

The Effect of Stretching Exercise on Reducing the Intensity of Osteoarthritis Knee Joint Pain in the Elderly in Kutambaru Village, Munthe District, Karo Regency

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ABSTRACT

Knee osteoarthritis is one of the main causes of chronic pain and decreased mobility in the elderly. This study aims to analyze the effect of stretching exercise on reducing the intensity of knee joint pain in the elderly in Kutambaru Village, Munte District, Karo Regency. The study used a pre-experimental pretest-posttest one group design with 21 respondents selected in total sampling. The stretching exercise intervention was carried out twice per week for 8 weeks. Pain intensity was measured using the Numerical Rating Scale (NRS) before and after the intervention. The results of the analysis showed a significant decrease in NRS score after intervention ($p = 0.000$). The average pretest NRS score of 37.14 decreased to 28.24 in the posttest. This study concluded that stretching exercise is effective in reducing the intensity of knee joint pain in the elderly with genu osteoarthritis, so it can be recommended as a community physiotherapy program.

INTRODUCTION

Osteoarthritis (OA) is a degenerative disease of the joints most commonly found in the elderly population, characterized by progressive damage to the joint cartilage, the formation of osteophytes, and changes in subchondral bones. According to the World Health Organization (2019), the prevalence of knee OA reaches 9.6% in men and 18.0% in women over the age of 60, with an increasing trend as the population ages. In Indonesia, RISKESDAS data (2019) shows that the prevalence of joint disease is 7.3%, with the incidence of knee OA increasing significantly in the elderly age group. This condition has an impact on the decline in mobility, quality of life, and productivity of the elderly.

Risk factors for knee OA include age, gender, obesity, joint injury, repetitive physical activity, and joint structural abnormalities. The progressive course of the disease and its chronic nature make knee OA a public health problem that requires continuous treatment. Common symptoms of knee OA include pain, stiffness, limited range of motion, and joint deformities. Joint pain in OA is closely related to impaired daily activity functioning, so effective interventions are needed.

One of the recommended non-pharmacological managements is therapeutic exercises, including stretching exercises. Stretching aims to improve muscle flexibility, reduce soft tissue tension, and improve joint range of motion. According to Nelson and Kokkonen (2019), regular stretching can optimize joint function and prevent injury. Stretching exercises are divided into several methods, such as static stretching, dynamic stretching, and active isolated stretching, each of which has specific mechanisms and benefits.

Recent research shows that stretching exercise is effective in reducing pain and improving function in people with knee OA. A meta-analysis (2023) reported that a home-based exercise program that includes stretching was able to significantly reduce pain (SMD = -0.32; $p < 0.01$) and improve the quality of life of people with knee OA. In addition, a systematic review of 2024 confirmed that isolated stretching provided a moderate but significant improvement in knee flexion range of motion.

In Indonesia, stretching exercise interventions have not been evenly applied in primary health services, especially in rural areas. Kutambaru Village, Munte District, Karo Regency is one of the areas with a fairly high elderly population, where most of them have complaints of knee pain due to OA. Based on an initial survey (2023), 76 out of 255 elderly people in this village reported knee pain of varying severity.

The main problem faced by the elderly with knee OA is limited physical activity due to pain, which has an impact on decreased independence and quality of life. Conservative solutions such as stretching exercises are a potential option because they can be done at a low cost, minimal risk, and can be taught to be done independently at home. Stretching, through the mechanism of increasing muscle elasticity and reducing tension in the tissues around the joint, is able to reduce the mechanical load on the knee joint and minimize pain.

Several studies support the effectiveness of stretching in the treatment of knee OA. Suhartono (2019) reported that stretching exercise therapy significantly

reduced joint pain and increased mobility in the elderly. Research by Amin (2019) shows that the active isolated stretching method is more effective than the contract-relax method in increasing the flexibility of the hamstring muscles, which contributes to the stability of the knee joint.

However, there is still a research gap related to the implementation of stretching exercise programs in rural communities in Indonesia, especially in the elderly population with knee OA. Most research was conducted in clinical or urban settings, with better resources and access to health services. The geographical conditions, education level, and lifestyle of rural communities can affect the acceptance rate and success of interventions.

Based on this background, this study aims to analyze the effect of stretching exercise on reducing the intensity of knee joint pain in the elderly in Kutambaru Village, Munte District, Karo Regency. The novelty of this research lies in the application of stretching exercise interventions directly in rural communities with an educational approach, which is expected to become a model of sustainable non-pharmacological interventions in similar areas.

The scope of the study includes the identification of pain levels before and after stretching interventions, analysis of the effectiveness of the interventions, as well as a discussion of the implications of the findings on community physiotherapy practice. Thus, the results of this study are expected to enrich the literature related to the non-pharmacological management of knee OA at the primary level and provide a basis for the development of a broader community-based physiotherapy program.

LITERATURE REVIEW

Stretching Exercise

Stretching exercise is a form of physical exercise that aims to stretch muscles and soft tissues to improve flexibility, joint range of motion, and reduce muscle tension (Nelson & Kokkonen, 2019). Stretching can be divided into two main types, namely *static stretching* and *dynamic stretching*. *Static stretching* is done by holding the position of the muscles in a stretched state for a few seconds, while *dynamic stretching* involves active movements that are performed repeatedly (Mondam & Shahrudin, 2018).

Osteoarthritis Knee Joint Pain

Knee osteoarthritis is a degenerative disease of the joints characterized by the degradation of articular cartilage, the formation of osteophytes, and changes in joint structure that cause pain, stiffness, and decreased function (American College of Rheumatology, 2019). The prevalence of knee OA increases with age, especially in postmenopausal women (Rola Hamood, 2022). Pain in knee OA can be measured using the *Numerical Rating Scale* (NRS), which is effective for assessing changes in pain before and after intervention (Oliver, 2020).

The Effect of Stretching on Knee OA Pain

The main mechanisms of stretching in reducing pain involve increased muscle flexibility, decreased soft tissue stiffness, and increased proprioception

(Wismanto, 2019). A study by Suzuki et al. (2019) shows that home exercise programs, including stretching, can significantly reduce pain and improve knee joint function. A recent meta-analysis also confirmed that physical exercise-based interventions had a significant effect on the reduction of knee OA pain, with a *standardized mean difference* reaching -0.32 (Liu et al., 2023).

Research Gaps

Although many studies have proven the effectiveness of stretching, most are done in urban settings or formal health facilities. This research has a novelty by applying stretching exercise interventions directly in rural communities, involving the elderly with knee OA, and using an educational approach that facilitates the adoption of programs as part of daily activities.

METHODOLOGY

Research Design This study uses a pre-experimental design with a pretest-posttest one group design. This design was chosen to measure changes in knee joint pain intensity before and after the stretching exercise intervention without a control group. The measurement was carried out using the Numerical Rating Scale (NRS) instrument, which has been validated as a high-reliability pain measurement tool in the elderly population.

Location and Time of Research The research was carried out in Kutambaru Village, Mute District, Karo Regency, North Sumatra. The study was conducted from September to October 2024, with a frequency of intervention twice per week for eight weeks.

Population and Sample Research The population in this study is all elderly in Kutambaru Village who experience knee joint pain due to osteoarthritis genu. Samples were determined using total sampling techniques based on inclusion and exclusion criteria. The number of samples that met the criteria was 21 respondents.

Criteria Included

- The elderly are ≥ 45 years old.
- Diagnose knee osteoarthritis by a healthcare professional.
- Experiencing knee joint pain with an NRS scale of ≥ 3 .
- Willing to participate in all intervention sessions and sign informed consent.

Exclusion Criteria

- Have a history of acute injury or fracture of the lower limb in the last three months.
- Experiencing neurological or cognitive impairments that hinder the performance of exercises.
- Undergoing another physiotherapy program that may affect the results of the study.

Research Variables

Variabel independen: Stretching exercise

Dependent variables: Intensity of knee joint pain (NRS scale). 3.5 Research Instrument The main instrument is the Numerical Rating Scale (NRS), in which respondents are asked to rate their pain level from 0 (no pain) to 10 (very intense pain). NRS was chosen because it is easy to use, has good validity and reliability in the elderly population, and can quantitatively measure pain changes.

Stretching Exercise Intervention Procedure Stretching exercise intervention is carried out by researchers with the help of trained physiotherapists. The exercises are focused on the quadriceps and hamstring muscles to reduce the mechanical load on the knee joint and improve tissue flexibility.

Implementation stages:

1. **Preparation:** Respondents were given explanations and demonstrations of stretching movements.
2. **Implementation:**
 - Quadriceps Stretch:** Standing position with one leg bent back, held by the hand for 30 seconds, repeated 3 times per side.
 - Hamstring Stretch:** Sitting position with one leg straight, bending towards the leg straight until you feel stretched, held for 30 seconds, repeated 3 times per side.
 - Calf Stretch:** Standing position with one foot in front, back leg straight, heel against the floor, held for 30 seconds, repeated 3 times per side.
3. **Cooling:** Light stretch of the entire limb for 2–3 minutes.
The intervention was carried out twice per week, the duration of each session \pm 15–30 minutes, for 8 consecutive weeks.

Data Collection Procedure

1. **Pretest:** Measurement of knee joint pain level using NRS before the first stretching session.
2. **Intervention:** Implementation of stretching program according to the procedure.
3. **Posttest:** Measurement of knee joint pain level using NRS after the last session.
4. Data analysis is analyzed using the latest version of SPSS. The analysis includes:
5. **Descriptive statistics:** To describe respondent characteristics (age, gender, BMI, occupation) and pretest–posttest pain values.
6. **Normality test:** Kolmogorov-Smirnov Test to determine the distribution of data.
7. **Hypothesis test:** Paired t-test is used when the data is normally distributed; The Wilcoxon signed-rank test is used when the data is abnormal. The significance level was set at $p < 0.05$.

Research Ethics Research has received approval from the authorities at STIKes Siti Hajar Medan. Respondents signed informed consent before the study began. The principles of confidentiality and anonymity were maintained during

the research. No serious risks were identified from participation in this intervention. With this methodology, it is hoped that the results of the study can show a clear relationship between the implementation of stretching exercise and the reduction of knee joint pain intensity in elderly people with genous osteoarthritis in rural communities.

RESEARCH RESULT

Respondent Characteristics

This study involved 21 elderly respondents who met the inclusion criteria. The distribution of respondent characteristics is shown in the following table:

Table 1. Characteristics of Respondents by Age

Age	Frequency	Percentage
45-59 years old	11	52,4%
60-74 years old	10	47,6%
75-90 years	0	0%
Total	21	100%

Table 2. Frequency Distribution of Respondents' Gender

Gender	Frequency	Percentage
Man	0	0%
Woman	21	100%
Total	21	100%

Table 3. Distribution of Respondents' Work Frequency

Work	Frequency	Percentage
Self employed	4	19%
PNS	1	4,8%
Farmer	16	76,2%
Total	21	100%

Table 4. Characteristics of Respondents Based on BMI

Category	Frequency	Percentage
Normal	11	52,4%
Fat	2	9,5%
Obesity	8	38,1%
Total	21	100%

Table 5. Pretest and Posttest Average Scores

Variabel	N	Min	Max	Mean	SD
Pretest	21	33	49	37,14	3,785
Posttest	21	24	38	28,24	3,590

Normality Test

The results of the Kolmogorov-Smirnov test showed a **value of p = 0.200** (> 0.05), so that the data was normally distributed and qualified for the parametric test.

Uji Hypothesis (Paired t-Test)

Table 6. Paired Samples Statistics

Variabel	Mean	N	SD	THEY
Pretest	37,14	21	3,785	0,826
Posttest	28,24	21	3,590	

Tabel 7. Paired Samples Correlation

Variabel	N	Correlation	Itself.
Pretest & Posttest	21		

Hasil Paired t-Test

The **p value = 0.000** (< 0.05) showed that there was a significant difference between NRS scores before and after the stretching exercise intervention.

Data Visualization

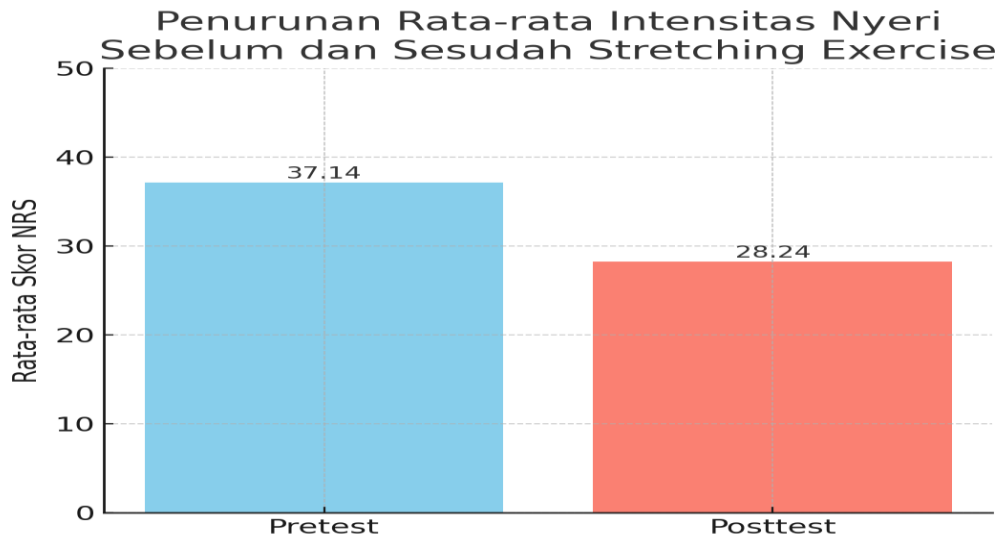


Figure 1. Average NRS Pretest and Posttest Scores

(bar graph shows decrease from 37.14 to 28.24)

Here is a bar graph showing the average decrease in pain intensity (NRS score) before and after the stretching exercise intervention.

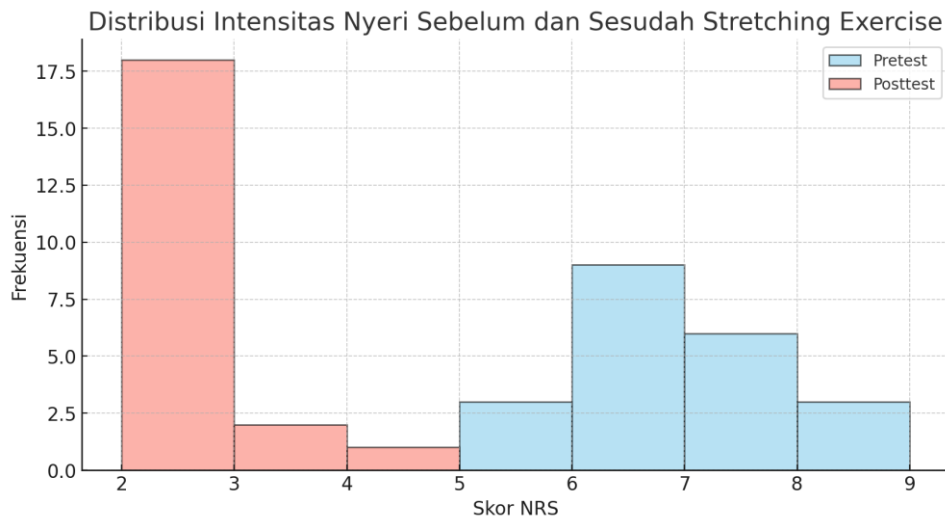


Figure 2. NRS Score Distribution Histogram

(histogram shows the shift in score from medium/heavy to light category)

This is a histogram of the distribution of NRS scores for pretest and posttest, which shows a shift in pain distribution from moderate/severe to mild after stretching exercise interventions.

Summary of Key Findings

All respondents were women with an age range of 45–74 years. The majority of respondents work as farmers (76.2%). There was a significant decrease in the average NRS score by **8.9 points** after the intervention.

Stretching exercises performed twice per week for 8 weeks are effective in reducing the intensity of knee joint pain in the elderly with genu OA.

DISCUSSION

The results of this study showed a significant decrease in the intensity of knee joint pain in elderly people with genous osteoarthritis after an eight-week stretching exercise intervention, with a frequency of twice per week. An average decrease in NRS scores of 8.9 points indicates that this exercise has a meaningful clinical effect and can be applied practically in rural communities.

These findings are in line with research by Suzuki et al. (2019) who reported that home-based exercise programs, including stretching, were able to improve muscle strength, joint flexibility, and reduce pain in seniors with knee OA. A recent meta-analysis study by Liu et al. (2023) also supports the effectiveness of physical exercise in lowering knee OA pain, with a statistically significant effect.

The physiological mechanisms underlying the effectiveness of stretching exercise include increasing muscle length and tissue elasticity, reducing ligament stiffness, and proprioceptor stimulation that affects pain modulation through the central nervous system (Wismanto, 2019; Nelson & Kokkonen, 2019). Stretching can also improve local blood circulation, reduce muscle spasms, and improve neuromuscular balance.

Interestingly, this research was conducted in villages with the majority of respondents working as farmers, which have a fairly high level of daily physical activity. Nonetheless, knee OA pain persists, possibly due to age factors, repetitive workload, and a history of joint injury. The implementation of a structured stretching program has a positive effect, even in populations that are used to moving.

The limitation of this study is that there is no strict control of the physical activity and diet of the respondents outside the intervention session. In addition, the study only involved women, so the results could not be generalized to elderly men. The implication of this study is the need to integrate stretching exercise programs in community physiotherapy services, especially in rural areas, as a cheap, easy, and low-risk non-pharmacological intervention. Going forward, follow-up research may consider a combination of stretching with other interventions such as strengthening *exercises* or mind-body activities such as yoga and Tai Chi, which have been shown to provide additional benefits in the management of knee OA.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

This study proves that *stretching exercise* carried out twice a week for eight weeks is effective in reducing the intensity of knee joint pain in elderly people with genous osteoarthritis in Kutambaru Village, Munte District, Karo Regency. An average decrease in NRS scores of 8.9 points indicates a meaningful clinical effect. This intervention can be a simple, inexpensive, and safe alternative to non-

pharmacological therapies to improve the quality of life of the elderly in rural communities.

Recommendations

1. **For Health Practitioners:** **Stretching** exercise programs can be integrated into community physiotherapy services and used as part of a promotive-preventive program to reduce knee OA pain.
2. **For the Village Government:** Supporting the implementation of structured elderly gymnastics programs on a regular basis by involving health workers or physiotherapists.
3. **For the Next Researcher:** It is recommended to conduct a study with a larger sample, involving male participants, and combine *stretching exercises* with muscle strengthening exercises for more optimal results.
4. **For the Elderly:** Do *stretching exercises* regularly, both at home and in group activities, to maintain joint flexibility and reduce the risk of recurrent pain.

ADVANCED RESEARCH

This study opens up opportunities for further studies related to the effectiveness of *stretching exercise* in more varied populations and methods. Some research directions that can be developed, including:

1. **Population Variation**
To engage male participants and a wider age group, including pre-elderly age (40–59 years), to see differences in intervention responses.
Involve populations with comorbidities such as diabetes mellitus or hypertension often found in the elderly, to test the safety and effectiveness of exercise.
2. **Comparison of Interventions**
Combining *stretching exercises* with *strengthening exercises*, balance exercises, or mind-body approaches such as yoga and Tai Chi.
To compare the effectiveness of *static stretching* versus *dynamic stretching* or *proprioceptive neuromuscular facilitation* (PNF) methods.
3. **Duration and Intensity of Exercise**
Examine the effects of exercises with different frequencies and durations, such as three times per week or longer session durations.
See if the positive effects persist in the long term after the intervention is stopped.
4. **Technological Approach**
Develop app-based exercise programs or video tutorials to facilitate self-paced exercises at home, as well as monitor patient compliance.
Using *wearable devices* to monitor the quality of movement and the respondents' daily physical activity levels.
5. **Broader Outcome Measurement**
In addition to measuring pain with NRS, add functional measurements such as the *Western Ontario and McMaster Universities Osteoarthritis Index* (WOMAC) or the *6-Minute Walk Test*.
Evaluate changes in quality of life, balance, and fall risk.

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