Review

Effectiveness Range of Motion Therapy and Warm Water Compresses on Increasing Muscle Strength in Non-Hemorrhagic Stroke Patients: Scoping Review

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ABSTRACT

Background: Stroke is the most common cause of disease in the world and is the highest cause of death in Indonesia, so prevention is essential to minimize disability and stroke death. To restore and increase muscle strength in stroke patients, the solution is to do Range Of Motion (ROM) Exercises and Warm Compresses. This Scoping Review aimed to identify the effectiveness of Range Of Motion therapy and warm compresses on increasing muscle strength in non-hemorrhagic stroke patients.
Methods: The method used is a Scoping Review using journal databases from PubMed, Science Direct, and Google Scholar in the range of 2020-2023 with the keywords "Range Of Motion Therapy", "Warm Compress", "Muscle strength" and "Non-Hemorrhagic Stroke" and stroke obtained as many as 2381 articles.
Results: Search for articles according to the criteria and get 10 ready to be reviewed. The articles describe the effectiveness of ROM therapy and warm compresses in increasing muscle strength in non-hemorrhagic stroke patients.
Conclusion: It is expected in stroke patients to attempt to control Range Of Motion therapy and warm water compresses.

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Introduction

Stroke is a neurological deficit disease caused by bleeding or blockage that can cause disability or death. Stroke is also the leading cause of death in almost all hospitals in Indonesia, amounting to 14.5% (Rakhma et al., 2023). Overall, stroke is divided into two types, namely Hemorrhagic Stroke and Non-Hemorrhagic Stroke. Non-hemorrhagic stroke occurs due to blockage of blood vessels caused by blood circulation to the brain partially or wholly stopped (Widyastuti & Listrikawati, 2023). Stroke can cause physical disorders as well as psychological disorders. Stroke survivors say that they lack confidence after a stroke and feel incredible frustration, in addition, the psychological impact on stroke patients can affect mental power,

consciousness, concentration, learning ability, and other intellectual functions (Putri et al., 2023). Several factors can cause stroke. Such factors include irreversible risk factors and modifiable risk factors. Age, gender, race and genetics are factors that cannot be changed. While hypertension, smoking, obesity, and diabetes mellitus are factors that can still be changed, do not carry out healthy living behaviours, do not routinely do routine checks and eat foods with high salt content (Wahyuni et al., 2021).

According to global stroke statistics, about 15 million people in all virtual countries suffer a stroke each year, with 1 in 6 people in the world suffering a stroke. In Indonesia, 43.1% of strokes are diagnosed by health workers in the age group of 75 years and over and 0.2% in the age group of 15-24 years. Strokes that are not treated properly can cause high mortality. Stroke is a dangerous condition that needs to be treated as soon as possible because brain cells can die in minutes. Sudden death can be established if the person is in a dire situation. (Akmal et al., 2023)

Range of motion (ROM) is an exercise performed to maintain or improve the perfection of the ability to move joints normally and length to increase muscle mass and tone. (Daulay & Hidayah, 2021)Mobilising joints with ROM exercises can prevent complications such as pressure pain, contractures, thrombophlebitis, and decubitus, so early mobilisation is important to do regularly and continuously. Giving ROM exercises that need to be clarified early can increase muscle strength because they can stimulate the motor unit. The more motor units involved, the more muscle strength and loss of hemiparesis patients will increase. If not treated immediately, there will be permanent disability. (Aryanti et al., 2023).

When stopping the inflammatory process through RICE (Rest, Ice, Compres, Elevation), treatment needs to be changed with heat therapy. Increased heat therapy circulation in the area of the damaged tissue release device can repair bodily injury. This helps reduce stiffness in the area of joint injury. The heater is worn for 20 to 30 minutes three to four times daily. Warm compresses manage pain by providing heat energy through conduction, where the heat can cause vasodilation (dilation of blood vessels), increase muscle relaxation to improve circulation and increase the intake of oxygen and nutrients to the tissues. Vasodilation due to warm compresses can dilate arterioles, causing decreased resistance, increased oxygen intake (O2) and decreased smooth muscle contractions in blood vessels. (Wibowo et al., 2021)

Muscle weakness in stroke patients will affect muscle contractions. Muscle contraction is due to reduced blood supply to the brain, thus inhibiting the primary nerves of the brain and spinal cord. Inhibition of oxygen and nutrients to the brain causes serious health problems because it can cause hemiparesis and even death. The occurrence of impaired levels of physical mobilisation in patients is often caused by movement in the form of bed rest. The effects of a weakened muscle state associated with a lack of physical activity are usually apparent within a few days. The brain's control to regulate muscle movement decreases function, resulting in reduced muscle mass (Purba et al., 2022).

Methods

This study adopts a scoping review methodology guided by the PICOS (Population, Intervention, Comparison, Outcomes, Study design) framework to systematically analyze the effectiveness of ROM therapy and warm compresses in increasing muscle strength among non-hemorrhagic stroke patients. The PICOS framework ensures a structured approach by focusing on the following criteria:

Population: All non-hemorrhagic stroke patients who experienced weakness in muscle strength and decreased physical activity. Intervention: Use of MMT (Manual Muscle Testing), Handgrip Dynamometer, Medical Research Council Scale, and Goniometer. Comparison: Similar interventions to compare the effectiveness of the methods mentioned above. Outcome: Effectiveness of ROM therapy and warm compresses in increasing muscle strength. Study Design: Research conducted using a systematic review approach. The inclusion criteria also included publications from 2020 to 2023 in English and Indonesian languages. Articles and studies published before 2020 were excluded. The literature search was conducted independently by the authors using databases and journals that provided studies relevant to the research focus. The collected data were then mapped to identify recurring themes, evidence gaps, and critical findings across the selected articles.

Each author contributed to the study as follows: the first author identified and selected articles based on inclusion and exclusion criteria; the second author reviewed the articles for relevance and quality; and the third author synthesized and mapped the findings to align with the research objectives.

Additionally, the results and interpretations were validated through discussions with experts in stroke rehabilitation and physical therapy. This expert feedback enriched the analysis and provided additional insights to strengthen the conclusions of the review. The final set of articles included publications from 2020 to 2023, which were reviewed collaboratively to provide a comprehensive understanding of the effectiveness of ROM therapy and warm compresses in improving muscle strength in non-hemorrhagic stroke patients.

Results

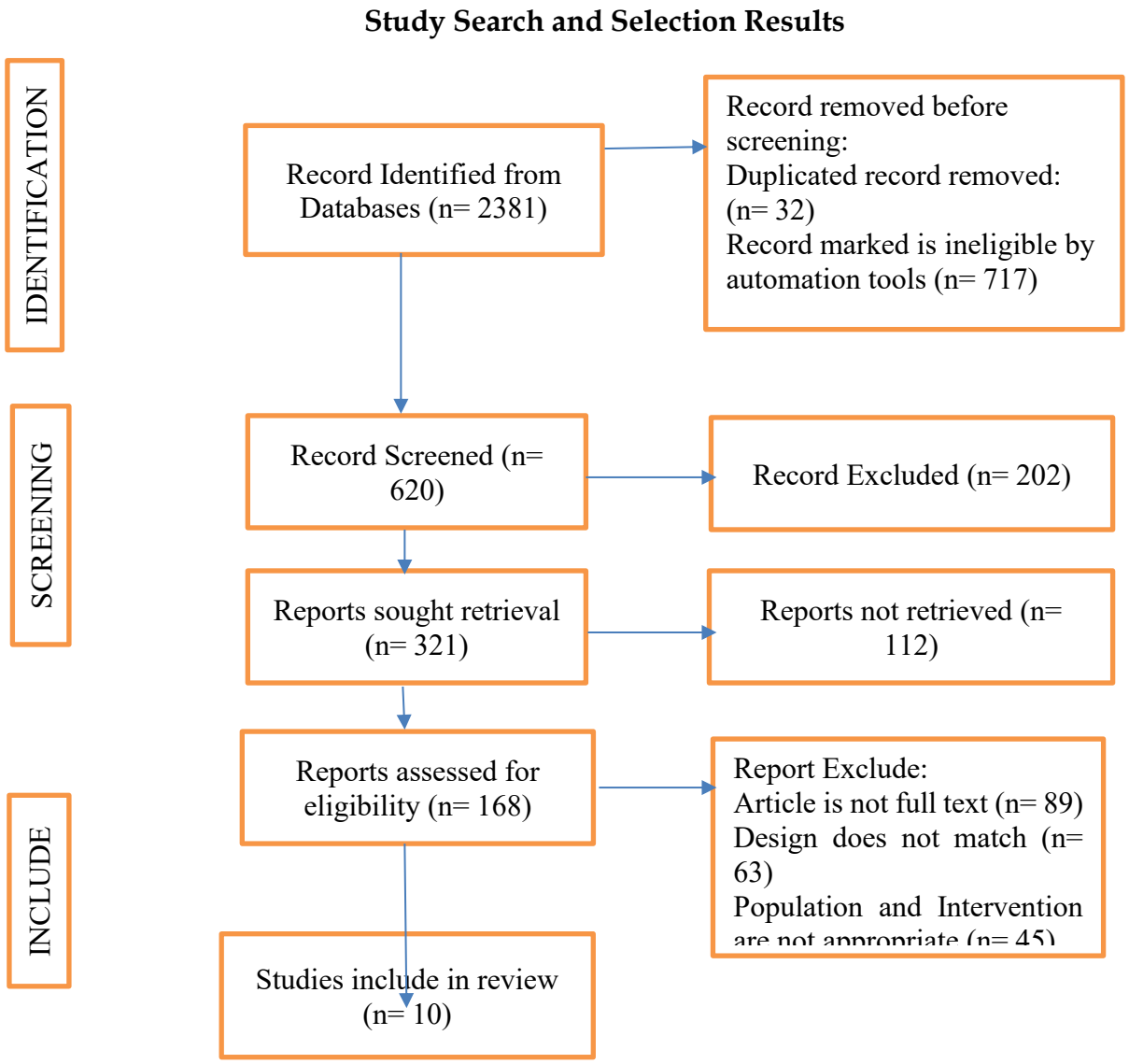

Figure 1. Flowchart PRISMA

An analysis was performed to assess the methodological quality of each study using the JBI Critical Appraisal Checklist to determine the validity of the results and review recommendations. In the final screening, 35 studies achieved a score of 50%. They were ready to synthesise the data, but because the assessment could be therapeutic and the articles used in the Scoping Review, there were 10 articles.

This study analyzed various articles published between 2020 and 2024 from three major databases: PubMed, Google Scholar, and Science Direct. A total of 150 articles were identified and categorized into quantitative, experimental, case studies, and descriptive research types. PubMed contributed 75 articles, primarily quantitative. Google Scholar provided 50 articles covering a mix of experimental, explanatory, and case studies. Science Direct contributed 25 articles, mostly descriptive. Of the total, 10 articles were included in the final results, comprising 5 quantitative, 3 descriptive, 1 experimental, and 1 case study, reflecting a diverse distribution of research across data sources.

Table 3 Literature Search Results

No	Title and Author	Method	Result	Conclusion
1	Penyuluhan Pencegahan Stroke Dan Faktor Risikonya Pada Lansia (Rakhma et al., 2023).	Design : Quasi Experimental Sample: 56 clients Variable Independent Stroke Prevention Counseling Dependent: Factors The risk to the elderly I: Pre-Test and Post-Test A: Normality and homogeneity test and paired T-test	The results obtained are assessed using the Normality test and homogeneity and paired T-test, obtained p value < 0.005. This shows an increase in knowledge after the speaker gives the material. Therefore, this counselling activity succeeded in increasing knowledge about stroke prevention and risk factors in older people.	Oleh karena itu, kegiatan penyuluhan ini berhasil meningkatkan pengetahuan mengenai pencegahan stroke dan factor risikonya pada lansia.
2	Pasien Stroke Non Hemoragik Dengan Intervensi Rom Pasif Untuk Meningkatkan Kekuatan Otot (Aryanti et al., 2023)	D: study cases S: 10 persons V: Independent: Passive ROM intervention. D: Muscle Strength I: Observation A: Descriptive Analysis	Results show that Passive ROM can increase muscle strength in Non-Hemorrhagic Stroke patients	From the study of passive ROM therapy in non-hemorrhagic stroke patients, there was a change in increased muscle strength after the intervention.
3	Efektivitas ROM(Range off Motion) terhadap Kekuatan Otot pada Pasien Stroke di Rumah Sakit Royal Prima (Purba et al., 2022)	D: Quasi Experiment, group Observational sheet. S: 20 persons V.Independen: ROM(Range off Motion) Dependent: Muscle Strength I: Pre-Posttest with Observational sheet. A: Uji Wilcoxon.	Results before doing ROM exercises are mostly. Respondents' muscle strength was on a scale of 3 (67.9%), and minority muscle strength was 4 (10.7%). After doing ROM (Range of Motion) exercises, there was an increase in muscle strength where the majority on a scale of 4 is (45.5%) and the muscle is the minority. Strength is on a scale of 5 (30.0%). Data analysis with the Wilcoxon test obtained a value of 0.004 <alpha value of 0.05	The conclusion is that ROM (Range of Motion) practically affects muscle strength in stroke patients at Royal Prima Medan Hospital in 2021. So, stroke patients can utilise and perform ROM (Range of Motion) exercises as an alternative that benefits their health, especially in increasing muscle strength.
4	Perbandingan Metode Algoritma Naïve Bayes Dan	D: Quantitative S: 12 persons	Result the accuracy obtained by using the K-	The comparison results based on the test results found an ROC diagram like in

No	Title and Author	Method	Result	Conclusion
	K-Nearest Neighbors Untuk Klasifikasi Penyakit Stroke (Akmal et al., 2023)	V. Independen: Metode Algoritma Naïve Bayes Dan K-Nearest Neighbors I: Cross Validation A: Naïve Bayes and K-Nearest Neighbors Algorithm Techniques.	Nearest Neighbors algorithm amounted to 94.36% of the grouping results It can be affixed to help doctors in the examination of stroke	Table 4 with AUC points (Under Curve zone), Naïve Bayes algorithm of 0.817 with the examination of the results of Good Grouping, and the K-Nearest Neighbors algorithm proved the AUC result of 0.633 with the examination of the results of Sufficient Grouping. Further research needs to be done on other methods and algorithms to produce better and higher-quality classification results.
5	Penyuluhan Latihan Range Of Motion Dan Kompres Hangat Terhadap Kekuatan Motorik Otot Ekstremitas Atas Pada Pasien stroke(Wibowo et al., 2021)	D: Quasi Experiment(Pre-Test dan Pro-Test) S: 12 responded V. Independent: Range Of Motion and Warm Compress. Dependent: Motor strength of extremity muscles. I: Pre-test, Counseling Process, and Post Test A: Uji Wilcoxon.	The evaluation results showed an increase in aspects of knowledge and understanding of patients and patients' families related to ROM therapy and warm compresses in patients and patients' families after counseling and being able to implement or apply them.	Pemberian terapi ROM dan kompres hangat dilakukan secara teratur selama 7 hari, hal tersebut digunakan untuk meningkatkan kekuatan otot lengan dan bahu pasien yang mengalami penurunan kekuatan otot pada pasien stroke hingga terjadi peningkatan kekuatan otot.
6	The Effect Of Health Knowledge About Stroke On The Family Level (Wahyuni et al., 2021)	D: Quasi-experiment S: 1 person V.Independen: The Effect Of Health Knowledge. Dependen: The Family Level. I: Planning, Implementation, and Evaluation A: Pre-Test and Post-Test	Results: The evaluation of health extension activities to provide awareness of stroke was successfully achieved with indicators of timeliness and duration, participation, knowledge, job description, and problem-solving. This activity needs to be encouraged by All elements to increase public awareness	The evaluation of health counselling activities to raise awareness of stroke was successfully achieved with timeliness and duration, participation, knowledge, job description, and problem-solving indicators. All elements need to encourage this activity so that public awareness increases.
7	Asuhan Keperawatan Pada Pasien Stroke Non Hemoragik : Gangguan Mobilitas Fisik Dengan Intervensi Latihan Rom	D: Descriptive with case study approach S: 1 patient	Studies show that the management of nursing care with a medical diagnosis of non-hemorrhagic stroke in meeting the needs of activity and exercise with nursing	Nursing care in Non-Hemorrhagic Stroke patients: Impaired Physical Mobility with Active ROM Exercise Intervention and Warm Compresses

No	Title and Author	Method	Result	Conclusion
	Aktif Dan Kompres Hangat (Widyastuti & Listrikawati, 2023)	V: Independent: Active ROME exercise intervention and warm compress Dependent: Physical Mobility Impairment I: Manual Muscle Testing (MMT) A: Uji Wilcoxon.	problems and physical mobility disorders carried out active ROM intervention nursing actions and warm compresses for 5 days active ROM movements are carried out twice a day in the morning and evening, warm compresses are carried out 3 times a day in the morning, In the afternoon, and in the afternoon results were obtained an increase in muscle strength. Recommendations for active ROM intervention and warm compresses are practical in non-hemorrhagic stroke patients.	can increase muscle strength.
8	Pengaruh Latihan Range Of Motion (ROM) Pasif Terhadap Kekuatan Otot dan Rentang Gerak Sendi Ekstremitas Pada Pasien Pasca Stroke (Daulay & Hidayah, 2021)	D: Quasi-experiment with one group pretest and post-test approach S: 17 responded V. Independent: Range Of Motion(ROM)Passive. Dependent: Range of motion of extremity joints I: One Group Pretest And Post Test A: Uji Wilcoxon.	The results showed the effect of passive ROM exercise on muscle strength with a p-value of 0.001 in the upper extremities and a value of 0.001 in the lower extremities. The results also showed the effect of passive ROM exercise on joint range of motion with a p-value of 0.001 in the upper extremities and a p-value of 0.001 in the lower extremities. Nurses can recommend ROM exercises as one of the rehabilitation programs for handling post-stroke patients.	Nurses can recommend ROM exercises as one of the rehabilitation programs for handling post-stroke patients.
9	Motion (Rom) Pasif Pada Pasien Stroke Non Hemoragik Dalam Pemenuhan Kebutuhan Mobilitas Fisik (Putri et al., 2023)	D: Descriptive S: 7 patients V. Independen: Motion (Rom) Pasif. Dependent: Physical Mobility Needs I. Nursing care, which includes assessment, nursing diagnosis,	The results obtained after implementing the Passive Range Of Motion (ROM) for 3 days found no changes in muscle strength values in both patients.	Nursing evaluation for 3 days found no increase in changes in muscle strength values in both patients.

No	Title and Author	Method	Result	Conclusion
		planning, implementation, evaluation A: Uji Wilcoxon.		
10	Penerapan Terapi Range Of Motion (Rom) Terhadap Peningkatan Kekuatan Otot Pada Pasien Dengan Stroke (Permatasari et al., 2024).	D: Study Kasus Sample : 2 responden V.Independen:Application Of Range Of Motion (Rom). Dependen: Therapy To Increasing Muscle Strength. I: SOP(Standard Operating Procedure), ROM (Range of Motion), muscle strength observation sheet A: Uji Wilcoxon.	The results of the assessment showed that after the application of passive ROM, subject 1's muscle strength increased to 4, and subject 2's increased to 3. Conclusion: Passive ROM can increase muscle strength in stroke patients. Patients with non-hemorrhagic stroke can apply passive ROM properly and correctly.	The application of passive ROM can increase muscle strength in stroke patients. Patients with non-hemorrhagic stroke can apply passive ROM properly and correctly.

Discussion

Based on the results of a review of 10 journals, range-of-motion exercises and Warm Water Compressions are very effective in increasing muscle strength in non-hemorrhagic stroke patients. Stroke is a disease that attacks the brain area. This disease is severe because the brain is a vital organ that controls all human body functions. If you have a stroke, it can cause motor organ disorders in a person's body. Cerebral circulatory disorders (GPDO) are neurological deficits that commonly arise and must be intervened in an emergency and appropriate manner. Non-hemorrhagic stroke is an abnormality of brain function that appears suddenly because it is caused by cerebral circulatory dysfunction and can arise in anyone and at any time. (Sutejo et al., 2023).

Weakness of muscle strength in stroke patients will affect muscle contractions. The effects of stiffness in muscle conditions related to lack of physical movement generally arise within a few days. One form of rehabilitation exercise considered adequate to prevent disability in stroke patients is range of motion (ROM) exercises and warm compresses. This is because it can prevent a decrease in joint flexibility and joint stiffness. Range of Motion is the patient's optimal ability to perform movements. There are two types of ROM, active and passive ROM. Passive ROM is a valuable exercise that prevents muscle and joint elasticity by passively performing the patient's movements. The joints that are moved in passive ROM are all of the human body or only in the affected extremities, and the patient cannot run independently. Passive ROM therapy is implemented slowly and vigilantly so as not to cause fatigue. Must observe several stages in performing a ROM exercise program, such as the client's age, diagnosis, vital signs, and length of bed restRom's intervention should be timely, for example, after bathing or daily care has been completed. (Permatasari et al., 2024). According to previous studies, the effectiveness of active ROM on increasing muscle strength in non-hemorrhagic stroke patients is accepted by the conclusion that most muscle stiffness suffered by 2 patients muscle strength scale increased from a scale of 2 to 3. The influence of active ROM exercise to increase muscle strength in stroke patients (Nurtanti & Ningrum, 2019). Active ROM exercises and the results of passive ROM research support the idea that range of motion (ROM) is effective for increasing muscle strength, so nurses can educate subjects and families. (Merdiyanti et al., 2021).

Warm Compresses can be used both dry or wet, and at any temperature. A warm compress is a compress that uses warm or hot media with a temperature of 40°C-45°C. The recommended warm compress can be made using a bottle filled with hot water, steam, hot mud, towels, or other substances. Based on physiological principles, the body's response to heat causes vasodilation, decreased blood viscosity, decreased muscle stiffness, maximised tissue metabolism, and optimised capillary permeability. The human body's reaction to scientific heat is used for therapeutic purposes in various diseases and conditions. Using a heated jar covered with cloth as a warm compress, heat is transferred directly from one object with a higher temperature to another through

conduction (Hari, 2023). The benefits of warm water therapy are the physical effect of heat or warmth, which can cause liquids, solids, and gases to expand in all directions and increase chemical results. In tissues, it can raise metabolism simultaneously with improved blood circulation. Physiologically, the body's response to heat can have an impact on dilating blood vessels, lowering the viscosity of blood and minimising muscle tension by increasing tissue metabolism and increasing capillary permeability, this warm response to water is used for therapeutic needs. The body has various conditions (Rina et al., 2020).

Conclusion

This Scoping Review shows that Range-of-Motion Therapy and Warm Water Compresses effectively increase Muscle Strength in non-homorrhagic stroke Patients. Range-of-motion therapy is one of the non-pharmacological therapies for muscle strength rehabilitation, and it can return a person to his original condition or to a better condition than his current condition. The addition of warm compresses can cause vasodilation to launch oxygen and blood to all parts of the body. Future research should explore the combined effects of Range-of-Motion Therapy and Warm Water Compresses on long-term functional recovery and quality of life in stroke patients, including those with different levels of disability.

Authors Contributions

The authors' contributions to this Scoping Review are multifaceted and integral to the development of the manuscript: one author meticulously formulated the research objectives, conducted a thorough review of existing literature, and synthesized key findings to establish the theoretical framework; another author critically analyzed the selected literature, identified gaps and emerging trends, and provided insightful interpretations; while a third author meticulously crafted the manuscript, ensuring clarity of presentation, coherence of arguments, and adherence to scholarly standards.

Conflicts of Interest

I affirm that no financial, personal, or organizational conflicts of interest were involved in this research, guaranteeing that the results presented are unbiased and solely based on the data collected and analyzed.

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References

Akmal, K., Faqih, A., & Dikananda, F. (2023). Perbandingan Metode Algoritma Naïve Bayes Dan K-Nearest Neighbors Untuk Klasifikasi Penyakit Stroke. *JATI (Jurnal Mahasiswa Teknik Informatika)*, *7*(1), 470–477. https://doi.org/10.36040/jati.v7i1.6367

Aryanti, A. D., Rohmah, M., A3, S. F., Saputra4, R., 1, 2, 4, Madani, U. Y., & Tangerang, 3RS AN-NISA. (2023). Pendahuluan Pertengahan. *Jurnal Keperawatan*, *1*(1), 23–27. https://risji.com/index.php/jurkep/article/view/12

Daulay, N. M., & Hidayah, A. (2021). Pengaruh Latihan Range Of Motion (ROM) Pasif Terhadap Kekuatan Otot dan Rentang Gerak Sendi Ekstremitas Pada Pasien Pasca Stroke. *Jurnal Kesehatan Ilmiah Indonesia (Indonesian Health Scientific Journal)*, *6*(1), 22. https://doi.org/10.51933/health.v6i1.395

Hari, P. (2023). *Differences in the Effectiveness of the Active Rom Assimilitively*. *4*(5), 975–982.

Merdiyanti, D., Ayubbana, S., & Sari HS, S. A. (2021). Penerapan Range of Motion (Rom) Pasif Untuk Meningkatkan Kekuatan Otot Pasien Stroke Non Hemoragik. *Jurnal Cendikia Muda*, *1*, 98–102. http://jurnal.akperdharmawacana.ac.id/index.php/JWC/article/viewFile/187/98

Nurtanti, S., & Ningrum, W. (2019). Efektiffitas Range Of Motion (ROM) Aktif Terhadap Peningkatan Kekuatan Otot Pada Penderita Stroke Hemoragik. *Jurnal Keperawatan GSH*, *7*(1), 14–18.

Permatasari, I., Utami, I. T., & Ludiana. (2024). Penerapan Terapi Range Of Motion (ROM) Terhadap Peningkatan Kekuatan Otot Pada Pasien Dengan Stroke. *Jurnal Cendikia Muda*, *4*, 255–261.

Purba, S. D., Sidiq, B., Purba, I. K., Hutapea, E., Silalahi, K. L., Sucahyo, D., & Dian, D. (2022). Efektivitas ROM (Range of Motion) terhadap Kekuatan Otot pada Pasien Stroke di Rumah Sakit Royal Prima Tahun 2021. *JUMANTIK (Jurnal Ilmiah Penelitian Kesehatan)*, *7*(1), 79. https://doi.org/10.30829/jumantik.v7i1.10952

Putri, P., Jawiah, & Azzahra, S. F. (2023). Penerapan Range Of Motion (Rom) Pasif Pada Pasien Stroke Non Hemoragik Dalam Pemenuhan Kebutuhan Mobilitas Fisik. *Jurnal Aisyiyah Medika*, *8*(2), 371–381. https://doi.org/10.36729/jam.v8i1

Rakhma, T., Dewi, L. M., Putri, N. M., Ruspita, W. S., Madania, M., Khusna, S. A., Fadhilah, N., & Feriyanto, D. D. (2023). Penyuluhan Pencegahan Stroke Dan Faktor Risikonya Pada Lansia. *Jurnal Pengabdian Masyarakat Medika*, 23–28. https://doi.org/10.23917/jpmmedika.v3i1.1316

Rina, L., Sinurat, E., Ningsih, S. D., Syapitri, H., Sari, U., & Indonesia, M. (2020). *Pengaruh Rendam Kaki Dengan Air Hangat Terhadap*. *3*(1), 58–65.

Sutejo, P. M., Hasanah, U., Dewi, N. R., Dharma, A. K., & Metro, W. (2023). Penerapan Rom Spherical Grip Terhadap Kekuatan Otot Ekstremitas Atas Pada Pasien Stroke Di Ruang Syaraf Rsud Jend. Ahmad Yani Metro Application of Rom Spherical Grip To Upper Extremity Muscle Strength in Stroke Patients in the Nerve Space Rsud Jend. Ahmad. *Jurnal Cendikia Muda*, *3*(4), 521–528. https://www.jurnal.akperdharmawacana.ac.id/index.php/JWC/article/view/500/333

Wahyuni, A. N., Fadilah, A., Asmara, A. N., Rahayu, A., Rahmat, D., & Koswara, A. (2021). The effect of health knowledge about stroke on the family level. *Jurnal Kolaborasi Inspirasi Masyarakat Madani*, *1*(1), 42–51.

Wibowo, N. A., Sumara, R., Chandra Anindita, A., Intan, P., Progam, F., Ners, S. P., & Kesehatan, I. (2021). *Penyuluhan Latihan Range of Motion Dan Kompres Hangat Terhadap*

Kekuatan Motorik Otot Ekstremitas Atas Pada Pasien Stroke Di Rumah Sakit Husada Prima Surabaya.

Widyastuti, P., & Listrikawati, M. (2023). Program Studi Keperawatan Program Diploma Tiga Fakultas Ilmu Kesehatan Universitas Kusuma Husada Surakarta 2023 Asuhan Keperawatan Pada Pasien Stroke Non Hemoragik : Gangguan Mobilitas Fisik Dengan Intervensi Rom Pasif Aktif Bilateral. *NASKAH PUBLIKASI*.