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Effectiveness of Infrared Therapy on Pain in Musculoskeletal Disorders: A Narrative Review Based on Recent Literature

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Abstract

Introduction: Musculoskeletal disorders are a primary global health concern, contributing significantly to chronic pain, physical dysfunction, and reduced quality of life. Infrared (IR) therapy has emerged as a non-invasive intervention with potential benefits in pain relief, inflammation reduction, and tissue healing.
Methods: A narrative review was conducted using two electronic databases: PubMed (11 articles) and Google Scholar (4 articles). Article selection involved screening titles, abstracts, and full texts based on predefined inclusion and exclusion criteria. Relevant data were extracted, including study design, sample characteristics, therapeutic approach, and outcomes.
Results: Most reviewed studies reported that IR therapy effectively reduces pain, improves local blood circulation, decreases inflammation, promotes muscle relaxation, and facilitates tissue repair in patients with musculoskeletal disorders. However, heterogeneity in study design, sample size, and limited reporting on dosage protocols were noted.
Conclusion: Infrared therapy is an effective and non-invasive modality for managing musculoskeletal pain and may be an adjunct to conventional treatment. Further high-quality studies are recommended to standardize therapeutic protocols and validate clinical efficacy.

Keywords: Infrared radiation, infrared therapy, musculoskeletal disorders

Introduction

Musculoskeletal conditions are among the leading causes of chronic pain, physical impairment, and functional decline, significantly impacting quality of life. Globally, approximately one in three individuals experiences musculoskeletal pain, making it a significant public health concern. These conditions not only result in disability but also reduce productivity and impose a substantial burden on healthcare systems.[1] According to global data, musculoskeletal disorders account for approximately 149 million cases of disability, representing around 17% of the total global disability burden.[2]

The etiology of musculoskeletal disorders is multifactorial, involving overuse injuries, traumatic events, and chronic degenerative conditions such as neuropathy and myalgia.[3] Management typically focuses on symptom relief through pharmacological means, such as analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs), glucocorticoids, and opioids, and non-pharmacological interventions, including physiotherapy, exercise therapy, and electro-physical modalities. However, conventional methods often fall short in addressing the underlying mechanisms of chronic pain and may carry risks of side effects or dependency, particularly in long-term use.[4]

In response to these limitations, alternative non-invasive interventions are increasingly being explored. One such modality is infrared (IR) therapy, which has shown promising therapeutic potential in recent years. IR radiation stimulates the production of nitric oxide (NO), promoting vasodilation and improved blood perfusion to damaged tissues, thereby accelerating tissue repair.[5] IR therapy has also been shown to reduce oxidative stress, inhibit pro-inflammatory cytokines, and modulate cellular signalling involved in pain pathways. These biological effects contribute to its analgesic and anti-inflammatory properties. Evidence from clinical studies indicates that IR therapy may be effective in reducing pain associated with conditions such as osteoarthritis, fibromyalgia, and other musculoskeletal disorders, with outcomes typically assessed using validated tools such as the Visual Analog Scale (VAS) and the Numeric Rating Scale (NRS).[6]

Despite this growing evidence base, the scope and methodological quality of the available literature remain variable. Most studies have investigated IR therapy within specific patient populations or clinical settings, often without direct comparison to other treatment modalities.[7] Moreover, concerns regarding the standardization of treatment protocols, dosage, and treatment duration limit the generalizability of existing findings. IR therapy's diagnostic accuracy and long-term efficacy also remain subject to debate, as highlighted by several meta-analyses.[8]

Given these gaps, a comprehensive synthesis of the current literature is warranted. The present review aims to critically evaluate scientific evidence on the effectiveness of infrared therapy in reducing pain associated with musculoskeletal disorders. By focusing on pain outcomes measured through objective assessment tools and examining

the role of IR therapy as a complementary or alternative treatment option, this review seeks to clarify its clinical relevance and potential integration into multidisciplinary pain management strategies.

Methods

This narrative review was conducted to explore the effectiveness of infrared (IR) therapy in reducing musculoskeletal pain. The research was structured using the PICO framework—Population, Intervention, Comparison, and Outcome—which is commonly used in qualitative research, particularly for clinical questions addressing therapeutic interventions. In this review, the population of interest consisted of individuals with musculoskeletal disorders (P), the intervention under review was infrared therapy (I), and the primary outcome (O) focused on pain reduction. There was no specific comparison group (C), as the aim was to evaluate the effectiveness of infrared therapy alone.

A comprehensive literature search was performed using the Google Scholar and PubMed databases between February and March 2025. The keywords used for the search included: “Infrared Therapy” OR “Infrared Radiation” AND “Musculoskeletal Disorder” OR “Musculoskeletal Disease.” Boolean operators "AND" and "OR" were applied to refine the search results. Filters were used to include only articles published in English, with full-text availability, and published between 2018 and 2024—the studies considered for review employed randomized controlled trials (RCTs) and experimental study designs. Initially, the search yielded 15 articles, which were narrowed down through various screening processes.

Following the screening with the applied filters, 15 articles remained for further evaluation. These articles were then assessed based on the inclusion and exclusion criteria. Articles were included if they were relevant to infrared therapy for musculoskeletal pain, published in English, had full-text availability, and were published between 2018 and 2024. Articles were excluded if they were unrelated to the topic, discussed confounding medical conditions, or lacked full-text availability. This process resulted in 7 articles meeting the inclusion criteria.

From the eligible articles, seven were selected for inclusion in the final review. These included five randomized controlled trials (RCTs) and two quasi-experimental studies. Data extraction was performed to gather relevant information, including study design, sample characteristics, outcome measurement tools, and the main results related to pain reduction. Given the diversity in study designs, outcome measures, and patient populations, a meta-analysis was not conducted. Instead, a narrative synthesis was employed to summarize the findings and provide a comprehensive overview of the effects of infrared therapy on musculoskeletal pain outcomes.

This review does not include a quantitative synthesis due to the heterogeneity in the studies. Instead, it presents the findings descriptively, allowing for an exploratory understanding of the effectiveness of infrared therapy in managing musculoskeletal pain. The PICO framework guided the synthesis, focusing on the population of individuals with musculoskeletal disorders, the infrared therapy intervention, and the pain reduction outcome.

Additionally, sensitivity and subgroup analyses were planned to enhance the interpretation of the findings. Sensitivity analysis aimed to assess the robustness of the findings by exploring variations in study assumptions or design, such as comparing results between RCTs and quasi-experimental studies. Subgroup analysis focused on identifying differences in effectiveness based on factors such as age, gender, type of musculoskeletal disorder, or geographical location. These analyses were intended to provide more precise clinical recommendations.

The extracted data from the selected studies included author names, publication year, study design, sample size and characteristics, type of musculoskeletal condition, type of infrared therapy used, pain measurement tools (such as Visual Analog Scale and Numerical Rating Scale), main findings, and study conclusions.

Result

A systematic evaluation of the effectiveness of infrared therapy for musculoskeletal pain reduction was conducted using the PICO (Population, Intervention, Comparison, Outcome) framework to ensure methodological rigor. The process was initiated with clear problem identification and keyword selection, allowing for comprehensive searches across major scientific databases, namely PubMed and Google Scholar. Boolean operators and specific keyword combinations were applied to maximize the retrieval of relevant literature. After collecting an initial pool of articles, a two-stage screening process was implemented: first at the title and abstract level, and subsequently at the full-text level. Inclusion criteria encompassed articles published in English, full text availability, studies published within the past decade, and study designs such as randomized controlled trials (RCTs) or quasi-experiments. Studies failing to meet these criteria were excluded.

Data extraction involved systematically recording study characteristics, including sample size, demographic information, intervention specifics, comparator details (if any), outcome measures used to assess pain reduction, and reported results. A descriptive synthesis of the findings was then performed to highlight the impact of infrared therapy on musculoskeletal conditions. The detailed workflow of study selection is illustrated in Figure 1, and a comprehensive overview of the included studies, along with their key characteristics and findings, is provided in Table 1. This structured approach ensures the reliability and validity of the conclusions drawn regarding the therapeutic potential of infrared interventions.

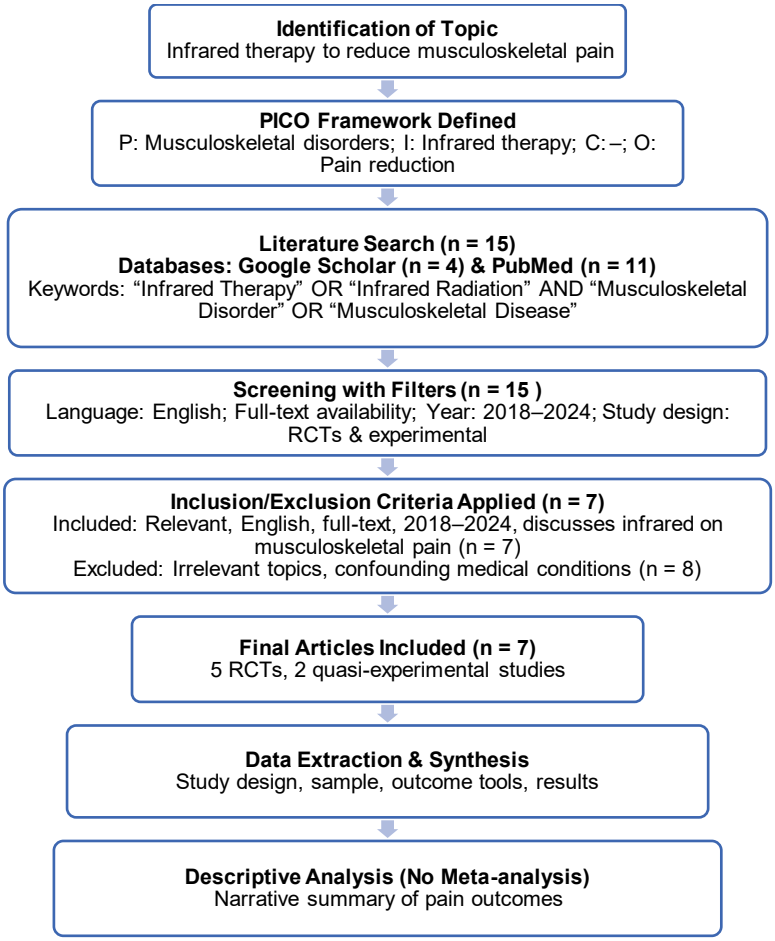

Figure 1. Flowchart of Literature Screening and Inclusion

Table 1. Summary of Reviewed Studies on Infrared Therapy for Musculoskeletal Pain

Author(s) / Journal	Study Design	Sample	Pain Measurement Tools	Key Findings
Salm et al., Journal of Neuroimmunology	RCT	n = 60 (patients with fibromyalgia)	SF-MPQ, VAS, FIQ	Combined aquatic exercise and Far Infrared therapy (cFIR) significantly reduced pain compared to aquatic exercise with placebo shirt.
Usman et al., Kong Physiotherapy Journal	RCT	n = 80 (patients with osteoarthritis)	WOMAC, SF-36, VAS	Combination therapy group showed significantly greater pain reduction than infrared-only group.
Key Title et al., Scholar Journal of Applied Medical Sciences	RCT	n = 40 (patients with chronic low back pain due to lumbar spondylosis)	Oswestry Disability Index, VAS, Modified Zung Index	Infrared radiation significantly reduced pain and improved function in patients with lumbar spondylosis.
Klemm et al., Journal of Back and Musculoskeletal Rehabilitation	RCT	n = 30 (patients with axial spondyloarthritis)	BASDAI, BAS-G	sl-wIRAR significantly reduced pain (VAS: 4.1 ± 2.4 to 2.6 ± 2.0, p = 0.006) and improved global well-being (BAS-G); no change in serum cytokines.
Klemm et al., International Journal of Hyperthermia	RCT	n = 60 (patients with axial spondyloarthritis)	NRS, BASDAI, Functional Index	Significant pain and disease activity reduction in sl-wIRAR group (p < 0.0005), showing efficacy for axSpA management.
Untari et al., Bangladesh Journal of Medical Science	Quasi-experimental	n = 36 (elderly and pre-elderly adults with musculoskeletal pain)	VAS	Infrared therapy significantly reduced pain; Wilcoxon and Mann-Whitney tests confirmed pre-post and between-group differences.
Putra et al., Jurnal Universitas Jember	Quasi-experimental	n = 34 (elderly patients with osteoarthritis of lower extremities)	VAS	Significant pain reduction post-intervention (p = 0.000) in the treatment group using infrared therapy.

This review encompasses seven articles from various countries, reflecting considerable geographic and demographic diversity, including Nigeria, South Africa, Brazil, Indonesia, Bangladesh, and Germany. Among these, Germany contributes the highest number of studies addressing the use of infrared therapy in the management of musculoskeletal disorders. Thus, the articles analyzed in this review represent a globally diverse population, encompassing multiple ethnic groups and cultural backgrounds. This suggests that research on infrared therapy in the context of musculoskeletal conditions holds broad relevance and has been applied across different regions of the world.

The review includes studies employing various research designs from these countries, notably randomized controlled trials (RCTs) and quasi-experimental studies. The most commonly used design among the selected articles is the RCT, which is widely regarded as the gold standard for evaluating the effectiveness of an intervention. RCTs are

preferred due to their methodological rigor, particularly their ability to control confounding variables and provide more substantial evidence to support clinical recommendations.

Additionally, the reviewed studies demonstrate a wide range of outcome measurement tools used to evaluate the effectiveness of infrared therapy in managing musculoskeletal pain. These instruments include the Visual Analog Scale (VAS), Numeric Pain Rating Scale (NPRS), Numerical Pain Number (NPN), Bath Ankylosing Spondylitis Patient Global Score (BAS-G), the SF-36 (Short Form Health Survey), the Oswestry Disability Index, the Modified Zung Index, and digital algometers.

This diversity in measurement tools highlights the variability in assessment approaches researchers adopt across different settings. However, it also reflects a lack of standardization in evaluating the effectiveness of infrared therapy for musculoskeletal disorders. The absence of uniformity in outcome assessment poses a challenge to the direct comparison of study results. It may hinder the development of universal guidelines or clinical recommendations regarding infrared therapy for musculoskeletal conditions.

The lack of standardized outcome measures emerges as a key limitation in assessing the effectiveness of infrared therapy, as the divergent tools employed across studies make it difficult to draw direct comparisons. For instance, a study utilizing the VAS might significantly reduce pain, whereas another using the NPRS may not yield comparable findings. This raises concerns about whether infrared therapy consistently yields effective outcomes across various conditions and populations.

Although the articles reviewed suggest that infrared therapy holds therapeutic promise, the potential for bias in the included studies has not been systematically analyzed. This represents a critical area for further research. Potential biases, such as publication bias or measurement bias, related to study design warrant closer scrutiny, as they may affect the validity of the conclusions.

Future studies should consider conducting detailed subgroup analyses to enhance understanding of infrared therapy's efficacy. For example, stratifying data by musculoskeletal condition (e.g., osteoarthritis versus fibromyalgia) may clarify whether infrared treatment is more effective for specific types of pain. Moreover, analyzing outcomes based on patient characteristics, such as age, disease severity, or psychological factors, may offer valuable insights into the variables influencing therapeutic effectiveness.

Discussion

The study titled *Aquatic Exercise and Far Infrared (FIR) Modulates Pain and Blood Cytokines in Fibromyalgia* by Rodríguez-Huguet reveals that Far Infrared (FIR) therapy can influence pain reduction in fibromyalgia patients through several mechanisms.[9] FIR can enhance blood circulation and improve tissue oxygenation, contributing to the healing process and inflammation reduction.[10] Additionally, FIR therapy has decreased pro-inflammatory cytokines such as IL-6 and Tumor Necrosis Factor (TNF), which are associated with chronic pain. The local temperature increase from the FIR application can relax muscles and reduce tension, further contributing to pain reduction. By reducing inflammation and improving circulation, FIR aids in pain modulation and improves the quality of life for fibromyalgia patients.[10] These findings align with the research conducted by Inou & Kabaya on the biological activities caused by far-infrared radiation [11]

The journal titled *Effects of Combination Therapy and Infrared Radiation on Pain, Physical Function, and Quality of Life in Subjects with Knee Osteoarthritis* demonstrates that infrared radiation impacts pain reduction in knee osteoarthritis through several mechanisms. Infrared radiation improves blood circulation to the affected area, facilitating the delivery of oxygen and nutrients while eliminating metabolic waste products, thus reducing inflammation and accelerating the healing process.[12] Furthermore, infrared radiation helps relax tense muscles, which often contribute to musculoskeletal pain, and thus, muscle relaxation can reduce the perceived pain. Infrared radiation also stimulates fibroblast cells and enhances collagen synthesis, which is crucial for tissue repair, aiding in the healing of damaged tissue and reducing pain. Lastly, infrared radiation affects pain receptors in the skin and subcutaneous tissues, diminishing pain perception by inhibiting signals sent to the brain.[7] Thus, using infrared radiation in therapy significantly benefits knee osteoarthritis patients' pain management.[12] This is in agreement with the study by Hsieh et al. titled *Therapeutic Effects of Short-Term Monochromatic Infrared Energy Therapy on Patients with Knee Osteoarthritis: A Double-Blind, Randomized, Placebo-Controlled Study* [13]

The journal *The Infrared Radiation's Effects on Patients with Chronic Low Back Pain Due to Lumbar Spondylosis* demonstrates that infrared radiation influences pain reduction in chronic low back pain cases resulting from lumbar spondylosis through several mechanisms. The local temperature increase from infrared therapy can enhance blood circulation in the affected area, helping to reduce muscle stiffness and accelerate healing by delivering more oxygen and nutrients to the injured tissues.[14] Moreover, the heat generated by infrared radiation can relax muscles, alleviating the tension and spasms that often contribute to pain. Infrared radiation may also help reduce inflammation by modulating immune responses and lowering the production of pro-inflammatory cytokines, which play a role in pain and swelling reduction in the affected area.[7] Lastly, infrared radiation stimulates cellular metabolism and accelerates tissue regeneration, assisting in repairing tissue damage that may be causing pain. Therefore, using infrared radiation in therapy for chronic low back pain offers significant pain reduction benefits and improves patient function.[14]

Klemm et al.'s study titled *Treatment of Back Pain in Active Axial Spondyloarthritis with Serial Locoregional Water-Filtered Infrared A Radiation* reveals that water-filtered infrared A radiation (wIRAR) can influence pain reduction through several mechanisms.[15] This radiation increases tissue temperature in the affected area, contributing to vasodilation and enhanced blood flow. This increased blood flow helps reduce muscle tension and promotes tissue healing, which can, in turn, alleviate pain.[16] seconds, wIRAR can affect immune cell activity and reduce inflammation by decreasing pro-inflammatory cytokines and enhancing anti-inflammatory cytokines, thus helping to reduce pain associated with inflammatory conditions like axial spondyloarthritis (axSpA).[17] Third, the analgesic effects of wIRAR can

be attributed to its influence on the central nervous system, where increased temperature can modulate pain signals sent to the brain, thus reducing pain perception.[18] Therefore, using wIRAR to treat low back pain in patients with axSpA provides benefits through a combination of physiological and biochemical effects.[17]

The journal titled *Serial Locally Applied Water-Filtered Infrared A Radiation in Axial Spondyloarthritis - A Randomized Controlled Trial* by Klemm et al. reveals that the use of water-filtered infrared A radiation (wIRAR) can affect pain reduction through several mechanisms.[19] This infrared radiation increases tissue temperature in the affected area, potentially enhancing blood circulation and accelerating the healing process. The temperature increase can also reduce muscle tension and improve tissue elasticity, reducing pain. Additionally, wIRAR can affect the levels of pro-inflammatory cytokines, such as tumor necrosis factor alpha (TNF-α).[19] This study found that the application of serial locally applied wIRAR led to a significant reduction in TNF-α levels in the intervention group, which may contribute to reducing inflammation and pain. Thus, the combination of thermal effects and reduction of inflammatory cytokines explains the mechanism of pain reduction in patients with axial spondyloarthritis (axSpA) who received this therapy.[20]

The study titled *Difference in the Effectiveness of Infrared Therapy for Reducing Musculoskeletal Pain in the Elderly* by Untari et al. (2024) physiologically demonstrates that infrared therapy can reduce pain through several mechanisms, including enhanced blood circulation, reduced inflammation, stimulation of the healing process, and indirect analgesic effects on the nervous system.[21] Infrared waves penetrate the body's tissues, improving blood flow to the irradiated area, delivering more oxygen and nutrients to inflamed or painful tissues, and accelerating the healing process.[18] Additionally, this therapy reduces inflammation by influencing biochemical processes within cells, reducing the production of pro-inflammatory cytokines and increasing anti-inflammatory cytokine production, which, in turn, alleviates pain. Infrared waves also stimulate fibroblast cells and enhance collagen synthesis, essential for repairing damaged tissues that cause musculoskeletal pain. Lastly, infrared therapy can affect the nervous system by reducing pain signal transmission to the brain, altering pain perception, and providing significant analgesic effects.[22] Thus, infrared therapy effectively reduces musculoskeletal pain through complex physiological mechanisms. These findings align with the research conducted by Tsai & Hamblin titled *Biological Effects and Medical Applications of Infrared Radiation* [21]

The study titled *Infrared Therapy Reduces Lower Extremity Pain in the Elderly with Osteoarthritis* by Putra et al. (2021) physiologically demonstrates that infrared therapy can reduce pain in musculoskeletal disorders through several mechanisms.[23] First, this therapy enhances blood flow to the affected area, helping reduce the accumulation of metabolic substances, such as substance P, which can cause pain.[24] Furthermore, infrared therapy warms muscle tissue, reducing muscle tension and stiffness, relieving pain, and improving mobility. This therapy also stimulates parasympathetic activity and reduces sympathetic activity, helping reduce pain and fatigue.[7] In addition, increased blood flow and reduced muscle tension also play a role in reducing inflammation, which is often a primary cause of pain in musculoskeletal conditions. These mechanisms explain the effectiveness of infrared therapy in reducing pain in patients with musculoskeletal disorders, including osteoarthritis [23]

Summary of Reviewed Studies on Infrared Therapy for Musculoskeletal Pain

Infrared therapy has demonstrated significant effectiveness in reducing pain among patients with musculoskeletal disorders, including conditions such as osteoarthritis and muscle injuries. Many patients report notable improvements in pain levels and overall quality of life following treatment. Beyond pain reduction, the use of infrared therapy also positively impacts mobility and flexibility, particularly in individuals who experience movement limitations due to chronic pain. The therapeutic effects of infrared radiation are primarily achieved through enhanced blood circulation, inflammation reduction, tissue healing stimulation, and indirect analgesic effects on the nervous system.

Comparative studies suggest that infrared therapy may offer greater benefits than conventional physical therapy approaches, especially regarding pain relief and patient comfort. However, the existing body of research displays considerable variability in study design and methodology, with randomized controlled trials (RCTs) recognized as the gold standard for evaluating intervention efficacy. Regarding application parameters, an optimal session duration of 20 to 30 minutes is generally recommended, with treatment frequency tailored to the patient's specific clinical condition.
Despite these promising findings, many studies face limitations related to sample size, study design, and short follow-up periods, which constrain the generalizability of the results. Therefore, further research employing more rigorous methodologies and larger, more diverse samples is necessary to strengthen the evidence base supporting infrared therapy. Overall, infrared therapy holds considerable potential as a non-invasive and natural alternative for managing musculoskeletal pain, offering patients an option associated with minimal risks and side effects.

The studies cited utilize various study designs, including randomized controlled trials (RCTs) and experimental studies. RCTs are the dominant study design and are considered the strongest research method for evaluating the effectiveness of an intervention. This is because RCTs provide more valid and reliable evidence regarding the outcomes and can control for other variables that might influence the results.

Sample sizes in the studies vary, with some studies involving relatively small samples, such as 30 participants, which may limit the generalization of the results. Additionally, some studies involve 50 participants, which is still considered small and may limit the generalizability. The confidence in the reported results may be affected by limitations in blinding and the use of self-reported data, which can influence the validity of the results. However, the use of RCTs as the primary

Design provides a stronger foundation for clinical recommendations.
Findings from this review suggest that infrared therapy effectively reduces pain, improves circulation, reduces inflammation, relaxes muscles, and accelerates tissue healing in musculoskeletal disorders. Infrared therapy is a safe and non-invasive alternative for pain management. It can be integrated into broader therapeutic approaches, enriching treatment options available to healthcare professionals.

Implications for Practice

For healthcare providers, particularly physiotherapists, infrared therapy can expand the range of available treatments, offering an additional option tailored to individual patient needs. This therapy can enhance blood circulation, reduce inflammation, relax muscles, and promote tissue healing, all of which contribute to improved patient quality of life.

For patients, infrared therapy may provide more effective pain reduction and physical function improvement without relying on medications, leading to better adherence to treatment plans and more positive long-term outcomes.

Critique of the Research Based on Seven Literature Articles

The results of this study indicate that workload, work posture, and age are significant factors affecting lower back pain complaints, aligning with the initial research aim to evaluate the risk factors in farmers. The strengths of the seven articles reviewed lie in the various trials conducted with the infrared therapy program. All studies demonstrated that this intervention program effectively reduces pain in musculoskeletal disorders and improves patients' quality of life. This result contrasts with the study by Widaningsih et al. (2019), likely due to differences in the type of work and the prolonged exposure to static postures among the subjects in our research.

However, this research has notable limitations. One such limitation is the scarcity of relevant and available articles on the use of infrared therapy in reducing pain associated with musculoskeletal disorders. While several studies show positive results, the number of studies available for reference remains limited, especially those with strong experimental designs and representative samples.

Furthermore, sample sizes in some studies were small, involving only 30 to 50 participants. This small sample size limits the generalization of the results to a broader population. In addition, some studies had very short durations, such as only lasting 7 days. This brief duration may not be sufficient to evaluate the long-term effects of the intervention provided.

There were also limitations in blinding and the use of self-reported data by participants, which could affect the validity of the study results. Inadequate blinding increases the risk of bias in the outcome assessment. Researchers also faced challenges accessing a broader range of articles, including paid articles, and encountered incomplete information regarding the dosage and procedures used in the studies. While diverse measurement tools can provide a broader perspective, they can also lead to inconsistencies in the measurement outcomes between studies, making direct comparisons difficult.

Further research must address these limitations, especially regarding dosage parameters and more detailed therapeutic protocols. Currently, information about the dosage and procedures used in infrared therapy is often incomplete, which can impact the consistency and effectiveness of results. Standardization in the use of measurement tools and more structured research methods is also required to ensure this therapy's consistent and practical application in various clinical contexts. With more controlled research and larger sample sizes, it is hoped that stronger evidence will be gathered regarding the effectiveness and mechanisms of infrared therapy, allowing it to be more widely integrated into musculoskeletal pain management.

Conclusion

Based on the findings and discussion, it can be concluded that infrared therapy shows promising potential in reducing pain in patients with musculoskeletal disorders. This therapy offers a safe, non-invasive, and effective alternative for pain management and could serve as an adjunct treatment to reduce reliance on pain medications. Additionally, infrared therapy has the potential to be integrated into broader therapeutic approaches for managing musculoskeletal disorders, providing additional benefits such as improved blood circulation, reduced inflammation, muscle relaxation, and accelerated tissue healing.

Several studies, such as those by Untari et al. (2024) and Tsai & Hamblin (2017), support the effectiveness of infrared therapy in alleviating pain by enhancing circulation, reducing inflammation, and stimulating healing processes. Despite these positive outcomes, some studies show inconsistent results, particularly when therapy duration is short or small sample sizes. Such findings highlight the need for further research with more controlled methodologies and standardized protocols to ensure consistent and optimal results.

Future research should focus on larger sample sizes, more robust experimental designs, and clear guidelines on dosage and therapy protocols. A systematic review and meta-analysis approach could also provide more reliable conclusions about the effectiveness of infrared therapy. Clinical recommendations should consider patient-specific factors, particularly for those with chronic pain conditions such as osteoarthritis and chronic low back pain.

To optimize the application of infrared therapy, healthcare professionals, especially physiotherapists, should undergo proper training, select appropriate patients, and monitor the therapy's effectiveness to maximize the application of infrared therapy. Regular evaluations will help ensure its safe and efficient use as part of a multimodal pain management approach.

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