Title: The Effect of Resistance Exercises and Red Ginger Compress on Elderly People with Osteoarthritis (a Quasi-Experimental Study)

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Abstract

Purpose : This study aimed to determine the effectiveness of resistance exercise and red ginger compresses in elderly people with osteoarthritis by measuring uric acid levels, pain scale, and muscle strength of participants.

Methods : The research design in this study was quasi-experimental. A total of 60 participants who met the inclusion and exclusion criteria were randomly divided into 3 groups: group P1 (single resistance exercise intervention), group P2 (combination of resistance exercise with red ginger compresses), and group K (control). Single or combined interventions were administered three times a week for four weeks.

Results : The results for the three groups are presented as mean ± SEM to see the differences before and after the intervention. The results showed that uric acid levels decreased more in the group that received resistance exercises and red ginger compresses than in the treatment group alone or the control group ($p < 0.001$). Likewise, the results of the pain scale showed a significant decrease in the combination and single intervention groups compared to the control group ($p < 0.001$). Muscle strength levels and ADL levels increased in both the single and combination intervention groups and were significantly different compared to the control group ($p < 0.001$). Overall, the intervention group with the combination of resistance exercises and red ginger compresses showed better results compared to the group that only received a single intervention.

Conclusion : Physical exercise, including resistance exercises combined with red ginger compresses, can be an adjunct therapy in the treatment of osteoarthritis, which can minimize pain and increase muscle strength.

Keywords: osteoarthritis, uric acid, resistance exercises, ginger compress

Highlighting

- Resistance exercise can help reduce osteoarthritis pain.
- Regular resistance exercise can improve muscle strength and daily living activities for osteoarthritis sufferers.
- The combination of resistance exercises with red ginger compresses can be an additional therapy in treating symptoms caused by osteoarthritis.

Plain language summary

Osteoarthritis is a chronic joint disease caused by various factors, one of which is high uric acid levels. High uric acid levels can accumulate in the body's joints, with the knee being the most commonly affected. A typical symptom of osteoarthritis is joint pain. Joint pain can interfere with daily activities and reduce muscle strength. Self-administered complementary therapies are crucial for osteoarthritis sufferers to minimize pain and improve their ability to function.

Physical exercise is a good option for increasing muscle strength and activity. Resistance exercise offers various benefits in minimizing osteoarthritis symptoms. Regularly performing resistance exercises three times a week can help lower uric acid levels in individuals with osteoarthritis. Furthermore, resistance exercise can reduce pain, increase muscle strength, and improve daily living activities in osteoarthritis sufferers. In addition to resistance exercise, the use of red ginger compresses can also provide positive results in reducing osteoarthritis symptoms. The combination of resistance exercise and red ginger compresses has been shown to provide better results in reducing pain, increasing muscle strength, and improving daily living activities in osteoarthritis sufferers.

Introduction

Osteoarthritis is a common disease that occurs in people worldwide, especially among the elderly. This condition is characterized by thickening of the subchondral bone, osteophyte formation, ligament damage, and inflammation of the synovium, decreased muscle mass, bone density, metabolism, and decreased nervous system function [1], [2]. These changes result in decreased function and tissue damage in the musculoskeletal system, making the aging process a major factor contributing to the development of osteoarthritis. Pain is the main symptom most frequently reported and usually worsens during activity or weight-bearing, while joint stiffness often occurs after periods of immobility, such as after waking up [3], [4]. The accumulation of these pathological changes disrupts joint function, reduces mobility, and negatively impacts daily activities (Activities of Daily Living/ADL) as well as the quality of life of elderly individuals with Osteoarthritis [5], [6].

Osteoarthritis has a prognosis that progressively worsens over time and, if left untreated, can lead to decreased muscle strength, impaired physical mobility, and reduced ability to perform ADL (activities of daily living). The decline in muscle strength in elderly individuals with Osteoarthritis can be managed through physical exercise aimed at improving muscle strength. Resistance exercise is a type of light to moderate-intensity exercise that can accelerate muscle strength improvement, reduce pain, and enhance daily functioning in Osteoarthritis patients compared to regular weight training. Resistance exercise is performed for 25 minutes with 5 minutes of warming up and 5 minutes of cooling down [7], [8]. S In addition to improving muscle strength, resistance exercise also plays a role in enhancing body balance, thereby reducing the risk of falls in the elderly [9].

The implementation of physical muscle-strengthening exercises can be combined with the use of medications to reduce pain and improve joint function. A complementary therapy that can be combined with resistance exercise is red ginger compress. Red ginger (Zingiber Officinale

Roscoe Var. Rubrum) is known to have high antioxidant components as well as strong anti-inflammatory and analgesic effects [5]. Some of the active compounds found in red ginger include Gingerol, Shogaol, Paradol, and Zingerone. The anti-inflammatory effect of red ginger works by modulating the concentration and activity of inflammatory mediators in Osteoarthritis [10], [11]. However, there are still limited research studies discussing the benefits of red ginger compresses in relieving pain and minimizing osteoarthritis symptoms.

The red ginger compress intervention is a non-pharmacological therapy performed by applying 20 grams of grated ginger topically to the painful area of the body for 20 minutes, three times a week. The application of the red ginger compress provides a relaxing sensation, while the distinctive aroma of ginger synergistically helps relax the muscles and reduce pain perception. The warming effect of ginger induces local vasodilation, which improves blood circulation in the affected area, thereby accelerating the elimination of metabolic waste products that trigger pain, while simultaneously delivering oxygen and nutrients needed for tissue healing [12], [13]. The reduction in pain can enhance comfort and improve the ability to perform ADL.

Material and methods

This study is a quantitative study using a quasi-experimental method with a pre-test and post-test design with a control group. Observations were conducted in November 2024 with a study population consisting of elderly people with Osteoarthritis in health services. Sampling was determined using random sampling. Each participant who met the inclusion criteria was given an equal opportunity to determine the sample group. The sample used in this study consisted of 20 participants for each group; the groups used were 3 groups: the control group, treatment group 1, and treatment group 2, resulting in a total sample size of 60 participants.

The sampling technique employed was purposive sampling with inclusion and exclusion criteria. The Participants were randomly divided into three groups: two experimental groups

(n=20) and one control group (n=20). Group P1 consisted of 20 participants who received a single intervention, namely resistance exercise. Group P2 consisted of 20 participants who received a combination intervention of resistance exercise and red ginger compress. Meanwhile, the control group did not receive any intervention and was only observed as a comparison group.

Data collection and measurement were carried out in two stages, namely before the intervention (pre-test) and after the intervention (post-test). There were four parameters of data measurement: uric acid level examination, pain scale measurement using the NRS (Numeric Rating Scale), qualitative assessment of muscle strength using MMT (Manual Muscle Testing), and assessment of the level of independence in performing daily activities (ADL) using the Katz Index.

The inclusion criteria included elderly individuals aged 60–72 years with Osteoarthritis who were able to perform resistance exercise with light to moderate intensity. In addition, participants should not have mobility limitations or paralysis. The exclusion criteria included absence from two or more scheduled intervention sessions and unwillingness to continue treatment.

Ethical considerations in this study included informed and voluntary consent, the right to withdraw from the study, and confidentiality protection. All participants provided consent after being given a clear explanation to participate in the study.

Analysis

The measurement data are presented as mean ± SEM. Normality was tested using the Shapiro–Wilk test. For normally distributed data, differences between pre-test and post-test were analyzed using the Paired Samples Test, followed by One-Way ANOVA and Tukey HSD Post Hoc test for intergroup comparisons. For non-normally distributed data, the pre–post analysis

was performed using the Wilcoxon Signed-Rank test, followed by the Kruskal–Wallis test and Mann–Whitney U test for intergroup comparisons. Data were considered statistically significant if $p \leq 0.05$. All analyses were performed using SPSS software.

Resistance Exercise

The resistance exercise intervention was conducted to improve muscle strength and joint stability in elderly individuals with Osteoarthritis. The exercise was administered for 3 weeks with a frequency of three sessions per week. Each session lasted approximately 20–25 minutes and consisted of three phases: warm-up, main exercise, and cool-down. Warm-up (5 minutes): light movements such as static and dynamic stretching to reduce the risk of injury. Main exercise (10–15 minutes): included simple resistance movements using a resistance band or body weight. Exercises performed included hip adduction–abduction, hip flexion–extension, hip external–internal rotation, knee flexion–extension, and ankle dorsiflexion–plantarflexion. Exercise intensity was gradually increased according to participants' abilities, starting from 50% to 70% of 1RM (one repetition maximum). Cool-down (5 minutes): stretching of the quadriceps, hamstrings, and calves.

The resistance exercises were supervised by healthcare professionals, with safety monitoring including heart rate, respiration, and pain signs.

Red Ginger Compress

The intervention procedure was carried out for 3 weeks with a frequency of three times per week. Each session lasted 20–30 minutes, following the stages below. In the combination intervention, the red ginger compress was applied prior to the resistance exercise.

Preparation: fresh red ginger was cleaned and then grated or crushed. Application: the compress was placed on the joint area experiencing pain, such as the knee or hip, which had been sterilized beforehand, and then covered with a dry cloth or hypafix to help retain the heat for a longer duration. Duration: the compress was maintained for 20 minutes and could be replaced if it started to cool. Monitoring: participants were asked to report their comfort level and any skin reactions, such as excessive redness or intolerable burning sensation

Procedure

Before the study was conducted, the researchers first obtained permission from the relevant authorities. Prospective participants who met the inclusion criteria were then contacted and provided with an explanation regarding the objectives, benefits, and procedures of the study. After expressing their willingness, participants were asked to sign an informed consent form to participate in the study.

Data collection was carried out in two phases, namely the pre-test phase and the post-test phase. In the pre-test phase, measurements of uric acid levels, pain scale, muscle strength, and Activity of Daily Living (ADL) were conducted using predetermined instruments. Following this, participants underwent the intervention according to their assigned groups. After the intervention period was completed, a post-test was conducted using the same procedures, which included measurements of uric acid levels, pain scale, muscle strength, and ADL. The pre-test and post-test data were then analyzed to determine differences and the effectiveness of the intervention.

Result

Table 1 shows the distribution of respondent characteristics by age and gender. The number of participants in each group (P1, P2, and K) was 20. The age range of respondents in the three groups was 60–71 years and was relatively similar across all groups. This indicates that the

respondents' age characteristics align with the study's target population, namely elderly people with osteoarthritis. Gender distribution shows that the majority of respondents in all three groups were women. This data aligns with the prevalence trend of osteoarthritis, which states that this disease is more common in women aged 50 years and over.

Table 1. Participants characteristics based on age and gender

		Age	Gender	
			M	F
	n		Frequency (%)	Frequency (%)
P1	20	60 – 71	7 (35,0%)	13 (65%)
P2	20	60 – 70	7 (35,0%)	13 (65%)
K	20	60 – 70	8 (40,0%)	12 (60%)

The Effect of Resistance Exercise and Red Ginger Compress on Uric Acid Levels

Uric acid levels were measured before and after the intervention of resistance exercise and red ginger compress for 3 weeks in the treatment group (P1 and P2) and group K. Before the intervention, the average uric acid levels in group K were 5.97 ± 1.26, group P1 was 6.00 ± 1.04, and group P2 was 5.90 ± 1.31. After the intervention, the results of the measurement of uric acid levels in group K were 5.95 ± 1.26, group P1 was 5.63 ± 1.08, and group P2 was 5.18 ± 1.28.

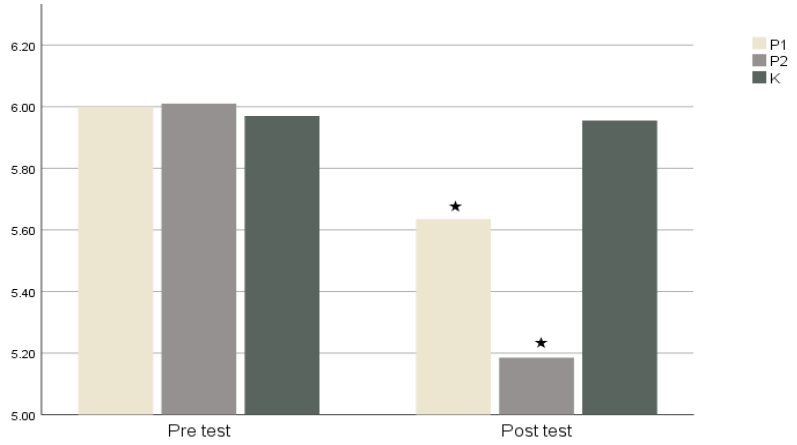

Figure 1. Uric acid levels before and after the intervention in each group. Data are presented as mean ± SEM (n=20).

Figure 1 illustrates that before the intervention, all three groups showed relatively high average uric acid levels. After the intervention, groups P1 and P2 showed a decrease in uric acid levels, while group K did not show a decrease in uric acid levels. The analysis results showed a significant difference between groups P1, P2, and the control ($p < 0.001$) with uric acid levels being more controlled in group P2 ($p < 0.001$) which received a combination of resistance exercise and red ginger compress intervention. Meanwhile, the post-test results also showed that group P1 experienced a significant decrease compared to the control group ($p < 0.001$). The most optimal decrease in uric acid levels was shown by group P2, which indicates that the combination of interventions is more effective than a single intervention.

The Effect of Resistance Exercise and Red Ginger Compress on Pain Scale

The pain scale was measured before and after the resistance exercise and red ginger compress intervention in groups P1, P2, and the control group. Before the intervention, the average pain scale in group K was 3.90 ± 1.619, group P1 was 4.10 ± 1.252, and group P2 was 4.20 ± 1.399. After the intervention, the results of the pain scale measurement in group K were 4.55 ± 1.317, P1 was 2.55 ± 1.504, and group P2 was 1.90 ± 1.294.

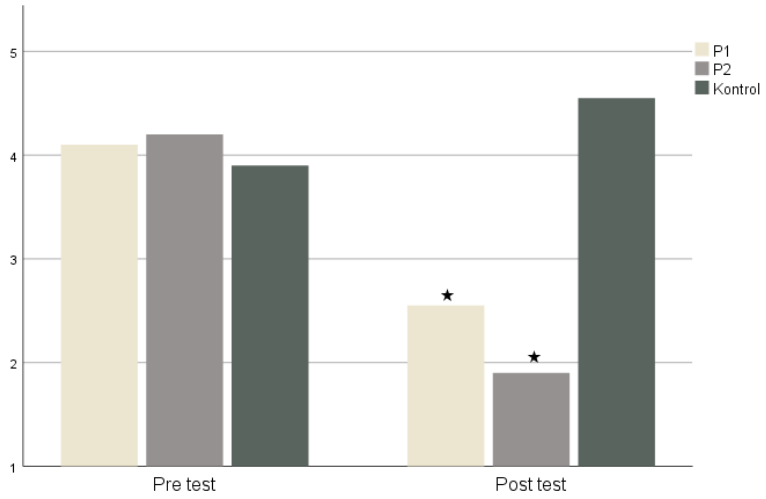

Figure 2. Pain scale before and after the intervention in each group. Data are presented as mean ± SEM (n=20).

Figure 2 illustrates that before the intervention, the three groups showed an average pain scale in the moderate pain category. After the intervention, there was a decrease in the pain scale in groups P1 and P2. This was inversely proportional to group K which showed an increase in the pain scale. The analysis results showed a significant difference between groups P1, P2, and K ($p < 0.001$). Group P1 showed a significant decrease in pain compared to the group K ($p < 0.001$), while group P2 also showed a significant decrease compared to the control group ($p < 0.001$). This indicates that the second intervention was effective in reducing the pain scale, with higher effectiveness in group P2 ($p < 0.001$) which received a combination of resistance training and red ginger compresses. This indicates that providing intervention with the addition of red ginger compresses made a significant contribution to reducing the pain scale.

The Effect of Resistance Exercise and Red Ginger Compress on Muscle Strength

Muscle strength was measured before and after the intervention of resistance exercise and red ginger compress in groups P1, P2 and the control group. Before the intervention, the average level of muscle strength in group K was 2.45 ± 0.999, group P1 was 2.10 ± 0.887, and group

P2 was 2.25 ± 0.910. After the intervention, the results of the average measurement of muscle strength in group K were 1.90 ± 0.912, group P1 was 3.40 ± 0.768, and group P2 was 3.75 ± 0.761.

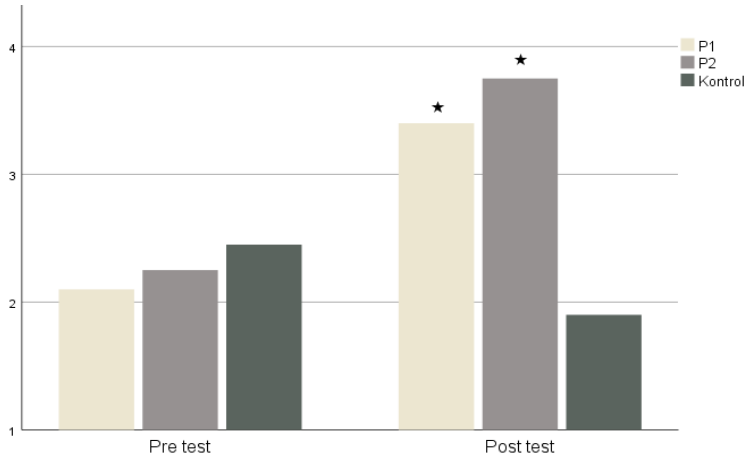

Figure 3. Muscle strength levels before and after the intervention in each group. Data are presented as mean ± SEM (n=20).

Figure 3 illustrates that in the pre-test phase, muscle strength scores were relatively low and similar across groups P1, P2, and K. In the post-test phase, it can be seen that groups P1 and P2 showed an increase in muscle strength compared to the pre-test phase. Meanwhile, the control group actually showed a decrease in muscle strength. The post-test results showed that both groups, P1 ($p < 0.001$) and P2 ($p < 0.001$), experienced a significant increase in muscle strength scores. The final results showed no significant difference between groups P1 and P2 ($p < 0.202$); however, there was a significant difference between P1 and the control group ($p < 0.001$), as well as between P2 and the control group ($p < 0.001$). This indicates that the addition of red ginger compresses does not provide a significant additional effect on muscle strength, and resistance exercise is the main intervention recommended in increasing muscle strength.

The Effect of Resistance Exercise and Red Ginger Compress on ADL

ADL scores were measured before and after the resistance exercise and red ginger compress intervention in groups P1, P2, and the control group. Before the intervention, the average ADL score in group K was 2.75 ± 1.333, group P1 was 2.20 ± 0.951, and group P2 was 2.70 ± 1.380. After the intervention, the average ADL score in group K was 2.45 ± 1.317, group P1 was 3.35 ± 0.875, and group P2 was 4.00 ± 1.556.

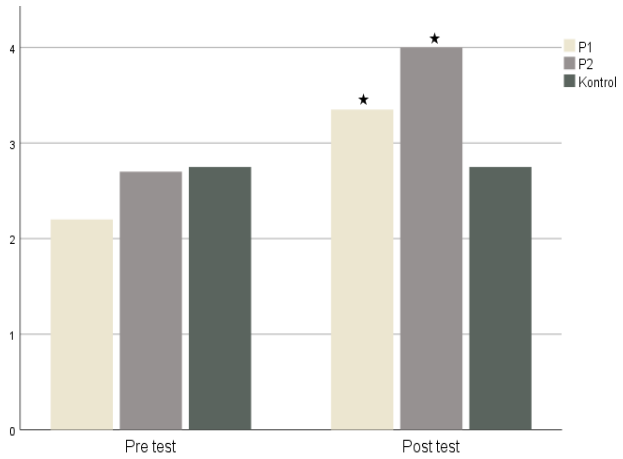

Figure 4. ADL levels before and after the intervention in each group. Data are presented as mean ± SEM (n=20).

Figure 4 illustrates that before the intervention, the ADL scores of groups P2 and K showed higher and similar averages compared to group P1. After the intervention, there was a significant increase in ADL scores in both groups P1 ($p < 0.001$) and P2 ($p < 0.001$), while the control group showed no change in ADL scores. The final results showed no significant difference between groups P1 and P2 ($p < 0.262$); however, there was a significant difference between P1 and the control group ($p < 0.001$), as well as between P2 and the control group ($p < 0.001$). This indicates that the additional benefit of red ginger compresses on ADL is not significantly proven, and resistance exercise is the main recommended intervention in improving ADL.

Discussion

Osteoarthritis is a degenerative joint disease characterized by progressive damage to cartilage, leading to inflammation and pain, particularly in the knees and hips. This degeneration in elderly individuals results from age-related tissue and organ decline. The chronic inflammation of osteoarthritis is closely related to increased uric acid levels, which can worsen joint damage and cause more severe pain. Furthermore, this condition can lead to decreased muscle strength and limitations in activities of daily living (ADL), thus impacting the quality of life of the elderly [14], [15].

In this study, before the intervention, both the control and treatment groups had average uric acid levels in the high category, severe pain scales, low muscle strength, and low ADL scores. This indicates that Osteoarthritis in the elderly at the study site has significantly affected physiological conditions, especially joint function and independence in activities. Recent research shows that Osteoarthritis of the knee is one of the leading causes of disability in the elderly population globally, and impacts the loss of independence and increases the burden on families and the health system. A cohort study in Asia reported that more than 60% of elderly people with Osteoarthritis experience moderate to severe limitations in ADL, with the level of dependence increasing with the severity of Osteoarthritis. [16], [17]. This finding is in line with research by Lentz [18] which reported that Osteoarthritis causes mobility impairment, increased dependence on basic activities, and an increased risk of complications due to decreased muscle strength and joint stability.

The results of the study showed that after 3 weeks of intervention, there was a significant decrease in uric acid levels in groups P1 (resistance exercise) and P2 (a combination of resistance exercise and red ginger compresses), while the control group showed no significant changes. A greater decrease in uric acid levels occurred in P2. This indicates that the combination of physical exercise and red ginger compresses has a synergistic effect in reducing

uric acid levels. The mechanism of reducing uric acid levels through resistance exercise is related to increased purine metabolism and increased blood circulation, which accelerates uric acid excretion through the kidneys. [19]. In addition, red ginger contains gingerol and shogaol compounds which have anti-inflammatory and antioxidant properties, and are able to reduce the activity of the xanthine oxidase enzyme which is involved in the formation of uric acid. [20]. Gupta's research [21] also reported that topical red ginger therapy was effective in reducing uric acid levels and improving symptoms of joint inflammation in Osteoarthritis.

A significant reduction in pain scale was also found in groups P1 and P2, with the greatest reduction in group P2. Resistance exercise can reduce pain by increasing the release of endorphins, which act as the body's natural analgesics, and increasing joint stability, thereby reducing pressure on degenerating cartilage [22]. Meanwhile, the warming effect of red ginger compresses triggers local vasodilation, which increases blood flow, accelerates the removal of pain-causing metabolic waste products, and provides muscle relaxation. Topical application of red ginger for 20 minutes can reduce osteoarthritis pain intensity by up to 50% compared to conventional therapy. The findings of this study are consistent with these results, where the highest pain reduction occurred in the combination group due to the dual mechanism of physical exercise and topical herbal therapy [23], [24].

In terms of muscle strength, this study showed significant improvements in groups P1 and P2. Resistance exercise is a form of training designed to increase muscle strength and endurance through repeated contractions against a load. This exercise stimulates muscle fiber hypertrophy and increases neuromuscular activation, which in older adults can prevent muscle atrophy due to inactivity. [25]. Resistance exercise three times a week for three weeks significantly increased knee muscle strength in osteoarthritis patients. The greater increase in muscle strength in group P2 suggests that pain reduction through red ginger compresses facilitated more optimal exercise performance, resulting in maximum strength gains [26], [27].

Positive changes also occurred in ADL, with the P2 group showing a higher increase in ADL scores than the P1 group. This improvement in ADL occurred because the combination of interventions improved mobility, reduced dependency, and increased confidence in performing basic activities in older adults. This is supported by research showing that structured physical exercise in older adults with osteoarthritis improves independence and quality of life. [28]. Red ginger provides analgesic and anti-inflammatory effects that reduce mobility restrictions, allowing older adults to perform physical activities better. Physiologically, the synergistic mechanism of these two interventions can be explained as follows: resistance exercise strengthens the muscles around the joint, increasing stability, and improving tissue perfusion, while red ginger compresses reduce inflammatory mediators such as TNF-α and IL-6, which exacerbate joint damage [29], [30]. This combination produces optimal effects in reducing Osteoarthritis symptoms while improving function.

The results of this study have important implications for nursing practice and public health. Non-pharmacological interventions such as resistance exercise and red ginger compresses can be a safe, affordable, and effective alternative in the management of osteoarthritis in the elderly, reducing dependence on nonsteroidal anti-inflammatory drugs (NSAIDs), which carry the risk of long-term side effects. This program can also be implemented at the healthcare level to improve the quality of life of the elderly.

However, this study has limitations, such as the relatively short intervention duration (3 weeks) and limited sample size. Further studies with longer durations, larger sample sizes, and assessment of inflammatory biomarkers are needed to strengthen the evidence for the effectiveness of this intervention.

Conclusion

This study showed that the combination of resistance exercise and red ginger compresses was most effective in lowering uric acid levels and reducing pain in elderly people with

osteoarthritis compared to resistance exercise alone or a control group. Both interventions effectively improved muscle strength and activity of daily living (ADL), but resistance exercise was the primary factor in improving muscle strength and ADL. The combination of these two therapies can be used as an alternative non-pharmacological intervention to manage osteoarthritis and improve quality of life in elderly people. Further research is needed using long-term, large-scale randomized controlled trials to provide a basis for applying research findings to scientific knowledge related to health improvement, particularly in participants with osteoarthritis.

Ethical Consideration

Compliance with Ethical Guidelines. This study was approved by the Health Research Ethics Committee of Universitas Muhammadiyah Purwokerto. Registration Number: KEPK/UMP/103/VI/2025.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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Author's Contributions

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of the results, and manuscript preparation. Each author approved the submission of the final version of the manuscript for publication.

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