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Range of Motion Exercise to Improve Muscle Strength among Stroke Patients: A Literature Review

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Abstract. Stroke was a disturbance in part or all brain function caused by abnormal blood flow to the brain, disrupting bodily functions such as muscle weakness. One of the efforts that could be done to overcome muscle weakness in stroke patients was the Range Of Motion (ROM) exercise which could be done independently or assisted by health workers. The purpose of this literature review was to identify the effect of range of motion (ROM) exercise in increasing muscle strength in stroke patients. This study used a descriptive method with a literature review approach. The search strategy used six international journal databases: PubMed, JSTOR, Wiley Online Library, Sage Journal, ScienceDirect, and Taylor & Francis Online. In addition, a search was conducted on one national journal database, namely Google Scholar. The selection was conducted by assessing articles that met the inclusion criteria, such as publication range from 2005-2021, in English, Indonesian, and other languages that can be translated and opened full access text. After the selection process, nine articles that met the inclusion criteria were obtained, with 197 respondents assigned randomly and grouped into 58 control groups, 55 intervention groups, 84 combined groups. The results showed that the ROM exercise method positively affected increasing muscle strength in stroke patients. Based on these results, it could be concluded that this nurse's independent intervention needed to be carried out in stroke patients to increase muscle strength.

Keyword: Muscle strength, Range Of Motion (ROM), stroke

INTRODUCTION

Stroke was a sudden attack in the brain, causing partial or complete brain function disruption as a sign of blood flow to the brain. It could be caused by several factors such as rupture of certain blood vessels in the brain and blockages in brain blood vessels, which could cause cells -Brain cells were deprived of oxygen and nutrient supply, resulting in the death of brain cells in a relatively short time (1). WHO 2014 stated that stroke was a condition in which blood flow to the brain was cut off, and stroke caused physical impairment and disability in the sufferer (2). This because most of the body's control lied in the brain, both sensory and motor.

In Devenport's and Dennis's research, it was stated that stroke was broadly divided into two, namely ischemic stroke and hemorrhagic stroke (3). Ischemic stroke was a disorder in the brain caused by a blockage in the brain's blood vessels so that the tissues in the brain experienced an ischemic or lack of oxygen and nutrients. Ischemic stroke was also often known as non-hemorrhagic stroke. Meanwhile, hemorrhagic strokes occurred due to injury to the arteries, so that microaneurisms that ruptured and caused obstruction to blood circulation in the brain could cause bleeding in the brain (4).

The incidence of ischemic stroke accounted for 80% of the incidence, while the percentage of hemorrhagic stroke was 15% -30%. This clearly showed that ischemic strokes were a more significant proportion of stroke patients (5). Stroke was a medical emergency, recorded as the most important contributor of death in the world. In 6 hours, a stroke could kill at least one person in the world. It could be estimated that the incidence of stroke recorded per year was ten people, with 5 million of them died, and 5 million experienced permanent disability. In Indonesia, the death rate from stroke was still high and was the leading cause of disability which was predicted to be a disease burden, and the economy would increase in 2020 (6). This was confirmed by the Ministry of Health of the Republic of Indonesia (2018), with the number of sufferers reaching 10.5 people/mile (7).

Risk factors of stroke include heredity, age, gender, socioeconomics, geographic location, foods high in fat and calories, less consumption of fruits and vegetables, smoking, alcohol consumption, lack of physical activity, hypertension (8). In addition, obesity, atherosclerosis, primary artery, heart disease (heart failure), and dyslipidemia also were reminded as potential factors (2).

The disruption of blood supply to the brain due to blockage or bleeding could cause decreased or even loss of brain function rapidly. In the body, the role of the brain was as a control center and coordinating body movements. The presence of tissue damage on some sides of the brain could cause a decrease in the ability to move one part of the body. This was commonly called hemiparesis. Muscle strength would decrease so that it disturbed the ability to carry out daily activities (9). In preventing the physical and mental disabilities in stroke sufferers, proper treatment was needed. It was said that 30% -40% of stroke sufferers could recover perfectly if handled in the golden period or the first 6 hours.

On the other hand, if there was no excellent handling during that time, it was likely that you would experience physical and mental disabilities. Patients with hemiparesis stroke would experience permanent disability if they were not treated immediately. This was because sensory and motor nerves that were not used and stimulated would die, and muscles would lose their function if they were not used (10).

The tools of the movement consisted of muscles and bones, with their respective functions as an active means of motion and a passive means of motion. The cooperation between muscles and bones produced a movement that could be done to meet the needs of the activity. Meanwhile, muscle strength was the ability of muscles in quality and quantity to develop muscle tension in contracting (11).

Non-pharmacological therapy in patients with hemiparesis and hemiplegia could be done using Range of Motion (ROM) exercises. ROM was an exercise that could maintain or improve the level of perfection of muscle tone, muscle strength, and ability to move joints. In increasing muscle strength, ROM exercises could be done from an early age. The more motor units that were produced, the muscle strength would increase (10).

Commonly, the used ROMs were active ROM training and passive ROM. Active ROM was an exercise to maintain or improve the perfection of joint movement and muscle strength that was done alone without assistance (12). Whereas passive ROM exercises were movement or energy used from other people, usually passive ROM was used in semicoma or coma patients (11).

The effectiveness of passive ROM exercises would increase muscle strength, improve muscle tone, increase joint mobility, improve muscle tolerance for activity, and reduce the risk of losing bone mass (9). As with passive ROM exercises, giving active ROM exercises early in stroke patients could increase muscle strength (12).

However, it was necessary to do a comprehensive study to determine the impact of ROM exercises to increase muscle strength based on existing research to be applied in the nursing care process (Evidence-Based Research) (13). The fact was that in the field, there were rarely any ROM training interventions by officers to stroke patients.

OBJECTIVE

This study was conducted systematically following the scientific method of literature review to explain the effectiveness of ROM exercises on increasing muscle strength in stroke patients.

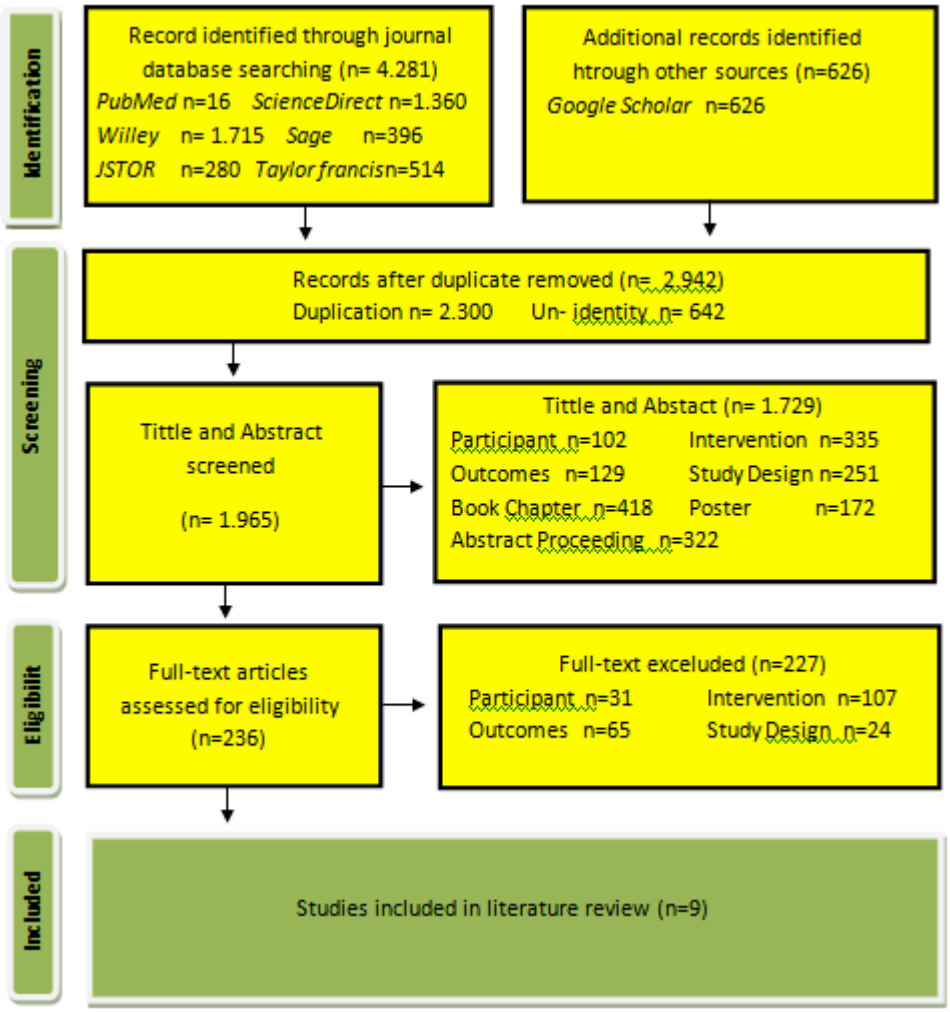
METHOD

The search strategy was carried out on several journal databases, including; PubMed, JSTOR, Wiley Online Library, Sage Journal, and Taylor & Francis Online, ScienceDirect. The keywords used for advanced search engines; [All: room exercise] AND [All: muscle strength AND [All: stroke]. In addition, the researcher also searched one journal database, namely Google Scholar.

The inclusion criteria in this literature review were published from 2005 to 2021 in English, Indonesian, and other languages translated version with open access and complete access in the original article form. The PICO strategy including Participants or population (P) were stroke patients; intervention (I) was ROM exercise; Outcomes (O) muscle strength; and study Design (S) was an experimental study. The exclusion criteria were book chapters, abstract proceedings, and posters. The authors conducted a process analysis of each of the articles reviewed and extracted the detailed information needed to assess the effectiveness of ROM exercises for enhancing muscle strength in stroke patients.

The selection process was initiated by removing duplicates with inappropriate article titles to search for baseline data using the Microsoft Excel 2007 application. The abstracts from the selected articles were further analyzed to ensure compliance with the inclusion criteria. In the second round of the article selection process, the author conducts a full-text review to prevent doubts about the selected article. Furthermore, the authors searched for and selected the studies that were considered the most relevant to be reviewed using PIOS. All articles that met the inclusion criteria were reviewed in their entirety.

Picture 1.
PRISMA diagram



All articles were thoroughly reviewed, specifically criticized, and rated using the Critical Appraisal Skills Programmed (CASP) instrument by three independent authors (YS, WW, DA). The articles chosen were articles with a good CASP level with a value of 7-8 points and 5-6 points sufficient. The author discussed it with a senior mentor (FAF) to assess articles and ranking scores. If there was still doubt, the author conducted a CASP with a senior researcher (HS) by examining it.

This study had extracted data on the intervention and control groups consisting of: total number of respondents, intervention, methods, results, and critical assessments.

Table 1.
Respondent characteristics

Variable	Category	N	%	Mean	Deviation Standard
Age	Middle Adult (35-45) years)	29	27.6	35.0	10.39
	Late adulthood (46-55 years)	47	49.8		
	Elderly (> 55 years)	29	27.6		
Gender	Male	52	48.0	47.0	7.07
	Female	44	42.0		

Since this research review included only level I, II, and III evidence studies, where the research steps were not homogeneous, no meta-analysis was carried out. The findings in this study were presented in a narrative summary form with treatment groups with or without treatment or regular care.

RESULTS

1) Article Selection

Articles were identified using a predefined search keyword in a combined database search from 2005-2021 yielded 4.907 screened articles. The number of participants involved in this study was 197 people assigned randomly, with 58 participants in the intervention group, 55 participants in the control group, and a combined 84 people. The results showed a positive effect on increasing muscle strength in patients. This literature consisted of 9 articles, and all interventions were reported to be significantly effective in increasing muscle strength. The subjects in this study were patients with stroke disease.

2) Intervention

The interventions in this literature review use a passive and active range of motion exercises. Passive ROM is used in articles 1, 2, 3, and 4. The procedure performed with the assistance of a health care provider is usually given to patients with decreased consciousness and total paralysis (14). Furthermore, active ROM, often called ROM, is carried out in articles 5, 6, 7, 8, and 9. The procedure is usually carried out without the help of a health worker and is equipped with supporting tools such as holding a rubber ball carried out in article number 5. This intervention has proven to flex muscles, especially in hand (15). In article number 9, active ROM exercises are given to the accompaniment of music. In addition to training and strengthening muscles, this exercise can reduce depression and increase positive perceptions in stroke patients (16).

3) Instrument

Measurement of muscle strength in this literature review uses several instruments, including (a) observation sheet, (b) muscle strength scale, (c) goniometer. The observation sheet instrument is used in articles 1, 2, 3, 4, 5, 6, and 8. This instrument has been tested for its validity and reliability so that it is proven to be a measuring tool used to measure muscle strength. The data obtained through the observation sheet is processed to obtain results that assess changes in muscle strength (17).

Furthermore, the muscle strength scale measuring instrument is used in articles 2, 3, 7, and 9. The first instrument, the muscle strength scale, has also been tested for its validity and reliability. This measuring tool works by providing several movements with loads on the muscles on a scale of 0-5. The higher the number, the better the muscle strength, conversely the lower the number, the worse the muscle strength (16).

4) Results

Article number 1 states a change in the average value of the previous muscle strength, namely, from 2.6 to 3.6, and the Paired T-test results show a value of 0.000. It was indicated that passive range of motion training in stroke was beneficial to increase muscle strength (18). Then article number 2 also uses passive ROM intervention and produces several categories of muscle strength. The Wilcoxon test results showed a significance value, namely ρ value of 0.000. This indicated that there is a significant relationship before and after the test. The significance value is also equal to the Paired T-test results in the first article (14). Similar to the previous article, article number 3 also uses passive ROM training interventions and paired a T-test with a significance value of

ρ value 0.01. The significance value in the second article is much smaller than the third article, but both are still below the α value, namely 0.05. Therefore, it has a change in positive results from before and after the test (19). Passive ROM intervention was also carried out in the article number with significant differences before and after the intervention with a significance value of 0.008 using the paired t-test (20).

Article number 5 also states that the Wilcoxon test results are significant with a ρ value of 0.08, in this study, this study was carried out by providing a range of motion intervention in the form of gripping a rubber ball, after the intervention, the strength of the hand muscles increased and flexibility. However, it was not done passively, and the whole body as in previous studies, but this study provides evidence of benefits for stroke patients who experience muscle weakness in the limbs, especially the hands (15). Article number 6 uses two respondent groups, namely the control group and the intervention group. The result of the statistical test in the intervention group was a value of ρ value of 0.000. In the control group ρ value of 0.16, there was a significant change in the intervention group (21). Likewise, Article number 7 states a significance value of ρ value 0.001 after observations were made before and after the intervention was carried out and then tested with a paired t-test (17). Article number 8 also states that range of motion exercises have a good effect on increasing muscle strength. The results in this article are also the same, as indicated by a significance value of ρ value 0.003 (22). Article number 9 uses a muscle strength scale instrument to evaluate research. After intervening for 6 and 12 months, the right upper limb has a positive change to be precise on the right shoulder with a value of ρvalue <αvalue = 0.001 <0.05. The results of statistical tests also showed a significant number of right leg muscle strength as evidenced by the value of ρvalue. <αvalue = 0.002 <0.05, ROM training in this study was accompanied by music and also affected reducing levels of depression and increasing positive perceptions so that the increase in positive perceptions would increase the ability of daily activities (16)

Table 2.
Characteristics of the article

No	Author (Year) Title	Method	Result
1	*Harahap, M. P. (2019) 'Pengaruh Range Of Motion Pasif Terhadap Peningkatan Kekuatan Otot Pasien Post Stroke di Wilayah Kerja Puskesmas Pancur Batu Kabupaten Deli Serdang Tahun 2019*	**Objective:** The study aimed to identify the effect of passive Range Of Motion exercise on increasing muscle strength in post-stroke patients at Pancur Batu Health Center, Deli Serdang Regency. **Design:** Quasi Experiment **Sample:** 10 respondents **Intervention:** Passive ROM Exercise **Instrument:** observation sheet	This study states that there is an effect of muscle strength from providing passive Range Of Motion (ROM) exercises as evidenced by the results of the paired T-test, namely ρ <α = ρ value = 0.000 <α = 0.05.
2	*Mulyanti, S. (2015) 'Pengaruh Range Of Motion (Rom) Pasif Terhadap Kekuatan Otot Pada Pasien Stroke Dengan Penurunan Kesadaran Di Ruang Hcu Igd Rsud Dr. Moewardi Di Surakarta Tahun 2012'*	**Objective:** to analyze the effect of Range Of Motion (ROM) on passive muscle strength in stroke patients with decreased consciousness **Design:** Quasi Experiment **Sample:** 13 respondents **Intervention:** Passive ROM Exercise **Instrument:** observation sheet and muscle strength scale	There is a difference in muscle strength scale before and after the Passive ROM is indicated by a significance value (ρ) of 0.000.
3	*Endah Sri Rahayu, N. (2020) 'Pengaruh Latihan Range Of Motion (ROM) Pasif Terhadap*	**Objective:** The study aimed to determine the effect of Passive Range Of Motion (ROM) exercise on increasing muscle strength in Non-	This study states that passive Range of Motion (ROM) exercises affect increasing muscle strength, as evidenced

	Peningkatan Kekuatan Otot Pada Pasien Stroke Non Hemoragik Di Ruang Rawat Inap Di RSUD Kota Tangerang'	Hemorrhagic Stroke patients in the Rawat Inap room at Tangerang City Hospital. **Design:** Quasi Experiment **Sample:** 14 respondents **Intervention:** Passive ROM Exercise **Instruments:** observation sheets and muscle strength scale	by the value of ρ value = 0.01 <0.5.
4	*Rahmadani, E. and Rustandi, H. (2019) 'Peningkatan Kekuatan Otot Pasien Stroke Non Hemoragik dengan Hemiparese melalui Latihan Range of Motion (ROM) Pasif'*	**Objective:** to analyze the increase in muscle strength in Non-Haemorrhagic Stroke patients with hemiparesis through passive range of motion (ROM) exercises at Curup Bengkulu Hospital 2019 **Design:** Quasi Experiment **Sample:** 20 respondents (10 intervention group, 10 control group) **Intervention:** Passive ROM Exercise **Instrument:** observation sheet	The results showed the passive range of motion training on non-hemorrhagic stroke patients with a significance value in the control group (ρ = 0.008) and the intervention group (ρ = 0.5).
5	*S. Susanti, D. Bistara (2019) 'Pengaruh Range of Motion (ROM) terhadap Kekuatan Otot pada Pasien Stroke'*	**Objective:** To determine the Range of Motion (ROM) muscle strength in stroke patients at Bulak Banteng Health Center, Surabaya **Design:** Pre Experiment **Sample:** 32 Respondents **Intervention:** ROM exercise **Instrument:** observation sheet	There is an effect of Range Of Motion (ROM) exercise as evidenced by a significance level of ρ value = 0.00 with α = 0.05 (ρ <α) on the right hand while the left-hand shows a significance level of ρ value = 0.00 with α = 0.05 (ρ < α).
6	*Marlina (2014) 'Pengaruh Latihan Rom Terhadap Peningkatan Kekuatan Otot Pada Pasien Stroke Iskemik Di RSUDZA Banda Aceh'*	**Objective:** To determine the effect of ROM on increasing muscle strength in dr. Zainoel Abidin Banda Aceh. **Design:** Quasi Experiment **Sample:** 50 respondents with 25 control groups and 25 intervention groups **Intervention:** Range Of Motion (ROM) Exercise **Instrument:** Observation Sheet	This study was declared significant as evidenced by the value of ρ value = 0.000 <0.05 (ρ <α)
7	*Yudha, F. and Amatiria, G. (2014) 'Pengaruh Range Of Motion (Rom) Terhadap Kekuatan Otot Pasien Pasca Perawatan Stroke'*	**Objective:** The study aimed to explain the effect of Range Of Motion (ROM) on patients' muscle strength in the Rehabilitation Unit at dr. H. Abdul Moeloek, Lampung Province **Design:** Quasi Experiment **Sample:** 20 respondents Intervention: Range Of Motion **Instruments:** goniometer and muscle strength scale	There is an effect of Range Of Motion (ROM) exercise on increasing muscle strength in patients in the rehabilitation unit of dr. H. Abdul Moeloek, Lampung Province as indicated by the value of ρ <α = ρ value = 0.001 <α = 0.05.
8	*Sikawin, C., Mulyadi, N. and Palandeng, H. (2013) 'Pengaruh Latihan Range of Motion (Rom) Terhadap Kekuatan Otot Pada Pasien Stroke Di Irina F Neurologi Blu Rsup Prof. Dr. R. D. Kandou Manado'*	**Objective:** to identify Range Of Motion exercises on muscle strength of stroke patients at BLU Prof. Dr. R. Kandou Manado **Design:** Quasi Experiment **Sample:** 15 respondents **Intervention:** Range Of Motion Exercise **Instrument:** observation sheet	This study states the results of statistical tests with a value of ρ <α = ρ value = 0.003 <α = 0.05, which means that there is an effect of Range Of Motion (ROM) training on increasing muscle strength at BLU RSUP Prof. Dr. R. Kandou Manado.

9	*K. Gi-yeon, K. Boeun, H. Heo et al. (2012) 'Effects of a Muscle Strengthening Exercise, Activities of Daily Living, Health Perception, And Depression in Post-Stroke Erders'*	**Objective:** The study aimed to determine the effect of muscle strength training program, activity daily living (ADL), perception, and depression in the elderly after stroke. **Design:** Experimental **Sample:** 23 respondents with 13 respondent intervention group and 10 respondent control group **Intervention:** Range Of Motion Exercise and music **Instrument:** muscle strength scale	There was a positive change as indicated by a significant value in the strength of the right shoulder ρ <α value = 0.001 <0.05, right leg ρ <α value = 0.002 <0.05 in the intervention group and compared with the control group ρ <α value = 0.21 <0.05 and ρ < α value = 0.006 <0.05 after 12 weeks of intervention

DISCUSSION

The assessment of the increase of muscle strength in this literature review used an observation sheet instrument. This measurement tool was used in all reviewed articles. Observation sheets were given pre-test and post-test to measure how effective the exercise to increase muscle strength.

In article number 1, it was conducted on 10 respondents with 6 male and 4 female. Before the passive ROM exercise, the pre-test measurements were carried out and evaluated with the post-test observation sheet to review the increase in muscle strength after training. The intervention was carried out with the assistance of a nurse. The results stated that the average value of muscle strength during the pre-test was 2.60, then the average value changed in the post-test assessment, which was 3.90. The results of statistical tests also stated that the value of ρ <α = ρ value = 0.000 <α = 0.05 so that it could be noted that there was an increase in muscle strength after exercise (18).

The research results in article number 2 were conducted on 13 respondents with 10 male respondents and 6 female respondents using the exact measurement as article number 1, namely the observation sheet. Then the intervention carried out was passive ROM exercises with the help of nurses to respondents who experience decreased awareness. The number of elderly respondents who experienced a decrease in awareness was 12 people and 4 adults. The value of muscle strength with the trace category was 11 people; 5 people were categorized as having poor muscle strength. No respondent had the category of zero, fair, good, and average muscle strength. Then after the intervention, 7 respondents were categorized as having poor muscle strength, and 9 respondents were classified as fair. The results of statistical tests showed that there was a change in muscle strength after exercise, as evidenced by the value of ρ value = 0.000 eat ρ <α (0.000 <0.05) (14).

In article number 3, research was conducted on 14 respondents, with 9 respondents in the early adult category and 5 late adults. This study used a quasi-experimental design. This study was undertaken to determine passive Range Of Motion (ROM) exercise on increasing muscle strength in Non-Hemorrhagic Stroke patients in the inpatient room at the Tangerang City Hospital. The research instrument used a muscle strength measuring device and a checklist table observation sheet to determine the changes that occurred after the exercise. Changes in muscle strength could be seen in several changes in degree, namely before the intervention. The number of respondents with second-degree muscle strength was 2 respondents. After the intervention, there was a change in respondents with second-degree muscle strength to become one respondent. Then, the difference in strength at degree 3 before intervention was made by 8 people. after the intervention was done to 6 people. Furthermore, the number of respondents with muscle strength of grade 4 before the intervention was 4 people and after the intervention were 7 people. The results of the non-parametric test with the Wilcoxon Match Pair Test showed the significance value of ρ <α = ρ value = 0.01 α = 0.5 so that it could be stated that Passive ROM training could increase

muscle strength (19).

Furthermore, article number 4 used a quasi-experimental research design with 20 respondents divided into 2, namely the intervention group with 10 respondents and the control group with 10 respondents. This research analyzed the increase in muscle strength in non-hemorrhagic stroke patients with hemiparesis through Passive Range of Motion (ROM) exercises at Curup Bengkulu Hospital 2019. The intervention was carried out for 5 days with 2 times a day of exercises. Then the muscle strength was assessed before the intervention was carried out on the first day and the fifth day after the intervention. The pre-test mean value in the intervention group was 1.60 with a standard deviation of 0.69, and for the control group, it was 1.80 with a standard deviation of 0.63. Then the value of the study showed that there was an effect of passive Range of Motion training on non-hemorrhagic stroke patients with a significance value in the control group ($\rho = 0.008$) and the intervention group ($\rho = 0.5$), the control group showed a significant number, namely ρ value = 0.008 ($\rho < \alpha$) (0.008 <0.05) and in the intervention group the statistical results were not significant, namely ρ value = 0.5 ($\rho = \alpha$) (0.5 = 0.05) (20).

Then article number 5 uses a pre-experimental research design. The study was conducted to know the muscle strength of Range of Motion (ROM) in stroke patients at Bulak Banteng Health Center, Surabaya. The number of respondents was 32 respondents with 17 male and 15 female. Furthermore, four people aged less than 30 years, 15 30-50 years, and 15 over 50 years. ROM exercises are equipped with a support device, namely gripping a rubber ball to increase muscle strength. The value of muscle strength and the right-hand pre-ROM test on a scale of four were 17 people, and there was an increase in the number of respondents after the post-test was carried out to 25 people. Then the value of muscle strength and ROM of the left hand during the pre-test with four people were 7 people and after the post-test also increased to 17 people. The research instrument used the pre-test and post-test observation sheets to assess the changes before and after ROM exercises. The results of the Wilcoxon test analysis showed the value of $\rho < \alpha = \rho$ value = 0,000 $< \alpha = 0.05$ on the right hand and $\rho < \alpha = \rho$ value = 0.02 $< \alpha = 0.05$ so that there is an influence of Range Of Motion. (ROM) training to increase muscle strength (15).

In article number 6, 50 respondents have divided into 2 groups: the control group was 25 respondents, and the intervention group was 25 respondents. The intervention was given for 6 days. The effect of muscle strength was assessed at the pre-test and post-test, then a comparison of the pre-test and post-test results was carried out. Respondent characteristics are based on age, gender, risk factors, and stroke. It was known that the age of respondents 51-70 years old as many as 15 respondents (60%) more than 30-50 years old respondents, namely as many as 10 (40%) in the intervention group. Meanwhile, in the control group, it was also known that 14 respondents (56%) aged 51-70 years (56%) were more than 30-50 respondents (44%). The sex of male respondents was 15 respondents (60%) more than female respondents, namely as many as 10 (40%) in the intervention group. Whereas in the control group, it was also known that the same as the intervention group, namely that the sex of male respondents was 15 respondents (60%) more than women, namely as many as 10 respondents (40%). It was known that the most risk factor for stroke was hypertension, namely 19 respondents (76%) more than diabetes mellitus by 4 respondents (16%), and the slightest cause of heart disease was 2 (8%) in the intervention group. Meanwhile, in the control group, it was also known that the risk factors for diabetes mellitus were 13 respondents (52%) more than hypertension, namely as many as 12 respondents (48%). In the control group, there was no heart disease at risk of stroke. It was known that most strokes occurred for the first time, namely 21 respondents (84%) more than the second attack, namely 4 respondents (16%) much compared to the second attack as many as 7 respondents (28%). The research instrument was the same as using the observation sheet. This research

was conducted with a quasi-experimental design. This study aimed to determine the effect of ROM in increasing muscle strength in Ischemic Stroke patients at dr. ZaenalAbidin Hospital, Banda Aceh. The results of this study were declared significant as evidenced by the value of ρ value = 0.000 <0.05 (ρ <α)(21).

Furthermore, article number 7 used the Quasy Experiment design with a sample size of 20 respondents. Most of the respondents were the elderly at 85%, had a stroke <6 months as much as 70%, and those who had a first attack stroke were 85%. Furthermore, the difference in the average muscle strength on day 1 and day 28 is 0.45. The difference between the values of day 1 and day 28 is 6.65. The purpose of this study was to determine the effect of Range of Motion (ROM) on muscle strength in non-hemorrhagic stroke patients in the Hospital Rehabilitation unit dr. H. Abdul Moeloek, Lampung Province. The research instrument used an observation sheet and a muscle strength scale to assess changes in muscle strength that occurred before and after ROM exercises. The results showed an increase in the muscle strength of the respondents where there was a significant difference between the value of muscle strength on the first day and the 28th day with a value of ρ <α = ρ value = 0.001 <α = 0.05 (17).

In article number 8, a study was conducted on 15 respondents, including patients with Hemorrhagic Stroke and Non-Haemorrhagic Stroke who were respondents in this study aged 18-78 years. Age grouping was divided into 3 categories, <40 years 2 people (13.3%), 41 - 60 years 7 people (46.7%),> 60 years 6 people (40.0%). The risk of having a stroke increased from age 45 years. After reaching 50 years of age, each additional three years of age increased the risk of stroke by 11-20%. Most younger people could get a stroke due to certain arterial pathology, brain tumors, and medications such as oral anticoagulants, amphetamines, various addictive drugs, and oral contraceptives. This study used a quasi-experimental design. This study aimed to identify Range of Motion (ROM) exercises on muscle strength in stroke patients at BLU Prof. Dr. R. Kandou Manado. The research instrument used observation sheets. The results of observations after ROM exercises were carried out 5 times a day within 10 minutes and carried out 8 exercises intending to know the changes that occurred after ROM exercises. This study stated that there was an effect of ROM training on increasing muscle strength with a value of ρ<α = ρ value = 0.003 <α = 0.05 (22).

Article number 9 is a study conducted in South Korea on 23 stroke patients with 13 intervention group grouping with 6 (46.2%) male gender characteristics and 7 female (53.8%) female sex characteristics. Then the control group of 10 people with gender characteristics, namely 5 men (50%) and 5 women (50%), the intervention was carried out on elderly respondents. About 46.2% of respondents suffered the hemiparesis category in the left extremity in the intervention group, and 2 (20.0%) respondents in the control group. Furthermore, 3 (23.0%) respondents in the intervention group and 1 (10.0%) respondents in the control group were categorized as good hemiparesis. As many as 4 (30.7%) respondents in the intervention group and 7 (70.0%) people in the control group had the category of no hemiparesis. The study was conducted by providing a range of motion training intervention accompanied by music that trained nurses had previously demonstrated. The intervention was carried out for 12 weeks on older adults who had a chronic stroke with hemiparesis or not intending to increase muscle strength and improve daily activities. The instrument used to measure muscle strength was a muscle strength scale evaluated by the researcher after the intervention. This study stated that muscle strength training with ROM accompanied by this music positively affected muscle strength of the right upper limb after 6 and 12 weeks of exercise. the significance value of ρvalue <αvalue = 0.001 <0.05, then the statistical test results of the right leg muscle strength after intervened for 12 weeks for ρ <α = 0.002 <0.05. The intervention was also can reduce the depression status of the respondents so that the increase in positive perceptions, the greater the chance of success in this study (16).

ROM exercises could prevent complications such as urinary tract infections, aspiration pneumonia, tenderness, contractures, and thrombophlebitis. According to the theory of Potter and Perry (2005), ROM improved the level of perfection in the ability to move joints and muscle strength (12).

This research was a contribution to the development of nursing science. The effectiveness of ROM exercises to increase muscle strength could be an additional alternative in providing nursing care to stroke patients.

CONCLUSION

This study showed that ROM exercise had a positive effect on increasing muscle strength in stroke patients. Based on the analysis of several studies, ROM exercise was recommended to be performed in stroke patients to increase muscle strength both in patients with decreased consciousness or not.

Researchers recommended that a follow-up study on ROM exercise could compare other interventions in more specific stroke patients so that a meta-analysis could be carried out with a more in-depth analysis. The names of the authors listed in this article had no affiliation or financial and close personal relationship. All differences of opinion were resolved through discussion.

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