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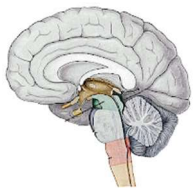

The Effect Of Quadricepts Strengthening Exercise On Increasing Muscle Strength And Decreasing Pain Intensity In Genu Osteoarthritis Patients At Bhayangkara Kediri Hospital

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ABSTRACT

Osteoarthritis is a joint deformity, often found in progressive degeneration of the articular cartilage, resulting in loss of joint space. Genu osteoarthritis patients complain of pain, limited movement, and a decrease in their functional activities. Patients with severe complaints use mobility aids for walking activities. This research uses a quasiexperimental design with one group pre and post test design approach. The sample for this research was 30 respondents. The sampling technique for this research is purposive sampling, which is a sample selection technique by selecting samples among a number of populations that are in accordance with what the researcher desires. There is an effect of quadriceps strengthening exercise on increasing muscle strength and reducing pain intensity in osteoarthritis genu patients at Bhayangkara Kediri Hospital in 2023. The average muscle strength of genu osteoarthritis patients before quadriceps strengthening exercise was 3.533 and the average pain intensity of genu osteoarthritis patients before quadriceps strengthening exercise was 4.8. The average muscle strength of genu osteoarthritis patients after quadriceps strengthening exercise was 4.6 and the average pain intensity of genu osteoarthritis patients after quadriceps strengthening exercise was 3.05. There is an effect of quadriceps strengthening exercise on increasing muscle strength with P-value 0,000<0,05 and effect of quadriceps strengthening exercise on reducing pain intensity in osteoarthritis genu patients signification p value 0,000<0,05.

INTRODUCTION

Patients visiting the Bhayangkara Hospital Kediri Medical Rehabilitation Installation in 2022 were found to have the second highest number of osteoarthritis genu sufferers after low back pain. This gives rise to the idea that this case of genu osteoarthritis is a common complaint. Most patients with this genu osteoarthritis complain of pain, limited movement, and a decrease in their functional activities. It is not uncommon for patients with severe complaints to use mobility aids for walking activities.

One of the problems with degenerative joints is osteoarthritis. Osteoarthritis is a degenerative disease of the joints resulting in inflammation as evidenced by the occurrence of pathological changes throughout the joint structure. The changes that occur include loss or reduction of hyaline joint cartilage which then results in thickening and sclerosis of the subchondral bone, increased osteophytes at the ends of the joints, stretching of the joint capsule, mild synovitis and then weakening of the muscles supporting the joints due to excessive mechanical stress. (Winangun 2019).

Osteoarthritis is a joint deformity, often found in progressive degeneration of the articular cartilage, resulting in loss of joint space. Structural abnormalities of all tissues in joints including subchondriacal,

synovial, cartilage, joint capsule and joint ligaments. (Sari, Putri et al. 2022). According to WHO, degenerative joint disease or osteoarthritis is a result of abnormalities in the joint cartilage or cartilage, these abnormalities are characterized by clinical, histological and radiological changes. In sufferers, osteoarthritis has an asymmetric nature, no inflammation and no systemic component. (Ismaningsih, 2018).

According to Kenneth, osteoarthritis is a degenerative joint disease that is often found in people of advanced age, sometimes also in middle age. Osteoarthritis in another sense means failure to repair damage to the joints caused by excessive mechanical stress. (Abdurrachman, et al, 2019). According to an international institution that conducts research and is evidence based on osteoarthritis, The Osteoarthritis Research Society International (OARSI) says that one of the most effective non-operative treatments for osteoarthritis patients is the provision of exercise therapy. This non-operative treatment can have the effect of reducing pain or soreness and increasing the ability for functional activities for sufferers of osteoarthritis genu. Quadriceps strengthening exercise is one of the exercise therapies that can be given to people with osteoarthritis genu. (Laasara, 2018)

Quadriceps strengthening exercise is an exercise for the thigh muscles that is a combination of several exercises such as isotonic and isometric. To relieve greater pain, isotonic exercises can be given. During initial strength training, patients with osteoarthritis who have knee pain should be given isotonic exercises. For joints with acute inflammation or unstable joints, isometric exercises should be given. When osteoarthritis sufferers with joint swelling and pain are given light pressure during isometric contractions which can be tolerated well. The starting point for a strengthening program and for more dynamic movements is to prepare the joints by improving muscle strength and static resistance. (Ismaningsih, 2018).

In line with this research is research that was carried out by Ismaningsih in 2018 with the title "Physiotherapy Management in Bilateral Osteoarthritis Genus Cases with Neuromuscular Taping and Strengthening Exercise Interventions to Increase Functional Capacity" which was carried out every day for one week. The results of the research obtained were the differences between patients before and after being given Neuromuscular Taping and Strengthening Exercise interventions which could increase functional activity in patients with bilateral genu osteoarthritis. Researchers focus on contributing to researching the effect of quadriceps strengthening exercise on increasing muscle strength and reducing pain intensity in osteoarthritis genu patients at Bhayangkara Hospital, Kediri. It is hoped that from this research significant results will be obtained according to previous research, namely increasing muscle strength and reducing pain intensity in genu osteoarthritis patients.

METHODS

This research uses a quasi-experimental design with a one group pre and post test design approach. The sample in this study consisted of 30 respondents. The sampling technique in this research is purposive sampling, namely a sample selection technique by selecting samples from among a number of populations that are in accordance with the wishes of the researcher.

RESULTS AND DISCUSSION

The results of this study describe the characteristics of Osteoarthritis Genue patients. Table 1 shows that the results of the majority of patients were 56.7% female and 43.3% male. Then, the majority of Osteoarthritis Genue patients are aged 61-70 years, 56.7%.

Table 1. Characteristics of Osteoarthritis Genue respondents

Characteristics	Parameter	Total	Percentage (%)
Gender	Man	13	43,3
	Woman	17	56,7
Age	45-60 year	8	26,7%
	61-70 year	17	56,7%
	>70 year	5	16,6%

Table 2. Identification of muscle strength and pain intensity of Osteoarthritis Genue respondents

Score	Muscle strength		Pain intensity	
	Pre	post	Pre	post
Mean	3,5333	4,6	4,93	3,20
Minimum	3	4	4	2
Maksimum	4	5	7	5

From Table 2, the effect of the intervention, the significance result of the Paired T test is 0.001< α (α=0.05, the average before quadriceps strengthening exercise is 3.5333 with a minimum value of 3 and a maximum value of 4. Then the average value -The average after giving quadriceps strengthening exercise was 4.6 with a minimum value of 4 and a maximum value of 5. Meanwhile, the average pain intensity before giving quadriceps strengthening exercise was 4.93 with a minimum value of 4 and a maximum value of 7. And the average pain intensity after giving quadriceps strengthening exercise it was 3.2 with a minimum value of 2 and a maximum value of 5.

Table 3 The effect of quadriceps strengthening exercise on muscle strength and pain intensity in genu osteoarthritis patients

Variable	Signifikasi Wilcoxone
The effect of quadriceps strengthening exercise on muscle strength in osteoarthritis genu patients	0,000
The effect of quadriceps strengthening exercise on pain intensity in osteoarthritis genu patients	0,000

Based on table 3, Wilcoxon significance results of 0.000<α (α=0.05) can be interpreted as having an effect of quadriceps strengthening exercise on muscle strength in patients with osteoarthritis genu, while Wilcoxon significance results of 0.000<α (α=0.05) can have an effect of quadriceps strengthening exercise on pain intensity of genu osteoarthritis patients at Bhayangkara Kediri Hospital in 2023.

1. Identify muscle strength before quadriceps strength training

Based on data identifying muscle strength in genu osteoarthritis patients, the average before administering quadriceps strengthening exercise was 3.5333 with a minimum value of 3 and a maximum value of 4. Osteoarthritis is a chronic inflammation that involves mechanisms from the innate immune system. Synovitis can appear in the early stages of the disease, namely the infiltration of inflammatory

cells into the synovium, but more often occurs in more advanced stages, which can be related to the severity. In addition to plasma proteins (C-reactive protein, which has been proposed to be a marker of the onset and progression of osteoarthritis), prostaglandins (PGE2), leukotrienes (LKB4), cytokines (TNF, IL1, IL6, IL15, IL17, IL18, IL21), growth factors (TGF, FGFs, VEGF, NGF), nitric oxide, and cartilage damage occurs when proteoglycans and collagen are degraded due to the induction of matrix metalloproteinases and other hydrolytic enzymes (such as cyclooxygenase two and prostaglandin E) (Juan C Mora, 2018).

Osteoarthritis, as explained by Ahmad Zaki (2013), can be further divided into primary and secondary forms. Primary (idiopathic) osteoarthritis is caused by a degenerative process that increases with age and can attack more quickly in people with certain genetic predispositions or whose joints experience excessive stress due to daily activities. As a result of changes in the joint microenvironment caused by disease, deformity, or trauma, secondary osteoarthritis develops (Ahmad Zaki, 2013).

Based on data on the characteristics of respondents based on gender, the majority of respondents were female, amounting to 13 respondents (65%). According to Kim (2011) in Yosika (2017) states that Osteoarthritis genu occurs more often in women, with a 95% confidence interval (CI) of 2.1. (Yosika, 2017). These two factors alone are enough to indicate that women are at a higher risk for developing osteoarthritis genu than men.

There is evidence that muscle dysfunction is involved in the pathogenesis of genu osteoarthritis. The lower leg muscles are the natural support of the knee joint and improper alignment of the knee can originate proximally, and that poor force production due to muscle weakness can be a factor that ultimately causes stress on the knee. Muscles play a major role in joint structure and function, as demonstrated by the disuse of the quadriceps femoris muscle that accompanies knee joint pain, quadriceps muscle weakness has been noted by the American Academy of Orthopedic Surgeons as a risk factor for structural damage to the knee joint, muscle weakness affects the anteroposterior stability of the knee joint and makes patients feel unstable, causing decreased self-confidence and decreased performance and independence in daily activities, causing disability and dysfunction in genu osteoarthritis patients. (Bennel et al, 2019) (Narayan, 2021)

According to researchers' assumptions, osteoarthritis genu is a disorder of old age, or a disease that is most likely to occur in the elderly. This condition occurs due to the accumulation of physical activity that has occurred for a long time and compensates the body for a reaction. Over a long period of time, osteoarthritis builds up which can cause pain and reduce muscle strength on a daily basis. genu osteoarthritis often affects elderly patients and women, this is because women have hormones that can increase the growth of purine and keratin. Older women are also likely to be overweight due to lifestyle habits that occur throughout their lives, which can increase the risk of developing osteoarthritis genu.

2. Identify Pain Intensity Before Quadriceps Strengthening Exercise

Based on data identifying the pain intensity of genu osteoarthritis patients, the average pain intensity before administering quadriceps strengthening exercise was 4.93 with a minimum value of 4 and a maximum value of 7.

Research through case studies conducted by Sari and Susilo (2022) showed that clients with genu osteoarthritis felt pain during the examination starting from getting up from a sitting position with a pain scale of 3, walking increased pain 2 and climbing stairs 3 traps experienced increased pain 2. The

patient complained of Difficulty and pain when changing from a sitting to standing position resulting in discomfort when working and carrying out daily activities. (Sari and Susilo, 2022).

Based on data on the characteristics of respondents based on age, the majority of respondents were 61-70 years old, 12 respondents (60%). Those aged 65 years and over are the age group most often affected by osteoarthritis genu (Anwer & Alghadir, 2014). In 2015, the US National Library of Medicine's National Institute of Health reported that the worldwide prevalence of Osteoarthritis genu was 25.4% based on radiographs and symptoms, with 15.4% of the population occurring in those over 65 years of age. Kenneth (2005) in Yosika (2017) states that changes in joint cartilage cause disruption of chondrocyte function and the development of abnormal, smaller proteoglycan aggregates. Articular cartilage experiences a loss of compressibility due to changes in the diameter and orientation of collagen fibers which are responsible for these biomechanical changes. Water content, the ratio of chondroitin sulfate to keratin sulfate, synthetic activity of chondrocytes, and overall articular cartilage thickness and volume all decrease with age (Yosika, 2017). The prevalence of osteoarthritis (OA) sufferers in Indonesia reached 11.1% at ages 45-54 years, at ages 55-64 years it was 15.5%, at ages 65-74 years it was 18.6% and at ages >75 years it was 18.6%. 18.9% of people suffer from osteoarthritis. East Nusa Tenggara (NTT) provinc e has the highest prevalence of osteoarthritis, namely around 33.1% and the province with the lowest prevalence is Riau, namely around 9%, while in East Java the prevalence rate is very high, namely around 27%. (Riskesdas 2018).

Pain is an unpleasant sensory and emotional experience that occurs due to damage to body tissue, both actual and potential. Pain is a multi-dimensional sensory experience that differs from one person to another in terms of intensity (mild, moderate, severe) and quality of pain (dull, sharp, burning), duration (transient, intermittent, persistent), and spread of pain (superficial or deep, localized or diffuse). Even though pain is a sensation, pain can be described as a form of suffering (Bahrudin, Moch., 2017)

According to researchers' assumptions, pain in genu osteoarthritis patients occurs due to the addition of crystals which create unevenness in the joint cartilage which causes friction between the joints during activities. Over a long period of time, the cartilage becomes harder. Continuous biomechanical changes with increasing age and decreased function result in pain suffered by the patient.

3. Identify muscle strength after quadriceps strengthening exercise

Based on identification data, the average muscle strength of genu osteoarthritis patients after quadriceps strengthening exercise is 4.6 with a minimum value of 4 and a maximum value of 5.

Apart from being given to sufferers of mild to severe osteoarthritis genu, this exercise is also safe to be given to sufferers of osteoarthritis genu with comorbid obesity and a history of TKA. Where in a study comparing quadriceps strengthening intervention with weight bearing or non-weight bearing, it had the same effect without any significant difference in reducing pain intensity. The form of quadriceps strengthening exercise is a combination of concentric, eccentric and isometric exercises. Where isometric training has a beneficial effect in the early stages of rehabilitation because the movement is without changes in muscle length with a limited range of motion, while isokinetic training is a movement that is assisted by a tool as an external load to increase the strength of all muscles through a full range of motion even though both forms of exercise Although it has been shown to be effective in reducing pain and improving physical function, isokinetic training has a long-term effect in increasing higher muscle strength. Strengthening exercise provides effective results which can be used as a basis

for providing intervention to increase quadriceps muscle strength in osteoarthritis sufferers because the quadriceps muscle contributes to stabilizing the knee joint, joint stabilization can be disturbed when the quadriceps muscle is weak, which can increase the risk of damage to the structure of the knee joint which can cause inflammation. and trigger pain. (DeVita et al. 2018) (Kilinc et al., 2020) (Moreira et al., 2019).

According to the researchers' assumptions, after Strengthening exercise therapy there was an increase in muscle activity in carrying out contractions. Gradual training according to the patient's indications and strength will increase muscle mass, the muscles will become bigger and create greater strength. Consistently doing this results in joint resistance becoming stronger and more constant.

4. Identify the intensity of pain after quadriceps strengthening exercise

Based on data identifying the pain intensity of genu osteoarthritis patients, the average pain intensity before quadriceps strengthening exercise was performed. The average pain intensity after quadriceps strengthening exercise was 3.2 with a minimum value of 2 and a maximum value of 5.

The difference between pain intensity before and after doing quadriceps strengthening exercises, there was a significant change in results, namely a decrease in pain intensity. Likewise, in quadriceps muscle strength, there was an increase in muscle strength values. In line with increasing muscle strength and decreasing pain intensity, it can increase the range of motion of bending movements in the knee joint, this can also increase the functional activity of osteoarthritis genu sufferers.

According to researchers, increasing muscle strength can have an impact on reducing the intensity of pain felt by patients suffering from osteoarthritis genu. When the mass of the thigh muscles increases, the strength of the thigh muscles will increase so that the knee will be more comfortable when used for activities because the pain felt will decrease and can also increase the range of motion of the knee joint.

5. **The effect of quadriceps strengthening exercise on muscle strength in osteoarthritis genu patients**

Based on the data, it can be seen that the number of respondents who experienced an increase in muscle strength after doing quadriceps strengthening exercise was 26 respondents, 4 respondents experienced no change, and 0 respondents experienced a decrease. The Wilcoxon significance result of $0.000<\alpha$ ($\alpha=0.05$) can be interpreted as having an effect of quadriceps strengthening exercise on the muscle strength of genu osteoarthritis patients at Bhayangkara Kediri Hospital in 2023.

Research by Sari and Susilo (2022) Measurements were carried out on first arrival using MMT and the Jette Scale. Patients complain of difficulty and pain when changing from a sitting to standing position, resulting in discomfort when working and carrying out daily activities. After treatment in the 2nd week, patients can carry out activities with reduced discomfort. However, he was still unable to resist maximum resistance when given resistance by the therapist. Up to the 8th treatment, the patient complained of a slight feeling of discomfort in the knee but when given resistance by the therapist, the patient was able to resist maximum resistance. Strengthening exercise provides effective results which can be used as a basis for providing intervention to increase quadriceps muscle strength in osteoarthritis sufferers because the quadriceps muscle contributes to stabilizing the knee joint, joint stabilization can be disturbed when the quadriceps muscle is weak, which can increase the risk of damage to the structure of the knee joint which can cause inflammation. and trigger pain. Thus, strengthening the quadriceps muscle group can have an effect on increasing muscle strength and increasing functional activity which

can be measured using Manual Muscle Testing and the Jette scale. (Bartholdy et al. 2017) (DeVita et al. 2018)

In quadriceps strengthening exercise there is a combination of several exercises such as isometric and isotonic. Isometric training is a form of exercise where the exercise is static without involving movement in the joints which can result in painful stimulation of the joints. According to Matrahman (2018), isometric exercises on the quadriceps can increase the strength of the front thigh muscles, making the joint more stable and the muscle tissue in the knee more comfortable, thereby reducing the intensity of pain and increasing the range of motion of the knee joint. Isotonic exercise is an exercise that combines concentric and eccentric contractions. According to Parkhouse in Retno Isti (2022), isotonic training is a form of dynamic training where muscle contractions utilize changes in load and muscle length during the exercise. Isotonic exercises are dynamic exercises with joint movements in the range of motion of the joints that utilize constant or changing resistance or loads that cause joint movement. Matrahman (2018), Retno Isti (2022).

According to researchers' assumptions, quadriceps strengthening exercises are a combination of concentric, eccentric and isometric exercises. Where isometric training has a beneficial effect in the early stages of rehabilitation because the movement is without changes in muscle length with a limited range of motion, while isokinetic training is a movement that is assisted by a tool as an external load to increase the strength of all muscles through the range of motion. This combination movement can have a broad impact in increasing muscle contact which is expected to increase mass and have more strength than before therapy.

6. The effect of quadriceps strengthening exercise on the intensity of pain in osteoarthritis genu patients

Based on the data, it can be seen that the number of respondents who experienced a decrease in pain intensity after doing quadriceps strengthening exercise was 24 respondents, 5 respondents experienced no change, and 1 respondent experienced an increase in pain intensity. Wilcoxon significance results of $0.000<\alpha$ ($\alpha=0.05$) can influence quadriceps strengthening exercise on the pain intensity of genu osteoarthritis patients at Bhayangkara Kediri Hospital in 2023.

Research conducted by Egwu (2018) The results showed that supervised Quadriceps Strengthening Exercise and Self-Management Education were both effective in reducing pain and disability in knee osteoarthritis but the improvement in results was better maintained with Self-Management Education. The significant difference between pain measures before and after exercise is because this increase in quadriceps muscle strength breaks the pain cycle by reducing muscle spasms, increasing muscle strength and increasing circulation, which reduces metabolic concentration. Strengthening exercise intervention with weight bearing or non-weight bearing has been proven to reduce pain intensity compared to aerobic exercise. Other research also shows significant changes in pain scores through comparisons before and after giving quadriceps strengthening exercise as measured by VAS and WOMAC (Bokaeian et al., 2018).

Putri Intan and Taufik Eko (2022) stated that strengthening the quadriceps muscles has a good effect on reducing pain intensity and restoring functional activity in sufferers of osteoarthritis genu. In this study, it was also said that people with genu osteoarthritis who still have good muscle strength will experience less pain relief and better functional activities than genu osteoarthritis sufferers whose quadriceps muscle strength is weaker. Strong quadriceps muscles can stabilize the knee joint because

they can reduce the impact that occurs on the joint. This can happen because strong quadriceps muscles will spread the force over a wider area until the intensity of the pain decreases. In this study, the reduction in pain and disability in the experimental group could be attributed to increased quadriceps muscle strength and thus increased stability, leading to reduced pain and disability. By prioritizing slow movements to break down deposits and form new gaps to regulate collagen synthesis, this plastin substance functions as a replacement for new tissue consisting of proteins containing amino acids that will be synthesized, with the aim of reducing the formation of abnormal adhesive (stiffness). Knee ROM can be increased by increasing protein contractility and the oxidation system in the quadriceps muscle, which is characterized by increasing muscle oxygen supply as an initial increase in metabolism and tissue repair (Susilawati et al., 2015).

According to researchers' assumptions, the muscle strength experienced by patients after quadriceps strengthening exercise will make patients more willing to do activities because the joint space becomes wider so the pain they feel will be reduced. Quadriceps strengthening exercise can improve joint function, increase joint strength, protect joints from damage by reducing stress on joints, prevent disability and improve physical fitness.

CONCLUSIONS AND RECOMMENDATIONS

There is an effect of quadriceps strengthening exercise on increasing muscle strength and decreasing pain intensity in osteoarthritis genu patients at Bhayangkara Hospital, Kediri in 2023. With the results of this research, it is hoped that it can become one of the protocols for treating osteoarthritis genu patients in health service institutions, in order to increase the patient's functional activity, quality of life of patients and quality of health services**.**

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