

The effect of osteoarthritis exercise on pain and joint range of motion in osteoarthritis patients El efecto del ejercicio para la osteoartritis sobre el dolor y la amplitud de movimiento de las articulaciones en pacientes con osteoartritis

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Abstract. Aims. Osteoarthritis is a degenerative and progressive disease characterized by abrasion of joint cartilage and irregular formation of new bone on the surface of the joints. Pain becomes the main symptom followed by a decrease in joint range of motion, causing disability and interfering with daily activities. The purpose of this study was to determine the effect of osteoarthritis exercise on pain and joint range of motion in osteoarthritis patients. Methods. The research design used a *quasy experiment* with a *non-equivalent control group design* approach. The sample used was 70 respondents for each intervention group and control group. Intervention in the form of physical *exercise osteoarthritis exercise* guided by an instructor and using audio-visual media. Exercise is carried out 3 times a week for 2 weeks. For *stretching* and *flexibility exercises* using yoga mats and bath towels and for *strength building* exercises using chairs. The pain scale was measured with a *numeric rating scale (NRS)* instrument and measurement of joint range of motion using a goniometer. Data analysis used numerical comparative analytic paired-sample t test and independent t test. Findings. The results showed that the results of the paired t test ($p < 0.05$). thus indicating that there is an effect of providing osteoarthritis gymnastics training intervention on reducing the pain scale. The results of the paired t test ($p < 0.05$). thus indicating that there is an effect of providing osteoarthritis exercise training interventions on the scale of joint range of motion. The results of the independent t test ($p < 0.05$), meaning that there is a difference in the osteoarthritis pain scale before and after the intervention, while the test for differences in joint range of motion scale shows a non-significant value of $p > 0.05$. Conclusion. The conclusion of the study was that there was an effect of osteoarthritis gymnastics training in reducing the osteoarthritis pain scale and joint range of motion scale. Then there is no difference between the control group and the intervention group who get gymnastic exercises and do not get osteoarthritis gymnastic exercises.

Keywords: Osteoarthritis exercise; Osteoarthritis; Pain, Joint range of motion

Resumen. Objetivos. La osteoartritis es una enfermedad degenerativa y progresiva caracterizada por la abrasión del cartilago de las articulaciones y la formación irregular de hueso nuevo en la superficie de las articulaciones. El dolor se convierte en el síntoma principal seguido de una disminución del rango de movimiento de las articulaciones, provocando discapacidad e interfiriendo con las actividades diarias. El propósito de este estudio fue determinar el efecto del ejercicio para la osteoartritis sobre el dolor y la amplitud de movimiento de las articulaciones en pacientes con osteoartritis. Métodos. El diseño de la investigación utilizó un cuasi experimento con un enfoque de diseño de grupo de control no equivalente. La muestra utilizada fue de 70 encuestados para cada grupo de intervención y grupo de control. Intervención en forma de ejercicio físico sobre artrosis guiado por un monitor y utilizando medios audiovisuales. El ejercicio se realiza 3 veces por semana durante 2 semanas. Para ejercicios de estiramiento y flexibilidad utilizando esterillas de yoga y toallas de baño y para ejercicios de fortalecimiento utilizando sillas. La escala de dolor se midió con un instrumento de escala de calificación numérica (NRS) y la medición del rango de movimiento articular mediante un goniómetro. El análisis de datos utilizó la prueba t analítica comparativa numérica para muestras pareadas y la prueba t independiente. Recomendaciones. Los resultados mostraron que los resultados de la prueba t pareada ($p < 0,05$). lo que indica que existe un efecto de proporcionar una intervención de entrenamiento de gimnasia para la osteoartritis en la reducción de la escala de dolor. Los resultados de la prueba t pareada ($p < 0,05$). lo que indica que existe un efecto al proporcionar intervenciones de entrenamiento con ejercicios para la osteoartritis en la escala del rango de movimiento de las articulaciones. Los resultados de la prueba t independiente ($p < 0,05$), significa que existe diferencia en la escala de dolor por artrosis antes y después de la intervención, mientras que la prueba de diferencias en la escala de rango de movimiento articular muestra un valor no significativo de $p > 0,05$. Conclusión. La conclusión del estudio fue que el entrenamiento de gimnasia para la osteoartritis tenía un efecto en la reducción de la escala de dolor de la osteoartritis y la escala de rango de movimiento de las articulaciones. Entonces no hay diferencia entre el grupo de control y el grupo de intervención que realizan ejercicios de gimnasia y no realizan ejercicios de gimnasia para la osteoartritis.

Palabras clave: Ejercicio para osteoartritis; Osteoartritis; Dolor, rango de movimiento de las articulaciones.

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Introduction

Osteoarthritis according to the American College of Rheumatology is a heterogeneous group of conditions that lead to joint signs and symptoms (Duarte et al., 2022). Osteoarthritis is a degenerative and progressive disease characterized by abrasion of joint cartilage and the formation of irregular new bone on the surface of the joints.

Pain is the biggest main symptom in joints with osteoarthritis and disability in patients so that it interferes with daily activities from mild to severe levels (de Frutos et al., 2022; Muntaner Mas et al., 2016).

The negative impact for the elderly who experience osteoarthritis is a decrease in quality-of-life expectancy, such as severe fatigue, decreased range of motion and pain in the joint area (Mosquera & Vargas, 2021). Stiffness is

worse in the morning when you wake up, severe pain at the start of movement but stiffness will not last long, which is only less than a quarter of an hour. Morning stiffness leads to decreased ability to perform extension movements, limited physical mobility, and systemic effects such as organ failure and death (Atukorala & Hunter, 2023; Quintero et al., 2024; Ruiz Montero & Baena Extremera, 2011).

As we age, the density and elasticity of joints and bones decrease. Data from Infodatin for the elderly, joint disease is in second place as the most prevalent health problem after hypertension (Fepriyanto et al., 2019). Riskesdas data in 2018 shows that joint diseases are in third place as the most common disease suffered by the elderly after hypertension and dental problems (Kemenkes RI, 2018).

Osteoarthritis is one of the most common musculoskeletal disorders worldwide, causing pain, loss of function, disability, and reduced quality of life (Atukorala & Hunter, 2023). Osteoarthritis occurs in one-third of people over 60 years of age. The prevalence in the United States is estimated to be 7-33%, with prevalence increasing with age; the knee is the most commonly affected part (Yahaya et al., 2021). Data in Indonesia, the prevalence of osteoarthritis reaches 5% at age <40 years, 30% at age 40-60 years, and 65% at age >61 years. Osteoarthritis causes the main complaint of pain in the sufferer. Elderly health problems with joint pain in Indonesia that occur at the age of 55-64 years are 15.5%, age 65-74 years are 18.6% and age 75 years and over are 18.9%. The prevalence rate of joint disease based on diagnosis in the population aged ≥ 15 years in Jambi Province is 8.9% (Kemenkes RI, 2018).

Osteoarthritis causes pain and limits the range of motion of the joints, resulting in impaired walking and interference with activities of daily living (Garcia et al., 2023). In addition to pharmacological treatment, therapy in the form of physical exercise or exercise is one of the most important in non-pharmacological treatment. *Osteoarthritis exercise* is a safe and inexpensive method of treating osteoarthritis and has been shown to slow disease progression, relieve pain, and increase joint range of motion. Clinical guidelines recommend general physical exercises to treat osteoarthritis including aerobic exercise (such as jogging, cycling, and swimming) and specialized knee exercises, which include *osteoarthritis exercises*, proprioceptive exercises, and range of motion exercises (Fepriyanto et al., 2019; Juliao Vargas et al., 2023).

Stretching maximizes the distance between the origin and the insertion of a muscle to enhance ROM, prevent injuries, and alleviate muscle soreness. Static stretching (holding a stretched position for an extended period of time) is preferred over ballistic or dynamic stretching because it effectively improves ROM with little risk for injury. It is important to stress to patients that flexibility training be performed after a warm-up period; there is an increased risk of muscular injury if stretching is performed cold (Knudson, 2018).

Therefore, strength training is a sensible strategy. Strength training is beneficial to older adults because it promotes bone strength and muscle growth or, at the very least, prevents or slows further weakening and loss. This increase in strength is primarily driven by neurologic and timing mechanisms in older adults as opposed to hypertrophy, as is observed in younger adults (Fragala et al., 2019; Hong & Kim, 2018; Rodrigues et al., 2022).

Puskesmas Simpang IV Sipin is one of the health centers in the government area of Jambi City. The incidence of osteoarthritis disease has increased every year. In 2017 there were 263 cases, in 2018 there were 378 cases, in 2019 there were 332 cases and in 2020 there were 343 cases. The results of interviews with nurses in the General Poly, pain and stiffness are problems that are often complained of by people with osteoarthritis. When symptoms arise, most of them only rub warm oil and consume pain relievers bought at stalls. It is difficult to limit activities due to work demands. The community does not know and has never done joint movement exercises to reduce the condition of osteoarthritis so that it does not get worse.

The disease can affect one or more joints, especially weight-bearing joints such as the knee and hip joints. Joint cartilage degeneration is usually accompanied by changes around the affected joint, such as muscle weakness and new bone growth, which results in reduced joint mobility and function. A well-designed exercise program, including aerobic and resistance training, flexibility and joint mobility, accompanied by weight management, medication, physiotherapy, joint protection, and surgery, if necessary, will improve complaints and reduce the impact of osteoarthritis on the patient's life.

This research holds substantial potential for enhancing the quality of life among the elderly, particularly those dealing with osteoarthritis. Earlier studies have explored movement exercises aimed at augmenting knee joint range of motion and reducing pain (Matongka et al., 2021), as well as exercises aimed at alleviating joint stiffness (Laasara, 2018). However, what sets the current study apart from these previous works is the utilization of a distinct intervention known as osteoarthritis exercise.

This study aims to determine the effect of osteoarthritis exercise on pain and joint range of motion in osteoarthritis patients.

Methods

Design

The research design used a *quasy experiment* with a *non-equivalent control group design* approach. In this design, both the experimental group and the control group are compared. The two groups are given a pretest, then given treatment, and finally given a post-test.

Participants

Participants who took part in the study were 70 respondents for each intervention group and control group. Participants are elderly people who live in the working area of the Simpang IV Sipin health center in Jambi city, Indonesia, which was carried out in January-September 2023, randomly selected with inclusion criteria such as respondents who live with their families, and still have a life partner.

Exercise procedure

Stretching/Flexibility

All stretching and flexibility exercises should be performed twice a week for 20 to 30 minutes each and repeated 2 to 3 times. Patients should manage their own active ROM. As stretching and flexibility increase, active ROM may increase, and stretches may be held longer. Stretching is done after physical activity as it can be harmful when done before (do not cold stretch the muscles). Encouraging participants to warm up is recommended before any exercise (Liguori & Medicine, 2020). Simple walking or gentle ROM repetitions of the target body area for a few minutes is often sufficient (Peterson et al., 2019).

Strength Building

All strength training exercises should include warm-ups and cooldowns. Exercises should start with 15 to 20 repetitions each (1 set), 2 to 3 sets (per side where applicable), and be performed twice a week. Each exercise should be held for 2 to 3 seconds and progress to 5 to 10 seconds as the patient becomes stronger. The goal is to slowly increase the number of repetitions to 30 and then add external resistance such as a cuff weight. These are low-weight, high-repetition exercises. A patient's own body weight is sufficient to start; no additional load is needed. Once this becomes easy, additional resistance or weight can be added. The purpose of these exercises is to strengthen the existing muscle, not necessarily to add to it, especially in the early stages of exercise. Patients need only perform as much, and as far, as their ROM and pain allows. Because most patients will be focusing on lower body exercises, it is important to include the upper body for a well-rounded workout, which will also help with weight loss or weight control (Peterson et al., 2019).

Data collection

Participants were informed about the study and gave informed consent. Furthermore, the intervention was given in the form of osteoarthritis physical exercise guided by an instructor and using audio-visual media. Exercise was carried out 3 times a week for 2 weeks. For stretching and flexibility exercises using yoga mat and bath towel tools given to the intervention group and for strength building exercises using chair tools given to the control

group. measurement of joint range of motion using a goniometer. For NRS pain, the participants were asked to rate the average pain intensity in activities of daily living during the previous day by selecting a value from 0 to 10 (0 indicating no pain and 10 indicating the worst pain imaginable).

Statistical data

Presentation of characteristic data is done by providing an overview of the percentage distribution of variables. The numeric data is displayed in the form of mean data, standard deviation (SD) and median value of each variable (pre-posttest). Data analysis used a numerical comparative analytic test paired-sample t test to determine the effect of intervention on pain scale and ROM. The second statistical test is the independent t test which serves to determine the difference in the effect of intervention in the two study groups. All data were analyzed using SPSS software version 16.0 with the assumption that it is significant if $p < 0.05$.

Ethical considerations

This research was approved by ethics No. LB.02.06/2/868/2023 from Health Polytechnic of Jambi, Jambi Province, Indonesia.

Result

An overview of the characteristics of respondents can be seen in table 1 below.

Table 1.
Distribution of respondents' characteristics

Characteristics	Control		Intervention	
	n (%)	Mean±SD	n (%)	Mean±SD
Age		66.04±4.72		66.37±4.52
Gender				
Male	22 (31.4)		21 (30)	
Female	48 (68.6)		49 (70)	
Length of illness				
> 3 years	50 (71.4)		34 (48.6)	
≤ 3 years	20 (28.6)		36 (51.4)	

Table 1 shows that the average age of respondents in the control and intervention groups is 66 years, with almost the same proportion of respondents and women. In the variable of length of osteoarthritis pain, the control group is dominant > 3 years while the intervention group has almost the same proportion.

Table 2 shows that the results of the paired t test ($p < 0.05$). thus, indicating that there is an effect of providing osteoarthritis exercise training intervention on reducing the pain scale.

For further details regarding the impact of exercise on the osteoarthritis pain scale, please refer to Figure 1.

Table 3 shows that the results of the paired t test ($p < 0.05$). thus, indicating that there is an effect of providing osteoarthritis exercise training intervention on the scale of

joint range of motion.

For more details about the Effect of exercise on joint range of motion scale, can be seen in Figure 2.

Table 2.
Effect of exercise on osteoarthritis pain scale

Control group	N	Mean±SD	Median	p
Pre	70	4.49±1.20	4.5	0.000
post	70	4.04±1.31	4.0	
Intervention group				0.000
Pre	70	4.80±1.40	4.8	
post	70	2.54±1.32	2.5	

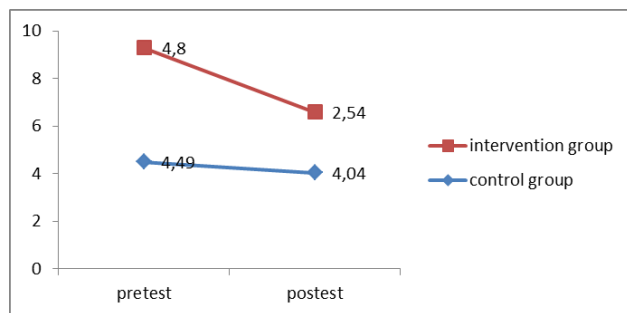


Figure 1. Effect of exercise on osteoarthritis pain scale

Table 3.
Effect of exercise on joint range of motion scale

Study group	N	Mean±SD	Median	p
Control group				0.000
Pre	70	135.47±15.22	135	
post	70	136.74±15.20	135	
Intervention group				0.000
Pre	70	130.47±15.22	130	
post	70	144.44±14.60	143	

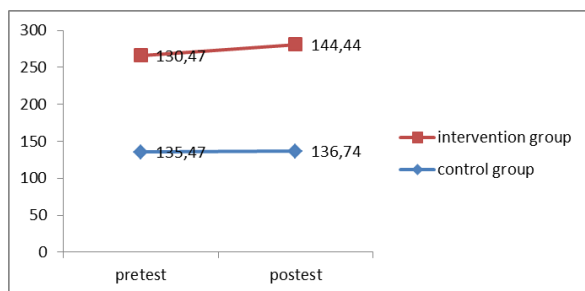


Figure 2. Effect of exercise on joint range of motion scale

Table 4.
Pain scale, joint range of motion scale in control group and intervention group

Study group	Mean±SD	P
Pain scale		
Control (pre-post)	4.26±1.272	0.001
Intervention (pre-post)	3.67±1.764	
Joint range of motion scale		
Control (pre-post)	136.11±15.17	0.476
Intervention (pre-post)	137.46±16.43	

Table 4 shows that the results of the independent t test (p) <0.05, meaning that there is a difference in the osteoarthritis pain scale before and after the intervention, while the test for differences in joint range of motion scale shows a non-significant value of p> 0.05.

Discussion

Osteoarthritis is also called degenerative joint disease, where damage and decreased function due to aging has an important influence on the development of osteoarthritis (Cortez et al., 2023; Jiménez et al., 2019). This forces a decrease in activity or immobilization. To this day, osteoarthritis is the most frequent musculoskeletal disorder in the elderly (Budiman & Widjaja, 2020).

Degenerative changes cause the smooth, white, translucent cartilage to become dark and yellow, the surface becomes rough and softening occurs. As the cartilage layer thinning occurs, the bone surfaces grow closer together. This results in pain, stiffness and decreased function associated with signs of inflammation such as tenderness, warmth and swelling. (Abdurrachman et al., 2019; Novianti et al., 2019).

In order to reduce the pain scale and increase joint range of motion, the researchers conducted research on the effect of osteoarthritis exercise (Atukorala & Hunter, 2023). The results of this study indicate that there is an effect of osteoarthritis exercise on reducing the pain scale and increasing the range of motion of joints with osteoarthritis patients with a p value <0.05. This shows that osteoarthritis exercises are able to (1) maintain muscle strength, (2) maintain joint movement, (3) improve blood flow, (4) avoid deformities. Osteoarthritis exercises result in increased blood circulation to the joint capsule and increase joint flexibility so that pain can be reduced and even resolved (Fepriyanto et al., 2019; Matongka et al., 2021).

In this study, it can be reported that osteoarthritis exercises are proven to reduce pain and increase joint range of motion in osteoarthritis patients, it can be seen descriptively that there is a decrease in the number or scale of pain and also increases the scale of joint range of motion.

Exercise therapy in osteoarthritis is therapy in the form of active movement exercises and in the form of exercises using resistance / load which aims to train muscles so that the muscles relax, prevent limitation of motion, maintain muscle elasticity and increase muscle strength. Exercise therapy must be individualized by considering aspects such as age, comorbidities, and interests of the patient.

Aerobic exercise in patients with moderate to severe intensity, recommended regularly 30 - 60 minutes / day for 3-5 days a week, where activities that can be done such as slow walking and doing light exercise. While heavy intensity, recommended as 20-60 minutes for 3-5 days / week, such as brisk walking, and light exercise. These exercises strengthen the joints and reduce the pain scale due to increased blood flow to the joints.

According to the researchers, routine gymnastic exercises can reduce the osteoarthritis pain scale due to the patient's weight loss. This is in line with the theory that gymnastics can also affect the decrease in body mass index

(BMI) and thigh circumference, because when someone does gymnastic exercises continuously, that person will experience weight loss, be free from several potential joint diseases, and their quality of life will be better (Fepriyanto et al., 2019). This research is in line with (Machado et al., 2019) that gymnastics is one of the best ways to lose weight, improve muscle health, and achieve a better quality of life.

Conclusions

Osteoarthritis gymnastics training has been observed to have a positive impact on reducing both the osteoarthritis pain scale and the joint range of motion scale. Notably, there is no discernible distinction between the control group and the intervention group, the latter of which received gymnastic exercises specifically designed for osteoarthritis relief, while the former did not.

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