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The effect of straight leg raise on reducing pain and increasing functional ability of the knee joint in patients with osteoarthritis genu

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Abstract

Background: Osteoarthritis of the genu is one of the most common types of osteoarthritis, especially in the elderly population. This disease causes the destruction of cartilage in the knee joint, leading to pain, stiffness, and decreased functional ability in performing daily activities. Postmenopausal women are more susceptible to osteoarthritis due to hormonal changes that affect bone and muscle health. Muscle strengthening therapy, such as the Straight Leg Raise (SLR), is used as one of the rehabilitation methods to reduce pain and improve functional ability in patients with osteoarthritis genu by strengthening the quadriceps muscles that support the knee.
Purpose: To assess how SLR exercise helps patients with knee osteoarthritis by lowering pain and increasing functional abilities.
Method: 24 patients were split into treatment and control groups in this quasi-experimental investigation. The Visual Analog Scale (VAS) was used to measure pain, and the Knee Injury and Osteoarthritis Outcome Score (KOOS) was used to measure functional ability.
Results: The treatment group showed significant reduction in tenderness and motion pain, as well as increased functional ability compared to the control group. Wilcoxon and Mann-Whitney U tests showed significant differences.
Conclusion: SLR exercises are effective in strengthening the quadriceps muscles, reducing pain, and improving knee stability. These results support previous studies on the benefits of strengthening exercises in patients with osteoarthritis.

Keywords: Functional Ability; Osteoarthritis; Pain; Physical Exercise; Straight Leg Raise.

INTRODUCTION

Osteoarthritis is one of the health problems that is often encountered due to changes in lifestyle and increasing age. Slowly progressing, osteoarthritis (OA) is a degenerative disease affecting the bones, ligaments, cartilage, and joint lining that can result in stiff joints (Ramadhani, 2019). In comparison to other joint illnesses, osteoarthritis is the most prevalent degenerative joint disease and the leading cause of restricted movement and function. All joints can be affected, but the most common is the weight-bearing joint, namely the knee joint (Nindawi, Susilawati, & Iszakiyah, 2021). Osteoarthritis is a disease that disrupts cartilage metabolism homeostasis with damage to the structure of cartilage proteoglycans, the cause of which is thought to be multifactorial, including due to age, mechanical or chemical stress, excessive joint use, anatomical defects, obesity, genetics and humoral (Arismunandar, 2015).

OA is associated with the aging process and prolonged exposure to stress that can affect the joints. Approximately 9.6% of OA cases worldwide are in men, while 18% are in women over 60,

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according to the World Health Organization. 5 percent of OA cases in Indonesia occur in men over the age of sixty-one. With 255 million people living there, the prevalence of knee OA is rather high in Indonesia, with 15.5% of males and 12.7% of women affected (Ahmad et al., 2018). Based on WHO data, 40% of the world's population over 70 years of age experience Osteoarthritis Genu. The prevalence of Osteoarthritis in Indonesia reaches 5% at the age of 61 years (World Health Organization, 2022). The biggest issue experienced by people with osteoarthritis is the restriction of their ability to perform functional tasks, such as walking long distances, getting out of a squat, climbing stairs, and so on, as well as the disruption of these activities.

Problems in osteoarthritis can be overcome by providing physiotherapy interventions such as physiotherapy modalities that can be given to overcome OA genu sufferers such as straight leg raise exercise therapy. Providing straight leg raise exercises can have an effect on reducing knee osteoarthritis pain which can increase functional activity in osteoarthritis sufferers. SLR is one of the physical therapies that can help increase lower extremity strength and help improve functions related to walking (Hidayatullah, 2013). with exercise therapy in the form of Straight Leg Raise. Straight Leg Raise aims to improve functional activity capabilities and isometric strengthening exercises for the quadriceps muscles with a focus on the rectus femoris muscle.

A degenerative condition of the knee joint, osteoarthritis genu is brought on by cartilage abrasion and the growth of new bone on the joint surface. It can result in pain, restricted movement, and weakness of the muscles and tendons (Pratama, 2019). This disease is divided into two types based on its aetiology, namely primary and secondary osteoarthritis. Primary osteoarthritis is caused by degeneration without congenital abnormalities, while secondary osteoarthritis is caused by trauma or congenital abnormalities such as metabolic, endocrine, and inflammatory disorders (Paerunan et al., 2019). The main risk factors that influence the development of osteoarthritis genu include age, gender, genetic factors, weight, joint injury, and exercise. Increasing age, especially in postmenopausal women, increases the risk of osteoarthritis, while acute joint injuries such as ligament and meniscus tears also increase the risk by five to six times (Hochberg, 2013).

Osteoarthritis is a gradual degenerative disease that causes pain, stiffness, and limited mobility due to destruction to the cartilage in the joints. Bone microfractures, joint structural alterations, and intra-articular hypertension brought on by swelling and mild inflammation are the main causes of osteoarthritis pain (Price & Wilson, 2006). Symptoms of osteoarthritis vary widely, ranging from mild to severe pain that limits movement, depending on the severity of joint damage (Suriani & Lesmana, 2013). The Visual Analog Scale (VAS) is used to measure pain severity; patients rate their discomfort on a scale of 0 to 100 mm, with higher scores denoting more severe pain (Pinzon, 2016). In addition, the patient's functional ability can be assessed using the Knee Injury and Osteoarthritis Outcome Score (KOOS), which evaluates five main dimensions: pain, symptoms, daily activities, sports function, and quality of life (Roos, 2014).

In osteoarthritis genu rehabilitation, Straight Leg Raise (SLR) exercise is often used as a method to reduce pain and improve functional ability. This exercise focuses on strengthening the quadriceps muscles, especially the rectus femoris muscle, which helps stabilize the knee joint and reduce the load on the area affected by osteoarthritis (Joseph et al., 2015). Studies have shown that SLR exercise can significantly reduce pain and improve walking function and daily activities in patients with osteoarthritis genu (Hidayatullah, 2013). By strengthening the muscles around the knee, this exercise is effective in increasing joint stability and improving the patient's quality of life.

RESEARCH METHOD

According to experts, Straight Leg Raise (SLR) exercises have been shown to be effective in strengthening the quadriceps muscles and improving knee stability and reducing pain in patients with genu osteoarthritis. According to Lee et al. (2022), strengthening the quadriceps muscles is very important for improving knee joint stability and reducing osteoarthritis symptoms, because quadriceps muscle weakness can cause knee instability, which worsens pain and dysfunction in

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osteoarthritis patients. In addition, a research carried out by Tanaka et al. (2021) demonstrated that for patients with osteoarthritis in their knees, muscular strengthening activities, such as SLR, can greatly enhance joint function and lower pain levels measured by the Visual Analog Scale (VAS).

This exercise not only increases muscle strength but also reduces pressure on the knee joint, thereby reducing the risk of worsening osteoarthritis (Chen et al., 2023). This is also similar, stating that quadriceps muscle strengthening exercises play an important role in osteoarthritis rehabilitation, significantly improving patients' daily functional abilities (Bennell, & Hinman, 2020). Recent research confirmed that SLR exercises can also improve proprioception or awareness of joint position, which helps maintain joint stability and reduces the risk of further injury in patients with knee osteoarthritis (Patel, & Mehta, 2023).

Thus, the application of SLR in this intervention is backed by the most recent research findings as a successful strategy for lowering pain and enhancing joint function in genu osteoarthritis patients. With a pretest-posttest methodology, this study employed a quasi-experimental design with two groups: the treatment group and the control group. While the control group merely received instruction without any physical exercise intervention, the treatment group received an intervention in the form of Straight Leg Raise (SLR) exercises. The study was conducted for three weeks, with the intervention given twice a week for a total of six sessions. Patients at Soedjono hospital Magelang who had been diagnosed with osteoarthritis genu made up the study's population. The research sample was selected by purposive sampling with inclusion criteria of patients diagnosed with osteoarthritis genu, having moderate to severe pain based on the Visual Analog Scale (VAS), and willing to participate in all research sessions. 24 patients in all were split up into two groups, the treatment group and the control group, each of which included 12 members.

Straight Leg Raise exercise was given to the treatment group with a focus on strengthening the quadriceps muscles, especially the rectus femoris, to improve knee stability and reduce pain. VAS was used to quantify pain, and the Knee Injury and Osteoarthritis Outcome Score (KOOS), which takes into account aspects of pain, symptoms, everyday activities, sports function, and quality of life, was used to measure functional ability. Both before and after the intervention, measurements were made. With a significance level of $\alpha = 0.05$, the Mann-Whitney U test was used to compare results between the treatment and control groups, and the Wilcoxon signed-rank test was used to evaluate differences within groups.

RESEARCH RESULTS

Table 1. Characteristic of Participants (N=24)

Variables	Results
Age (Mean±SD)(Range)(Year)	(60.85±0.489)(55-75)
Age (n/%)	
55-65	12/50.0
>65	12/50.0
Gender (n/%)	
Male	7/29.1
Female	17/70.9

Table 1. The age distribution of participants with osteoarthritis varies with mean age of participants was 60.85 ± 0.489, twelve (50%) are between the ages of 55 and 65, and twelve (50%) are above 65. Therefore, the results of the analysis show that the age of 55 to over 65 years is more dominant in cases of Osteoarthritis Genu. The frequency of the sex of the sample group was 7 males (29.1%) and 14 females (70%). The results of the analysis showed that female were more dominant than men in Osteoarthritis Genu.

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Table 2. Results of The Wilcoxon Test for The Control Group

	Pre KOOS – Post KOOS	Pre tenderness – Post tenderness	Pre motion pain – Post motion pain
Z	-3.063b	-3.166c	-3.140c
Sig.	.002	.002	.002

Based on the output of group 1 control, in the rank table it can be seen that all indicators have a negative rank which means that the pre value is higher than the post or there is a decrease in rank. With significance levels of 0.002, 0.002, and 0.002, the z test statistics for the three indicators are known to be -3.063, -3.166, and -3.140. If the significant value in this test is less than the significance level (α = 0.05), then H0 is rejected. In order to infer that there is a significant difference between the pre and post values on KOOS, Tenderness, and Motion Pain in group 1 control, it is decided to reject H0 because it is known that the three indicators have a significance value below the significance level.

Table 3. Wilcoxon Test Results for Treatment Groups

	PreKOOS - Post KOOS	PrePainPressure - PostPainPressure	PreMotionPain - PostMotionPain
Z	-3.064b	-3.140c	-3.145c
Sig.	.002	.002	.002

Based on the output of group 2 treatments, the rank table shows that all indicators have a negative rank, which means that the pre value is higher than the post or there is a decrease in rank. It is known that the z test statistics on the three indicators are -3.064, -3.140, and -3.143 with significance values of 0.002, 0.002, and 0.002. If the significance value is less than the significance level (α = 0.05), then H0 is rejected in this test. Since the three indicators are known to have significance values below the significance level, it is decided to reject H0 in order to draw the conclusion that the pre and post values on KOOS, tenderness, and motion pain in group 2 treatments differ significantly.

Table 4. Mann Whitney U Test Results for Control and Treatment Groups

	KOOS Difference	Difference in pressure pain	Pain on movement difference
Mann-Whitney U	24,000	21,500	16,000
Sig.	.037b	.027b	.007b

The results indicate that the KOOS variable has a Mann Whitney U test statistic of 24 with a significance value of 0.037, the Tenderness variable has a Mann Whitney U test statistic of 21.5 with a significance value of 0.027, and the Motion Pain variable has a Mann Whitney U test statistic of 14 with a significance value of 0.007. If the significant value in this test is less than the significance level (α = 0.05), then H0 is rejected. In order to conclude that there is a significant difference in KOOS and Motion Pain between group 1 control and group 2 treatment, it is decided to reject H0 because it is known that the KOOS, Tenderness, and Motion Pain variables have a significance value smaller than the significance level.

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DISCUSSION

This study examines the effect of Straight Leg Raise (SLR) on reducing pain and increasing functional ability in patients with osteoarthritis genu. Based on the results of the study, most participants were women, in accordance with the finding that the prevalence of osteoarthritis is higher in women. According to Silverwood et al. (2020), the condition of osteoarthritis in women increases after menopause due to hormonal changes that cause decreased bone density and muscle strength. In weight-bearing joints like the knees, this raises the risk of osteoarthritis. In this study, 70% of participants were women, indicating that gender factors play a significant role in the prevalence of osteoarthritis genu. In addition, age also plays an important role, with participants aged 55-65 years and over 65 years dominating the study sample. According to Cross et al. (2021), the joint degeneration that occurs with age results in a reduction in knee joint stability and elasticity, thereby increasing the risk of osteoarthritis genu in the older population.

Straight Leg Raise exercise significantly reduced pain intensity in both groups (control and treatment), which was evaluated using the Visual Analog Scale (VAS). The measurement results showed a decrease in tenderness and motion pain in both groups after 6 therapy sessions for 3 weeks. Compared to the control group, the treatment group saw a more notable decrease in pain. In addition, there was a significant difference ($p = 0.002$) between the motion pain and tenderness variables according to the Wilcoxon test results. The reason this exercise works is that it develops the quadriceps muscle, which is crucial for stabilizing the knee joint and lessening the strain on the osteoarthritis-affected area. This is also supported by research from Kim et al. (2020), which found that strengthening the quadriceps muscle can effectively reduce pain symptoms in knee osteoarthritis.

In addition to reducing pain, patients with osteoarthritis genu also demonstrated improved functional abilities after SLR training. Measurements using the Knee Injury and Osteoarthritis Outcome Score (KOOS) showed a significant increase in daily activities and quality of life of patients after the intervention. Williams et al. (2021) stated that continuous strengthening exercises can improve joint mobility and function in osteoarthritis patients, thereby improving quality of life. The results of the Wilcoxon test in the control and treatment groups showed a significant increase in functional ability after training ($p = 0.002$). The treatment group, which received intensive SLR training, experienced a higher increase than the control group. This proves that SLR is effective in improving knee function, especially in activities such as walking and standing. This opinion is supported by Gupta et al. (2022), who stated that increased knee joint function after muscle strengthening exercises is directly related to improved quality of daily activities in osteoarthritis patients.

In terms of increasing functional ability ($p = 0.037$), decreasing tenderness ($p = 0.027$), and decreasing motion pain ($p = 0.007$), the treatment group and the control group differed significantly from one another, according to the findings of the Mann-Whitney U test. The treatment group showed better results in terms of decreasing pain and increasing knee function compared to the control group, which only received education. According to Hunter and Bierma-Zeinstra (2023), structured physical exercise is more effective than non-physical interventions in improving joint function and reducing pain in osteoarthritis. All pain measures, including motion pain and tenderness, as well as functional capacity, showed an important distinction between the treatment group and the control group.

This study supports studies conducted in Indonesia, that looked at the connection between age and the extent of joint deterioration in patients with osteoarthritis in the knee (Paerunan et al., 2019). The results confirmed that old age and obesity are the main risk factors, which are also the focus of this study. Through their research, rehabilitation exercises such as SLR were seen as an effective method in improving joint function and reducing pain, although the degree of joint damage continued to increase with age (Paerunan et al., 2019). Meanwhile, research also showed that SLR exercises significantly increased quadriceps muscle strength and reduced pain, even though there were no notable differences between the group that did SLR exercises and the group that used a stationary bicycle. In the context of this study, the conclusion that SLR is a useful intervention was reinforced by the fact that it was demonstrated to be superior in lowering pain and improving functional

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ability in individuals with genu osteoarthritis (Mas'ud, Hasbiah, & Hendrik, 2021).

This study demonstrates that patients with osteoarthritis genuinum benefit from straight leg lift exercises in terms of both pain reduction and improved functional abilities. This finding supports previous studies stating that SLR exercise can be used as an effective physiotherapy modality in treating knee joint problems due to osteoarthritis. This exercise helps strengthen the muscles around the knee, improves joint stability, and ultimately, improves the quality of life of patients with osteoarthritis genu.

CONCLUSION

In individuals with osteoarthritis genu, the Straight Leg Raise (SLR) exercise has been demonstrated to be beneficial in lowering discomfort and enhancing functional abilities. Significant pain reduction and improvement in day-to-day activities were demonstrated by evaluation utilizing the Knee Injury and Osteoarthritis Outcome Score (KOOS) and Visual Analog Scale (VAS). This exercise strengthens the quadriceps muscle, which helps stabilize the knee joint and reduces pressure on the damaged area, making it an effective therapy for knee osteoarthritis.

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