



Impact of Tera Exercise on Musculoskeletal Health in Older Adults

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Abstract

Background of study: The aging process in older adults is accompanied by musculoskeletal changes that frequently manifest as joint pain, impairing daily functioning, independence, and overall quality of life. Non-pharmacological interventions are increasingly explored, with tera exercise—a light exercise emphasizing stretching, joint mobility, flexibility, circulation, and relaxation—emerging as a promising approach.

Aim : This study aimed to evaluate the effectiveness of tera exercise in reducing joint pain among elderly residents of a private nursing home in Jakarta, thereby providing empirical evidence for its role as a non-pharmacological intervention to improve musculoskeletal health and quality of life.

Methods: A quasi-experimental design with a one-group pretest–posttest approach was employed. Using purposive sampling, 20 respondents were recruited. Joint pain levels were measured using the Numeric Rating Scale (NRS) before and after a two-week tera exercise program conducted three times per week. Data were analyzed using the Wilcoxon Signed Rank Test.

Result: Prior to the intervention, 10 respondents (50%) reported mild to moderate pain, while 10 respondents (50%) experienced severe to very severe pain. After the intervention, 17 respondents (85%) reported mild to moderate pain, and only 3 respondents (15%) remained in the severe to very severe category. Statistical analysis yielded a p-value < 0.05 and a Z-score of -2.646, indicating a significant reduction in joint pain.

Conclusion: Tera exercise is an effective non-pharmacological strategy for alleviating joint discomfort and improving musculoskeletal health among older adults in nursing home settings. However, limitations include the small sample size and absence of a control group. Future studies should employ larger samples, randomized controlled designs, longer observation periods, and examine additional factors such as physical activity, psychological status, and pharmacological therapies.

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INTRODUCTION

Background of the study

The Indonesia Ministry of Health Law Number 17 of 2023 defines older adults as individuals aged 60 years or above, establishing a national legal framework for aging. Similarly, the [World Health Organization \(WHO, 2022\)](https://www.who.int/news-room/fact-sheets/detail/ageing-and-health) identifies older adults as those entering the final stage of life and

experiencing the aging process. Global demographic transitions have contributed to a significant rise in the elderly population, accompanied by an increase in chronic health conditions that affect mobility, particularly musculoskeletal joint disorders ([Nguyen et al., 2025](#))

Worldwide, the population aged ≥ 60 years increased from one billion to 1.4 billion in 2024, with projections reaching 2.1 billion by 2025. Rising life expectancy has also expanded the population aged ≥ 80 years, which is expected to triple to 426 million by 2025. Notably, two-thirds of the global elderly population are projected to reside in low- and middle-income countries, highlighting the urgent need for effective health strategies in resource-constrained settings ([Noto et al., 2023](#)).

In Indonesia, the National Socio-Economic Survey (Susenas, BPS 2024) reported that older adults comprise 28.11% of the adult population. In Jakarta, older adults represent 10.19% of the population, with women predominating at 52.81% compared to men at 47.19%. East Jakarta hosts the largest concentration, with approximately 320,000 individuals, accounting for 20% of the province's elderly population, underscoring the growing urban burden of aging.

Increasing life expectancy has contributed to a rise in chronic health problems, particularly musculoskeletal disorders such as joint pain. With advancing age, joint flexibility, muscle strength, and mobility decline significantly, making older adults more vulnerable to pain that reduces quality of life and increases dependency. Globally, the prevalence of joint pain has reached 528 million people, reflecting a 113% increase in recent years. In Indonesia, the National Basic Health Survey (Riskesdas, 2018) reported joint pain prevalence of 20.9% among women and 16.3% among men. While pharmacological treatments such as paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), and opioids remain widely used, non-pharmacological interventions are increasingly emphasized. These include progressive muscle relaxation, finger relaxation techniques, deep breathing exercises, and elderly exercise programs. Among them, Tera exercise has gained popularity in Indonesian elderly communities as a light, structured, and enjoyable intervention that effectively reduces joint pain, maintains physical health, and enhances quality of life. The rising prevalence of musculoskeletal pain among Indonesian older adults necessitates effective non-pharmacological interventions like Tera exercise. The objective of this study is to examine the effect of Tera exercise on reducing joint pain among older adults at the East Jakarta Nursing Home.

Literature review:

The aging process in the musculoskeletal system is characterized by progressive structural and functional changes ([Reid, 2023](#)). One of the primary alterations is the thinning of cartilage, which serves as a cushion between bones. The reduction in cartilage thickness diminishes the joints' ability to bear loads and decreases friction ([Loeser, 2010](#)). In addition, the production of synovial fluid, which functions as a lubricant for the joints, also declines, thereby reducing smooth movement and increasing the risk of pain. With advancing age, the elasticity of joint tissues significantly decreases, limiting movement flexibility. This condition is further exacerbated by increased friction between bones due to reduced cartilage and synovial fluid. Moreover, the strength of muscles supporting the joints also declines ([Cruz-Jentoft et al., 2019](#)), making older adults more vulnerable to mobility impairments and musculoskeletal pain. The combination of these changes contributes to reduced quality of life, increased dependency, and a higher risk of disability among the elderly population ([Amorim et al., 2022](#)).

As age progresses, decreased tissue elasticity, cartilage thinning, and reduced synovial fluid trigger joint degeneration. This condition is worsened by obesity, which increases mechanical load on the joints, particularly the knees and hips. Recent longitudinal research in Malaysia confirmed that advanced age and obesity are significant predictors of joint pain in older communities, with obesity doubling the risk of osteoarthritis ([Ooi et al., 2024](#)). Furthermore, a history of joint diseases

such as osteoarthritis or rheumatoid arthritis accelerates structural damage and exacerbates pain symptoms ([WHO, 2023](#)).

Low levels of physical activity also represent an important factor contributing to joint pain. Insufficient movement leads to muscle weakness, reduced flexibility, and diminished joint stability, thereby increasing susceptibility to pain. Recent studies indicate that older adults with low physical activity levels have a higher prevalence of joint pain compared to those who are regularly active ([Ooi et al., 2024](#)). This underscores the importance of lifestyle-based interventions, including light exercise and structured training programs, to maintain musculoskeletal health and reduce the burden of joint pain in the elderly population ([Lim et al., 2024](#)).

Restricted range of motion and muscle weakness cause older adults to struggle in maintaining balance while walking or performing daily activities. This condition increases the risk of falls, which represent a major health concern among the elderly. Falls not only result in physical injuries but also have psychological consequences, such as recurrent fear that further limits mobility ([Cruz-Jentoft et al., 2019](#); [Lee et al., 2022](#)).

One effective non-pharmacological intervention to improve mobility and reduce joint pain is *Tera Exercise*. This exercise emphasizes light, structured, and easily performed stretching and joint movements for older adults. Recent studies have shown that regular mobility exercises can enhance flexibility, muscle strength, and mobility, while reducing the risk of falls among the elderly ([Wahyuni & Nurrohmah, 2024](#); [Amorim et al., 2022](#)).

Beyond improving mobility, activity-based interventions such as *Tera Exercise* also play a role in maintaining psychological health in older adults. Structured physical activity has been proven to reduce anxiety levels, increase self-confidence, and strengthen social interactions among participants. This is particularly important since limited mobility and joint pain often lead to social isolation in the elderly. Recent studies emphasize that group exercise programs provide dual benefits, improving physical function while simultaneously enhancing mental well-being ([Reid, 2023](#); [Tao et al., 2025](#)).

The effectiveness of *Tera Exercise* as a non-pharmacological intervention also aligns with global recommendations on fall prevention in older adults. Routine stretching and joint-strengthening exercises have been shown to improve balance, enhance coordination, and reduce the risk of fall-related injuries. Thus, *Tera Exercise* functions not only as a therapy for joint pain but also as a preventive strategy to maintain independence in daily activities. Empirical evidence from community-based studies demonstrates that older adults who actively participate in exercise programs experience lower fall incidence compared to those who do not ([Ooi et al., 2024](#)). Therefore, *Tera Exercise* can serve as both a preventive and rehabilitative strategy in maintaining musculoskeletal health among the elderly ([Asadi et al., 2023](#)).

Gap analysis:

Although musculoskeletal aging and its clinical consequences are well documented, significant gaps persist in current research. Existing studies emphasize pharmacological management, while structured non-pharmacological interventions such as culturally adapted exercise programs remain underexplored. Evidence from community-based initiatives is fragmented, with limited large-scale longitudinal trials assessing sustained effectiveness in diverse elderly populations. Psychosocial outcomes, including anxiety reduction and social interaction, are insufficiently addressed compared to physical health measures. Consequently, integrated preventive and rehabilitative approaches—particularly involving *Tera Exercise*—require rigorous empirical validation to establish comprehensive strategies for elderly musculoskeletal health.

Rationale of the study:

The elderly population is rapidly increasing worldwide, accompanied by rising musculoskeletal disorders that impair mobility and independence. In Indonesia, joint pain prevalence among older adults remains high, significantly reducing quality of life and increasing dependency. Pharmacological treatments are widely used, yet non-pharmacological interventions such as structured exercise programs remain underexplored. Tera Exercise offers a culturally adapted, light, and enjoyable intervention proven to improve mobility and reduce joint pain. This study investigates Tera Exercise effectiveness in reducing joint pain among older adults at the East Jakarta Nursing Home ([Hastuti et al., 2024](#)).

Purpose or Hypotheses of the study:

The purpose of this study is to evaluate the effectiveness of Tera Exercise as a non-pharmacological intervention for reducing joint pain and improving musculoskeletal health among older adults in East Jakarta. Based on existing evidence, the hypothesis of this study is that participation in Tera Exercise will significantly improve physical and psychosocial outcomes in older adults. Specifically, it is expected to reduce joint pain, enhance mobility and muscle strength, lower fall incidence, and promote psychological well-being. This integrated hypothesis reflects the potential of *Tera Exercise* to serve both preventive and rehabilitative functions in elderly care.

METHOD

Research Design

This study employed a quantitative, quasi-experimental approach using a One-Group Pretest–Posttest Design. Joint pain levels were measured before (O_1) and after (O_2) the intervention, with Tera Exercise (X) serving as the treatment ([Susanto & Gunardi, 2022](#)).

Participant

The study involved older adults actively participating in Tera Exercise activities at the East Jakarta Nursing Home.

Population and the methods of sampling Instrumentation (sample of questions, scoring method, and psychometric properties (validity and reliability) : The population consisted of 41 older adults eligible to participate in Tera Exercise activities. The sample size was determined using Slovin's formula with a 5% margin of error. Sampling was conducted through non-probability purposive sampling, selecting participants based on predefined inclusion criteria. A total of 20 older adults met the eligibility requirements and were included in the Tera Exercise program.

The Numeric Rating Scale asks respondents to rate joint pain severity from 0 to 10, providing subjective pain measurement. Scores range from 0 indicating no pain to 10 representing the worst possible pain experienced by elderly participants. The Numeric Rating Scale demonstrates strong validity, showing high correlation with other pain scales ranging between 0.86 and 0.95. Reliability of the Numeric Rating Scale is excellent, confirmed by test–retest consistency with intraclass correlation coefficient values near 0.95. The Abbreviated Mental Test assess orientation, memory, and attention, ensuring reliable cognitive evaluation among participants. Higher scores in AMT indicate better cognitive function, supporting accurate classification of elderly participants' cognitive status. The Instrumental Activities of Daily Living questionnaire measures independence in daily tasks such as shopping, cooking, and financial management. Scores range from dependent to independent, with higher values reflecting greater autonomy in daily instrumental activities among elderly individuals. AMT and IADL instruments are widely validated, ensuring consistent and accurate measurement of cognitive and functional status.

Instrument

Pain was assessed using the Numeric Rating Scale, with pretest scores 36–54 and posttest scores expected between 22–35. Cognitive function was evaluated using the Abbreviated Mental Test to exclude significant cognitive impairment. Functional independence was measured with the Instrumental Activities of Daily Living questionnaire, validated and reliable for geriatric populations.

Procedures and if relevant, the time frame

The study was conducted at East Jakarta Nursing Home, from October 2025 to January 2026, covering operational preparation, intervention delivery, and reporting. Participants underwent pretest pain assessment, followed by structured Tera Exercise sessions, and posttest pain reassessment. Data were analyzed using descriptive and inferential statistics. Pretest and posttest scores were compared using paired t-tests to determine the effectiveness of Tera Exercise in reducing joint pain. If the data were not normally distributed, the Wilcoxon Signed-Rank Test was applied as the appropriate non-parametric alternative. This ensured methodological rigor by selecting statistical procedures consistent with the distributional characteristics of the data. This study was limited to older adults actively participating in Tera Exercise at a single nursing home in East Jakarta. The use of purposive sampling restricts generalizability beyond the study population. Additionally, the short intervention period may limit conclusions regarding long-term effectiveness.

RESULTS AND DISCUSSION

Results

The study involved 20 elderly participants at East Jakarta Nursing Home, who were given tera exercise interventions three times per week for two weeks.

Descriptive Analysis of Respondent Characteristics

Table 1. Characteristics of Respondents (n = 20)

Variable/ Category	Frequency (n)	Percentage (%)
Age		
60–69 years	12	60
≥70 years	8	40
Gender		
Male	9	45
Female	11	55
Marital Status		
Married	14	70
Widowed/Single	6	30
Education Level		
Primary	8	40
Secondary	7	35
Higher	5	25

The majority of participants were aged between 60 and 69 years, representing 60% of the sample, while 40% were aged 70 years or older. Gender distribution showed that females accounted for 55% of respondents, slightly higher than males at 45%. This indicates that elderly women were more represented in the study population.

In terms of marital status, most respondents were married (70%), whereas 30% were widowed or single. This finding suggests that the majority of elderly participants still lived with a spouse, which may influence their social support and coping mechanisms. Education levels varied, with primary education being the most common (40%), followed by secondary education (35%), and higher education (25%).

Overall, the descriptive data highlight that the study population was predominantly younger elderly, female, married, and with lower educational attainment. These demographic characteristics provide important context for interpreting the effectiveness of tera exercise interventions, as age, gender, marital status, and education may influence health behaviors and responsiveness to non-pharmacological therapies.

Descriptive Analysis of the Joint Level of Pain (before and after intervention)

Pain levels were measured using the Numeric Rating Scale (NRS) before and after the intervention. The joint pain levels of respondents before the Tera exercise intervention are presented in Table 2 below:

Table 2. Frequency Table of Joint Pain Levels Before Intervention

Pain Category	Frequency (n)	Percentage (%)
Mild–Moderate Pain	10	50
Severe–Very Severe Pain	10	50

The frequency distribution of joint pain before the intervention shows that 50% of respondents experienced severe to very severe pain. The remaining respondents were categorized as having mild to moderate pain. This condition illustrates that joint pain was a significant problem among the elderly population. The baseline data highlight the urgent need for non-pharmacological interventions to alleviate pain complaints. Equal distribution between mild–moderate and severe pain indicates heterogeneous pain severity among participants. The presence of severe pain in half the sample suggests substantial functional limitations in daily activities. These findings emphasize the importance of early intervention strategies to prevent worsening musculoskeletal conditions. The baseline pain profile provides a strong foundation for evaluating the effectiveness of Tera exercise interventions.

Table 3. . Frequency Table of Joint Pain Levels After Intervention

Pain Category	Frequency (n)	Percentage (%)
Mild–Moderate Pain	17	85
Severe–Very Severe Pain	3	15

Prior to the intervention, 50% of respondents reported moderate to severe pain. After the intervention, 85% of respondents reported mild to moderate pain, while only 15% remained in the severe pain category. The increase in mild–moderate pain cases indicate significant improvement in pain management among elderly participants. This shift demonstrates the therapeutic potential of Tera exercise interventions. The reduction of severe pain cases highlights the effectiveness of non-pharmacological approaches for geriatric care. These findings support integrating Tera exercise into routine elderly health programs.

Table 4. Analysis of Pain Reduction Before and After Tera Exercise Intervention

Variable	Z-value	p-value
Pain Level (Pre–Post NRS)	-2.667	< 0.05

Statistical analysis using the Wilcoxon Signed Rank Test revealed a significant reduction in pain levels ($p < 0.05$), confirming the effectiveness of tera exercise in alleviating joint pain among the elderly. The negative Z-value indicates a consistent reduction in pain scores after the intervention. This statistical outcome strengthens the evidence of therapeutic benefit. The significant p-value confirms that observed changes were unlikely due to random variation.

The findings demonstrate that Tera exercise effectively reduced joint pain among elderly participants. This supports its role as a non-pharmacological intervention. The results highlight the importance of structured physical activity in geriatric pain management. The statistical evidence provides strong justification for integrating Tera exercise into elderly care programs. Such interventions can improve mobility and independence. These outcomes emphasize the relevance of exercise-based strategies in enhancing quality of life for older adults.

Discussion

The study involved 20 elderly participants residing at STW Ria Pembangunan, East Jakarta. The majority of respondents were aged 60–69 years (60%), while 40% were aged ≥ 70 years. Females accounted for 55% of the sample, slightly higher than males at 45%. Most respondents were married (70%), and primary education was the most common educational attainment (40%).

These demographic characteristics suggest that the study population was predominantly younger elderly, female, married, and with lower educational attainment. Such factors may influence health behaviors, coping strategies, and responsiveness to non-pharmacological interventions. Similar demographic patterns have been reported in geriatric exercise studies across Asia ([Ooi et al., 2024](#)).

Pain levels were assessed using the Numeric Rating Scale (NRS). Prior to the intervention, 50% of respondents reported mild–moderate pain, while the remaining 50% experienced severe–very severe pain. This equal distribution highlights heterogeneous pain severity among participants. The presence of severe pain in half the sample suggests substantial functional limitations in daily activities.

Baseline data emphasize the urgent need for non-pharmacological interventions to alleviate musculoskeletal pain. Comparable findings were reported in *The Lancet Healthy Longevity* ([Skou et al., 2023](#)), where elderly populations demonstrated high prevalence of severe joint pain prior to structured exercise interventions ([Muna & Hartati, 2024](#)).

Following two weeks of Tera exercise conducted three times per week, significant improvements were observed. Seventeen respondents (85%) reported mild–moderate pain, while only three respondents (15%) remained in the severe pain category. This shift demonstrates the therapeutic potential of Tera exercise in reducing pain severity.

The reduction in severe pain cases highlights the effectiveness of structured physical activity as a non-pharmacological approach. These findings align with evidence from *BMC Geriatrics* ([Ooi et al., 2024](#)), which confirmed that low-impact exercise interventions reduce osteoarthritis-related pain and improve functional independence among older adults ([Nayab et al., 2024](#)).

Statistical analysis using the Wilcoxon Signed Rank Test revealed a significant reduction in pain levels ($Z = -2.667$, $p = 0.008$, $p < 0.05$). The negative Z-value indicates consistent improvement in pain scores after the intervention. The significant p-value confirms that observed changes were unlikely due to random variation ([\(Sendi et al., 2023\)](#) ; [\(Priyanto et al., 2022\)](#))

These results provide strong justification for integrating Tera exercise into elderly care programs. Similar statistical outcomes have been reported in randomized controlled trials of exercise

therapy for musculoskeletal pain ([Reid, 2023](#)). The evidence supports Tera exercise as a safe, accessible, and effective intervention for geriatric pain management.

Implications

The results imply that tera exercise can be integrated into geriatric nursing practice as a routine intervention for managing musculoskeletal pain. It provides a practical, low-cost, and accessible therapy that can be implemented in nursing homes, community health centers, and elderly care programs. Furthermore, the intervention supports holistic nursing care by addressing both physical and psychological aspects of health, promoting relaxation, and reducing dependency on pharmacological treatments.

Research contribution

This study contributes to the growing body of evidence supporting non-pharmacological interventions for elderly care. It provides empirical data on the effectiveness of tera exercise in reducing joint pain, reinforcing its role as an evidence-based practice in geriatric nursing. Additionally, the study expands the scope of previous research by incorporating a structured intervention program with measurable outcomes, offering a replicable model for future studies and clinical applications.

Limitations

The study was limited by its small sample size ($n = 20$) and short intervention period (two weeks). The use of a one-group pretest-posttest design without a control group restricts the ability to generalize findings. Pain measurement relied solely on the NRS, which captures intensity but not functional outcomes or psychosocial impacts. Moreover, the study was conducted in a single institution, limiting external validity across diverse elderly populations.

Suggestions

Future studies should employ randomized controlled trial designs to validate the effectiveness of Tera exercise. Large-scale trials are essential to establish external validity ([Skou et al., 2023](#)). Longer observation periods will capture sustained benefits. This approach will provide stronger empirical evidence for clinical application.

Additional outcome measures should be incorporated beyond pain intensity. Functional mobility, independence, and psychological well-being are critical indicators of elderly health ([Amorim et al., 2022](#)). Including these outcomes will provide a holistic understanding of intervention benefits. Such comprehensive evaluation aligns with global geriatric care standards.

Collaboration with community health programs can enhance sustainability of Tera exercise interventions. Evidence shows that group-based exercise improves both physical and social outcomes ([Wahyuni & Nurrohmah, 2024](#)). Integration into national elderly care policies will broaden accessibility. This ensures long-term impact on musculoskeletal health and quality of life.

CONCLUSION

Tera Exercise has been demonstrated to be an effective non-pharmacological intervention for reducing joint pain and enhancing musculoskeletal health among older adults. The significant reduction in pain levels following the intervention underscores that structured, culturally adapted exercise programs can improve mobility, independence, and overall quality of life in the elderly population. Beyond validating the initial hypothesis, these findings highlight the potential of Tera Exercise to be developed as a standard component of geriatric care. Future studies should involve larger and more diverse samples, randomized controlled trial designs, and longer observation periods to strengthen external validity, while also incorporating broader outcome measures such as functional mobility, incidence of falls, psychological well-being, and social interaction. From an implementation perspective, the results support the integration of Tera Exercise into nursing home

routines, community health programs, and national elderly care policies. With wider adoption, this intervention offers a sustainable strategy to reduce reliance on pharmacological therapies, promote holistic health, and address the growing burden of musculoskeletal disorders in aging populations.

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AUTHOR CONTRIBUTION STATEMENT

SS designed the study and developed the methodological framework. SS and DJP performed data analysis and interpreted the results. SS and TLH contributed to manuscript writing and final editing. DJP was responsible for field coordination and data collection. All authors reviewed and approved the final manuscript.

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