



## **LEG EXERCISE CAN REDUCE PAIN AND IMPROVE FUNCTIONAL ACTIVITY ABILITY OF OSTEOARTHRITIS PATIENTS**

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ABSTRACT	Keywords
<p>Osteoarthritis (OA) is a non-inflammatory degenerative joint disease that can affect health and tends to cause joint pain, decreased ability to function and has an impact on reducing the quality of life of sufferers. This disease most often occurs in the knee. Generally, the cause of osteoarthritis is unknown, and is called primary osteoarthritis. Efforts to reduce pain in osteoarthritis patients and improve functional activity ability are by giving leg exercise. This study aims to determine the effect of leg exercise on joint pain and functional ability of elderly people with osteoarthritis. The research design used is a pre-experiment design using the type one group pretest-posttest design without control group. The sampling technique used purposive sampling with a total of 39 respondents. Pain assessment using Verbal Descriptor Scale (VDS) and functional ability in knee osteoarthritis (OA) patients assessed using WOMAC parameters. Data were analyzed using the Wilcoxon Signed Rank Test for joint pain data and the Paired Samples T-Test for functional ability data. The results of the Wilcoxon Signed Rank Test test obtained a p value = 0.001 (p &lt;0.05) which means that there is an effect of leg exercise on reducing pain in osteoarthritis patients at the Mulia Hati Wonogiri General Hospital. The results of the Paired Samples T-Test Test showed a value of p = 0.001 (p &lt;0.05), so there is an effect of leg exercise on improving the functional abilities of osteoarthritis patients at the Mulia Hati Wonogiri General Hospital. It is hoped that parties related to this condition can provide and provide education on leg exercise methods to reduce pain and improve the functional abilities of osteoarthritis sufferers.</p>	<p><b>Leg exercise, osteoarthritis, joint pain, functional ability, quality of life</b></p>

## INTRODUCTION

Osteoarthritis (OA) is a chronic disease characterized by abnormalities in bone cartilage, which is the part of the joint that lines the ends of the bones to facilitate joint movement. Abnormalities in the cartilage will result in bones rubbing against each other, resulting in symptoms of stiffness, restriction of movement in the joint and pain (Mahmoudian et al., 2021). This causes discomfort in some patients. Disorders of comfort are a state or feeling of less relief, less pleasant and perfect in the physical, psychospiritual, environmental and social dimensions (Februanti, 2019).

Malanga et al., 2020 mentioned that OA is one of the ten most disabling diseases in developed countries. Worldwide estimates are that 9.6% of men and 18.0% of women aged over 60 years have symptomatic OA. 80% of those with OA will have limitations in movement, and 25% are unable to perform their major daily living activities. Whereas in Indonesia, the prevalence of OA is 11.9% of the total Indonesian population with the highest incidence rate at the age of > 75 years, which is 33%.6 For knee OA, the prevalence is quite high, namely 15.5% in women and 12.7% in men (Lespasio, et al., 2017).

Osteoarthritis can change the alignment of walking patterns, posture, and physical activity levels. This is influenced by the role of changes in joint biomechanics, thus affecting the function and quality of life of sufferers such as daily functional activities, such as weight-bearing activities involving knee flexion, sitting and getting up from a chair or toilet, going up and down stairs, squatting. Rheumatoid arthritis patients also experience physical limitations such as recreation, gardening, swimming, and household activities (Kisner & Colby, 2022).

Pain is a feeling that is often complained of by osteoarthritis patients to doctors at the beginning of coming to health

services or hospitals. The pain felt in osteoarthritis patients includes non-neurogenic neuromusculoskeletal pain, usually often referred to as altralgia, namely pain due to pathological processes in the joints. The process of pain in the joints can be caused by inflammatory, immunologic, non-infectious, bleeding and malignant processes (Arlis, 2017). In research conducted by Ismail (2017), it was found that the characteristics of pain intensity measured using (VAS), mild pain amounted to 22.9%, moderate pain 50.0% and severe pain 27.1% of the total 70 respondents.

Functional impairment in osteoarthritis patients is caused by pain. This pain is associated with decreased functional activity and muscle strength. The muscle is the main stabilizer of the knee joint which functions as a protector of the knee joint structure. With this pain, it will also reduce the range of motion of the joint because with this pain the joint is rarely moved. Decreased strength accompanied by loss of functional muscle contraction power will result in non-synergistic (non-physiological) contractions, thereby increasing excessive loading stress on one of the joint contact surfaces, which will then increase the progressivity of the joint degenerative process (Khairuruizal, Irianto and Ramba, 2019).

A person's functional level can be improved in various ways, including increasing muscle flexibility, reducing pain and increasing functional activities in patients with knee osteoarthritis. Stretching is considered capable of increasing muscle flexibility. There are various types of stretching that can be given, one of which is hold relax (Yudiansyah & Prafitri, 2021).

Bellamy, et all (2014) state that doing leg exercises regularly with ideal movements can reduce pain and improve joint repair. This is supported by the theory from Park, et all (2015) which states that if

the exercise is done correctly and regularly, within 2 weeks the pain will decrease. However, you must pay attention to your ability and physical condition when doing this exercise. Haryoko and Bustam's research (2019) shows that there is a significant difference in the static ability of patients before and after routinely getting ankle strategy exercise intervention.

Although osteoarthritis does not lead to death, it can interfere with activities. Because the disturbance of joint pain in the knee, stiffness, and swelling often causes limitation of movement, so that it can have an impact on independence in self-care and adversely affect the quality of life. Based on this fact, researchers provide nursing interventions in the form of exercises, namely leg exercises to reduce pain and improve the functional activity abilities of osteoarthritis patients at Mulia Hati Wonogiri Hospital.

## METHOD

This type of research is a pre-experiment with a one group pretest-posttest design. The research approach is quantitative. One group pretest-posttest design is a research activity that provides an initial test (pretest) before being given treatment, after being given treatment then gives a final test. Leg exercise is done 4 times a week with implementation in the morning with a duration of 20-30 minutes per training session.

The population in this study were 64 patients with OA diagnosed in the last 3 months and a sample of 39 respondents was obtained. The sampling technique used by the author is non probability sampling with purposive sampling approach. purposive sampling. The sample selection criteria are as follows, namely Inclusion criteria Osteoarthritis patients based on medical examination and data from medical records Osteoarthritis patients who can see and listen

normally and Exclusion criteria Osteoarthritis patients who experience complications such as paralysis, experience Osteonecrosis B or Baker CYST Rupture, Osteoarthritis patients with special care and Osteoarthritis patients by taking drugs (anti-pain) 2 hours before leg exercise. The research has passed ethics and obtained a research permit from Mulia Hati Wonogiri Hospital with letter number 029/RSUMHi/XII/2021 and a certificate of completion of the research with letter number 014/RSUMHi/I/2022.

Pain measurement is carried out using the Verbal Descriptor Scale (VDS) The results of measuring the pain scale are assessed with the results: the highest value is 7 and the lowest value is 0. With criteria: Scale 1: no pain, Scale 2: very mild pain, Scale 3: mild pain, Scale 4: not so severe pain, Scale 5: moderately severe pain, Scale 6: severe pain, Scale 7: almost unbearable pain.... Physical and social functioning was evaluated using the WOMAC. The WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) is an index used to assess the state of patients with osteoarthritis of the knee. The measurement tool is a questionnaire containing 17 questions related to physical activity (The lower the total score, the better the functional ability).

The number of samples <50 then the normality test uses Shapiro-Wilk with a confidence level of 95%. Furthermore, the pain outcome was analyzed using the Wilcoxon Signed Rank Test because the data was not normally distributed, while the functional activity ability outcome used the Paired Samples T-Test test because the data was normally distributed.

## RESULTS

The study was conducted at Mulia Hati Wonogiri Hospital located on Jalan Raden Mas Said, Brumbung, Kaliancar,

Selogiri, Wonogiri, Central Java which has orthopedic poly services. Based on the research criteria with the screening sheet, 39 OA patients were obtained who were eligible to be research respondents. The frequency distribution of respondents based on age, gender, and occupation is shown in table 1.

**Table 1 Frequency Distribution of Respondents (n = 39)**

Characteristics	Frequency (f)	Percentage (%)
<b>Gender</b>		
Male	13	33,3
Female	26	66,7
<b>Age</b>		
46 - 55 years (early elderly)	12	30,8
56-65 years (late elderly)	27	69,2
<b>Jobs</b>		
IRT	9	23,1
Self-employed	14	35,9
Private	6	15,4
Not working	10	25,6

Table 1 shows that most of the respondents were female (66.7%), while 33.3% were male. The age of respondents was mostly between 56 to 65 years old (69.2%), with a small proportion between 46 to 55 years old (30.8%). Most respondents worked as self-employed (traders) at 35.9% and a small proportion of respondents who did not work (15.4%). The frequency distribution of respondents based on the pain

intensity of respondents before being given leg exercise is shown in table 2 below.

**Table 2 Frequency distribution of respondents based on pain intensity before being given leg exercise**

Pain intensity before leg exercise	Frequency (f)	Percentage (%)
No pain	0	0
Very mild pain	0	0
Mild pain	7	17,9
Moderately severe pain	15	38,5
Severe pain	17	43,6
Pain is almost unbearable	0	0
Total	39	100

Table 2 shows that most respondents before leg exercise experienced pain with severe pain intensity of 43.6%. A small proportion of respondents with mild pain (17.9%). The frequency distribution of respondents based on pain intensity after being given leg exercise is shown in table 3 below.

**Table 3 Frequency distribution of respondents based on pain intensity after being given leg exercise**

Pain intensity after leg exercise	Frequency (f)	Percentage (%)
No pain	0	0
Very mild pain	7	17,9
Mild pain	21	53,8
Moderately severe pain	11	28,2
Severe pain	0	0
Almost unbearable pain	0	0
Total	39	100

Table 3 shows that most respondents after leg exercise with a frequency of 4x a

week every morning with a duration of 20-30 minutes per therapy were 53.8% with mild pain intensity. A small proportion of respondents with very mild intensity pain (17.9%). The results of the normality test of pain intensity data on pre-test and post-test leg exercise respondents are shown in Table 4 below.

**Table 4. Results of the normality test of pain research data**

Data	Z	p	Conclusion
Pretest pain intensity	0,784	0,01	Not normally distributed
Post test pain intensity	0,799	0,01	Not normally distributed

The data normality test uses the *Shapiro Wilk* test considering the data is less than 50 respondents. Table 4 shows that the *pre-test* and *post-test* data on respondents' pain intensity have a significance value of  $p = 0.01$  ( $p < 0.05$ ) so that the data is not normally distributed. The research data was then tested using the *Wilcoxon* test. As for the effect of *leg exercise* on reducing the pain of Osteoarthritis patients The results of the test of the effect of *leg exercise* on reducing the pain of osteoarthritis patients are shown in table 5 below

**Table 5. Test results of the effect of leg exercise on reducing pain in osteoarthritis patients**

Pain	Mean±SD	Median	Mode	Min	Max	p-value
Pretest	4,25±0,75	4	5	3	5	0,001
Post test	3,10±0,68	3	3	2	4	

Table 5 shows the average value of respondents' pain at the time of the *pre-test*

of  $4.25 \pm 0.75$ , median value 4, mode 5. The lowest value was 3 and the highest was 5. Respondents' pain decreased in the *post test* as indicated by an average value of  $3.10 \pm 0.68$ , median value 3, mode 3. The lowest value was 2 and the highest was 4. From the description of respondents' pain data between the *pre-test* and *post-test*, it can be seen that there is a decrease in pain values, both the average value, median, mode, lowest pain value and highest pain value. Based on the results of the *Wilcoxon Signed Rank Test*, it is known that the  $p\text{-value} = 0,001$  ( $p < 0,05$ ) with the hypothesis decision is  $H_0$  rejected.  $H_0$  is rejected, meaning that there is an effect of *leg exercise* on reducing the pain of osteoarthritis patients at the Mulia Hati Wonogiri General Hospital.

For the *outcome* of osteoarthritis (OA) functional ability, the frequency distribution of the mean functional ability of osteoarthritis respondents before and after *leg exercise* can be shown in table 6 below.

**Table 6. Frequency distribution of respondents based on functional ability before and after being given leg exercise**

Function al ability	Mea n	Media n	SD	Mi n	Ma x
Pre test	44,78	44	5,689	34	54
Post test	54,52	56	3,159	43	63

The level of functional ability of osteoarthritis patients after being given *leg exercise* obtained the lowest score of 43.00 and the highest score of 63.00, a value of 54.52 and a standard deviation of 5.15, so that statistically it can be concluded that there is an increase in the functional ability of osteoarthritis respondents after being given *leg exercise*. To determine statistical tests on functional activity ability data, the data normality test is carried out which is listed in table 7 below.

**Table 7. Normality test results of functional ability research data**

Data	<i>p</i>	Conclusion
Functional ability <i>pre test</i>	0,269	normally distributed
Functional ability <i>post test</i>	0,298	normally distributed

From the data normality test, it was found that the data group before *leg exercise* was normally distributed  $\rho$  value = 0.269 > 0.05 and the data group after *leg exercise* was normally distributed  $\rho$  value = 0.298 > 0.05. Because the data obtained is normally distributed, it can be done with the *Paired Samples T-Test* test. The effect of the *leg exercise* method on the functional activity ability of osteoarthritis (OA) respondents can be seen in the following table.

**Table 8. Test results of the effect of leg exercise on ability functional osteoarthritis patients**

Functional ability	Mean	<i>T</i>	<i>p-value</i>
<i>Pre test</i>	44,78	-22,081	0,001
<i>Post test</i>	54,52		

Based on table 8 using the *Paired Samples T-Test test*, the  $\rho$  value = 0,001 ( $p$  value <0,05) was obtained, so  $H_0$  was rejected, which means that there is a significant effect of *leg exercise* on improving functional abilities in osteoarthritis patients

## DISCUSSION

Based on the results of the research conducted, 66,7% of respondents were female. According to Syahbani, et al., 2023 that female gender increases the risk of knee OA incidence by 1.84 times. The prevalence of knee OA increases significantly in women over 55 years of age when the onset of menopause begins in most women. During the age period of 50-80 years, women experience a significant reduction in estrogen hormones. Estrogen plays a role in

bone formation, working with vitamin D, calcium, and other hormones to effectively break down and rebuild bone according to the body's natural processes. Research conducted by Duha (2019) shows 78.8% of people with knee OA pain are women.

Most of the respondents in this study were known to be aged 56-65 years. Fatmawati in 2021 explained that a person's age has an important role in the occurrence of osteoarthritis, this is due to the aging process. Reduced joint proprioception, cartilage classification, and reduced chondrocyte function are problems that occur in the joints when the aging process comes, causing the joints to experience weakness. Another impact of the aging process is a decrease in muscle strength which occurs due to a decrease in muscle morphology. There is a *progressive* loss of *lean body mass* or active body tissue starting at the age of 40 years. This process occurs with a 2% decrease in basal metabolism accompanied by body systems, so that when age begins to increase, the incidence of knee osteoarthritis increases (Aini *et al.*, 2017). The results of research by Abdurrachman *et al.*, 2019 mentioned 62.5% of respondents aged between 65-69 years in research on the effect of *cycling exercise* on reducing pain in osteoarthritis.

The respondent's occupation data showed that 35.9% were self-employed. In'am & Darmawan in 2022 stated that factors that can play a role in increasing the risk of osteoarthritis are work or physical activity. The same opinion was expressed by Rachmi & Murdan in 2022 that the risk factors for the onset of knee osteoarthritis were due to work. *Osteoarthritis* is found in heavy physical laborers, especially those who use a lot of strength resting on the knees and waist and in long work duration. A higher prevalence of knee OA is found in porters, farmers or traders compared to workers who do not use knee strength such



as administrative workers. Strenuous physical activities such as prolonged standing (2 hours or more daily), long walking (2 hours or more daily), are risk factors for knee *osteoarthritis*.

Based on the research data, it is known that most respondents (43.6%) experienced osteoarthritis pain before *leg exercise* in the severe pain intensity category. Delaney in 2021 defines knee osteoarthritis as a degenerative joint disease related to damage to the cartilage of the knee joint, a disease of joint cartilage damage that develops slowly and has no known cause, although there are several risk factors that play a role, such as age, gender, history of knee trauma, obesity and excessive physical activity. Research conducted by Indrayana in 2020 explained that the respondent's knee OA pain after doing *range of motion exercise* experienced a decrease in pain levels.

Based on the results of the study, the researcher obtained data that knee OA pain in respondents was more after excessive physical activity. The daily physical activities carried out by respondents as self-employed (traders) in the market have quite heavy activities such as lifting merchandise such as various types of vegetables, fruit, or basic necessities such as rice, making respondents experience pain in the knee. The routine activities carried out by respondents who experience OA pain are in line with the opinion of Utari (2021), that heavy physical activity such as prolonged standing (2 hours or more every day) affects the level of knee OA pain.

The intensity of knee osteoarthritis pain in respondents after *leg exercise* with a frequency of 4x a week every morning with a duration of 20-30 minutes per therapy has decreased. after doing *leg exercise* it was found that 28.2% of respondents experienced quite severe pain 53.8% of respondents with mild pain intensity, and

17.9% of respondents with very mild intensity pain. According to the *gate control theory*, the effort to close the defense to prevent the release of substance C and substance P which are pain transmitters is to produce a dominant input of beta-A fibers that will inhibit pain, this effort can be done one of them with *leg exercise* (Beard *et al.*, 2019). According to Noret *et al.*, 2022 states that *leg exercise* done regularly can improve blood circulation and stimulate an increase in body enzymes that play a role in the process of tissue oxygenation.

Giving *leg exercise* to respondents for 4 times in 1 week, can help reduce the intensity of knee OA pain. *Leg exercise* when done properly and correctly can reduce cytokine levels in synovial fluid of respondents with knee pain, by inhibiting cartilage degradation and improving pain symptoms. Cytokines are one of the chemical mediators of inflammation and if cytokine levels drop, the mechanism of stimulation of *nociceptors* by *noxious* is inhibited and the transduction process in the pain mechanism is inhibited. The types of cytokines that play a role are TNF $\alpha$  and IL-1B. TNF- $\alpha$  and IL-1B function to stimulate the release of prostaglandins and nitric oxid (NO) which are useful in reducing prosteoglandin synthesis and reducing bone matrix. This makes the joint surface slippery and the joint easy to move. *Leg* respondents if done regularly will increase blood circulation so that metabolism increases and there is increased diffusion of joint fluid through the bone matrix (Mikkelsen *et al.*, 2022). *Leg exercise* is highly recommended for respondents because it can directly improve the health of respondents, namely by increasing joint mobility, strengthening the muscles that support and protect joints, reducing pain, and reducing joint stiffness (Lee *et al.*, 2020).

Regular *leg exercises* can help several mechanisms in the process of reducing pain

intensity, namely reducing inflammatory chemical mediators such as cytokines, reducing MMP-3 which plays a role in cartilage matrix degradation, increasing metabolism and strengthening the *quadriceps* muscle. With these mechanisms, the chemical and mechanical noxious stimulus that affects tissue damage becomes minimal. If the stimulus that causes pain is minimal, the initial process of pain is inhibited so that it will affect the next process, namely transmission, perception and modulation (Tamsuri et al., 20120). *Leg exercise* in an effort to reduce pain works by reducing stimulation of nerve endings or blocking their direction of travel. A study describes osteoarthritis interventions which explain that non-pharmacological treatments, such as exercise, are very effectively used especially among older people in reducing joint pain levels (Quicke, et al., 2020.).

Functional ability is a process to determine the patient's ability to carry out specific activities in relation to daily life routines that are integrated in their activity environment (Rosadah & Aktifah, 2021). Meanwhile, functional disability is an inability to carry out a certain activity or activity as befits a normal person caused by a condition of loss or disability, whether psychological, physiological, or abnormalities in anatomical structure or function (Khairurizal, et al., 2019).

Body parts that experience injury or damage due to many factors, one of which is rheumatoid arthritis. Osteoarthritis can change posture, alignment of walking patterns and level of physical activity, which is more or less influenced by the role of changes in joint biomechanics, thus affecting the function and quality of life of patients such as, daily functional activities, such as weight-bearing activities involving knee flexion, sitting and getting up from a chair or toilet, going up and down stairs,

squatting. Rheumatoid arthritis patients also experience physical limitations such as recreation, gardening, swimming, and household activities (Kisner & Colby, 2022).

Based on the results of statistical analysis using the *Paired Samples T-Test test*, the  $p$  value is 0.001, which means that there is a significant effect of leg exercise on improving the functional abilities of osteoarthritis patients. The results of this study are in accordance with the explanation of Wahyuni and Zakaria (2021) that leg exercises can have a major influence on improving functional abilities. According to Suwarni et al., (2017) continuous muscle contraction will increase the action potential and nerve impulses originating from the spinal cord. This nerve impulse will be regulated in part by signals transmitted from the brain to the motor neurons in the anterior spinal cord, and in part by signals originating from the muscle bundle contained in the muscle itself.

Regular and monitored *leg exercise* 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 so that it can lead to functional muscle recovery (Arifin, et al., 2020). The results of this study are in line with supporting the results of previous studies that elderly patients with knee osteoarthritis can safely practice an aerobic walking program for 12 weeks. The 12-week aerobic walking program was successful in increasing step count and functional capacity and knee pain. Therefore, aerobic walking program should be considered as physical therapy in the improvement of pharmacological treatment of functional capacity and symptoms of knee osteoarthritis for elderly patients suffering from knee osteoarthritis (Shahine, et al., 2020).



Age is one aspect of the internal risk factors for the incidence of osteoarthritis. Some interventions are very effective in reducing joint pain to the incidence of osteoarthritis, especially in the elderly age group. The interventions provided can be with some physical exercises by stimulating the range of motion, education and family support in handling osteoarthritis in the elderly to create more independent elderly and can improve the quality of life of sufferers (Fatmala, & Hafifah, 2021). The limitation of this study is that the researcher did not measure the respondent's Body Mass Index (BMI) again, which may affect the intensity of knee pain. This is because the RM data of OA patients at the hospital recorded showed that their BMI was all normal.

## CONCLUSIONS

Statistically there is an effect of *leg exercise* on reducing pain and increasing the functional ability of osteoarthritis patients at the Mulia Hati Wonogiri General Hospital. It is hoped that parties related to this condition can provide and provide education on the *leg exercise* method to overcome the symptoms of osteoarthritis and improve the quality of life of osteoarthritis sufferers.

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