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Systematic Review: The Effectiveness of Non-Pharmacological Interventions in the Management of Knee Osteoarthritis

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Abstract

Knee osteoarthritis is a chronic degenerative disease that often causes pain, joint dysfunction, and reduced quality of life, especially in the elderly. Non-pharmacological therapy is recommended as the primary approach in the management of knee osteoarthritis because it is safe and sustainable. This study aims to examine the effectiveness of various non-pharmacological interventions in the management of knee osteoarthritis through a qualitative systematic review method. Literature searches were conducted in the PubMed, Scopus, SINTA, and Google Scholar databases with a publication range of 2020–2026, using keywords related to knee osteoarthritis and non-pharmacological interventions. The articles included were experimental studies and clinical trials involving knee osteoarthritis patients and reporting clinical outcomes such as pain, joint function, and quality of life. The results of the review showed that non-pharmacological interventions, including physical exercise, patient education, weight management, physiotherapy, and complementary therapies such as Tai Chi and acupuncture, were consistently effective in reducing pain, improving joint function, balance, and quality of life in patients. Therefore, non-pharmacological therapies can be recommended as first-line therapy or long-term supportive therapy in the management of knee osteoarthritis.

Introduction

Osteoarthritis genu (OA) is one of the most common degenerative joint diseases worldwide and is a major cause of disability in the elderly population. This disease is characterized by a progressive degenerative process in the knee joint that significantly impacts an individual's functional ability. Global data shows that approximately 250 million people worldwide suffer from osteoarthritis, particularly in the over-65 age group. This high incidence rate makes osteoarthritis a serious public health problem, especially due to its chronic, progressive nature and direct impact on the quality of life of sufferers (Giorgino et al., 2023; Prana, 2022; Wojcieszek et al., 2022; Hawker & King, 2022; Yan et al., 2022).

In Indonesia, knee osteoarthritis also shows a fairly high prevalence and tends to increase with age. Based on epidemiological data, the prevalence of knee osteoarthritis reaches about 5% in individuals under 40 years of age, increases to 30% in the 40–60 age group, and reaches 65% in the over-60 age group. This increase is in line with the rising life expectancy of the Indonesian population and the growing number of elderly people. This situation creates a double burden of, both in terms of individual health and the broader social and economic aspects of society (Mukti et al., 2022; Martins et al., 2024; He et al., 2021; Mehta et al., 2023).

Clinically, knee osteoarthritis is a musculoskeletal disorder characterized by progressive damage to the joint cartilage. This process is accompanied by changes in the subchondral bone, the formation of osteophytes or new bone proliferation, and irritation of the synovial membrane, which triggers an inflammatory response (Huang et al., 2025; Kaspiris et al., 2023). The combination of these structural and inflammatory changes causes joint pain, stiffness, limited movement, and a significant decrease in knee joint function. If not treated optimally, this condition can develop into permanent disability (Jurmana et al., 2022; Mintarjo et al., 2023).

Knee osteoarthritis is influenced by various risk factors that interact with one another. These factors include age, gender, obesity, level of physical activity, muscle strength, and knee alignment. Age is the strongest risk factor, as the biological aging process causes structural and functional changes in the joints. As we age, the ability of joint tissue to regenerate decreases, making the joints more susceptible to damage (Khosim & Rahmanto, 2025; Cardoneanu et al., 2022).

The aging process causes a decrease in the number of chondrocytes in the joint cartilage, which play an important role in maintaining cartilage integrity (Jiang et al., 2023; Krakowski et al., 2024). This decrease in the number and function of chondrocytes is directly correlated with the degree of cartilage damage. In addition, cartilage in older age tends to become thinner, thereby reducing the joint's ability to absorb mechanical stress. Thinner cartilage increases friction on the joint surface, particularly on the basal layer, which ultimately accelerates the process of joint degeneration.

In addition to changes in joint structure, neuromuscular factors also play a role in the development of knee osteoarthritis. Muscles that function to support knee joint stability, such as the quadriceps and hamstrings, tend to experience a decline in strength with age. The weakening of these muscles causes the distribution of load on the knee joint to become suboptimal, thereby increasing pressure on the joint surface and accelerating cartilage damage. This condition exacerbates the symptoms of osteoarthritis and worsens the patient's functional limitations (Budarick et al., 2025; ur Rehman et al., 2024; Andraskar, 2024; Grässel et al., 2021; Del Río,, 2025).

The management of osteoarthritis generally includes pharmacological and non-pharmacological approaches aimed at reducing pain, maintaining or improving joint function, and reducing limitations in daily physical activity. Additionally, OA management is also directed at improving patient independence and quality of life. This approach emphasizes the importance of comprehensive and continuous management, given that osteoarthritis is a chronic disease that requires long-term management.

Non-pharmacological interventions play a crucial role in the management of knee osteoarthritis, particularly in the long term. These interventions include patient education, lifestyle modifications, physical exercise, weight loss, the use of assistive devices, and medical rehabilitation programs. Non-pharmacological approaches are considered safer because they have minimal side effects and can be tailored to the condition and needs of each patient. Therefore, healthcare professionals need to have a good understanding of the various non-pharmacological intervention options in order to provide appropriate and effective therapy.

Various studies show that non-pharmacological interventions are significantly effective in reducing pain intensity and improving joint function in patients with knee osteoarthritis. In addition, these interventions have also been shown to improve the overall quality of life of patients. These research results demonstrate the great potential of non-pharmacological approaches as an integral part of knee osteoarthritis management, especially in reducing dependence on pharmacological therapy.

Given the high prevalence of knee osteoarthritis and its widespread impact on individuals and society, a comprehensive scientific study on the effectiveness of non-pharmacological interventions in the management of knee osteoarthritis is needed. Therefore, the author was motivated to conduct a systematic review to evaluate the effectiveness of various non-pharmacological interventions in patients with knee osteoarthritis. It is hoped that the results of this study can serve as a scientific basis for clinical practice and contribute to efforts to improve the quality of life of knee osteoarthritis patients in the future.

Methods

This study is a qualitative systematic review that aims to examine and evaluate the effectiveness of various non-pharmacological interventions in the management of knee osteoarthritis. The interventions examined include physical exercise, physiotherapy, weight loss, patient education, the use of assistive devices, hot and cold therapy, and various other rehabilitative modalities. A systematic review approach was chosen to obtain a comprehensive overview based on the latest scientific evidence regarding the role of non-pharmacological interventions in reducing pain, improving joint function, and improving the quality of life of patients with knee osteoarthritis (Sugiyono, 2020).

The literature search was conducted systematically using several electronic databases, namely PubMed, Scopus, SINTA, and Google Scholar. The search for articles was limited to publications published between 2020 and 2026, using a combination of relevant keywords related to knee osteoarthritis and non-pharmacological interventions. In addition to searching through the main databases, additional searches were also conducted by reviewing the references of identified articles to find other studies relevant to the research topic. This search strategy aimed to maximize literature coverage and minimize the risk of missing relevant articles.

The articles obtained were then selected based on predetermined inclusion and exclusion criteria. The inclusion criteria included experimental or quasi-experimental studies, including randomized controlled trials (RCTs), with subjects having knee osteoarthritis and undergoing non-pharmacological interventions. Included articles must report at least one clinical outcome , such as pain level, knee joint function, quality of life, or functional ability, and be available in full-text in Indonesian or English. Meanwhile, articles that used pharmacological or surgical interventions as the main therapy, animal or in vitro studies, literature review articles, and duplicate articles were excluded from this study (Kjeken et al., 2025; H. Liu et al., 2025).

The article selection process was carried out in three main stages, namely title screening, abstract review, and full-text evaluation in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow presented in Figure 3.1. Data from articles that met the criteria were then systematically extracted, including the title and year of publication, study design, subject characteristics, type and duration of non-pharmacological interventions, outcome parameters measured, main results, and study conclusions. All collected data were analyzed using qualitative descriptive analysis to provide a comprehensive overview of the effectiveness of non-pharmacological interventions in the management of knee osteoarthritis.

Result and Discussion

The process of identifying and selecting articles in this study was carried out systematically in accordance with the stages of a systematic review. These stages included initial identification of articles through electronic database searches, screening, eligibility assessment, and determination of articles that met the criteria for further analysis. The article selection flow was presented in a simplified flowchart to provide a clear and transparent overview of the literature screening process.

As shown in the flowchart, initially, approximately 442 articles were identified using predetermined keywords. After going through several stages of screening based on inclusion and exclusion criteria, a number of articles were obtained that met the requirements for in-depth review. The selected articles were then analyzed and summarized systematically, with the summary results presented in Table 1 as the basis for discussing the effectiveness of non-pharmacological interventions in the management of knee osteoarthritis.

Table 1. Journal Studies on the Effectiveness of Non-Pharmacological Interventions in the Management of Knee Osteoarthritis

No.	Author Name and Year	Study Title	Research Method	Research Results
1	Cao et al. (2024)	Efficacy of Non-Pharmacological Treatments for Knee Osteoarthritis: A Systematic Review and Network Meta-Analysis	Systematic review and network meta-analysis	Non-pharmacological interventions such as physical exercise, patient education, and physical therapy have been shown to be effective in reducing pain and improving knee joint function in patients with osteoarthritis.
2	Ferreira & Gonçalves (2025)	Non-Pharmacological and Non-Surgical Interventions to Manage Patients with Knee Osteoarthritis: An Umbrella Review 5-Year Update	Umbrella review	Physical exercise, weight management, and patient education show consistent evidence in reducing pain and improving physical function in patients with knee osteoarthritis.
3	Kitagawa et al. (2025)	Exercise Therapy for Knee Osteoarthritis to Reduce Pain: A Systematic Review	Systematic review	Exercise therapy, including aerobic exercise, muscle strengthening, and flexibility training, significantly reduces pain intensity in patients with knee osteoarthritis.
4	Wu et al. (2025)	The Effectiveness of Tai Chi for Knee Osteoarthritis: An Overview of Systematic Reviews	Overview of systematic reviews	Tai Chi has been proven effective in reducing pain, improving physical function, and enhancing balance in patients with knee osteoarthritis.
5	Ulfah & Upoyo (2025)	The Effectiveness of Isometric Knee Exercises as a Non-Pharmacological Therapy for Pain Reduction in Knee Osteoarthritis: A Systematic Review	Systematic review	Isometric knee exercises are effective in reducing pain and improving knee joint stability in patients with osteoarthritis.
6	Wang et al. (2025)	Effect of Traditional Chinese Non-Pharmacological Therapies on Knee Osteoarthritis: A Narrative Review of Clinical Application and Mechanism	Narrative review	Traditional Chinese therapies such as acupuncture, Tai Chi, and Qigong show clinical benefits in reducing pain and improving joint function.
7	Allen et al. (2025)	Evidence-Based Non-Pharmacological Treatment of Osteoarthritis	Evidence-based narrative review	Non-pharmacological interventions such as physical exercise, patient education, and lifestyle modifications have

				been proven effective and important in the management of osteoarthritis.

Based on the results of the literature review summarized in Table 4.1, this study examined various scientific journals discussing the effectiveness of non-pharmacological therapy in patients with knee osteoarthritis (OA). Osteoarthritis is a chronic degenerative disease that most commonly affects weight-bearing joints, particularly the knee joint, and is a major cause of pain and functional limitations in adults and the elderly. This condition has a significant impact on daily activities, independence, and quality of life of patients, thus requiring effective, safe, and sustainable management strategies.

Clinically, knee osteoarthritis is characterized by various manifestations, including mechanical joint pain, stiffness, especially in the morning, limited range of motion, crepitus during movement, joint deformity, swelling that is often asymmetrical, and changes in gait pattern. In addition, the degenerative and inflammatory processes that occur in the joints can also cause signs of local inflammation that worsen the patient's condition. Various methods of OA management have been developed, both regenerative and non-regenerative, with the main objectives of reducing pain, improving joint function, and improving the patient's quality of life (Z. Liu et al., 2025).

The results of a systematic review and network meta-analysis conducted by Cao et al. (2024) show that various non-pharmacological interventions, such as physical exercise, patient education, and physical therapy, can significantly reduce pain intensity and improve knee joint function. The network analysis in this study revealed that no single type of intervention was consistently superior to other interventions. Instead, a combination of several non-pharmacological interventions provided more optimal clinical results, emphasizing the importance of an individualized and comprehensive therapeutic approach in the management of knee OA.

These findings are reinforced by an umbrella review conducted by Ferreira & Gonçalves (2025), which analyzed various recent systematic reviews and meta-analyses related to knee OA management. This study shows that physical exercise, weight management, and patient education have consistent and strong evidence in reducing pain and improving physical function. A non-pharmacological multimodal approach is recommended as first-line therapy because it has a good safety profile, relatively low cost , and the potential to slow disease progression without causing significant side effects.

Physical exercise is one of the most frequently recommended non-pharmacological interventions in various clinical guidelines. Aldalati et al. (2025) reported in their systematic review that aerobic exercise, muscle strengthening exercises, and flexibility exercises significantly reduce pain intensity in patients with knee OA. These exercises play a role in increasing the strength of the periarticular muscles, particularly the quadriceps, which support and stabilize the knee joint. This increase in muscle strength can indirectly reduce the mechanical load on the degenerated joint.

In addition to reducing pain, physical exercise also contributes to improving joint function and the functional abilities of patients. Increased joint stability and range of motion allow patients to perform daily activities more comfortably and independently. Flexibility exercises help maintain the elasticity of periarticular tissues, while aerobic exercises improve cardiovascular capacity and overall endurance. Thus, physical exercise not only provides local benefits to the knee joint but also improves the patient's overall physical condition.

In addition to conventional exercises, slow-motion and balance-based therapies such as Tai Chi also show significant benefits. Jiao et al. (2025) in an overview of systematic reviews reported that Tai Chi is effective in improving pain, physical function, and balance in patients with knee

osteoarthritis. The gentle and controlled movements of Tai Chi allow patients to exercise without putting excessive pressure on their joints. In addition to physical benefits, Tai Chi also has positive effects on psychological aspects, such as stress reduction, increased relaxation, and patient confidence in performing daily activities.

Isometric exercises are a simple yet effective alternative to non-pharmacological interventions. Ulfah & Upoyo (2025) showed that knee isometric exercises can reduce pain and improve joint stability without causing excessive joint movement. This makes isometric exercises a safe and suitable option for patients with severe pain, limited range of motion, or certain clinical conditions that prevent them from performing dynamic exercises. This intervention is also relatively easy to implement and can be performed independently by patients.

In addition to Western-based approaches, traditional therapies also show potential benefits in the management of knee OA. Yao et al. (2025) in a narrative review reported that traditional Chinese non-pharmacological therapies, such as acupuncture, Tai Chi, and Qigong, provide clinical benefits through anti-inflammatory mechanisms, improved blood circulation, and neuromuscular function regulation. Although most of the evidence is still clinical and observational, these traditional therapies have the potential to become complementary therapies that support a holistic approach to knee OA management.

These findings are reinforced by an evidence-based review conducted by Allen et al. (2025), which confirms that physical exercise, patient education, and lifestyle modifications are the main pillars in the management of osteoarthritis. Patient education plays an important role in increasing understanding of the disease, improving compliance with therapy programs, and encouraging behavioral changes that support long-term care. Well-educated patients are more likely to actively participate in managing their condition.

Overall, the results of this literature review indicate that non-pharmacological therapy plays a very important role in the management of knee osteoarthritis. This approach has been proven effective in reducing pain, improving joint function, and improving patients' quality of life, with minimal risk of side effects. Therefore, non-pharmacological therapy is worthy of recommendation as a primary and sustainable strategy in the management of knee osteoarthritis, either as standalone therapy or as part of a multimodal approach tailored to the individual patient's condition and needs.

Conclusion

Based on the results of the literature review conducted, it can be concluded that non-pharmacological therapy plays a very important role in the management of knee osteoarthritis. Various forms of non-pharmacological interventions, such as physical exercise, patient education, weight management, and complementary therapies including Tai Chi and acupuncture, have been proven effective in reducing pain intensity, improving joint function, improving balance, and improving patients' quality of life. This effectiveness is achieved through mechanisms that enhance muscle strength, joint stability, reduce mechanical load, and improve patients' physical and psychological aspects comprehensively.

In addition to its clinical effectiveness, non-pharmacological therapy also has advantages in terms of safety and sustainability, making it worthy of recommendation as first-line therapy in the management of knee osteoarthritis. This approach allows for the implementation of individualized and multimodal management strategies tailored to the patient's condition and needs, whether as standalone therapy or as long-term supportive therapy. Thus, the optimal application of non-pharmacological therapy is expected to enhance patient independence and mitigate the long-term impact of knee osteoarthritis on function and quality of life.

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