RANGE OF MOTION EXERCISE WITH A JAGGED RUBBER BALL CAN IMPROVE UPPER EXTREMITY MUSCLE STRENGTH IN STROKE PATIENTS

LATIHAN RANGE OF MOTION DENGAN BOLA KARET BERGERIGI DAPAT MENINGKATKAN KEKUATAN OTOT EKSTREMITAS ATAS PADA PASIEN STROKE

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ABSTRACT

The provision of ROM exercises with jagged rubber balls can increase the strength of the hand muscles of stroke patients. This study aimed to determine the effect of ROM exercises with serrated rubber balls on increasing the strength of the upper extremity muscles in stroke patients. Design of pre-test and post-test with one group. Selection of a nonprobability sample with a purposive sampling type, the sample is 11 people in the Tabanan General Hospital in the impatient ward in the stroke corner and outpatient ward. The average hand muscle strength in ROM exercises with a jagged rubber ball was distinguished by the male and female sex, namely before 12.5 and 12.7 after treatment, the average hand muscle strength was 15.2 and 15.6. Based on the mean value, patients with stroke experienced an increase in the normal category as measured using a hand dynamometer before and after giving therapy exercises by holding a jagged rubber ball. The test results of the analysis of the paired sample test above obtained a sig value of 0.000. In conclusion, there is a significant effect of ROM training by holding a serrated rubber ball on increasing upper limb muscle strength in stroke patients at Tabanan Hospital in 2022. It is hoped that it can be used as a nursing intervention to improve function in stroke and revive brain control over muscles.

Keywords: strokes; muscle strength; serrated rubber ball

ABSTRAK


Keywords: stroke; kekuatan otot; bola karet bergerigi
INTRODUCTION

Stroke is a cerebrovascular (cerebral blood vessel) disease characterized by impaired brain function due to damage or death of brain tissue due to reduced or blocked blood and oxygen flow to the brain. A decrease in muscle strength experienced by stroke patients is a functional disorder, one of which is related to motor and sensory (Rahmadani, E, 2019). The phenomenon of stroke is always accompanied by symptoms of muscle weakness in the upper and lower extremities, and some stroke patients experience bed rest. This will result in stroke patients experiencing psychosocial disorders such as difficulties in socializing (Rahman, R, 2017).

According to data from the World Stroke Organization (2019) it shows that every year there are 13.7 million new cases of stroke, and around 5.5 million deaths occur due to stroke. Approximately 70% of strokes and 87% of deaths and disabilities due to strokes have occurred in the last 15 years (World Stroke Organization, 2019). Basic Health Research in Indonesia is the largest and ranks first in Asia. The East Kalimantan region is the highest region with stroke (14.7%), followed by DI Yogyakarta (14.3%), Bangka Belitung and DKI Jakarta each (11.4%) and Bali is in 17th position with (10.8%). the most and ranks first in Asia (4). According to Health Profile 4 of Bali Province, the type of stroke that has a high prevalence rate is non-hemorrhagic stroke. Non-hemorrhagic stroke was included in the top 10 diseases in inpatients at the Bali Provincial General Hospital for 4 consecutive years, namely in 2014 - 2017 and there was an increase in the incidence of non-hemorrhagic stroke from 2015 to 2016 by 54% (Bali Provincial Health Office, 2017). In a preliminary study on medical records at Tabanan Hospital in the last 3 years in 2019 a total of 787 patients were found and in 2021 there were 651 and decreased to 484 in 2021. However, in Tabanan Hospital, stroke inpatients occupy the 2nd highest number after Covid-19 patients and is still relatively high which is a problem in stroke patients who experience decreased muscle strength.

The common problems encountered as a result of non-hemorrhagic strokes vary greatly depending on the area of the brain that is infarcted or tissue death and the location affected. One of them is experiencing weakness in sensory and motor (Barret, K. E5). Weakness occurs due to the death of the brain’s nerve tissue due to a stroke in the affected limbs such as the fingers. The process of decreasing muscle strength is caused by lesions of the upper motor neurons where the muscle fibers regulate their movement. According to previous studies (Wedri, 2017) it is caused by almost 85% of blood clot blockages, narrowing of arteries, and embolus from the heart or extracranial arteries, resulting in less blood supply/ stopped as a result of brain infarction. 90% of brain infarction occurs, as a result, there is no impulse and movement to the hand so the strength of the hand muscles decreases, and 55% of non-hemorrhagic stroke patients experience hand weakness (Warlow C, 2007) located in the impact area of the brain 90% broadman 4 (primary motor) and the area broadman 6 (premotor), as a result, there are no impulses and movements to the hands so that the strength of the hand muscles decreases, and 55% of non-hemorrhagic stroke patients experience hand weakness (Kisner Caroline 8). Therefore, there is an interruption of the blood supply to the brain which causes a disturbance in the function of neurons so that the transmission of impulses is disrupted and affects the strength of the upper extremity muscles in non-hemorrhagic stroke patients. (Warlow C, 2007).

Besides muscle weakness, muscle atrophy (disuse atrophy) also occurs. This is because the muscle fibers do not contract for a long time, so they slowly shrink (atrophy), where there is a change in the ratio between the muscle fibers and fibrous tissue. If a muscle is not used for weeks, the rate of breakdown of contractile proteins will take place faster than the rate of replacement, and therefore muscle atrophy occurs. (Prasetyo Y, 2007).

Efforts made by the hospital to reduce the prevalence of stroke and prevent a
decrease in muscle strength in non-hemorrhagic stroke patients, namely hospital management in collaboration with stroke specialist counselors to improve the quality of the stroke center through stroke management training programs for nurses in the room and carry out rehabilitation in the form of early mobilization, passive range of motion exercises (PROM) on the upper extremities as well as collaboration with trained medical rehabilitation or physiotherapy experts as a process of optimizing services and accessing guidance from specialist stroke doctors.

Upper extremity exercises with Range Of Motion where the most optimal in gripping a jagged rubber ball are exercises that do not cause fatigue, short duration but can be done as often as possible. The solution is to use a jagged rubber ball besides being used to increase hand muscle strength, a jagged rubber ball is also easy for patients to do and the materials used are easily available to patients. The jagged rubber ball is also light to carry so it can be used at any time if the patient experiences muscle weakness, especially the upper extremities (hands). It is of interest to the authors that more changes in muscle strength may occur in patients. Exercises performed by simply gripping a jagged rubber ball can increase muscle strength and provide therapy to innervation acupuncture points in patients with stroke. Grasping function exercises in which the movement of clenching the hands tightly will move the muscles to help revive the brain's control over the muscles (Is moyowati, 2019).

This training is a form of fundamental nurse intervention that can be carried out for the success of therapeutic regimens for patients and in efforts to prevent the occurrence of permanent disability conditions in hospitals, so as to reduce the level of dependence of sufferers on their families, increase self-esteem and sufferer's coping mechanisms. (Susanti S, 2019)

Based on the problems above, the researcher wants to conduct a study which aims to determine the Effect of ROM Exercise with Ragged Rubber Balls on Increasing Upper Extremity Muscle Strength in Stroke Patients at Tabanan Hospital.

METHOD
This type of research is pre-experimental using a one group pre-post test design approach. This study used 11 respondents who met the inclusion and exclusion criteria. The initial test was carried out by measuring muscle strength in the upper extremities and then given ROM exercises with a jagged rubber ball with a frequency of 2 times a day and carried out for 15 minutes for each exercise therapy, then on the 7th day a measurement test was given after giving ROM exercises with a jagged rubber ball.

This research was conducted at Tabanan Hospital from January to May 2022. The population in this study were all patients with a diagnosis of Non-Hemorrhagic Stroke who were hospitalized and outpatient at Tabanan Hospital, with sample selection, namely non-probability sampling using purposive sampling with a total sample of 11 respondents fulfilling inclusion and exclusion criteria. The dependent variable is an increase in muscle strength in the upper extremities and the independent variable is Range Of Motion exercises with a jagged rubber ball.

The types of data are primary data, namely name, sex, type of stroke and measurement of muscle strength with a Handdynamometer with an ordinal scale with categories (weak, normal and strong) and for secondary data, namely a preliminary study of the number of stroke patients in the last 3 years.

The data analysis technique used univariate analysis in which the measurement of muscle strength was analyzed by frequency distribution and bivariately using the Shapiro-Wilk normality test obtained sig > 0.05 and using the paired sample test. This research has carried out a research ethics test with letter number LB.02.03/E/A/KEPK/0161/2022
RESULTS

Table 1 Characteristic Frequency Distribution Based on Respondents’ Age at Tabanan Regional General Hospital in 2022 (n=11)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Mini</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>63.9</td>
<td>61</td>
<td>10.2</td>
<td>45</td>
<td>82</td>
</tr>
</tbody>
</table>

Table 1 mentioned the characteristics of respondents based on an average age of 63.9 years with a minimum age of 45 years and a maximum age of 82 years.

Table 2. Characteristic frequency distribution Respondents based on Gender of Non-Hemorrhagic Stroke Patients at Tabanan Regional General Hospital in 2022 (n=11) (n=11)

<table>
<thead>
<tr>
<th>Sex</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>7</td>
<td>63.6</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>36.4</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2 shows that most of the respondents are male as many as 7 people with a percentage of 63.6%.

Table 2. Upper extremity muscle strength before and after treatment in Stroke Patients at the Tabanan Regional General Hospital in 2022 (n=11)

<table>
<thead>
<tr>
<th>Muscle Strength</th>
<th>Pre Test</th>
<th>Male</th>
<th>Female</th>
<th>Post Test</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td></td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Min</td>
<td>3.7</td>
<td>6.6</td>
<td>6.3</td>
<td>9.5</td>
<td>6.3</td>
<td>9.5</td>
</tr>
<tr>
<td>Max</td>
<td>24.2</td>
<td>22.1</td>
<td>25.1</td>
<td>25.4</td>
<td>25.1</td>
<td>25.4</td>
</tr>
<tr>
<td>Mean</td>
<td>12.5</td>
<td>12.7</td>
<td>15.2</td>
<td>15.6</td>
<td>15.2</td>
<td>15.6</td>
</tr>
<tr>
<td>SD</td>
<td>7.04</td>
<td>7.50</td>
<td>7.22</td>
<td>7.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows muscle strength before being treated in male respondents the average muscle strength is 12.5 and in women is 12.7. While the muscle strength after being given treatment in men is 15.2 and in women is 15.6.

Table 4. Muscle strength based on categories before and after being given treatment in Non-Hemorrhagic Stroke Patients at the Tabanan Regional General Hospital in 2022 (n=11)

<table>
<thead>
<tr>
<th>Muscle Strength</th>
<th>Weak</th>
<th>Normal</th>
<th>Strong</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest Male</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>63.6</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>36.4</td>
</tr>
<tr>
<td>Posttest Male</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>7</td>
<td>63.6</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>36.4</td>
</tr>
</tbody>
</table>

Table 4 showed muscle strength before being treated in male respondents with a weak muscle strength category of 6 people and in women a total of 2 people. Meanwhile, muscle strength is in the weak category after being given treatment in a number of 3 men and 2 women.

Table 5 Differences in Muscle Strength in Non-Hemorrhagic Stroke Patients at the Tabanan Regional General Hospital in 2022

<table>
<thead>
<tr>
<th>Muscle strength</th>
<th>Mean</th>
<th>N</th>
<th>SD</th>
<th>SE</th>
<th>pvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Pre-Post</td>
<td>-27.2</td>
<td>7</td>
<td>1.94</td>
<td>.734</td>
<td>.010</td>
</tr>
<tr>
<td>Female Pre-Post</td>
<td>-28.2</td>
<td>4</td>
<td>1.55</td>
<td>.776</td>
<td>.036</td>
</tr>
</tbody>
</table>

Table 7 showed an increase in the muscle strength of stroke patients by practicing gripping a jagged rubber ball at the Tabanan General Hospital. From the statistical test “Paired Sample Test” the sig value was obtained, namely with each value for men and women p value 0.01 and 0.03 (p value < 0.05). This means that there is an effect that regular ROM exercises with jagged rubber balls can increase muscle strength in stroke patients at Tabanan Hospital.

DISCUSSION

Factors that trigger a stroke are mostly influenced by increasing age. Increasing a person’s age in adulthood is followed by the destruction of body tissues which causes a decrease in physical ability that occurs, namely a decrease in back muscle strength.
which affects activity. Decreased ability to carry out activities and decreased work ability is caused by a decrease in physiological and neurological functions, which also affects reduced elasticity so that it will result in sensory and motor decline which will affect muscle contraction. (Barrett 2014).

According to research (Matziou V, 2018.), age is a factor that affects muscle strength. Both men and women develop their muscle speed will reach a peak at the age of 25 years, and will experience a decrease of around 65% - 70% at the age of 65 years. Families helped respondents in carrying out rubber ball handheld therapy during the research process, by looking at the guidelines provided by researchers through videos about rubber ball handheld therapy. According to researchers, the role of the family is very important in carrying out hand-held rubber ball therapy. The family will help the respondent to do hand-held rubber ball therapy and the family will also help the recovery of stroke patients because it takes a long time to recover from stroke patients. Family empowerment or family empowerment allows families to coexist with patients, help patients, look after patients, help get information, work together between families and nurses, and participate in making decisions.

Characteristics of respondents based on gender shows that most of the respondents were male as many as 7 people with a percentage of 63.6%. Gender can be a risk factor for clinical outcomes in research (Eka & Wicaksana, 2017) of ischemic stroke in the Diponegoro Medical Journal with the result that the clinical outcome of male ischemic stroke patients is worse than that of women. Factors that are thought to be confounders in this study are age and smoking habits. This is because men have a higher risk of developing various complications such as thromboembolism with atrial fibrillation and cardioembolism.

The muscle strength of stroke patients before the intervention of hand-held therapy with serrated rubber balls as a whole experienced muscle weakness with the average result of muscle strength before being given treatment less than the normal rate, namely as many as 11 people (100%). According to research, this occurs due to disturbances in the motor neuron system which results in muscle weakness. In Stroke patients who experience muscle weakness and are not treated immediately, it will cause several disorders, namely decreased muscle strength, decreased movement, decreased body sensitivity and difficulty in carrying out daily activities and it can be concluded that as many as 11 respondents still experience weakness in muscle strength.

The results of the study are supported by research conducted by (Anita Pongantung, 2018) on stroke sufferers with a total of 40 respondents before treatment that the range of motion of post-stroke patients before performing range of motion exercises shows that the wide range of motion of the upper extremity joints is like a bullet joint, hinge joints, and condyloid joints have limitations, but after doing the range of motion exercises it shows that the wide range of motion degrees of the joints increases. Ischemic stroke patients need this ROM exercise because stroke patients can experience limb weakness, one of which is the upper extremity.

Based on the description of the research results and theory above, it was found that the decrease in muscle strength apart from age, muscle mass, lifestyle to motivate movement to exercise and unhealthy eating patterns also affect weakness in muscle strength. Respondents in this study also mostly never exercised or maintained their lifestyle. This is one of the main causes of stroke.

Based on the results of the frequency distribution analysis above, it was found that the strength of the upper extremity muscles in Stroke patients after being given ROM exercises with a jagged rubber ball at the Tabanan Hospital in 2022, namely all male women in the Weak category as many as 6 people (54.5%) and the Normal category as many as 5 people (45.5%), while for the Strong category, none (0%). It was found that
for the male sex there was an increase in muscle strength and an increase in the category level while for women the results of the increase did not occur and persisted but there was an increase when measuring with a handdynamometer even though it had not yet reached the normal category.

The increase in the muscle strength of the respondents in the weak category was because the six respondents had had a stroke for a long time and were already elderly. According to (Olviani, Y, 2017), the reason why the respondents did not experience an increase in muscle strength was the respondents who had had a stroke for more than 6 months where the penumbra cells had experienced muscle stiffness which could affect the function of motion in the hands optimally and also did not perform range of motion rehabilitation exercises quickly, precisely, periodically and continuously. The tool used is a jagged rubber ball because it has an effect on increasing the strength of the hand grip muscles and the muscles are increasing. This therapy functions to increase muscle strength, stimulate motor nerves in the hands and transmit them to the brain, and improve muscle tone and tendon reflexes that experience weakness (Adi, D, 2017).

Based on the results of the above study, ROM exercises with jagged rubber balls greatly affect the increase in muscle strength in stroke patients as a rehabilitation treatment that can be done for bedrest activities. This will help stimulate acupuncture points, especially on the hands which will indirectly give signals to the sensory nerves on the surface of the hands which will be conveyed to the brain and improve muscle tone and tendon reflexes that experience weakness (Adi, D, 2017).

Increased muscle strength of stroke patients by practicing gripping a jagged rubber ball at Tabanan Hospital from the statistical test "Paired Sample Test" obtained a sig value, namely with each value for men and women p value 0.01 and 0.03 (p value < 0.05). This means that there is an effect that regular ROM exercises with jagged rubber balls can increase muscle strength in stroke patients at Tabanan Hospital.

The data from the research showed that there was an increase in muscle strength in stroke patients by administering a serrated rubber ball handheld therapy intervention for 7 days. It was found that almost all respondents experienced an increase in muscle strength in the weak category to normal. While a small number of respondents remained in the weak or weak category. According to researchers, hand-held therapy with jagged rubber balls is one of the therapies used to increase muscle strength by stimulating the hands to make routine movements or muscle contractions.

According to (Irfan M, 2019), to stimulate hand movements with hand-held therapy a rubber ball is used to improve hand function properly, if you do it in stages and the procedure is correct then the muscle strength of Post CVA infarction patients can increase. Giving therapy in this phase is very good because it is in the rehabilitation process. Healing after CVA, with rubber ball hand-held therapy is carried out quickly in stages with appropriate procedures so that it will help recover physically quickly and optimally (Sofwan R, 2013).

The results of measuring muscle strength are in line with research conducted by (Pradesti, A, 2020) that most studies state that ROM exercises can increase the muscle strength of stroke patients at Hadam Malik General Hospital in Medan, where muscle strength before ROM exercises is 50% performed. at the age of 45-65 years this is due to decreased activity which causes muscle atrophy and weakness. Then there was an increase after doing passive ROM exercises, muscle strength increased from a scale of 2 to 3 using the Manual Muscle Test.

Study epidemiologi membuktikan Latihan ROM dengan bola karet bergerigi dapat memberikan rangsangan untuk meningkatkan aktivasi neuromuskular dan muskular serta kimiawi sehingga dapat merangsang syaraf otot ekstremitas khususnya parasimpatis untuk memproduksi asetilcolin sehingga dapat mengakibatkan kontraksi (Harrington, A, 2018).

Based on the results of studies, ROM exercises can be beneficial for smooth blood
circulation and can increase muscle strength. This is in accordance with (Pradestı, A, 2018.) stating that ROM exercises can train muscle tone and improve blood circulation, and if ROM is done regularly and is done in a relaxed manner it will increase the stimulus of the joints and nerves to respond to the motor function of the muscle tone of the extremities who was trained. The longer it will increase muscle strength. In addition, ROM exercises are carried out with the aim of maintaining joint mobility, maintaining or increasing muscle strength, preventing deformities and stimulating blood circulation (Anita F, 2018.). For maximum results, this ROM exercise must also be done regularly so that parts of the body that experience joint stiffness and weakness will provide changes that function to relax stiff joints (Anita F, 2018.).

CONCLUSION
The results of measurements of muscle strength before treatment were carried out with an average of 12.6 with a standard deviation of 6.83. The lowest score is 3.7 and the highest score is 24.2. So the patient's upper extremity muscle strength is still weak but can move the fingers.

The results of measuring muscle strength after treatment showed that the results of research on muscle strength had an average of 15.37, with a standard deviation of 6.83. The lowest value was 6.3 and the highest value was 25.4. The muscle strength of stroke patients after hand-held exercises with a jagged rubber ball increased in the normal category, namely able to move the fingers and hands and being able to resist light resistance.

There is an effect of ROM training with serrated rubber balls on increasing muscle strength in stroke patients at Tabanan Hospital in 2022 with the results of statistical tests using the Paired Sample Test, indicating that there is an increase in muscle strength before and after being given treatment with each muscle strength value, namely p value 0.000 . This shows that the p value <α (0.05).

Health workers, especially nurses at the Tabanan Hospital, should recommend ROM exercises by holding a jagged rubber ball for stroke patients who experience weakness in the upper extremities to accelerate the increase in muscle strength.

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