Unknown	Unknown
5	Helleana Eschmann, Martin E. Héroux, James H. Cheetham, Stephanie Potts, Joanna Diong	Unknown	Unknown	Unknown
6	Shindi Hapsari, Sonhaji, Nindya Nurulia	15-20	2	3
7	Susana Nurtanti and Widya Ningrum	15-20	2	30
8	Susanti and Difran Nobel Bistara	15-20	2	6

### Muscle Strength in Stroke Patients

Identify the results of muscle strength measurements before and after range of motion (ROM) exercise interventions from eight reviewed journal articles as presented in table 4 below.

Table 4. Muscle Strength Measurement Results Before and After Range of Motion Exercises

No	Author	Muscle Strength (Mean)	
		Pre-Intervention	Post-Intervention
1	Agriani, Nurul Aini, Sulaiman	2	3.8
2	Agusrianto and Nirva Rantesigi	2	3
3	Chandra Irawan, Mardiyono, Suharto, Aris Santjaka	2	3
4	Donghwan Park, Heon-Seock Cynn, Chunghwi Yi, Woochol Joseph Choi, Jae Hun Shim, Duck-Won Oh	Unkown	Unknown
5	Helleana Eschmann, Martin E. Héroux, James H. Cheetham, Stephanie Potts, Joanna Diong	0	1
6	Shindi Hapsari, Sonhaji, Nindya Nurulia	2	3
7	Susana Nurtanti and Widya Ningrum	2	3
8	Susanti and Difran Nobel Bistara	3	4

**Effect of Range of Motion Exercise on Muscle Strength in Stroke Patients**

Identify the results of an eight-journal statistical test related to the effectiveness of Range of Motion exercises against increased muscle strength in stroke patients as listed in table 5 below.

Table 5. Statistical Test Results of The Effect of The Range of Motion Exercise on Increasing Muscle Strength

No	Author	Statistical Test Result	
		$\rho$	$\alpha$
1	Agriani, Nurul Aini, Sulaiman	Unknown	Unknown
2	Agusrianto and Nirva Rantesigi	Unknown	Unknown
3	Chandra Irawan, Mardiyono, Suharto, Aris Santjaka	0.000	< 0.05
4	Donghwan Park, Heon-Seock Cynn, Chunghwi Yi, Woochol Joseph Choi, Jae Hun Shim, Duck-Won Oh	0.005	< 0.05
5	Helleana Eschmann, Martin E. Héroux, James H. Cheetham, Stephanie Potts, Joanna Diong	0.001	< 0.05
6	Shindi Hapsari, Sonhaji, Nindya Nurulia	0.000	< 0.05
7	Susana Nurtanti and Widya Ningrum	Unknown	Unknown
8	Susanti and Difran Nobel Bistara	0.000	< 0.05

**DISCUSSION**

Hartinah et al. (2019) explain that ROM exercises have been carried out at least five times a week to obtain maximum results. ROM exercises 1-2 times a day, and the duration of execution for each extremity is 20-30 minutes. Five journal articles performed ROM exercises for 15-20 minutes per session and performed two times a day for six days. In addition, some studies that are not wording the recommendations, namely the research of Agriani et al. (2020), who did ROM exercises for 10-15 minutes per session, were carried out two times a day for six days. In this study, the duration of exercise did not reach the standard number in doing ROM exercises. The research of Park et al. (2020) and Eschmann et al. (2019) did not know the duration of ROM exercises. Performing ROM exercises for stroke patients must be adjusted to the recommendations for both the type and time of implementation. It aims to maintain or increase muscle mass and muscle tone of patients with stroke who have decreased muscle strength (Agusrianto et al., 2020).

The distribution of the assessment of muscle strength before the range of motion exercise shows the average muscle strength before the intervention of the range of motion exercise is carried out, namely muscle strength 2. Muscle strength had been expressed on a scale of 0-5. For the value of muscle strength 2, namely, there is movement but cannot withstand gravity. Of the eight journal articles reviewed, the highest muscle strength was in Susanti and Bistara, (2019), namely with muscle strength 3, while the lowest was in the study of Eshmann et al. (2019) with 0 muscle strength. While in Park et al. (2020) research, muscle strength is unknown.

The distribution of muscle strength assessment after ROM exercise shows that the average muscle strength after the ROM exercise intervention increases from a scale of 2 to a scale of 3, wherein muscle strength with a scale of 3 can withstand movements against gravity. A journal article from Susanti and Bistara (2019) namely from a scale of 3 to 4 where muscle strength with a scale of 4 can withstand gravity and overcome minor obstacles (Irawan et al., 2018).

Based on statistical tests, almost all journals (90%) of ROM exercises showed a positive effect on increasing muscle strength in stroke patients, namely through a p-value <0,05, which means that ROM exercises are effective in increasing muscle strength for stroke patients. Regular ROM exercise is a treatment therapy of muscle exercises to maintain the patient's ability to run joints normally and completely and provided regular exercise can increase muscle strength in stroke patients (Susanti and Bistara, 2019). The identification results from eight journals showed an increase in muscle strength after doing both active and passive (ROM) exercises. Five of the eight journals showed that p-value <0.05, which means that ROM exercises carried out for both active and active stroke patients can increase muscle strength, while the other three journals did not mention the p-value but stated that ROM exercises had a positive impact on increasing muscle strength by increasing the scale of muscle strength in stroke patients.

**CONCLUSION**

ROM exercises are effective in increasing muscle strength in stroke patients. To get the benefits of increasing muscle strength, stroke patients must perform a range of motion exercises according to the recommendations, namely active and passive ROM exercises for six days, with two sessions per day, and per session for 15-20 minutes.



Recommendations for nurses in clinics that active and passive ROM exercises can give to increase muscle strength in the care of stroke patients effectively.

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