

## THE EFFECT OF STRENGTHENING EXERCISE ON THE QUADRICEPT AND HAMSTRING MUSCLES ON CHANGING FUNCTIONAL KNEES FOR PATIENTS WITH KNEE OSTEOARTHRITIS

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### **Abstract**

*Introduction Osteoarthritis is a failure to repair damage in the joints caused by excessive mechanical stress. This disease is chronic, degenerative, non-inflammatory, and slowly progressive, one of which is characterized by decreased function. Osteoarthritis is a form of osteoarthritis that affects people in old age or adulthood. The cause of osteoarthritis is not known with certainty, but age, gender, race, genetics, obesity, and physical activity are risk factors that lead to pathological changes and affect the decreased functional ability. This decrease in functional ability in osteoarthritis can be overcome by isometric exercise.*

*Methods: The research design used was a pre-experimental design with an approach of pretest-posttest one group design. The sampling technique used was total sampling, with a total of 20 respondents aged 40–70 years. Exercise with a frequency of 2 times a week for 8 weeks at an intensity of 3 repetitions for 15 minutes. The measuring instrument in this study used WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index). Normality test using the Shapiro-Wilk test, hypothesis testing using the Wilcoxon Test.*

*The results showed the level of functional ability before being given the intervention had an average value of 2.30 and after being given the intervention had an average value of 1.40. Statistical test results showed p-value = 0.000 (p 0.005). This shows that there is an effect of isometric exercise on changes in functional abilities of patients with Samarinda knee osteoarthritis at AW Sjahranie Hospital.*

*Conclusion: Giving isometric exercise to the quadriceps and hamstrings has an effect on improving the functional ability of the knee in patients with osteoarthritis.*

**Keywords: Isometric Exercise, Functional Ability, WOMAC, Knee Osteoarthritis**

### **Introduction**

Osteoarthritis is a degenerative joint disease that is often found as a result of the progressive destruction of articular cartilage and decreased synovial fluid that lubricates the joints. This disorder develops slowly, not Osteoarthritis is a degenerative joint disease that is often found as a result of the progressive destruction of articular cartilage and a decrease in the synovial fluid that lubricates the joints. This disorder develops slowly, asymmetrically, and non-inflammatoryly, characterized by the degeneration of joint cartilage and the formation of

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new bone (osteophytes) at the edges of the joints. Osteoarthritis generally attacks weight-bearing joints, especially the knee and hip joints. The incidence of knee and hip osteoarthritis is higher than other joints because these two joints support the body's weight more. In Indonesia, the prevalence of osteoarthritis is quite high, namely 5% at the age of 40 years, 30% at the age of 40–60 years, and 65% at the age of >61 years. According to the Basic Health Research Data (Riskesdas) in East Kalimantan in 2018, the prevalence of degenerative diseases was high. Osteoarthritis in Samarinda was 4.78%, Balikpapan was 5.31%, Bontang was 9.54%, and in Mahakam Ulu, the highest incidence of osteoarthritis was 25.86%.

From the aspect of general characteristics of patients diagnosed with osteoarthritis, it shows that age, gender, obesity, race/genetic, and trauma to the joints have a relationship with the occurrence of osteoarthritis. The prevalence of osteoarthritis increases dramatically among people over 50 years of age. This is due to age-related changes in collagen and proteoglycans, which decrease the tension of the joint cartilage and also due to a reduced supply of nutrients to the cartilage. Intense joint pain and stiffness that occurs in patients with knee osteoarthritis can cause problems in carrying out daily activities such as changing positions from sitting or lying down, walking, climbing stairs, standing for too long, praying, and, in more severe cases, causing disability and requiring assistive devices for walking. The presence of knee pain causes a person to be afraid to do activities or movements, resulting in a reduced quality of life. The recommended non-pharmacological therapy is knee exercise. Other types of exercise that can be done are strengthening exercises, including quadriceps and hamstring exercises, as well as aerobics such as walking, cycling, and swimming. The purpose of this exercise is to improve joint function, increase joint strength, protect joints from damage by reducing stress on joints, prevent disability, and improve physical fitness. This exercise is, of course, adapted to the patient's condition and ability.

Morphological and structural changes in cartilage are associated with age, including smoothing and thinning of the articular surfaces; decreased size and aggregation of the proteoglycan matrix; and loss of tensile strength and matrix stiffness. These changes are most often caused by a decrease in the ability of chondrocytes to maintain and repair tissues, such as the chondrocytes themselves, resulting in decreased synthesis and mitotic activity, decreased response to anabolic growth factors, and smaller and non-uniform synthesis of proteoglycans. Osteoarthritis can cause a decrease in functional ability as a result of pain, inflammation, and stiffness in muscles and joints. Decreased muscle strength accompanied by a loss of functional muscle contraction power will result in non-synergistic contractions. Patients with knee joint osteoarthritis will tend to overload their leg movements to avoid the pain and discomfort they feel. However, this tends to worsen the situation, such as the occurrence of symptoms in the form of atrophy of the muscles around the knee (Kisner & Colby, 2013).

To overcome these problems, there are many physiotherapy technologies available, such as exercise therapy. This is done to reduce the problems that exist in the soft tissue so that physical capacity and functional capabilities can be achieved optimally. While exercise therapy is one of the implementations of physiotherapy, which aims to prevent impaired function, develop, repair, restore, and maintain muscle strength, endurance, mobility, flexibility, stability, and functional ability. In this study, the researcher chose to use an exercise therapy modality, namely isometric strengthening exercise. When being given this exercise, it is expected to increase muscle strength and can relieve pain and stiffness, so that it can cause changes in the functional ability of knee osteoarthritis. Resistance exercise, or in this case, isometric exercise, given to patients with osteoarthritis provides clinically significant improvements in pain,

muscle strength, functional ability, and anti-inflammatory effects, and reduces the risk of disability (Kisner, 2013). Based on initial observations, it is known that the number of visits by knee osteoarthritis patients to the physiotherapy polyclinic is 60, with an average age of 45 years, from January to December 2020. Various interventions are provided to treat knee osteoarthritis in the form of analgesics, anti-inflammatory, and anti-inflammatory drugs. continued use of electrotherapy, such as transcutaneous electrical nerve stimulation (TENS) and infrared radiation (IRR). This treatment and intervention is temporary. The patient still feels recurring pain, so he has to go to the hospital again. Therefore, we need a method to reduce pain by minimizing the use of drugs.

From the description of the background above, it is clear that the researcher is interested in researching "The effect of giving strengthening exercise on changes in the functional activity ability of patients with knee osteoarthritis at AW Sjahranie Hospital, Samarinda." The purpose of this study was to determine the effect of strengthening exercise on changes in functional activity ability of patients with knee osteoarthritis at AW Sjahranie Hospital, Samarinda.

## **Method**

This study uses a pre-experimental design category with a pretest-posttest one-group design, which aims to record and measure the value of knee functional ability before and after strengthening exercises.

The study population was all knee osteoarthritis patients who visited the physiotherapy clinic of RSUD AW Sharanie Samarinda. The sample selection method used is non-probability sampling with purposive sampling. All knee osteoarthritis patients who were treated at the Physiotherapy Polyclinic who met the inclusion and exclusion criteria were included in the study. The inclusion criteria are: 40–70 years old, have radiological diagnostic results from a doctor suffering from knee osteoarthritis, have no osteopathic history, and are willing to follow the implementation of therapy for 2 times week and eligibility criteria There was no history of cancer, no fracture, no bone TB, and significant actual pain. The research sample that met the criteria was obtained from as many as 20 people. The instrument used in this study was the western Ontario and McMaster Universities osteoarthritis index (WOMAC). In this study, we use 2 variables, which consist of 1 independent variable and 1 dependent variable. The dependent variable (dependent) is Isometric Exercise and the dependent variable (dependent) is Knee Functional Ability.

This research was conducted in the medical rehabilitation installation of the physiotherapy unit. Prior to intervention, patients were asked for approval to be used as research samples by filling out an informed consent form. The intervention provided was in the form of strengthening exercises with isometric exercise techniques in knee osteoarthritis patients, adjusted to the patient's schedule for treatment at the hospital, namely 2 times a week for 8 weeks with 16 treatments. After the intervention was completed, a posttest was carried out in the form of measuring functional activity using the WOMAC form, which was carried out by the researcher directly. Statistical test using non-parametric wilcoxon test to determine the effect of giving strengthening exercise on pretest and posttest results.

## Results and Discussion

Table 1. Characteristics of research subjects

<b>Characteristics</b>	N	%
<b>Age</b>		
45 – 49 Years	2	10.0
50 – 59 Years	11	55.0
60 – 70 Years	7	35.0
<b>Characteristics</b>		
<b>Gender</b>		
Male	9	45.0
Female	11	55.0
<b>Characteristics</b>		
<b>Body Mass Index (kg/m<sup>2</sup>)</b>		
Normal Weight	1	5.0
Over Weight	3	15.0
Obese Tipe 1	14	70.0
Obese Tipe 2	2	10.0

Table 1 shows that most of the respondents in this study were aged 50–59 years (55%). The characteristics of respondents based on gender revealed more female respondents (55%) compared to male respondents (45%). Judging from the type of work of the respondents, most of them are private employees (40%), civil servants (20%), retired (20%), and household workers (20%). Respondents with a body mass index of type 1 obesity suffered more (70%) than respondents who had type 2 obesity (10%).

Table 2 Functional Activity Criteria

Criteria Activity	Pre test		Post test	
	n	%	n	%
Functional				
a. Low risk	-	-	12	60.
b. Medium risk	14	70.	8	0
c. High risk	6	0	-	40.
		30.		0
		0		-

Table 2 above shows that functional activity, prior to intervention (Pretest), obtained criteria for functional activity with a high risk of 6 people (30%) and with moderate risk (70%). Meanwhile, after giving the intervention (Posttest), the criteria were 8 people (40%) and 12 people (60%). It can be seen that the high risk did not exist after the intervention (posttest).

Table 3. Shapiro-Wilk . Normality Test Results

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PRETEST	.438	20	.000	.580	20	.000
POSTTEST	.387	20	.000	.626	20	.000

The results from Table 5.3 can be seen that the results of the normality test using Shapiro Wilk obtained the value for the pre-test variable is  $p = 0.000$ . While the post-test variable obtained the results of  $p = 0.000$ . The  $p$  value before and after treatment on the sample was less than ( $p < 0.005$ ), which means that the data was not normally distributed. Because there are data that are not normally distributed, the hypothesis test uses the Wilcoxon test

Table 4 Table of Wilcoxon Test Results

Pengukuran WOMAC	N	Mean Rank	<i>p</i> -value
<i>Pretest-Posttest</i>	20	9,50	0,000

The results from Table 4 show that  $\text{sig} = 0.00$  ( $p < 0.05$ ), which means that  $H_a$  is accepted, namely there is a change in the functional activity ability of the knee in patients with knee osteoarthritis after being given strengthening exercises with isometric exercise techniques.

#### Based on Sample Characteristics

##### a. Age

The sample in this study amounted to 20 people, including 11 men and 9 women, with an age range of 45–70 years. In the sample of this study, the respondents who experienced the most knee osteoarthritis were aged between 50-59 years; there were 11 samples (55.0%); ages between 45-49 years, there were 2 samples (10%); aged 60-70 years, there were 7 samples. (35%). These data indicate that people of pre-elderly age (50–59 years) can experience osteoarthritis of the knee. Osteoarthritis is considered a disease that occurs due to the normal aging process caused by increasing age. In this aging process, it is seen that there is a relationship with changes in the composition of joint cartilage that lead to osteoarthritis. This theory is in accordance with the results of the study, which can be seen in table 4.1, where the highest frequency of respondents is found to be >50 years old. Someone who has reached the age of > 50 years tends to experience osteoarthritis and this will increase when someone reaches the age of 60 years. This occurs due to a decrease in the quality of proteoglycans, collagen, and nutrient supply to the bone structure so that the quality of the tension decreases. Approximately 80% of osteoarthritis patients have a limited degree of movement and 20% are unable to carry out most of their activities in routine life needs, causing functional decline (Rahmadiyah et al., 2015).

#### b. Gender

This is in accordance with the statement of Zhang et al. (2015) that women are more than twice as likely to develop osteoarthritis as men. Although the prevalence of osteoarthritis before the age of 45 years is approximately the same in men and women, after 50 years the prevalence of osteoarthritis is higher in women, especially in the knee joint. Older women will experience various kinds of musculoskeletal complaints that can reduce their ability to carry out functional activities and decrease their quality of life (Kurniawan, 2015). Osteoarthritis is very closely related to a decrease in functional ability. This is because when women enter menopause, the hormone estrogen will decrease, which will cause significant changes in the hormone estrogen in women, and degeneration and aging will occur more quickly in women, which can increase cartilage classification and decrease chondrocyte function.

#### c. Body Mass Index (BMI)

There were 14 samples with BMI obesity type 1, 2 samples included in the criteria for obesity type 2, 3 samples included in the criteria for overweight and 1 sample included in the criteria for normal. One of the factors in the decline in functional ability in patients with osteoarthritis is body weight. Increased mechanical stress on the cartilage caused by excessive loading on the knee causes a person to carry out functional activities and social activities will be disturbed (Nurramadany, 2017). A person with a high BMI (overweight) will cause abnormal stress on the knee joint. Abnormal stress causes biophysical changes in the form of fracture of collagen tissue and degradation of proteoglycans. The presence of collagen tissue fracture allows synovial fluid to fill the gaps in the cartilage and form subchondral cysts (Aldila, 2016). BMI also affects a person's level of health and fitness. A person with excess body weight will very quickly get various types of diseases. This means that with increasing BMI, the level of health will decrease, which will affect daily activities so that functional abilities will decrease.

#### d. Based on Research Data Description

The change in WOMAC value before treatment was 2.30 and after treatment was 1.40. The high and low values are influenced by age, gender, and body mass index (BMI). The sample was given strengthening exercise with passive isometric technique, consisting of 10% of 45–49 years old, 55% of 50–59 years old, and 35% of 60–70 years old. This is in line with research conducted by Leong (2016), which says that the consequence of the aging process is that more joint and bone degeneration will occur due to low regeneration capacity in old age. In other words, age affects the level of effectiveness of the intervention (Kurniawan, 2015). The value of body mass index (BMI) in the sample showed that there were 2 people with type 2 obesity, 14 people with type 1 obesity, 3 overweight people, and 1 person with normal body weight. One of the factors that causes functional decline in osteoarthritis is weight. The weight factor that plays a role is a mechanical problem. With increasing mechanical stress on the cartilage, resulting in excessive loading on the knee area (Nurramadany, 2016).

#### e. Based on Research Test Results

Based on the results of WOMAC data processing before and after treatment on the sample using the Wilcoxon test, the value of  $p = 0.000$  ( $p < 0.05$ ) means that  $H_a$  is accepted and  $H_0$  is rejected. Thus, it can be concluded that there is an effect of giving strengthening exercise with passive isometric exercise techniques in increasing functional activity in knee

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osteoarthritis patients. Helmi (2012) states that the symptoms of knee osteoarthritis will be found when a person enters the age of 40 years as much as 5%, at the age of 40–60 years, and there will be an increase of 65% at the age of > 61 years, which will affect functional ability. While the body mass index (BMI) states that the greater the body mass index (BMI), the risk of suffering from osteoarthritis will increase, this will certainly affect the ability of physical function in carrying out daily activities. Research conducted by Anwer, S. & Alghadir, A. (2014) entitled Effect of isometric quadriceps exercise on muscle strength, pain, and function in patients with knee osteoarthritis, with research characteristics including age, gender, occupation, and mass index. body. The intervention results show that isometric exercise has a beneficial effect on improving functional ability in patients with knee osteoarthritis. Isometric exercise can have a great effect on increasing functional ability because of the role of large muscle groups that act as flexors and extensors. Giving strengthening exercise with isometric exercise regularly and monitoring it will improve nerve function and improve blood circulation, which has an impact on increasing muscle flexibility, increasing muscle strength and improving joint stability and mobility.

## Conclusion

Based on the results and discussion of the thesis entitled "The Effect of Strengthening Exercise on the Quadricep and Hamstring Muscles on Functional Changes in the Knee of Osteoarthritis Patients," shows that the functional ability of patients with knee osteoarthritis at AW Sjahranie General Hospital Samarinda before strengthening exercise intervention with isometric exercise techniques experienced knee functional problems. After intervention in the form of strengthening exercise with isometric exercise technique in patients with knee osteoarthritis, there was an increase in knee functional ability in patients with knee osteoarthritis. So it can be concluded that "There is an effect of giving strengthening exercises with isometric exercise techniques on functional changes in patients with knee osteoarthritis."

Based on the conclusions of the study entitled "The Effect of Strengthening Exercise on the Quadricep and Hamstring Muscles on Functional Changes in the Knee of Osteoarthritis Patients" there are several suggestions that the researcher wants to convey as follows:

- a. For Participants Provide advice to respondents to intervene with strengthening exercises with isometric exercise techniques to improve functional abilities in patients with knee osteoarthritis".
- b. For Additional Researchers Provide advice to further researchers to be able to control the factors that can affect the decline in functional ability in patients with knee osteoarthritis such as genetic factors, race, nutrition, physical activity, obesity level and type of work.
- c. For Teachers The results of this study can be used as a scientific reference and can be applied, especially in the musculoskeletal module related to improving functional ability in knee osteoarthritis.
- d. For Physiotherapy Professionals It is hoped that with the results of this study, other health workers can provide training information related to interventions that will be given and can apply strengthening exercises with isometric exercise techniques to improve functional abilities in patients with knee osteoarthritis.

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