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STRETCHING HAMSTRING EXERCISE AND STRENGTHENING QUADRICEP MUSCLE EXERCISE TO IMPROVE THE FUNCTIONAL ACTIVITIES OF PATIENTS WITH OSTEOARTHTRITIS GENU

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Abstract: In the population of developing countries, moderate or severe disability due to osteoarthritis is 10 percent, while in the population of low-income countries it reaches 33.5%, and disability due to arthrosis occupies 43.4% of the world's population. Osteoarthritis affects about 21% of adults (46.4 million people) in the United States, and this number is expected to increase to 67 million by 2030. Hamstring stretching exercises are very effective at increasing the flexibility of muscles and joints, thereby reducing or eliminating joint pain. This exercise can also improve circulation and strengthen bones. Strengthening the quadriceps muscles helps reduce pain, improves body function and quality of life for patients and slows disease progression. WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) is an index used to assess the condition of patients with osteoarthritis of the knee. Questions consisted of pain, stiffness, physical and social functioning. This study used a pre-experimental method with a pre-test and post-test research design that aimed to determine the effect of giving stretching hamstring exercise and strengthening quadriceps muscle exercise. The conclusion is that there is an effect of stretching hamstring exercise and strengthening quadriceps muscle exercise on increasing the functional activity of patients with osteoarthritis genu

Keywords: *Hamstring, Osteoarthritis, Strengthening, Stretching, Quadriceps*

BACKGROUND

Old age (elderly) is a time when humans finally experience it. Degenerative disease is a disease that occurs with age and is also caused by the decline in the function of human organs. The causes of degenerative diseases include a sedentary lifestyle, obesity, high stress and aging factors, which can cause myocardial abnormalities and atherosclerosis, causing insufficiency of coronary blood flow and high blood pressure (hypertension); this condition is a degenerative process (Sakinah et al., 2020). The predominant features include pain that becomes constant and more limited as the disease progresses, leading to reduced physical function and quality of life and often expensive joint replacement (Bennell et al., 2019). According to the World Health Organization (WHO), osteoarthritis of the knee is expected to be the fourth leading cause of disability by 2020. In developing country populations, moderate or severe disability due to osteoarthritis is 10 percent, while in populations of low-income countries it is 33.5%, and disability due to arthrosis occupies 43.4% of the world's population. Osteoarthritis affects approximately 21% of adults (46.4 million people) in the United States, and this number is expected to increase to 67 million by 2030 (Tanoeisan et al., 2019).

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Degenerative factors often occur in musculoskeletal disorders and often present with impaired function and movement. Osteoarthritis is a knee joint disease that is common in older people. OA patients tend to have problems with hamstring flexibility due to the duration of arthritis or the patient's walking pattern, resulting in shortening of the hamstring (Oktafianti et al., 2020). According to the American College of Rheumatology, the recommended treatment for osteoarthritis is non-pharmacological treatment, namely therapeutic modalities such as aerobic exercise, resistance training and psychosocial interventions. This type of exercise therapy focuses on strengthening muscles. Several muscle groups that play a role in regulating knee movement and stability are the quadriceps and quadriceps (Aqshadila et al., 2021).

The hamstrings are an important factor in movement control and are involved in various activities ranging from running and jumping forward, bending while sitting or standing, and postural control (Oktafianti et al., 2020). The thigh muscles are the main flexors of the knee and also affect the rotation of the tibia of the femur. The hamstrings play a role in controlling the forward momentum of the leg during the final swing. The hamstrings also support the posterior knee joint when the knee is extended while standing. Hamstring weakness can cause genu recurvatum (Can, 2018). The knee flexor muscle group is the thigh muscle which consists of the biceps femoris, semitendinosus, and semimembranosus muscles. In addition, the gracilis, sartorius, gastrocnemius, popliteus and plantaris muscles are also supported (Pratama, 2019).

M. Quadriceps femoris consists of four muscles M. Rectus femoris, M. Vastus lateralis, M. Vastus medialis, M. Vastus intermedius. The rectus femoris is the most commonly affected part of the quadriceps femoris because the rectus femoris contains type 2 white muscle fibers that can quickly generate energy for strenuous activities. M. rectus femoris is the part that is most easily injured when doing fast movements such as high jumps or when there is an obstacle during contractions. The four quadriceps muscles are connected to form a tendon and attach to the tibial bone (tibial tuberosity) via the patella ligament (Prasetio et al., 2015). Hamstring stretches are muscle stretches that increase muscle flexibility and joint range of motion. Hamstring stretching exercises are very effective for increasing the flexibility of muscles and joints, thereby reducing or eliminating joint pain. This exercise can also improve circulation and strengthen bones (Monayo & Akuba, 2019).

Stretching is a strenuous sport in which tense muscle positions are held for a long time. When a muscle is stretched, the muscle spindles are also stretched. Muscle spindles signal changes in length and how quickly changes in muscle length occur, muscle spindles signal the spinal cord to send information to the central nervous system. The tension created by the MTU (tendon motor unit) to elongate the muscle and facilitate impulses from afferent fibers to the muscle spindles and increases muscle relaxation by preventing tension in the muscle contraction unit being stretched so that the Stretch receptors are trained to increase muscle elasticity (Nurhayati et al., 2019), with repeated movements during stretching exercises, the work of the muscles around the joints increases thereby accelerating blood circulation, while metabolism also speeds up, so that the rest of the metabolism is transported into the blood circulation, so that the pain subsides (Paramita & Solahudin, 2017).

Strengthening the quadriceps muscles helps reduce pain, improves body function and quality of life for patients and slows disease progression. In addition, there are safety and cost-effective features that are very important for patients. Therefore, such treatment is unanimously recommended in several guidelines (Xie et al., 2018). When doing a strengthening quadriceps muscle exercise, an isometric contraction occurs in the muscles followed by relaxation as a result of the activation of the Golgi tendon organs. Signals from the activated Golgi tendon organs are conveyed in the spinal cord causing a reflex

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effect on the muscles. When muscle tension increases, the inhibitory effect of the organs can become so great that this inhibition will cause relaxation of the muscles which in turn can reduce pain, with strengthening involving the range of motion of the joints which can change the length of the muscles will be able to strengthen the muscles automatically. Simultaneously between agonist and antagonist muscles (Palguna et al., 2018). Strengthening quadriceps muscle exercise will increase quadricep muscle strength, reduce muscle atrophy, increase joint stability, with increased muscle strength it will reduce tissue damage around the joints, thereby reducing knee joint motion pain and increasing functional capacity. From the results of examinations and therapeutic actions carried out for 9 times, it can be concluded that the therapeutic measures have succeeded in increasing the strength of the quadriceps and hamstring muscles (Ikhlasinufus, 2022).

WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) is an index used to assess the condition of patients with osteoarthritis of the knee. A total of 24 questions consisting of pain, stiffness, physical and social functioning were evaluated using WOMAC. The measurement tool is in the form of a questionnaire containing 5 questions regarding pain, 2 questions related to joint stiffness and 17 questions related to physical activity. The lower the total value produced, it shows an improvement in functional ability (Thanaya et al., 2021). In measuring the functional activity of the patients above using WOMAC which has an interpretation of the total WOMAC score, including: 0-24: Mild, 24-48: moderate, 48-72: Severe, 72-96: very severe (Abdurachman et al., 2017).

METHOD

This study used a pre-experimental method with a pre-test and post-test research design that aimed to determine the effect of giving stretching hamstring exercise and strengthening quadriceps muscle exercise. This research took place in August-September 2022. The sample for this study used purposive sampling and complied with the inclusion and exclusion criteria. Inclusion criteria: Elderly with grade 2 degenerative OA genu at the Boyolali II Health Center, Boyolali District, Boyolali District, Elderly aged 65-75 years, Elderly male and female, Not experiencing cognitive impairment, Not obese. Exclusion criteria: Experiencing high blood pressure disorders, Patients with postoperative knee complaints, Have experienced sports injuries, Have experienced genu trauma or injuries to the knee joint at a young age. Drop Out Criteria: Patients who are not cooperative, Patients who do not fulfill attendance, Patients who have participated in activities but then experience physical problems, Resign as respondents, Respondents do not participate fully from start to finish or stop midway during the research.

The sample used in the study was 30 people. Data collection in this study used interview techniques and observation techniques to determine functional abilities in OA genu with the WOMAC (Western Ontario and McMaster Universities Osteoarhtritis Index) measuring instrument. Subsequent data collection by providing interventions Stretching Hamstring Exercise and Strengthening Quadriceps Muscle Exercise was carried out 3x/week for 3 weeks (9x). The data obtained was tested with the Wilcoxon test.

RESULT AND DISCUSSION

Table 1. It is known that most of those who experience OA Genu range in age from 65-70 years as much as 56.7% and those aged 71-75 years as much as 43.3%. In general, patients with osteoarthritis are in the age range of 66-75 years, 50 years is the minimum age used as one of the criteria for classifying

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osteoarthritis in the knee joint. One of the risk factors for osteoarthritis is age, which ranges from 50-79 years.

Table 1. Charateristics of Respondents by Age

Usia	(n)	(%)
65-70	17	56,7%
71-75	13	43,3%
Total	**30**	**100%**
Mean	70,20	
Upper Limit	75	
Lower Limit	65	

Tabel 2. Charateristics of Respondents by Gender

Gender	(n)	(%)
Female	17	56,7%
Male	13	43,3%
Total	**30**	**100%**

Table 2. It is known that most of those who experience OA Genu are women as much as 56.7% and men as many as 13 respondents 43.3%. Generally, osteoarthritis affects 60% of men and 70% of women. It is said that the prevalence of knee osteoarthritis in women is 14.9%, while in men it is 8.7%. It can be concluded that knee osteoarthritis often affects women aged > 40 years and over.

Tabel 3. Interpretasi WOMAC Sebelum Pemberian *Stretching Hamstring Exercise* dan *Strengthening Quadriceps Muscle Exercise*

WOMAC	(n)	(%)
Mild	12	40,0%
Moderate	18	60,0%
Total	**30**	**100%**

Table 3 shows that in this study, before being given the stretching hamstring exercise and strengthening quadriceps muscle exercise, the functional activity value of the respondents using WOMAC was mild, 12 respondents with a percentage of 40.0%. while those with moderate value were 18 respondents with a percentage of 60.0%.

Tabel 4. Interpretasi WOMAC Sesudah Pemberian *Stretching Hamstring Exercise* dan *Strengthening Quadriceps Muscle Exercise*

WOMAC	(n)	(%)
Mild	23	76,7%
Moderate	7	23,3%
Total	**30**	**100%**

Table 4. After the stretching hamstring exercise and strengthening quadriceps muscle exercise treatment, the WOMAC examination showed the results were 23 respondents in the mild category with a

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percentage of 76.7%, while in the moderate category there were 7 respondents with a percentage of 23.3%. In measuring functional activity using WOMAC there is a reduction in the total score but in the interpretation the WOMAC value is still classified as a moderate interpretation so it can be concluded that there is no increase in the WOMAC measurement index.

Tabel 5. Interpretasi WOMAC Sesudah Pemberian *Stretching Hamstring Exercise* dan *Strengthening Quadriceps Muscle Exercise*

Wilcoxon		*Mean*	*Z*	*Sig.(p)*
WOMAC Value	*Pre-Post Test*	7,00	-3,051	0,02

Table 5. The results of the Wilcoxon test show that from the pre-test and post-test functional activity data, a significant result was obtained p = 0.02, which means p <0.05, thus it was concluded that there was an effect of hamstring stretching exercise and quadriceps strengthening exercise on increasing functional activity in patients OA genu.

The working mechanism of stretching hamstring exercise and strengthening quadriceps muscle exercise to increase functional activity in patients with OA genu from the beginning of the meeting in the first week to the third week found that dynamic stretching exercises to maintain and increase the flexibility of joints, tendons, ligaments and muscles. The dynamic stretching method is carried out without assistance from other parties. Static stretching is done with the body remaining in its original position without moving, aiming to stretch the muscles at the most distant point and then stay in position. Static and dynamic stretching exercises are given for 3 weeks by following the steps described in the exercise procedure sheet. This stretching exercise is done 3 times a week for 15 repetitions of each exercise. As for the strengthening quadriceps muscle exercise, it is an isometric exercise with a type of muscle contraction exercise without any change in muscle length and is not followed by any change in joint movement. Dosage: the patient's position lying on his back with his legs straight then, the patient is asked to press the knees down and contract the muscles. With a dose for 3 weeks, 8 repetitions with a time of 5 minutes with a therapy schedule until the end of the study as many as 9 meetings.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that there is an effect of stretching hamstring exercise and strengthening quadriceps muscle exercise on increasing the functional activity of patients with osteoarthritis genu. Based on the results of the Wilcoxon test, the significance value was obtained, thus there was an effect after giving the stretching hamstring exercise and strengthening quadriceps muscle exercise.

AUTHOR CONTRIBUTION

All authors contributed fully to this writing.

Physiotherapy and Physical Rehabilitation Journal
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Web https://ojs.stikestelogorejo.ac.id/

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