ORIGINAL ARTICLE

Effect of Range of Motion Exercise With Rubber Balls on The Strength of Muscle Grasp in Non- Hemorrhagic Stroke Patients in Buleleng, Bali, Indonesia

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ABSTRACT

Introduction: Non-hemorrhagic stroke occurs when blood vessels in the brain are blocked, cutting off its supply of glucose and oxygen. A key issue for stroke patients is motor impairments, particularly hand dysfunction, affecting 88% of survivors. This study aims to see how range of motion exercises with a rubber ball improve the muscle strength of non-hemorrhagic stroke patients at Kertha Hospital Usada. **Method:** Research classification This is a pre-experimental One Group PreTest-PostTest study utilizing the Paired T-test. Data collection included Hand Grip Dynamometer a handheld muscle strength measurement tool, alongside observational sheets employing a purposive sampling technique, with a sample size of 13 individuals. **Results:** Before doing the exercises, the average muscle strength of the patients was 8. 46. After engaging in 5 to 10 minutes of range of motion exercises with a rubber ball, their strength increased to an average of 11.23. The study included 13 participants, mostly aged 55 to 69. Analysis of the data showed a significant improvement in grip strength, with a p-value of less than 0. 0001, confirming the success of the training program in increasing muscle strength. **Conclusion:** The average grip strength increased from an initial score ranging between 2 to 20 to a score ranging from 6 to 23 after the exercises, indicating that the range of motion exercises were beneficial for non-hemorrhagic stroke patients.
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Keywords: ROM, Therapy Gripping A Rubber Ball, Muscle Strength, Non-Hemorrhagic Stroke, Stroke Rehabilitation

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INTRODUCTION

Stroke is the third most common cause of mortality among people in the United States indicates that the prevalence of stroke has increased by almost 8 percent among young people aged 18-44 years (1). WHO reported that there is a total of 7.6 million patients who have had a stroke as well happen enhancement patient at each the year an estimated 500,000 and 125,000 people died because of a stroke (2). Pathological strokes are classified into two categories based on abnormalities: hemorrhagic stroke and non-hemorrhagic stroke (3). Hemorrhagic stroke resulting from cerebral hemorrhage. Non-hemorrhagic stroke is an ischemic event in the brain resulting from obstruction of blood vessels in the cranial region or inadequate cerebral perfusion due to numerous factors such as atherothrombosis, embolism, or hemodynamic instability (4). The annual mortality rate from stroke exceeds 200,000 individuals (5). The incidence of non-hemorrhagic stroke is significantly higher than that of hemorrhagic stroke, with a ratio of 70% to 30% for all stroke incidents (6).

Research conducted indicates a higher prevalence of non-hemorrhagic stroke patients compared to hemorrhagic stroke patients. Out of 637 stroke patients treated, 520 patients (81.6%) had non-hemorrhagic strokes, while 117 patients (18.4%) had hemorrhagic strokes(7). In Indonesia, the incidence rate of stroke is predicted to be 800-1000 cases annually, making it a contributing country (8). The most significant stroke occurrence in Asian nations. The incidence of stroke in Indonesia is 7.0 per thousand based on medical personnel diagnoses and 12.1 per thousand based on energy health or symptom diagnoses. 57.9% of stroke events have been diagnosed by a medical expert (9).

Stroke results in a motor impairment characterized by hemiparesis or hemiplegia, potentially leading to immobility (10). Hand dysfunction is the most prevalent functional impairment seen by stroke patients, affecting approximately 88% of those who have suffered a stroke. Weakness that manifests in the limb movements of the

body especially (11). The hand is controlled by the C7-T1 nerve, and disturbances in the anterior cerebral artery can affect blood supply to the somatosensory and motor cortices of the extremity. Individuals with muscular weakness will heavily rely on others (12). There are various therapeutic strategies that may be administered to the patient to enhance muscle strength, one of which is range of motion (ROM) exercises (1, 11, 13).

Range of motion (ROM) exercises consist of various movements executed on specific joints, aimed at enhancing flexibility and muscular strength (14,15). Classic measurement of hand muscle strength There exist five scales: 0, 1, 2, 3, 4, and 5. Scale 0 indicates stationary hands and fingers. Merely in position despite having been commanded (16). For movement, assign a value of 1 if muscular pressure is perceived. Contraction or elasticity is categorized as follows: scale 2 indicates the ability to move a muscle or weak area upon command; scale 3 denotes movement of a muscle with minimal resistance; scale 4 allows movement while opposing light resistance; and scale 5 signifies free movement capable of opposing significant resistance (17). The aim of this research was to assess the impact of range of motion exercises utilizing rubber balls on the grip muscle strength of patients who have experienced a non-hemorrhagic stroke in the Sandat Room of Kertha Hospital Usada.

MATERIALS AND METHODS

Samples

This study employed a pre-experimental design, namely a one-group pre-test and post-test methodology. Examine This study was conducted at Kertha Hospital Usada, involving 13 non-hemorrhagic stroke patients, utilizing purposive sampling for data collection. G*power sampel size was utilized to calculated the total sampel with 1.15 effect size factor. The criteria are participation in the study These are non-hemorrhagic stroke patients who have disturbances in motor abilities and muscle tone strength (18). To grasp a rubber ball and adjust its strength, the grip exercise is performed twice daily. Research duration of the study in one month, specifically October 2022. The research instrument employed will be the Hand Grip Dynamometer to test muscle strength changes. To quantify ROM, data collection is conducted via sheet observation of muscle strength changes using standard operating procedures (SOP) (19). Conduct research with a parametric paired dependent t-test with a significance level of p = 0.05.

Data Colection Instruments

Data gathering is conducted via the observation of variations in muscular strength with standardized standard operating procedures for Range of Motion Exercise by health profession organizations. Classic measurement of hand muscle strength There are five scales: 0, 1, 2, 3, 4, and 5. Scale 0 indicates that the hands and fingers are motionless. Merely in position despite having been ordered previously. For movement assessment, a scale of 1 indicates muscle contraction or elasticity upon palpation, scale 2 denotes the ability to move the muscle or weak area in response to command, scale 3 signifies movement of the muscle against minimal resistance, scale 4 reflects the capacity to move and counter light resistance, and scale 5 represents full movement with the ability to oppose suitable resistance.

Ethical Clearance

This work was approved by the Research Ethics Committee of Buleleng Health Sciences College, with ethical clearance number 836/EC-KEPK-SB/X/2023.

RESULTS

This study involved 13 respondents with non-hemorrhagic stroke. The characteristics of respondents based on age and gender are presented in Table I. The majority of respondents, specifically 10 individuals (76.9%), are aged between 55 and 69 years. The table indicates that the mean grip muscle strength in non-hemorrhagic stroke patients prior to ROM training with a rubber ball, based on 13 responses, was 8.46 (95% CI: 5.44 - 11.48) with a standard deviation of 1.385. The minimum grip muscle strength rating was 2, while the maximum was 20. The interval estimate indicates that 95% of individuals believe the mean grip muscle strength in non-hemorrhagic stroke patients in the Sandat room ranges from 5.44 to 11.48. The table indicates that the mean grip muscle strength of non-hemorrhagic stroke patients, following ROM exercises with rubber balls, is 11.23 (95% CI: 8.32 - 14.14) based on 13 respondents, with a standard deviation of 4.816. The minimum grip muscle strength number is 6, while the maximum is 23. The interval estimate indicates that there is a 95% confidence that the average grip muscle strength of non-hemorrhagic stroke patients in the Sandat room lies between 8.32 and 14.14. The grip muscle strength of non-hemorrhagic stroke patients before and after ROM exercise with a rubber ball is presented in Table II. The paired t-test showed a significant difference in grip muscle strength before and after ROM exercise with a rubber ball, with a p-value of 0.0001. Since the p-value was less than 0.05, the null hypothesis was rejected. This indicates that ROM exercise with a rubber ball had a significant effect on grip muscle strength among non-hemorrhagic stroke patients.

Table I. Characteristics of Respondents (n = 13)

Variable	Category	Frequency	Percentage (%)
Age	40-54 years	3	23.1
	55-69 years	10	76.9
Gender	Woman	6	46.2
	Man	7	53.8
Total		13	100.0

Note: Data are presented as frequency and percentage.

Table II. Grip Muscle Strength Before and After ROM Exercise with Rubber Ball (n = 13)

Measurement	Mean	Minimum	Maximum	SD	95% CI
Before ROM exercise with rubber ball	8.46	2	20	1.385	5.44-11.48
After ROM exercise with rubber ball	11.23	6	23	4.816	8.32-14.14

Note: Paired t-test result reported in the manuscript text: p = 0.0001.

DISCUSSION

Based on the findings from research completed prior to administering ROM exercises with rubber balls to non-hemorrhagic stroke patients at Kertha Hospital Usada, the researcher engaged in communication to foster mutual trust between respondents and researchers. Conduct muscle strength measurements using a handheld dynamometer and complete the observation sheet. Several factors may affect muscle strength, including age, gender, and specific health conditions. Muscle mass and strength typically diminish with age, commencing around 30 to 35 years, with a more accelerated decline occurring after 60 for women and 70 for men, a condition referred to as sarcopenia. Generally, men possess greater absolute strength than women attributable to factors such as muscle mass and fiber type. Furthermore, chronic diseases, obesity, and lack of physical activity can adversely affect muscle strength(20) . The majority of respondents, specifically 10 individuals (76.9%), are aged between 55 and 69 years.

The average strength of hand muscles in non-hemorrhagic stroke patients, prior to the administration of ROM exercises with rubber balls, was 8.09 (Mean) with a Standard Deviation of 4.682, based on a sample size of 114. Hand disorders, such as weakness, encountered by non-hemorrhagic stroke patients might impede their ability to perform daily activities, resulting in impairment. Patients with non-hemorrhagic strokes frequently endure disabilities of up to 70%, which can restrict their societal roles. One of the non-pharmacological therapy available for stroke patients is physical activity, such as ball exercises (17,21,22).

Psychological factors such as stress, anxiety, depression, and adverse self-perception can adversely affect muscle strength and growth. Stress, for instance, can result in elevated cortisol levels, which can obstruct protein synthesis and impede muscle development. Depression and anxiety may likewise influence muscle function and recovery. In contrast, favorable psychological states such as self-esteem and life satisfaction can be linked to enhanced muscle strength (23).

This issue aligns with the notion which asserts that repetitive hand grip exercises in stroke patients with paresis can increase brain plasticity, specifically the capacity for adaptation and alteration of the central nervous system following injury (4). When the brain is destroyed, the surrounding areas eventually assume its functions. Stroke rehabilitation must be conducted promptly, as the deterioration of muscle function is more pronounced than that of motor abilities (14). Ball gripping exercises activate sensory touch and pressure receptors in the extremities above. Stimulation This is transmitted to the cortical sensory via the C7-T1 neurons, which govern motor weakness in the fingers, directly to the limbic system. Mechanism bait return This response activates the nerve rapidly in reaction to stimulation(19), (24).

According to the study, the pre-intervention score for muscle power is 3, with muscle weakness attributed to a disruption in the nervous system (8). If a stroke patient with muscle weakness does not receive prompt therapy, consequences may arise. This can lead to several issues, including diminished muscle strength, reduced mobility, decreased bodily sensitivity, and challenges in performing daily activities (25), (26).

Following the completion of range of motion exercises utilizing rubber balls in non-hemorrhagic stroke patients exhibiting muscular weakness for a duration of 5-10 minutes, muscle strength was subsequently assessed using a Hand Grip Dynamometer and documented on an observation sheet. The average muscle strength result for non-hemorrhagic stroke patients post-ROM exercises with rubber balls was recorded as a mean of 10.96, with a standard deviation of 4.450, based on a sample size of 114 participants (27).

Appropriate range of motion exercises can enhance muscle strength in clients, particularly in the arms, shoulders, hands, and lower limbs, due to muscle engagement (9). This will impose a stress on the body during the exercise. Range of motion workouts involving a rubber ball concentrate on enhancing hand functionality (14). Therapy is perfect for strengthening muscles through the method of squeezing or gripping a rubber ball, which encourages finger movement via a firm grip. This exercise also aids in stimulating the brain's control over the affected muscles. The findings corroborated (28), (29) indicate that the score following the intervention in muscle power is 5. This occurs because therapy involving the manipulation of a rubber ball can stimulate muscle fibers. For contracted, although contraction is the sole occurrence, it happens only slightly each day (25).

The data analysis, utilizing a paired dependent t-test, indicates a p-value of less than α ($0.000 < 0.05$), leading to the rejection of the null hypothesis (H0). This suggests that ROM exercises with a rubber ball significantly influence muscle strength in non-hemorrhagic stroke

patients at Kertha Usada Hospital.

Hand dysfunction is a prevalent issue among stroke survivors, often resulting from damage to motor and sensory pathways. ROM exercises, such as squeezing a rubber ball, stimulate sensory receptors and activate motor neurons responsible for hand movements (30). This activity promotes neuroplasticity, facilitating cortical reorganization essential for functional recovery. Hand exercises using a rubber ball demonstrated that significantly increased muscle strength in non-hemorrhagic stroke patients, supporting the therapeutic value of such interventions (31).

The study aligns wherein data analysis was executed using a descriptive method To assess muscular strength before and after deployment, utilize a handgrip dynamometer. Grip function exercises involve tightly clenching the hand to help restore the brain's control over hand muscles. Range of motion exercises for the hands are important for daily activities and should be done twice a day for eight days to improve sensory and motor receptor training. This practice may also help increase the size of brain areas linked to other muscles. For grip exercises, using a rubber ball is recommended. Ensure that the fingers are corrected for a proper grip with the wrist at 450 degrees, gripping tightly for five seconds, then relaxing, repeating this seven times(32) (33).

The results indicate that the implementation of range of motion exercises using a rubber ball twice daily for four days, each session lasting 10-15 minutes, resulted in improved muscle strength (34). In subject I, muscle strength increased from 19.4 kg to 21.9 kg, but in subject II, it rose from 17.2 kg to 19.1 kg. Non-hemorrhagic stroke patients who regularly perform range of motion exercises with a rubber ball can sustain their capacity to engage in daily activities (21).

Based on research this concludes that power muscle handheld non-hemorrhagic stroke patients at Kertha Hospital Usada exhibit improvement in muscle weakness after undergoing ROM exercises with a rubber ball, provided these exercises are conducted in accordance with standard operating procedures and there is cooperation between the non-hemorrhagic stroke patients and the therapist during the therapy implementation process.

CONCLUSION

Data analysis utilizing a paired dependent t-test indicates a significance level (2-tailed) or p-value of 0.000. Since the p-value is less than 0.05 ($p<\alpha$), the null hypothesis (H0) is rejected. It may be concluded that ROM exercises using a rubber ball positively influence muscle strength in non-hemorrhagic stroke patients. Outcomes of the research This expectation can enhance perspectives and information regarding the administration of ROM exercises using a rubber ball as an alternative to address muscular weakness resulting from non-hemorrhagic stroke, in addition to serving as foundational data for subsequent study.

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REFERENCES

1. Rohmah N. Asuhan keperawatan pada pasien stroke non hemoragik dengan hemiparese melalui pemberian intervensi terapi genggaman bola karet (karya ilmiah akhir). Tangerang: Universitas Yatsi Madani; 2024.
2. Ton MD, Nguyen TM, Nguyen TH, Nguyen V, et al. Anticoagulation patterns in ischemic stroke patients with atrial fibrillation in developing country: insights from the Stroke Registry in Vietnam. J Cardiovasc Dev Dis. 2024;11(9):269. doi:10.3390/jcdd11090269
3. Owolabi MO, Thrift AG, Mahal A, Ishida K, Martins JO, et al. Primary stroke prevention worldwide: translating evidence into action. Lancet Public Health. 2022;7(1):e74-e86. doi:10.1016/S2468-2667(21)00230-9
4. Pearson-Stuttard J, Guzman-Castillo M, Penalvo JL, Rehm CD, Afshin A, et al. Modeling future cardiovascular disease mortality in the United States. Circulation. 2016;133(10):967-978. doi:10.1161/CIRCULATIONAHA.115.019904
5. Indrawati, Sudiana IK, Sajidin M. Active, passive, and active-assistive range of motion (ROM) exercise to improve muscle strength in post stroke clients: a systematic review. In: Proceedings of the 9th International Nursing Conference (INC 2018). SciTePress; 2019. p. 329-337. doi:10.5220/0008324803290337
6. Tongpangmeren, Baruah TS, Dihidar N, Paul M, Dutta A. Evaluation of proprioceptive neuromuscular facilitation (PNF) and therapy hand ball to improve motor dexterity in post-stroke patients. Int J Life Sci Pharma Res. 2023;13(6):L468-L481. doi:10.22376/ijlpr.2023.13.6.l468-l481
7. Rennert RC, Wali AR, Steinberg JA, Santiago-Dieppa DR, Olson SE, Pannell JS, et al. Epidemiology, natural history, and clinical presentation of large

vessel ischemic stroke. Neurosurgery. 2019;85 Suppl 1:S4-S8. doi:10.1093/neuros/nyz042
8. Dharmawita D. Stroke incidence rate based on age and gender in hemorrhagic and non-hemorrhagic strokes. J Med Malahayati. 2015;2(4):157-163.
9. Utomo YT. Characteristics of risk factors for hemorrhagic stroke and non-hemorrhagic stroke at Bekasi City Hospital. Syntax Lit J Ilm Indones. 2022;7(9):13584-13591. doi:10.36418/syntax-literate.v7i9.9463
10. Jamrern R, Singhnoy C, Suwanna P, Somsongkul V, Prajitr A, Ditwichairut R, et al. The effect of a PARA rubber ball training program on the hand and arm strength and the hand-eye coordination of older adults. J Health Res. 2019;9(1):12-18. doi:10.5923/j.health.20190901.03
11. Zahroh C, Septianingrum Y, Zulkarnain EV. The motor imagery (MI) intervention and rubber ball grafting therapy on rehabilitation and increasing motor strength in stroke patients: literature review. J Appl Nurs Health. 2024;6(1):71-80. doi:10.55018/janh.v6i1.177
12. Putra Kusuma A, Tri Utami I, Purwono J. The effect of "holding a serrated rubber ball" therapy on changes in muscle strength in stroke patients measured using a handgrip dynamometer in the neurology room of the General Hospital, Metro City. J Cendikia Muda. 2022;2(1):17-23.
13. Zahroh C, Septianingrum Y, Zulkarnain EV. The motor imagery (MI) intervention and rubber ball grafting therapy on rehabilitation and increasing motor strength in stroke patients: literature review. J Appl Nurs Health. 2024;6(1):71-80. doi:10.55018/janh.v6i1.177
14. Margiyati M, Rahmanti A, Prasetyo ED. Application of rubber ball grip exercises on muscle strength in non-hemorrhagic stroke clients. J Fisioterapi Ilmu Kesehat Sisthana. 2022;4(1):1-6.
15. Mareta Sari D, Kustriyani M. Application of grasp ball to overcome physical mobility impaired in non-hemorrhagic stroke patients. Prosiding Semin Nas Hasil Penelitian Pengabdi Masy. 2023;5(1):163-170.
16. Anggardani A, Nur Imamah I, Haniyatun I. Penerapan ROM exercise bola karet untuk meningkatkan kekuatan otot genggam pasien stroke di RSUD Dr. Moewardi Surakarta. J Ris Rumpun Ilmu Kesehat. 2023;2(2):86-97. doi:10.55606/jurrikes.v2i2.1738
17. Behm DG, Blazevich AJ, Kay AD, McHugh M. Acute effects of muscle stretching on physical performance, range of motion, and injury incidence in healthy active individuals: a systematic review. Appl Physiol Nutr Metab. 2016;41(1):1-11. doi:10.1139/apnm-2015-0235
18. Puspita T, Nur'aeni SH. An analysis of a rubber ball hand exercise on stroke patient: case study. J eduHealth. 2022;13(2):836-838.
19. Anggardani A, Nur Imamah I, Haniyatun I. Penerapan ROM exercise bola karet untuk meningkatkan kekuatan otot genggam pasien stroke di RSUD Dr. Moewardi Surakarta. J Ris Rumpun Ilmu Kesehat. 2023;2(2):86-97. doi:10.55606/jurrikes.v2i2.1738
20. Chen L, Nelson DR, Zhao Y, Cui Z, Johnston JA. Relationship between muscle mass and muscle strength, and the impact of comorbidities: a population-based, cross-sectional study of older adults in the United States. BMC Geriatr. 2013;13(1):74. doi:10.1186/1471-2318-13-74
21. Darmawan I, Utami IT, Pakarti AT. Application of range of motion (ROM) exercise rubber ball on muscle strength of non-hemorrhagic stroke patients. J Cendikia Muda. 2024;4(2):246-254.
22. Pedrosa GF, Silva DF, Hogan CJ, et al. Partial range of motion training elicits favorable improvements in muscular adaptations when carried out at long muscle lengths. Eur J Sport Sci. 2022;22(8):1250-1260. doi:10.1080/17461391.2021.1927199
23. Segura-Jiménez V, Tsiarleston G, Donoso B, Gil-Gutiérrez YM, Delgado-Fern6ndez M. Association of muscle strength, psychological factors, and central sensitization with movement-evoked pain in patients with nonspecific chronic low back pain: the BACKFIT Project. Sports Health. 2024;16(5):715-725. doi:10.1177/19417381241235152
24. Harista DR, Widyyati MIL, Nurseskasatmata SE, Sampang SNT. Penerapan terapi ROM latihan bola karet terhadap gangguan mobilitas fisik pada pasien stroke: literature review. Nurs Sci J. 2022;6(1):18-24.
25. Yuliyani FI, Hartutik S, Sutarto A. Application of rubber ball hand therapy to muscle strength in stroke patients in the Anyelir Ward of the Dr. Soediran Mangun Sumarso Regional General Hospital (RSUD) Wonogiri. J Ris Rumpun Ilmu Kesehat. 2023;2(2):37-48.
26. Azizah N, Wahyuningsih W. Genggam bola untuk mengatasi hambatan mobilitas fisik pada pasien stroke nonhemoragik. J Manaj Asuhan Keperawatan. 2020;4(1):35-42. doi:10.33655/mak.v4i1.80
27. Li XY, Hu R, Lou TX, Liu Y, Ding L. Global research trends in transcranial magnetic stimulation for stroke (1994-2023): promising, yet requiring further practice. Front Neurol. 2024;15:1424545. doi:10.3389/fneur.2024.1424545
28. Malaeb D, et al. Assessment of knowledge and awareness of stroke among Arabic speaking adults: unveiling the current landscape in seven countries through the first international representative study. Front Neurol. 2024;15:1492756. doi:10.3389/fneur.2024.1492756
29. Daroedono E, Wicaksono N. Simple geographic distribution of patients with stroke according to their medical care financing system in a private university hospital. Int Neuropsychiatr Dis J. 2024;21(6):41-54. doi:10.9734/indj/2024/

v21i6453
30. Mishchenko MM, Ognev VA, Mishchenko OM, Ponomaryov VI. Prevalence of anxiety and depression in patients after brain stroke. Clin Prev Med. 2023;7(4):41-47. doi:10.31612/2616-4868.4(26).2023.06
31. Rahmawati I, Dewi R, Pertami SB, Budiono, Pasaribu E. Hand exercise using a rubber ball increases grip strength in patients with non-haemorrhagic stroke. Malays J Nurs. 2021;12(3):32-36. doi:10.31674/mjn.2021.v12i03.005
32. Andriani D, Nigusyanti AF, Nalaratih A, Yuliawati D, Afifah F, Amatilah F, et al. Pengaruh range of motion (ROM) terhadap peningkatan kekuatan otot pada pasien stroke. Indogenius. 2022;1(1):34-40. doi:10.56359/igj.v1i1.59
33. Waruwahang AJ, Afriyanti L, Ruhdiyat A, Faizah A. The effect of range of motion (ROM) exercises on stroke patients. Zona Keperawatan. 2023;13(3):17-25. doi:10.37776/zk.v13i3.1268
34. Faridah AA, Istiqomah IN, Kurnianto S, Khovifah N. The effectiveness of range of motion (ROM) on increasing muscle strength in stroke patients: literature review. Nurs Health Sci J. 2022;2(2):137-142. doi:10.53713/nhs.v2i2.118