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NON-PHARMACOLOGICAL APPROACHES IN FIBROMYALGIA: EXERCISE, MANUAL THERAPY AND INNOVATIVE TECHNOLOGY-BASED INTERVENTIONS

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ABSTRACT

Background. Fibromyalgia is a chronic disorder characterized by widespread pain, fatigue, sleep disturbances, and mood disorders, affecting predominantly middle-aged women. Its complex pathophysiology involves both central and peripheral mechanisms, with management aimed at relieving symptoms while improving quality of life. Non-pharmacological interventions, including exercise, manual therapy, mind-body practices and emerging approaches like dry needling and virtual reality, show promise in improving patient outcomes.
Aim. To review current evidence on non-pharmacological interventions for fibromyalgia, focusing on their efficacy, safety and impact on pain, physical function, symptom management and quality of life.
Material and methods. A narrative review of studies from 2010–2025 was conducted using PubMed, ScienceDirect, and Google Scholar. Relevant articles were identified with keywords related to fibromyalgia and non-pharmacological treatments and the data was categorized by intervention type.
Results. Non-pharmacological interventions for fibromyalgia, including low-impact exercise, manual therapy, dry needling, acupuncture, cryotherapy and virtual reality, improve pain, physical function, fatigue, mood and quality of life. Exercise and mind-body practices enhance both physical and psychological well-being, while manual therapy and dry needling techniques reduce pain and improve sleep. Cryotherapy decreases inflammation and virtual reality shows promising effects on symptoms and enables home-based rehabilitation.
Conclusions. Non-pharmacological interventions, provide significant benefits for fibromyalgia, improving pain, fatigue, sleep and quality of life. Aquatic exercises offer short-term relief, while resistance and mind–body training support long-term improvements. Individualized, multidisciplinary approaches remain essential, and further research is needed to optimize treatment protocols.

KEYWORDS

Fibromyalgia, Physiotherapy, Physical Exercise, Virtual Reality

CITATION

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1. Introduction

Fibromyalgia is a chronic disorder characterized by widespread musculoskeletal pain, accompanied by nonspecific general symptoms such as excessive fatigue, headaches, sleep disturbances and anxiety or depressive disorders. [1,2] The clinical significance of fibromyalgia is underscored by its prevalence in the general population, which is estimated to range from 2% to 8%. [3] This renders fibromyalgia a significant burden on healthcare systems due to its high prevalence and chronic, heterogeneous clinical presentation. The condition also involves prolonged and complex diagnostic processes, as well as substantial indirect costs associated with frequent specialist consultations and numerous additional diagnostic procedures. [4] Epidemiologically, fibromyalgia most commonly affects middle-aged women. [5] Furthermore, this gender disparity is associated with higher levels of anxiety observed in women, distinct behavioral and physiological responses to pain, differences in the modulation of stimuli within the central nervous system and hormonal fluctuations related to the menstrual cycle. [6,7] Pathophysiological risk factors for the development of fibromyalgia have been the subject of scientific investigation for many years. In fibromyalgia, dysfunctions in monoaminergic systems have been observed, manifested by increased levels of excitatory neurotransmitters and decreased levels of serotonin and norepinephrine in descending pathways responsible for pain inhibition. Additionally, abnormalities in dopamine regulation and the functioning of the endogenous opioid system have been reported. Collectively, these phenomena suggest a central role of pathophysiological mechanisms in fibromyalgia. [7] In some patients with fibromyalgia, reduced density of small nerve fibers in the skin and signs of their dysfunction have been observed, suggesting that peripheral pathology (small-fiber neuropathy) may contribute to the generation of pain and autonomic symptoms. [8] Despite numerous clinical and scientific

studies, the pathogenesis of this disorder remains incompletely understood. [9] Due to its uncertain pathophysiology, fibromyalgia lacks fully effective treatment and therapeutic strategies largely focus on symptomatic management and improving patients' quality of life. [10] The management of fibromyalgia should adopt a multidimensional approach, as current evidence indicate the limited effectiveness of isolated pharmacotherapy and highlight the benefits of combining pharmacological and non-pharmacological strategies. [11,12,13] Moreover, medications used in the pharmacological management of fibromyalgia—such as tricyclic antidepressants, serotonin-norepinephrine reuptake inhibitors (SNRIs) and antiepileptic drugs—may cause numerous adverse effects, which in some patients limit treatment tolerance and reduce its acceptability. [13] Consequently, in recent years, several studies have focused on non-pharmacological strategies for the management of fibromyalgia, which demonstrate a more favorable safety profile and often yield greater clinical efficacy compared with pharmacological therapy. [10] Non-pharmacological interventions include a wide range of strategies, such as low-intensity aerobic exercise, resistance training, aquatic therapy, manual therapy and mind-body practices like yoga and Tai Chi. Emerging approaches, including dry needling, acupuncture, cryotherapy and virtual reality-based training, are also being explored for their potential to improve pain, physical function and overall quality of life in patients with fibromyalgia. [14,15]

2. Aim of the Study

The aim of this study is to provide a comprehensive review of non-pharmacological interventions for the management of fibromyalgia, including exercise-based therapies, manual techniques and emerging technology-assisted approaches, with a focus on their efficacy, safety and impact on pain, physical function, symptom control and patients' quality of life.

3. Research materials and methods

A narrative literature review was conducted using articles sourced from PubMed, ScienceDirect and Google Scholar. The search strategy involved combinations of the keywords "fibromyalgia", "treatment", "physical therapy", "manual therapy", "exercise", "virtual reality" and "non-pharmacological".

Reference lists of included papers were manually screened to identify additional sources. Original studies, systematic reviews and meta-analyses published between 2010 and 2025 were included. The information obtained in this process was then systematized and organized by assigning it to specific categories of non-pharmacological methods used in the treatment of fibromyalgia.

4. Research results

4.1 Low impact physical exercise (low impact PE)

Low-impact physical exercise refers to forms of kinesiotherapy that minimize mechanical stress on the joints and soft tissues. These exercises are designed to improve cardiovascular fitness, muscle strength, flexibility and overall functional capacity while reducing the risk of pain exacerbation or injury. [16] Examples include aerobic training, Pilates, stretching exercises and aquatic exercises. Numerous studies have demonstrated the beneficial effects of kinesiotherapy as an adjunct to standard therapies used in the treatment of fibromyalgia. [17] Moreover, some sources suggest that physical exercise should be considered a first-line treatment for patients suffering from this condition. [18] Low-impact physical exercise exerts beneficial effects not only on the specific pain symptoms of fibromyalgia 17], but also on associated psychological factors, including pain catastrophizing and chronic anxiety. [19] Patients have also consistently reported improvements in both quality of life and overall physical functioning. [16,19,20] Specific examples of low-impact physical exercise and their effects on disease progression and symptomatology are described below.

- Aerobic exercises

Aerobic exercise refers to a form of physical activity performed at moderate to high intensity, in which oxygen is the primary source of energy. These exercises aim to improve cardiovascular endurance, increase the oxygen-carrying capacity of muscles and enhance overall physical stamina. [21] The effects of aerobic exercise on symptoms and well-being in patients with fibromyalgia have been assessed in numerous studies. The results of these studies indicate reductions in pain, perceived fatigue and mood disturbances, as well as improvements in health-related quality of life (HRQOL) among groups receiving this intervention. [22] However, a thorough assessment of the effects of this type of exercise on patients' well-being and symptom severity is challenging due to substantial variations in the duration and frequency of aerobic training as well as the intensity of particular training sessions. [10] Furthermore, it can be difficult for patients to follow the training schedule consistently enough to obtain benefits due to the high severity of their underlying disease symptoms. [23]

- Dance therapy

Dance therapy is defined as structured sequences of movements which are performed simultaneously with music. It represents a specific form of exercise that integrates physical activity with social interaction and artistic expression. It can be considered as an enjoyable stimulus for physical training. [24,25] Dance is a form of physical activity during which endorphin release is stimulated, thereby improving both physical and social well-being. [26] Numerous benefits of this form of physiotherapy for patients with chronic pain have been reported in the literature. Improvements have been observed not only in cardiovascular and musculoskeletal function, but also in patients' motivation to participate in exercise in general, which consequently contributes to an enhanced quality of life. [26] It is also worth mentioning that dance therapy was found to be effective in improving body awareness and reducing pain perception, although its impact on reducing kinesiophobia appears to be limited. [27]

- Muscle stretching exercises

Muscle stretching exercises can be described as a form of physical activity aimed at deliberately elongating muscles and soft tissues (e.g. muscle fibers, tendons) to increase muscle–tendon flexibility, enhance joint range of motion and reduce muscle tension. [28] There are two commonly used flexibility training techniques: static stretching, which involves holding a muscle in an elongated position for a defined period of time, and dynamic stretching, which consists of active, controlled movement and can be used as a preparation for further physical activity. [29] Regular stretching may improve flexibility, joint mobility and muscle-tissue elasticity and is widely used in general fitness, sport training and rehabilitation contexts. [30,31,32] Patients with fibromyalgia may also experience muscle stiffness and tenderness as part of their condition, which makes stretching techniques particularly beneficial for them. [33] Significant improvements have been demonstrated in numerous studies investigating the effects of stretching exercises on pain perception in patients with fibromyalgia. [34] By reducing skeletal muscle tension and increasing both active and passive range of motion, these exercises help alleviate pain, mitigate the impact of fibromyalgia, reduce fatigue and improve sleep quality in this patient group. However, it should be emphasized that these studies are of moderate methodological quality. [10] Compared to resistance training, described in the following section, stretching exercises had a greater impact on overall quality of life, particularly regarding daily physical activity and pain perception. In contrast, resistance training provided more pronounced benefits in alleviating depression. [35]. Another study reported superior outcomes for the resistance training group in terms of multidimensional function and pain reduction, but no significant differences were observed for tenderness or muscle strength. [36]

- Resistance training

Resistance training is structured to increase muscle strength through working against an external load. Such resistance may involve specialized equipment, including dumbbells, barbells, or resistance bands, or it may even rely on one's own body weight. [37] The justification for implementing resistance exercises in patients with fibromyalgia is supported by studies demonstrating reduced muscle strength in this patient population. [38] Consequently, individualized progressive resistance training has been shown to be a practical exercise approach for women with fibromyalgia, leading to improvements in muscle strength, overall health status and immediate post-intervention pain levels. [38]

- Aquatic exercises

Aquatic exercise involves performing structured physical activity within a water environment rather than referring to a specific exercise modality. The distinctive physical properties of water—such as buoyancy, resistance, hydrostatic pressure and thermal conductivity—combined with the physiological responses to immersion, create a therapeutic setting that can positively influence patient outcomes. [39,40] These effects help reduce pain perception by stimulating mechanoreceptors and thermoreceptors, while also alleviating fatigue and enhancing overall quality of life. [39] Additionally, participation in aquatic exercise programs has been associated with improvements in sleep quality among individuals with fibromyalgia, further supporting its role as a valuable non-pharmacological intervention. [40]

- Tai Chi, Yoga, Breathing Exercises, and Pilates – mind-body exercises

Mind-body exercises are a form of physical activity that connects movement with breathing control and mindfulness. They require a high level of concentration and are often used in rehabilitation and treatment of chronic pain syndromes, including fibromyalgia. [41] What distinguishes this group of exercises from other interventions is their integrated impact on physical, psychological and behavioral domains. This effect is potentially highly beneficial for patients with fibromyalgia due to the diverse physical and emotional challenges they face. [42] Regular practice of Tai Chi has been associated with significant reductions in pain intensity, fatigue and sleep disturbances, along with improvements in overall functioning and quality of life in

fibromyalgia patients. [43]. Compared to standard aerobic exercise, structured Tai Chi interventions (particularly when maintained for 24 weeks) have demonstrated greater improvements in global fibromyalgia impact (as measured by FIQR), anxiety, self-efficacy and coping strategies. [44] Moreover, Yoga appears to positively influence mental and psychosocial dimensions — reducing fatigue, anxiety and depressive symptoms, improving coping strategies and enhancing perceived quality of life among individuals with fibromyalgia. [45] Increasingly popular in recent years, reformer Pilates exercises have been shown to improve clinical outcomes and muscle strength, whereas traditional home-based mat Pilates has demonstrated benefits in reducing the number of painful regions, enhancing clinical and biopsychosocial status while also improving the physical component of quality of life. [46]

4.2 Manual therapy

Manual therapy can be described as a physiotherapeutic procedure in which the therapist, using specific techniques and manipulations, assesses and treats disorders related to the musculoskeletal system. [47] These techniques are primarily aimed at improving functional mobility and minimizing pain symptoms. [48] Symptoms of various conditions—many of which are not directly attributable to the musculoskeletal system—have been reported to improve with the application of manual therapy interventions. These include disorders such as migraine, anxiety, hypertension and depression. [49] In the population of patients with fibromyalgia, the application of manual therapy techniques appears particularly promising in reducing pain symptoms, due to their influence on ascending nociceptive pathways potentially involved in central sensitization, as well as their capacity to modulate pain through both mechanical and neurophysiological mechanisms. [50] Moreover, studies also demonstrate improvements in maintaining restful sleep, as well as in anxiety and depressive symptoms that commonly accompany the primary condition. [49] It is essential that manual therapy applied to patients with fibromyalgia is both pain-free and progressive, with intensity gradually increased in accordance with the symptoms experienced by the patient. [49,51]

4.3 Dry needling and acupuncture

Dry needling represents an additional physiotherapeutic intervention that may serve as a non-pharmacological treatment approach for fibromyalgia. This technique involves the insertion of thin, sterile needles directly into the muscle tissue. In contrast to acupuncture, which has its origins in traditional Chinese medicine, dry needling specifically targets myofascial trigger points, which are frequently associated with pain and muscular dysfunction. [52,53,54] In contrast, acupuncture involves the insertion of needles into precisely defined points that correspond to specific health conditions or symptoms. [55] The analgesic effects of both interventions are mediated by the influence of hormones and neurotransmitters on the central nervous system, through the stimulation of nerve fibers and activation of a cascade of pain-modulating endorphins, serotonin and noradrenaline. [56]. In 2022, a meta-analysis demonstrated that dry needling may induce short-term improvements in patients with fibromyalgia regarding pain, quality of life, vitality and social functioning. The study also highlighted that the use of acupuncture combined with other treatments, such as manual therapy, is an effective approach to reduce the reliance on analgesic medications and improve pain perception as well as the quality of life from the short-term up to 12 months. [56]

4.4 Cryotherapy

Cryotherapy is a therapeutic method in which low temperatures are applied either to specific tissues (local cryotherapy) or to the patient's entire body (whole-body cryotherapy). [57,58] This intervention is extensively used in the management of sports-related injuries owing to its capacity to decrease the inflammatory response, including the formation of tissue oedema. [59] Whole-body cryotherapy (WBC) consists of exposing the patient to a chamber with precisely controlled temperatures for brief durations (typically 2–5 minutes). WBC has been demonstrated to possess analgesic and anti-inflammatory properties. [58] The beneficial effects of cryotherapy in patients with fibromyalgia have been attributed to a reduction in oxidant levels, thereby limiting muscle microdamage and facilitating accelerated muscle recovery following routine physical activity. [60] Moreover, cryotherapy, both local and whole-body (WBC), contributes to the reduction of perceived pain in patients with fibromyalgia by modulating pain signal transmission in the central and peripheral nervous systems, as well as by decreasing the levels of pro-inflammatory cytokines such as interleukin-6 (IL-6) and tumor necrosis factor alpha (TNF-α), which further exacerbate pain perception. [58; 61] Cryotherapy may also improve sleep quality in patients with fibromyalgia by reducing pain and muscle tension. Additionally, improvements in depressive and anxiety symptoms have been observed, likely as a result of modulation of the hormonal and neurotransmitter systems. [57]

4.5 Virtual reality – new possibilities for physical therapy and rehabilitation

Virtual reality (VR) is a modern technology that, through human–computer interaction, enables patients to respond to virtual stimuli within the real-world environment. [62] Virtual Reality-Based Therapy (VRBT) is founded on the use of this technology in rehabilitation processes for patients suffering from chronic neurological disorders, musculoskeletal conditions or chronic pain syndromes, including fibromyalgia. [63] A particularly advanced technological method is Immersive VR (iVR), which employs specialized headsets and headphones to display 360° 3D digital images, allowing complex scenarios to be reproduced with high realism. During these sessions, patients interact with the virtual environment and perform various tasks—both everyday and atypical—using a hand controller or their own hands, benefiting from multisensory stimulation in a safe and controlled setting. [62,63] Recent advances in these technologies have transformed them from a futuristic concept into a viable approach with substantial potential for pain management. [64] Recently, several randomized controlled trials (RCTs) have been conducted examining the effects of VR on the clinical symptoms of fibromyalgia. Their findings indicate reductions in pain intensity, fatigue and the severity of anxiety and depressive symptoms, as well as an overall improvement in quality of life among patients with fibromyalgia undergoing VRBT interventions. [65, 66] The particularly favorable outcomes associated with VRBT are thought to stem from the influence of emotions closely linked to the limbic system, which can modulate pain processing through descending pathways. Engaging with VRBT as a form of distraction may redirect attention away from nociceptive input, as the multiple neurophysiological interactions between the visual and somatosensory systems can slow the perception of incoming pain signals. Moreover, pleasant and game-like virtual experiences may evoke positive emotional states that strengthen endogenous pain inhibition. [62] It is crucial to highlight that patients themselves report their experiences with this type of therapy as highly satisfactory. [64] VRBT also offers a unique opportunity to be used as a form of telephysiotherapy. It can be implemented at home, thereby improving patient access to physiotherapy protocols, which is particularly beneficial for individuals who, due to health or socio-environmental reasons, have difficulty leaving their homes. This approach was also utilized during the COVID-19 pandemic. [62] The use of VR is additionally being investigated in other chronic pain conditions, including in women affected by endometriosis. [67]

5. Conclusions

Diagnostic and therapeutic management of fibromyalgia has posed challenges for clinicians since many years. [68]. Therefore, a consensus about the most appropriate and beneficial therapeutic approach is still not reached. [69] The physiotherapy- and movement-based rehabilitation approaches outlined in the above review demonstrate beneficial effects on the various symptoms experienced by individuals with fibromyalgia. However, there is controversy as to which type of exercise is the most profitable. [14] In simplified terms, it can be stated that aquatic exercise appears to be the most effective short-term intervention for reducing pain intensity, whereas resistance training demonstrates the greatest long-term benefits in this regard. [14] Another meta-analysis indicates that mind–body and strengthening exercises improve fatigue, whereas aerobic and strengthening exercises enhance sleep quality. [18] Due to the moderate quality of the studies and the resulting data, it is difficult to determine which rehabilitation approach is the most appropriate. [70] Nevertheless, increasing evidence supports the benefits of exercise training, with clear indications that, when properly prescribed, it can be performed safely without causing adverse effects. [71] A multidisciplinary and multimodal approach is currently considered the gold standard in the therapeutic management of patients with fibromyalgia. [18] It should be emphasized that patients with fibromyalgia represent a highly heterogeneous population; therefore, non-pharmacological interventions should be tailored according to each individual's physical function, pain severity and other specific fibromyalgia symptoms. [10] It is also important to adjust the intensity and difficulty of exercise to each individual patient due to the occurrence of activity-induced pain in fibromyalgia. [38] Activity-induced pain refers to the exacerbation of pain following physical activity, even at low or moderate intensity. This phenomenon is thought to result from altered central pain processing and heightened sensitivity of the nervous system, which can limit patients' tolerance for exercise and physical rehabilitation. However, a properly tailored rehabilitation program should significantly reduce the likelihood of its occurrence. [72] The most recent guidelines from the Centers for Disease Control and Prevention (CDC) recommend that non-pharmacological approaches be prioritized and fully implemented before considering opioid therapy for the management of chronic pain in patients with fibromyalgia. [64] Further research employing rigorous methodology and standardized treatment protocols is needed to more accurately evaluate the effectiveness of physical therapy interventions on the diverse symptoms experienced by individuals with fibromyalgia. [73,74] In conclusion, it is important to emphasize that patients with fibromyalgia should engage in physical activity not only due to the primary condition itself, but also because of the potential benefits for multiple organ systems and the overall improvement in health, associated with regular exercise. [75,76,77]

Disclosure
The authors declare no conflict of interest.
Supplementary Materials
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