THE EFFECT OF COMBINATION THERAPY OF STRAIGHT LEG RAISING EXERCISE AND RESISTED ACTIVE MOVEMENT ON PAIN RELIEF IN OSTEOARTHRITIS PATIENTS

Tri Sella Anggraini[1], Husni[1*], Mardiani[1]
[1]Poltekkes Kemenkes Bengkulu
Corresponding author: husni@poltekkesbengkulu.ac.id

ABSTRACT

Background: Osteoarthritis is a degenerative joint disease that frequently causes chronic pain, decreased mobility, and reduced quality of life. Non-pharmacological management through exercise therapy is recommended to reduce pain and improve joint function.
Purpose: To determine the effect of a combination of Straight Leg Raising Exercise and Resisted Active Movement on pain intensity among osteoarthritis patients.
Methods: This study used a quasi-experimental design with a pretest-posttest control group approach. A total of 60 respondents were selected using purposive sampling and divided into intervention and control groups, each consisting of 30 respondents. The intervention group received a combination of Straight Leg Raising Exercise and Resisted Active Movement, while the control group received Range of Motion exercises. Pain intensity was measured using the Numeric Rating Scale . Data were analyzed using Wilcoxon and Mann-Whitney tests**.**
Results: The average pain score in the intervention group decreased from 4.57 to 2.83, while in the control group it decreased from 4.43 to 3.23. Wilcoxon test showed significant differences before and after intervention in both groups (p=0.000). Mann-Whitney test showed a significant difference in pain reduction between groups (p=0.001). The median reduction in pain score was 2.00 in the intervention group and 1.00 in the control group.
Conclusion: The combination of Straight Leg Raising Exercise and Resisted Active Movement significantly reduced pain intensity among osteoarthritis patients and was more effective than Range of Motion exercises.

Keywords: Osteoarthritis; Pain; Resisted Active Movement; Straight Leg Raising Exercise.

Received June 25th, 2026; Revised July 1st, 2026; Accepted July 3rd, 2026
DOI:https://doi.org/10.36720/nhjk.v15i1.916

BACKGROUND

Osteoarthritis (OA) is a degenerative joint disease characterized by progressive cartilage damage, subchondral bone changes, osteophyte formation, and local inflammation that cause pain and limited joint function. OA is a leading cause of disability and reduced quality of life in adults and the elderly (Raja S et al., 2022). According to a 2023 World Health Organization report, there are approximately 528 million people with osteoarthritis worldwide, and this number continues to rise. In Indonesia, the prevalence of OA has also increased significantly, especially in the age group over 40 (WHO 2023). Osteoarthritis can be managed through pharmacological and non-pharmacological approaches. Non-pharmacological therapy is a primary recommendation because it is relatively safe, easy to perform, and has minimal side effects (Yudiansyah, 2024). One widely used intervention is physical exercise or exercise therapy, which aims to increase muscle strength, joint flexibility, and improve lower extremity function. Regular exercise can help reduce pressure on the joints, thereby alleviating pain (Kitagawa *et al.,* 2025).

Several factors contribute to the development and progression of osteoarthritis, including aging, obesity, previous joint injuries, repetitive mechanical loading, and occupational activities involving prolonged standing, squatting, or heavy lifting (Rahmi, 2023). These factors increase stress on the knee joint, resulting in cartilage degeneration and worsening clinical symptoms. Obesity, in particular, is recognized as one of the most significant modifiable risk factors because excessive body weight increases joint loading and accelerates structural damage in the knee joint (Steoarthritis, 2025). Chronic pain experienced by patients with osteoarthritis is not only caused by cartilage degeneration but also by inflammatory processes involving the synovial membrane, subchondral bone, ligaments, and surrounding muscles (Utami & Laksmita, 2024). Persistent pain may lead to decreased physical activity, muscle weakness, reduced functional ability, and a decline in quality of life. Therefore, interventions that target both pain reduction and muscle strengthening are essential to improve functional outcomes and prevent further disability among individuals with osteoarthritis (Mei *et al.,* 2022)

The Straight Leg Raising Exercise (SLR) is a quadriceps strengthening exercise performed by raising the leg straight without bending the knee menurut Silaen & Sudaryanto, (2024) this exercise can increase thigh muscle strength, improve knee joint stability, and reduce mechanical stress on degenerative joints. Meanwhile, Resisted Active Movement (RAM) is an active movement exercise that provides resistance to optimally improve muscle strength, endurance, and neuromuscular control. The combination of these two exercises is thought to have a synergistic effect in reducing osteoarthritis pain compared to either exercise alone (Mien & Ca, 2022). Pain is a major complaint in osteoarthritis patients, disrupting daily activities. OA can be managed pharmacologically or non-pharmacologically. One effective non-pharmacological approach is physical exercise aimed at increasing muscle strength, joint stability, and reducing pain (Thahira *et al.,* 2024) The Straight Leg Raising Exercise (SLR) strengthens the quadriceps without putting excessive pressure on the knee joint, while the Resisted Active Movement (RAM) improves muscle strength and neuromuscular control

through resistance training. The combination of these two exercises is thought to provide a more optimal effect in reducing osteoarthritis pain. (Iqbal *et al.*, 2024).

OBJECTIVE

To determine the effect of combination therapy of Straight Leg Raising Exercise and Resisted Active Movement on pain in osteoarthritis patients in the working area of Sawah Lebar Community Health Center, Bengkulu City in 2026.

METHODS

This study used a quasi-experimental design with a pretest-posttest control group approach. The study was conducted in the Sawah Lebar Community Health Center (Puskesmas) area of Bengkulu City in 2026. The sample size was 60 respondents, divided into two groups: 30 in the intervention group and 30 in the control group. Respondents were selected using a purposive sampling technique based on predetermined inclusion and exclusion criteria. The inclusion criteria were patients diagnosed with osteoarthritis, aged 40 years and above, experiencing knee pain, able to communicate effectively, and willing to participate in the study. Patients with severe physical disabilities, cognitive impairment, or other musculoskeletal disorders that could interfere with the intervention were excluded from the study.

Prior to the intervention, all respondents underwent baseline pain assessment using the Numeric Rating Scale (NRS). Participants in the intervention group performed a combination of Straight Leg Raising Exercise and Resisted Active Movement according to a standardized protocol under researcher supervision. The exercises were conducted regularly for four weeks. Meanwhile, participants in the control group received conventional Range of Motion (ROM) exercises according to standard care procedures. Following the intervention period, pain intensity was reassessed using the same instrument. The Numeric Rating Scale (NRS) was used as the primary instrument for measuring pain intensity. The NRS is a widely accepted and validated tool for assessing pain severity, consisting of a numerical scale ranging from 0 (no pain) to 10 (worst possible pain). Higher scores indicate greater pain intensity.

Ethical approval for this study was obtained from the Health Research Ethics Committee prior to data collection. All participants were informed about the study objectives, procedures, potential benefits, and risks before providing written informed consent. Confidentiality and anonymity of participant information were maintained throughout the research process. Results: The intervention group received a combination of straight leg raises and active range of motion exercises with resistance for four weeks, while the control group received range of motion (ROM) exercises. Pain intensity was measured using a Numeric Rating Scale (NRS). Data were analyzed using the Wilcoxon test to determine differences before and after the intervention, and the Mann-Whitney test to determine between-group effects, with a significance level of $\alpha = 0.05$.

Tabel 1. Respondent Characteristics

No	Variables	Group		*P Value*
		Intervention (n=30)	**Control (n=30)**	
1	**Age**			
	Mean	50.23	50.67	
	Median	50.50	52.00	
	Min	40	40	0.683*
	Max	59	59	
	SD	5.67	5.98	
	CI 95%	48.11–52.35	48.43–52.90	
2	**Gender**			
	Man	14 (46.7%)	14 (46.7%)	1.000**
	Woman	16 (53.3%)	16 (53.3%)	
3	**Type of work**			
	Manual (Teacher, Housewife)	13 (43.3%)	17 (56.7%)	0.302**
	Using Tools (Farmers, Laborers, Craftsmen)	17 (56.7%)	13 (43.3%)	
4	**Body Mass Index**			
	18,5–24,9 : Normal	4 (13.3%)	2 (6.7%)	0.667**
	25–29,9 : Overweight	13 (43.3%)	15 (50.0%)	
	>30 : Obesity	13 (43.3%)	13 (43.3%)	

***Uji Mann Whitney**Uji Chi Square*

Most of the respondents were female, engaged in heavy physical work, and were in the overweight to obese category.

Tabel 2. Average Pain Score Before and After Intervention

Variables	Group		*P Value*
	Intervention	**Control**	
NRS Score Before Intervention			
Mean	4.57	4.43	
Median	5.00	4.00	
Min	4	4	0.306*
Max	5	5	
SD	0.50	0.50	
CI 95%	4.38–4.75	4.25–4.62	

Mann Whitney

NRS Score After Intervention		
Mean	2.83	3.23
Median	3.00	3.00
Min	2	2
Max	4	4
SD	0.64	0.67
CI 95%	2.59–3.08	2.98–3.49

There was a decrease in average pain scores in both groups after the intervention. However, the decrease in the intervention group was greater than in the control group.

Tabel 3. Wilcoxon Test Results

	N	Median (Min-Max)	Z	*P value*
Intervention Numeric Rating Scale Score				
Before Intervention	30	5.00 (4-5)	-4.901[b]	0.000****
After Intervention	30	3.00 (2-4)		
Control Numeric Rating Scale Score				
Before Intervention	30	4.00 (4-5)	-5.108[b]	0.000****
After Intervention	30	3.00 (4-5)		

*****Uji wilcoxon***

There was a significant difference between pain scores before and after the intervention in both groups.

Tabel 4. Mann-Whitney Test Results

Variabel	n	Median (Min-Max)	U	*P value*
Intervention Numeric Rating Scale Score				
Intervention Group	30	2.00 (1-3)	246.000	0.001*
Control Group	30	1.00 (1-2)		

Mann Whitney

There was a significant effect of combination therapy of SLR and RAM on reducing osteoarthritis pain compared to the control group.

DISCUSSION

The study results showed that the combination of Straight Leg Raising Exercise and Resisted Active Movement significantly reduced pain intensity in osteoarthritis patients. The reduction in pain scores in the intervention group was greater than in the control group. These results indicate that muscle strengthening and resistance training provide more optimal benefits than conventional ROM exercises (Coaccioli *et al.,* 2022). These findings are consistent with previous studies demonstrating that exercise-based interventions play an important role in reducing pain and improving physical function among patients with knee

osteoarthritis (Daşkapan *et al.,* C.E.). Strengthening exercises contribute to enhanced muscle performance, improved joint stability, and decreased biomechanical stress on affected joints, thereby alleviating pain symptoms and improving mobility. Furthermore, combining strengthening and resistance exercises may produce greater therapeutic effects than a single exercise modality because it simultaneously targets muscle strength, endurance, and neuromuscular control (Yu *et al.,* 2022).

Straight Leg Raising Exercise works by increasing quadriceps muscle strength without placing excessive pressure on the knee joint. This increased muscle strength helps stabilize the joint and reduces mechanical stress on the articular surface, thus reducing pain (Bhatnagar et al., 2022). Furthermore, this exercise increases blood circulation, which aids tissue recovery and reduces joint stiffness (Dell *et al.,* 2025). Resisted Active Movement provides external resistance that stimulates neuromuscular adaptation, increasing muscle strength, joint stability, and movement control (Zeng et al., 2021). The combination of these two exercises produces a synergistic effect in improving joint function and reducing pain in osteoarthritis patients. These study results align with those of Iqbal *et al.,* (2024) and Bartolotti *et al.,* (2021) which demonstrated that physical exercise is effective in significantly reducing osteoarthritis pain.

The findings of this study are consistent with previous research showing that exercise-based interventions are effective in reducing pain and improving physical function in patients with osteoarthritis (Nirwana, 2024). Strengthening exercises targeting the quadriceps muscle have been shown to reduce joint loading, improve knee stability, and thus reduce pain intensity. A systematic review by Lim et al., (2024) reported that therapeutic exercise programs, specifically strengthening and resistance training, significantly reduced pain intensity and improved quality of life among patients with knee osteoarthritis. These findings support the use of a combination of Straight Leg Raise and Active Movement with Resistance as a non-pharmacological intervention for pain management in patients with osteoarthritis (Rafiq *et al.,* 2021).

CONCLUSION

The combination of Straight Leg Raising Exercise and Resisted Active Movement significantly reduced pain in osteoarthritis patients in the Sawah Lebar Community Health Center, Bengkulu City. The average pain score in the intervention group decreased from 4.57 to 2.83, while in the control group, it decreased from 4.43 to 3.23. The Mann-Whitney test showed a p-value of 0.001, proving that the combination of SLR and RAM therapy was more effective than ROM exercises in reducing osteoarthritis pain.

ACKNOWLEDGMENTS (if any):

The author would like to thank the Bengkulu Ministry of Health Polytechnic of Health, Sawah Lebar Health Center, Bengkulu City, the supervising lecturer, and all respondents who participated in this study.

CONFLICTS OF INTEREST

The author declares that there is no conflict of interest in this research

REFERENCES

Bartolotti, I., Roseti, L., Petretta, M., & Grigolo, B. (2021). *A Roadmap of In Vitro Models in Osteoarthritis : A Focus on Their Biological Relevance in Regenerative Medicine*.

Bhatnagar, G., Sahu, R. K., Rafi, M., Basha, A. S. K., & Chavhan, H. H. (2022). effectiveness of single leg mini squat and straight leg raise on pain intensity, muscle strength and physical function in patients with osteoarthritis KNEE in geriatric population. *International Journal of Health Sciences*, *6*(June), 7696–7710. https://doi.org/10.53730/ijhs.v6ns6.12160

Coaccioli, S., Sarzi-puttini, P., Zis, P., Rinonapoli, G., & Varrassi, G. (2022). *Osteoarthritis : New Insight on Its Pathophysiology*. 1–12.

Daşkapan, A., Anaforoğlu, B., Özünlü Pekyavaş, N., Tüzün, E. H., Nur Coşar, S., & Karataş, M. (2 C.E.). Comparison of mini-squats and straight leg raises in patients with knee osteoarthritis: A randomized controlled clinical trial. *Turkish Journal of Rheumatology*, *28*(1), 16–26. https://doi.org/10.5606/tjr.2013.2392

Dell, A., Recenti, F., Giardulli, B., Lawford, B. J., & Kiadaliri, A. (2025). Osteoarthritis year in review 2025 : Epidemiology and therapy. *Osteoarthritis and Cartilage*, *33*(11), 1300–1306. https://doi.org/10.1016/j.joca.2025.08.015

Iqbal, S., Khan, I. A., Khan, M. K., Ain, Q.-U.-, Arif, H., Bukhari, K. A., Bibi, R., Batool, U., Shahzad, M., & Saad, T. (2024). Therapeutic Utility of Mulligan Traction Straight Leg Raise Stretch and Proprioceptive Exercises in Osteoarthritis Treatment. *Cureus*, *16*(11). https://doi.org/10.7759/cureus.74382

Kitagawa, T., Isaji, Y., Sasaki, D., Onishi, K., Hayashi, M., & Okuyama, W. (2025). *Effectiveness of exercise therapy in patients with knee osteoarthritis : an overview of systematic reviews*. 1–9. https://doi.org/10.1136/bmjopen-2024-093163

Lim, J., Choi, A., & Kim, B. (2024). The Effects of Resistance Training on Pain, Strength, and Function in Osteoarthritis: Systematic Review and Meta-Analysis. *Journal of Personalized Medicine*, *14*(12), 1–11. https://doi.org/10.3390/jpm14121130

Mei, Y., Williams, J. S., Webb, E. K., Shea, A. K., Macdonald, M. J., & Al-khazraji, B. K. (2022). *Roles of Hormone Replacement Therapy and Menopause on Osteoarthritis and Cardiovascular Disease Outcomes : A Narrative Review*. *3*(March), 1–11. https://doi.org/10.3389/fresc.2022.825147

Mien, E., & Ca, H. (2022). *The Effect of Straight Leg Raise Exercise with Static Bicycles on Increasing Quadriceps Muscle Strength in Knee Osteoarthritis Patients The Effect of Straight Leg Raise Exercise with Static Bicycles on Increasing Quadriceps Muscle Strength in Knee Osteoarthritis Patients*. *April*.

Nirwana. (2024). *Hubungan massa otot dengan tingkat nyeri pasien osteoartritis lutut di rumah sakit bethesda lempuyangwangi yogyakarta*.

Rafiq, M. T., Hamid, M. S. A., & Hafiz, E. (2021). *Effect of Progressive Resistance Strength Training on Body Mass Index , Quality of Life and Functional Capacity in Knee Osteoarthritis : A Randomized Controlled Trial*. *July*.

Rahmi, R. (2023). Faktor-Faktor Yang Berhubungan Dengan Kejadian Abortus. *Jurnal Media Kesehatan*, *6*(2), 169–179. https://doi.org/10.33088/jmk.v6i2.209

Raja S, Carr D, Cohen M, Finnerup N, Flor H, & Gibson S. (2022). The Revised IASP Definition Of Pain: Concepts, Challenges, And Compromises. *Pain*, *161*(9), 1976–1982. https://doi.org/10.1097/j.pain.0000000000001939.The

Silaen, N. B., & Sudaryanto, W. T. (2024). The effect of straight leg raise on reducing pain and

increasing functional ability of the knee joint in patients with osteoarthritis genu. *Malahayati International Journal of Nursing and Health Science*, *7*(9), 1054–1060. https://doi.org/10.33024/minh.v7i9.765

Steoarthritis, K. E. O. (2025). *H a u , o , a f d k o*. *16*, 77–87.

Thahira, Y. M., Jufri Latief, Helmiyadi Kuswardhana, Andi Dhedie Prasatia Sam, & Erick Gamaliel Amba. (2024). Insiden Osteoartritis Genu Tahun 2018 – 2022. *Fakumi Medical Journal: Jurnal Mahasiswa Kedokteran*, *4*(3), 231–238. https://doi.org/10.33096/fmj.v4i3.431

Utami, T., & Laksmita, D. Y. (2024). *Hubungan osteoarthritis terhadap sindrom metabolik pada pekerja Relationship of osteoarthritis to metabolic syndrome in workers*. *4*(2), 65–72.

WHO 2023. (n.d.). *Web annex Package of interventions for rehabilitation Module 2 Musculoskeletal conditions*.

Yu, G., Cao, F., Hou, T., Cheng, Y., Jia, B., Yu, L., & Chen, W. (2022). Astrocyte reactivation in medial prefrontal cortex contributes to obesity - promoted depressive - like behaviors. *Journal of Neuroinflammation*, 1–18. https://doi.org/10.1186/s12974-022-02529-4

Yudiansyah Slide, H. (2024). *Edukasi Pelatihan Tehnik Straight Leg Raise (SLR) dan Heel Slide Exercise Terhadap Penurunan Nyeri Lutut Akibat Ostheoartrithis Genu*. *6*, 191–199.

Zeng, C.-Y., Zhang, Z.-R., Tang, Z.-M., & Hua, F.-Z. (2021). Benefits and Mechanisms of Exercise Training for Knee Osteoarthritis. *Frontiers in Physiology*, *12*(December). https://doi.org/10.3389/fphys.2021.794062