

Effect of Combinations of Quadriceps Exercise and Hip Abductor Exercise on Pain in Knee Osteoarthritis Patients in Orthopedic and Traumatology Outpatient Care

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ABSTRACT

Background: Osteoarthritis is a disorder of the moving joints. Pain functioning are the main complaints of the disease osteoarthritis of the knee. The purpose of the study was to analyze the effect of a combination of quadricep exercise and hip abductor exercise on pain in knee among osteoarthritis patients.

Subjects and Method: The study was carried out at the East Java Regional Hospital for the period of December 2022 to March 2023. The study population was knee joint osteoarthritis patients of degree 1 to degree 2. The sampling technique used in this study was purposive sampling, with inclusion and exclusion criteria. The number of samples in quantitative research was 60 respondents. The dependent variable is pain, while the independent variable is quadriceps exercise and hip abductor exercise. The instrument used is the WOMAC questionnaire. Analysis of the study was using the Wilcoxon test and the mann whitney test.

Results: There was a significant difference in pain between the control and intervention groups after conducting a combination of quadriceps exercises and hip abductor exercises ($p=0.043$)

Conclusion: The combination of quadriceps exercise and hip abductor exercise is effective on pain reduction in knee osteoarthritis patients.

Keywords: quadriceps, hip abductor, osteoarthritis.

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BACKGROUND

Osteoarthritis is a disorder of moving joints (Pratama, 2019). Pain is a complaint that is felt in any part of the body caused by an inflammatory or idiopathic process. The onset of pain causes problems with the patient's physical ability to function such as changing positions from sitting or supine to a standing position and daily activities (Tavakoli-Far et al., 2021).

Pain occurs in more than half of all elderly with osteoarthritis, which causes more chronic pain than any other condition. This

extraordinary joint pain due to OA can result in a person's inability to carry out certain activities and results in as many as 80% of sufferers experiencing limited movement and 25% unable to even continue their usual activities (D.D.P. et al., 2018).

Globally, knee osteoarthritis occurs for more than 80% of osteoarthritis (OA) patients. In the United States, KOA (Knee Osteoarthritis) affects around 37% of adults over the age of 60 years old (Wang et al., 2021). In general, the prevalence of joint disease in Indonesia is very high by 30.3%. At

the age of 45-54 years old, the prevalence is 46.3%. Age 55-64 years old is 56.4%, age 65-74 years old is 62.9% and age over 75 years old is 65.4. Based on the 2018 Basic Health Research (RISKESDAS), the prevalence of joint disease based on the diagnosis by health workers reached 11.9%, while based on symptoms or diagnosis it was 24.7%. In East Java, the prevalence of joint disease is 26.9% (Health Research and Development Agency, 2018). In the preliminary study of interviews with knee OA patients, some of them experienced decreased mobility, and suffered from an inability to perform daily activities.

Based on the results of Magnetic Resonance Imaging (MRI), it was found that the sources of pain, joint stiffness, and physical function that occurred were thought to come from joint inflammation (synovitis), joint effusion, and bone marrow edema (Winangun, 2019). This will cause joint pain in OA sufferers and is included in the category of deep somatic pain where the pain receptors are located in the muscles and bones and other body supports (Tavakoli-Far et al., 2021). Pain classification is based on the Western Ontario and Mc Master Universities Osteoarthritis Index score interpretation, the pain score range is 0-4 (Karsten et al., 2019). Pain that is felt in OA patients includes non-neurogenic neuromusculoskeletal pain, and is often referred to as arthralgia, namely pain due to pathological processes in the joints (Sharma, 2021).

Management of osteoarthritis joint pain can be carried out with non-pharmacological therapy (education, physical therapy or rehabilitation), pharmacological therapy (medical), intra-articular therapy (intra-articular corticosteroid injections), surgery, and occupational therapy (assessment of the patient's functional ability) (Abramoff and Caldera, 2020). In pharmacological management, the potential for interactions

between one class of drugs of the non-pharmacological treatments is physical exercise. Physical exercises that are carried out are lower extremity strengthening exercises, especially quadriceps exercises which are very necessary for knee osteoarthritis patients (Xie et al., 2018).

Hip abductor strength plays an important role in decreasing the knee adduction moment. Quadriceps exercise is called static contraction, which is a muscle contraction where the joint is in a static state, a key exercise to maintain the health of the extensor mechanism. These activities lubricate the patellofemoral joint, increase superior glide of the patella (necessary for full knee extension), and increase or maintain quadriceps muscle strength. Full knee extension with quadriceps activation is required for a normal gait. Hip abductor exercises or hip abductor strength exercises play a major role in reducing knee adduction moments, as they counteract the decline of the contralateral swinging leg hip during the single leg stance of the gait phase. This intensifies the force on the medial knee portion of the stance leg. Theoretically, the higher the hip abduction force, the greater the adduction moment of the lower knee, which can decrease pain and improve function in patients with knee OA. Hip abductor exercises are performed 4 sets in the morning, and then continue in the evening for 3 days a week (Yuenyongviwat et al., 2020).

The combination of pharmacological and non-pharmacological therapy is an integrated management of osteoarthritis (Laksmi Ambardini, 2015). The lower quadriceps extremity strengthening combined with the hip abductor strengthening is a simple exercise aimed at relieving pain and improving the functional outcome of the knee. This incorporation in treating knee osteoarthritis patients produces good functional results and is cost-effective (Thaga-

dur et al., 2021). The assessment used in evaluating this combination of quadriceps exercise and hip abductor muscle is to use the WOMAC pain score (Mikuls et al., 2020). Based on the phenomenon above, the researcher was interested in conducting a study entitled "The Effect of a Combination of Quadricep Exercises and Hip Abductor Exercises on Pain in Knee Osteoarthritis Patients".

SUBJECTS AND METHOD

1. Study Design

This study used a quantitative method with a quasi-experimental design. The study was conducted at the Orthopedic and Traumatology Outpatient Hospital in the East Java Regional Hospital from December 2022 to March 2023.

2. Population and Sample

The study population was knee joint osteoarthritis patients of degree 1 to degree 2. The sampling technique used purposive sampling. The number of samples in quantitative research was 60 respondents.

3. Study Variables

The independent variable in the study was training using quadriceps exercises and hip abductor exercises in knee osteoarthritis patients. The dependent variable in the study was the pain of knee osteoarthritis patients.

4. Operational definition of variables
Providing a combination of quadricep exercises and hip abductor exercises is muscle strength training that can increase the stability of the knee joint, blood circulation, the function of the tissues around the joint increases.

Pain in knee joint osteoarthritis patients grade I-2 is an unpleasant subjective sensory and emotional experience caused by actual and potential tissue damage that is unpleasant to occur in a part of the body.

5. Study Instruments

Instrumental pain in patients with degree 1-2 knee osteoarthritis was measured using the WOMAC questionnaire.

6. Data analysis

The analysis used in this study is by using univariate and bivariate analysis with the Wilcoxon test and the Mann Whitney test.

RESULTS

1. Univariate Analysis

Based on the data presented in table 1, it is known that most of the respondents in the intervention group were aged 55-59 years old, female, graduated from high school and were not working. Whereas in the control group it was found that most were aged 55-59 years old, female, graduated from junior high school and did not work. The number of respondents was balanced between the intervention group and the control group, each group consisted of 30 respondents.

It is known that most of the respondents in the intervention group had a pre-pain category in patients with degree 1-2 knee osteoarthritis, namely moderate pain, a category of post pain in patients with degree 1-2 knee osteoarthritis, namely moderate pain. In the work unit variable, the numbers are balanced between the intervention group and the control group, and each group consisted of 30 respondents.

2. Bivariate Analysis

Table 2. showed the results of the data normality test on the pre-test pain variable in patients with knee joint osteoarthritis degrees 1-2. The results of the data normality test in the intervention group showed that the pain variable was normally distributed ($p \geq 0.05$). The results of the data normality test in the control group showed that the pain variable was not normally distributed ($p < 0.05$).

Table 3. showed the results of the data homogeneity test on the pre-test pain vari-

able in patients with degrees 1-2 osteoarthritis of the knee joint. The results of the data homogeneity test showed that the values in the intervention group and the control group were homogeneous ($p \geq 0.005$).

Table 4 showed the results of the analysis before and after conducting treatment in the intervention group using the Wilcoxon test showing that $p < 0.001$ ($p < 0.005$), so it can be concluded that there was a difference in pain before and after being given a combination of quadriceps exercises and hip abductor exercises in the intervention group.

Table 5 showed the results of the analysis before and after conducting treatment

in the control group using the Wilcoxon test showing that $p = 0.070$ ($p < 0.005$), so it can be concluded that there was a difference in pain before and after being given a combination of quadriceps exercises and hip abductor exercises in the control group.

Based on the table 6, showed that there was a significant difference in pain ($p = 0.043$) between the control and intervention groups after conducting a combination of quadriceps exercises and hip abductor exercises.

Table 1. Sample Characteristics

Characteristic	Category	Intervention group		Control group	
		n	%	n	%
Age	30-34 Years old	2	3.3	0	0
	35-39 Years old	0	0	0	0
	40-44 Years old	1	1.7	2	3.3
	45-49 Years old	4	6.7	2	3.3
	50-54 Years old	7	11.7	9	15.0
	55-59 Years old	12	20.0	12	20.0
Gender	60-64 Years old	4	6.6	5	8.4
	Female	23	38.3	25	41.7
Education	Male	7	11.7	5	8.3
	No Education	5	8.3	10	16.7
	Elementary School	7	11.7	4	6.7
	Junior High School	7	11.7	11	18.3
	Senior High School	11	18.3	4	6.7
Employment	University	0	0	1	1.7
	Farmer	2	3.3	2	3.3
	Entrepreneur	4	6.7	4	6.7
	Civil servant	2	3.3	3	5.0
	Self-employed	8	13.3	8	13.3
	Unemployed	12	20.0	10	16.7
Pre-pain in patients with knee joint OA degrees 1-2	Factory workers	2	3.3	3	5.0
	Low	0	0	0	0
	Mild	1	1.7	9	15.0
	Moderate	25	41.7	20	33.3
Post-pain in patients with knee joint OA degrees 1-2	Severe	4	6.6	1	1.7
	Extremely severe	0	0	0	0
	Low	0	0	0	0
	Mild	12	20.0	9	15.0
	Moderate	18	30.0	19	31.7
	Severe pain	0	0	2	3.3
	Extremely severe	0	0	0	0

Table 2. Data Normality Test Results.

Variable	Test	Intervention group		Control group	
		Statistics	Assumption	Statistics	Assumption
Pain	Pre-test	0.089	Normal	0.006	Abnormal

Table 3. Data Homogeneity Test Results

Variable	Test	Statistics	Assumption
Pain	Pre-test	0.404	Homogeneous

Table 4. Pain Variable Wilcoxon Test in the Intervention Group of Knee Osteoarthritis Patients in the Orthopedic and Traumatology Outpatient Ward at the Public Hospital

Variable	n	Mean Rank	p
Negative Ranks	26	15.31	<0.001
Positive Ranks	2	4.00	
Ties	2		

Table 5. Pain Variable Wilcoxon Test in the Control Group of Knee Osteoarthritis Patients in the Orthopedic and Traumatology Outpatient Ward at the Public Hospital.

Variable	n	Mean Rank	p
Negative Ranks	2	4.00	0.070
Positive Ranks	7	5.29	
Ties	21		

Table 6. Mann Whitney Test the Effect of a Combination of Quadriceps Exercises and Hip Abductor Exercises on Pain in Knee Osteoarthritis Patients

Variable	n	Mean Rank	p
Pain			0.043
Intervention group	30	26.02	
Control group	30	34.98	

DISCUSSION

Osteoarthritis is a degenerative joint disease of the joint cartilage with reactive changes at the joint boundaries such as subchondral bone changes, osteophyte formation, fibrous reaction in the synovium, bone marrow changes, and joint capsule thickening. The manifestations that often appear in this disease are stiffness and pain (Ulandari & Puspitasari, 2020). Pain is associated with an individual experience that is felt by everyone due to actual and potential tissue damage that

causes uncomfortable feelings both emotionally and sensory. The level of pain is described through the patient's report of the pain felt. The pain response felt by each patient is different so it needs exploration to determine the pain value. The difference in the level of pain perceived by patients is caused by the ability of one individual to another (Hawks and Joyce, 2014). One of the most widely used measures to evaluate clinically significant changes in patients with KOA is the WOMAC (Western Ontario and

McMaster Universitis Osteoarthritis Index). Pain subscale questions, each representing a different mechanical loading and by identifying activities with early symptoms, it can indicate when structural damage first occurred and therefore, which activities are associated with the onset of pain (Fathi, 2019). WOMAC is used to measure the pain of patients with knee OA consisting of 5 questions (Rashid et al., 2019). A high value obtained indicates the magnitude of the patient's functional limitations, while a lower value indicates an improvement in functional ability. In the aspect of pain, the parameters used are assessment when walking, climbing stairs, doing activities at night, at rest and when supporting.

In theory, giving a combination of quadriceps and hip abductor exercises will have an impact on reducing pain in knee osteoarthritis patients if the implementation is appropriate. In quadriceps and hip abductor exercises, ideally it can be given 3 times a week to show a long term effect after 3-4 weeks. In providing this exercise, which is integrated with the Kolcaba concept in the nursing process, it begins with the nurse's ability to assess the need for comfort related to physical, psychospiritual, sociocultural, environmental experiences of clients and family members. Nurses can identify comfort needs, especially needs that cannot be met by external support systems (Dowd, 2014). In this study, in providing training to patients, the nurses maintain interpersonal relationships by performing effective communication techniques and meeting patient needs such as the need for a sense of security and comfort.

This study is in line with research conducted by Wardojo et al. (2020) which stated that modality therapy such as exercise training has a significant and better effect in improving knee function, reducing pain and also improving quality of life. The decrease

in pain in this study was due to the active movements of the quadriceps and hip abductor strengthening exercises which increase the flexibility of joints and muscles, so as to have the effect of eliminating or reducing pain in the joints. This exercise can also strengthen bones and increase blood flow (Ma et al., 2020; Pramudaningsih and Devi, 2017).

The difference in knee pain in the intervention group and the control group showed the effectiveness of non-pharmacological therapy. This can be seen from the respondents who were given the intervention, complaints of knee pain decreased and felt more relaxed. If the exercise is done regularly, it will increase blood circulation so that metabolism increases and there is an increase in the diffusion of fluids through the bone matrix. Meeting the nutritional needs of cartilage is very dependent on the condition of the joint fluid, so if the joint fluid is good, the nutrient supply for cartilage will be adequate. Having strong muscle contractions due to strengthening exercise will facilitate the pumping action mechanism (pumping back circulating fluids) so that metabolic processes and local circulation can take place properly due to vasodilation and relaxation after maximum contraction of the muscles. Thus, the transport of metabolic and acetabolic remnants produced through the inflammatory process can run smoothly so that pain can be reduced.

AUTHOR CONTRIBUTION

Dia Metasari as the main researcher who selected topics, collected data, analyzed data, and wrote publication manuscripts. Tintin Sukartini and Arina Qona'ah as research members who assisted in preparing the publication manuscripts.

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CONFLICT OF INTEREST

There is no conflict of Interest in this study.

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