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REVIEW

Assessment of complementary and alternative medicine methods in the management of ankylosing spondylitis, rheumatoid arthritis, and fibromyalgia syndrome

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Abstract

A wide variety of musculoskeletal, arthritic, connective tissue, and vasculitic diseases fall under the umbrella of "rheumatic diseases". Ankylosing spondylitis, rheumatoid arthritis, and fibromyalgia syndrome are the three members of this disease group with relatively high prevalence. Pharmacological options are at the center of therapeutic algorithms in treating rheumatic diseases, particularly in reducing inflammation. Despite significant advances in pharmacological treatment in recent years, achieving complete treatment success in a group of patients is impossible. Therefore, patients with rheumatic diseases frequently utilize alternative treatment options, such as complementary and alternative medicine. Complementary and alternative medicine is a broad category of health practices not part of the leading health system. Patients with rheumatic diseases turn to complementary and alternative medicine for various reasons, including restricted access to some treatments due to high prices and rigorous regulations, worries about drug side effects, and symptoms that continue despite pharmacological treatment. In addition, because complementary and alternative medicine options are considered natural, they are frequently accepted as well tolerated and have few harmful effects. Ankylosing spondylitis, rheumatoid arthritis, and fibromyalgia syndrome are the primary foci of this comprehensive review. First, we attempted to summarize the non-traditional physical medicine and complementary and alternative medicine options that can be utilized to manage these diseases. Second, we addressed the link between exercise and inflammation in rheumatic diseases. We briefly discussed the possible benefits of exercise-based approaches. In addition, we highlighted the benefits of cooperation between rheumatology and physical medicine-rehabilitation clinics.

Keywords Ankylosing spondylitis · Spondyloarthritis · Rheumatoid arthritis · Fibromyalgia · Complementary therapies · Exercise

Introduction

Rheumatic diseases involve various musculoskeletal, arthritic, connective tissue, and vasculitic diseases [1]. Rheumatic diseases are associated with negative effects on daily living activities, a decrease in productivity and work efficiency, certain levels of disability, and deterioration in the quality of life [2]. In recent years, significant progress has been made in the pharmacological treatment of rheumatic diseases. However, some patients do not respond adequately to the main medical treatments. Therefore, patients with rheumatic diseases often choose different treatment options, such as complementary and alternative medicine (CAM) methods [3, 4].

CAM is defined as a wide range of health practices not integrated into the dominant health system [5]. Alternative medical systems, biologics, manipulative interventions, mind–body and cognitive techniques, and energy-based healing procedures are the major categories of CAM methods [6]. There are several reasons why patients with rheumatic diseases resort to CAM methods, such as limited

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access to some drugs due to high costs and strict regulations, concerns about drug side effects, and symptoms that persist despite medications. Since CAM methods are considered natural, they are often regarded as well tolerated and have minimal adverse events [7].

Exercise interventions have been suggested as an essential component of routine care for those suffering from diseases covering inflammatory arthritis, osteoarthritis, and fibromyalgia syndrome (FMS) [8]. Therefore, exercise and physical medicine practices are essential in managing rheumatic diseases.

This comprehensive review focused on three major rheumatic diseases: ankylosing spondylitis (AS), rheumatoid arthritis (RA), and FMS. We aimed to summarize the non-traditional physical medicine and CAM methods that can be used to manage these diseases. Additionally, we discussed why physical medicine-rehabilitation and rheumatology clinics should collaborate.

Search strategy

A search procedure was created based on the suggestions of Gasparyan et al. [9]. First, the following term combinations were used to search for articles in Web of Science, Scopus, PubMed/MEDLINE, and DOAJ: 'Ankylosing Spondylitis and Pilates' or 'Ankylosing Spondylitis and Massage' or 'Ankylosing Spondylitis and Balneotherapy' or 'Ankylosing Spondylitis and Spa Therapy' or 'Ankylosing Spondylitis and Yoga' or 'Ankylosing Spondylitis and Tai Chi' or 'Ankylosing Spondylitis and Acupuncture' or 'Ankylosing Spondylitis and Nutritional Therapy' or 'Ankylosing Spondylitis and Hypnotherapy' or 'Spondyloarthropathy and Pilates' or 'Spondyloarthropathy and Massage' or 'Spondyloarthropathy and Balneotherapy' or 'Spondyloarthropathy and Spa Therapy' or 'Spondyloarthropathy and Yoga' or 'Spondyloarthropathy and Tai Chi' or 'Spondyloarthropathy and Acupuncture' or 'Spondyloarthropathy and Nutritional Therapy' or 'Spondyloarthropathy and Hypnotherapy' or 'Rheumatoid Arthritis and Pilates' or 'Rheumatoid Arthritis and Massage' or 'Rheumatoid Arthritis and Balneotherapy' or 'Rheumatoid Arthritis and Spa Therapy' or 'Rheumatoid Arthritis and Yoga' or 'Rheumatoid Arthritis and Tai Chi' or 'Rheumatoid Arthritis and Acupuncture' or 'Rheumatoid Arthritis and Nutritional Therapy' or 'Rheumatoid Arthritis and Hypnotherapy' or 'Fibromyalgia and Pilates' or 'Fibromyalgia and Massage' or 'Fibromyalgia and Balneotherapy' or 'Fibromyalgia and Spa Therapy' or 'Fibromyalgia and Yoga' or 'Fibromyalgia and Tai Chi' or 'Fibromyalgia and Acupuncture' or 'Fibromyalgia and Nutritional Therapy' or 'Fibromyalgia and Hypnotherapy'. We only used controlled clinical trials, observational studies, reviews, and English-language papers. Other article types and papers not directly related to the issue were among the exclusion criteria.

Pilates

Pilates is a method of physical training centered on mind–body relaxation, emphasizing regulated movement, posture, and respiration. The main goal is to improve strength and flexibility considerably [10]. Although Pilates programs are primarily aimed at healthy individuals as a component of fitness activities, it has been reported to have beneficial effects on various musculoskeletal system disorders in recent years [11].

A randomized controlled trial in AS patients found that pilates improved physical capacity at a 24-week follow-up [12]. Another randomized controlled trial emphasized the efficacy of pilates as part of a multimodal exercise program in managing AS [13]. Oksuz et al. [14] divided AS patients into two groups and recommended a pilates program combined with aerobic exercise to group 1 and aerobic exercise alone to group 2. It was shown that the combined intervention is more effective regarding functionality and psychosocial status. Although it was revealed that the Pilates program improved respiratory muscle strength in AS patients, it was not superior to conventional exercise [15].

The number of articles evaluating the effectiveness of pilates in RA patients is limited. Yentur et al. [16] divided RA patients into three groups. Pilates was applied to the first group, aerobic exercise to the second group, and a combination of the two to the third group. Participants were followed throughout 8 weeks. In the Pilates group, positive effects were observed on fatigue, quality of life, aerobic capacity, and depression. However, the three groups were not superior to each other. It is difficult to produce precise results due to the short follow-up period and the insufficient sample size.

Altan et al. [17] divided FMS patients into two groups. Pilates was recommended to the first group, and relaxation and stretching exercises were recommended to the second group. Pain and disease activity improved in the Pilates group. In addition, the Pilates group's improvement was superior to the second group. A randomized controlled trial compared mat Pilates with aquatic aerobic exercise. In both groups, alleviation of FMS-related symptoms was detected in the 12-week follow-up. There was no superiority between the two groups [18]. Another randomized controlled trial comparing mat Pilates with aquatic aerobic exercise found that Pilates had a similar effect as aquatic aerobic exercise in FMS patients [19].

Pilates can be considered a different, safe, and potentially effective exercise approach in AS, RA, and FMS management. However, the number of high-quality articles is limited, particularly for RA patients. In addition, the lack of studies on the mechanism of action of Pilates in

rheumatic diseases is striking. Therefore, the influences of Pilates on pain mediators, inflammatory indicators, and oxidative stress parameters in patients with AS, RA, and FMS should be evaluated in future studies.

Massage

Massage therapy is one of the oldest methods to reduce pain, relieve muscle spasms and improve quality of life. Massage therapy can be defined as the manipulation and mobilization of soft tissue and joint structures with the help of hands or a hand-held instrument [20]. Various mechanisms have been proposed for the effect of massage on pain, such as gate control theory and increased endorphin levels [21].

The number of articles evaluating the effectiveness of massage in AS patients is limited. In a randomized clinical trial, AS patients were divided into two groups, with one group receiving deep tissue massage and the other receiving therapeutic massage. Both groups reported favorable clinical outcomes [22]. However, the lack of a control group, the small sample size, and the short follow-up period are the article's shortcomings, and the results are difficult to generalize.

A randomized controlled trial evaluated the efficacy of Swedish massage in RA. The patients were divided into two as control and massage groups. After 8 weeks of intervention, the pain level was lower in the massage group, and the need for painkillers was reduced [23]. Another randomized controlled trial separated RA patients into three groups: aromatherapy massage, reflexology, and control. It was stated that massage and reflexology positively affect pain and fatigue [24]. Sevgi Ünal Aslan et al. [25] divided RA patients into Reiki, hand massage, and control groups. The favorable influences of Reiki and hand massage on pain and fatigue were reported.

Toprak Celenay et al. [26] divided FMS patients into two groups. The first group received only exercise, while the second received both exercise and connective tissue massage. Exercise plus connective tissue massage was superior to exercise alone in relieving pain, fatigue, sleep disorder, and role constraints related to physical health. In addition, a meta-analysis of randomized controlled trials demonstrated that more than 5 weeks of massage intervention had beneficial short-term effects on improving pain, anxiety, and depression in FMS patients [27]. A meta-analysis investigating the effectiveness of massage therapy types in FMS stated that most types of massage enhance the quality of life [28]. Massage therapy provides short-term favorable effects, particularly on pain, exhaustion, sleep disturbance, and quality of life indices. However, there has yet to be a consensus on the application technique, duration, and frequency. Furthermore, the methodological shortcomings of existing articles should be considered.

Balneotherapy

Balneotherapy has been employed in treating musculoskeletal disorders and rheumatic diseases since ancient times. Balneotherapy encompasses immersion in baths containing thermal or thermo-mineral water from natural sources and mud and other natural peloid applications [29]. Although the exact mechanism of balneotherapy has not been revealed, possible mechanisms are thermal stimulation, the effect of mineral salt composition in bath applications, and the reflection of mud packs' physical and chemical properties [30].

A randomized controlled study conducted on AS patients reported that balneotherapy improved disease activity, quality of life, and functionality in the short term. Still, some beneficial effects were lost in mid-term follow-up [31]. Bestaş et al. [32] divided AS patients into three groups and followed up prospectively. Balneotherapy was recommended to the first group, water-based exercises to the second group, and land-based exercises to the third group. It was suggested that all three treatment modalities are effective in disease activity, functionality, quality of life, and mobility and are not superior to each other. In a systematic review, it was emphasized that studies are reporting the beneficial effects of balneotherapy, but studies with large samples and without methodological flaws are needed to provide clear conclusions [33].

The positive effects of balneotherapy on disease activity and functionality were demonstrated in RA patients. On the other hand, it was reported that the effects diminish in long-term follow-up [34, 35]. Spa treatment with saline balneotherapy was found to have an antioxidant effect in RA patients, but the influence on clinical findings is unclear [36]. The beneficial results of balneotherapy sessions were presented by a systematic review analyzing the effects of balneotherapy on the quality of life in RA patients [37]. However, a Cochrane review reported insufficient evidence to reveal balneotherapy's effectiveness in RA patients. In addition, the risk of bias and methodological shortcomings were highlighted [38].

The beneficial effects of balneotherapy on FMS-related symptoms were demonstrated in several studies [39–43]. It was determined that interleukin 1, prostaglandin E2, and leukotriene B4 levels, associated with pain and inflammation, decreased following balneotherapy in FMS patients [44]. In addition, balneotherapy was found to have an antioxidant effect in FMS patients [45]. It was reported that combining balneotherapy with aerobic exercise is more effective than aerobic exercise alone or balneotherapy alone [46]. In a meta-analysis, very low to moderate evidence suggest that balneotherapy can improve pain and quality of life in FMS patients and have a variable effect on tenderness and depression [47].

Yoga

Yoga is a set of practices originating from India and dating back to ancient times, including postural adjustments, breathing exercises techniques, and relaxation approaches. Studies show its positive effects on musculoskeletal disorders [48–50]. However, investigations with a high level of evidence evaluating the effectiveness of yoga in AS patients are limited. Combining stretching exercises with proper breathing techniques is part of yoga practice. This condition suggests that yoga may positively affect AS [7]. A randomized controlled trial testing the effectiveness of tele-yoga on AS patients during the COVID-19 era observed improvements in physical function and psychological state [51]. It has been demonstrated that yoga interventions are practicable and acceptable in AS [52].

Badsha et al. [53] assessed the efficiency of an 8-week structured yoga program in RA patients, and significant ameliorations were detected in the patient group (disease activity and global health status) compared to controls. However, there was no similar positive effect on the quality of life. A meta-analysis published in 2020 evaluated yoga's effectiveness in RA patients. The results supported that yoga may positively affect physical function, disease activity, and grip strength. However, there was no improvement in pain level, markers of inflammation, and the number of tender joints [54]. A randomized controlled trial was conducted to assess the efficacy of the Yoga daily life program in RA patients. Although it did not affect the quality of life, fatigue and psychological state benefits were reported [55].

The efficacy of an 8-week structured yoga program on FMS syndrome was investigated in a randomized controlled trial and found improvement in pain, psychological state, and fatigue [56]. In addition, a meta-analysis of the efficacy and safety of meditative treatment options in FMS revealed that yoga was beneficial and a safe practice on the main clinical signs of FMS [57].

Yoga seems to be an effective treatment option for various clinical manifestations of rheumatic diseases. However, inadequacy in sample sizes, methodological flaws, and risk of bias draw attention to yoga studies. Therefore, articles with a higher level of evidence are needed [58].

Tai Chi

Tai Chi is a traditional Chinese meditative practice that dates back to ancient times. It integrates deep diaphragmatic breathing and relaxation techniques with a series of gentle and controlled basic postures. Its goal is to unify the physical, psychological, social, and behavioral components and to increase inner harmony by strengthening and stretching the soft tissues [59]. In a controlled clinical study conducted on AS patients, an 8-week Tai Chi program was reported to impact disease activity and flexibility positively [60]. Patients with AS were divided into two groups in a randomized controlled clinical trial. One group was given a home exercise program, whereas the other group received Tai Chi movements in addition to the home exercise program. Although both groups reported positive outcomes, the Tai Chi group experienced more significant improvements in disease activity and quality of life [61].

Uhlig et al. [62] assessed the efficacy of Tai Chi in RA patients quantitatively and qualitatively. At the end of the 12-week follow-up period, improvements in lower extremity muscle function, physical performance, pain, and balance were observed. Shin et al. [63] evaluated the impact of Tai Chi on endothelial function and arterial stiffness in RA patients. After the program, assessments for endothelial function and arterial stiffness were substantially better in the Tai Chi group. No considerable differences were detected between the intervention and control groups in disease activity and disability parameters. A Cochrane review published in 2019 emphasized that Tai Chi's effect on RA is unclear. Due to the low level of evidence, a critical impact cannot be confirmed or excluded [64].

In a randomized controlled trial investigating the efficacy of a 12-week classical Tai Chi program on FMS patients, the intervention group showed more significant improvement in disease activity and quality of life indicators. In addition, well-being continued at the 24-week evaluation [65]. A randomized controlled study comparing the effects of Tai Chi and aerobic exercise in FMS patients found that Tai Chi had a similar impact with aerobic exercise and was even superior in some parameters [66]. A meta-analysis reported that Tai Chi is more beneficial than standard care in FMS. Furthermore, this meta-analysis emphasized that studies with a higher level of evidence are needed to recommend Tai Chi as an alternative to established treatment options such as aerobic exercise [67]. Another randomized controlled trial suggested that Tai Chi improved sympathovagal balance in FMS [68].

This low-cost and efficient symptom management option is a promising method that can be incorporated into the treatment strategies of patients with AS, RA, and FMS. However, multicenter, large sample and high-evidence studies are required.

Acupuncture

Acupuncture is a treatment modality used for over four thousand years in China and is considered an essential component of traditional Chinese medicine. Thin needles are implanted at certain places on the body for treatment, and a manipulation technique is performed. Acupuncture treatment aims to relieve symptoms and improve well-being by

stimulating meridians and acupuncture points and involves many different application techniques [69, 70].

A combination of needling, moxibustion, and other traditional Chinese medicine procedures is frequently used to gain greater efficacy in AS patients. In warm acupuncture, acupuncture and moxibustion are used together [71]. The meta-analysis by Xuan et al. [72] aimed to evaluate the effectiveness of needling alone in AS patients. Although beneficial results were reported in this meta-analysis, which included randomized controlled trials, emphasis was placed on methodological shortcomings and low quality of evidence.

The authors argued in a systematic review that acupuncture, alone or in conjunction with other modalities, is helpful for clinical signs of RA, has no notable adverse effects, and can enhance the functional status and quality of life. It was suggested that there could be several underlying mechanisms, including anti-inflammatory effects, antioxidative alterations, and regulation of immune system function [73]. In their meta-analysis, Lu et al. [74] found that acupuncture improved clinical signs and laboratory parameters in RA patients. However, some articles did not report favorable effects [75, 76]. This condition suggests that the efficacy of acupuncture in RA patients should be confirmed by research with high methodological quality and large samples.

In a meta-analysis evaluating the effectiveness of acupuncture in FMS patients, a considerable favorable effect was found in reducing pain and maintaining well-being [77]. Kim et al. [78] supported these findings in their meta-analysis. Zheng et al. [79] reported moderate evidence of acupuncture's effectiveness on FMS-related pain, but found no effect on fatigue, stiffness, sleep quality, and physical function. A Cochrane review evaluating the efficacy of acupuncture on FMS reported low to moderate evidence that acupuncture improves pain and stiffness compared to standard therapy. Furthermore, moderate evidence was presented that there was no difference between sham acupuncture and therapeutic acupuncture in pain, sleep, stiffness, and well-being [80].

Nutritional therapy

In recent years, there has been a surge of interest in the association between nutrition and gut microbiome, as well as inflammation and oxidative stress in rheumatic diseases. A systematic review emphasized that the evidence for a link between diet and AS was extremely limited due to the poor sample size, bias risk, and inadequate data reporting in most of the enrolled studies [81]. Some articles support the potential relationship between diet and oxidative stress in AS patients and suggest that positive effects can be obtained on disease activity by increasing adherence to the Mediterranean diet [82, 83].

Schonenberger et al. [84] investigated the effectiveness of anti-inflammatory diets (Mediterranean, vegetarian, vegan, ketogenic) in RA patients in a systematic review and reported positive results on pain. However, there was an emphasis on the high risk of bias and low level of evidence. Some studies showed curcumin supplementation improves inflammatory markers in RA patients [85, 86]. Probiotic supplementation may have benefits on CRP and RA activity, according to a meta-analysis assessing the effect of probiotics on RA. However, the level of evidence is low, and heterogeneity is evident [87]. There was insufficient evidence to support collagen supplementation in RA [88].

In a systematic review analyzing the effect of several types of diets on FMS, the results for nutritional therapy were considered to be but contentious promising. The emphasis was on poor methodological quality for articles on this topic [89]. Another systematic review investigating the impact of vegan and vegetarian diets on FMS found positive and promising results on pain, sleep, and quality of life. Still, it noted the low methodological quality [90]. A randomized controlled clinical trial evaluated the efficacy of tryptophan and magnesium-enriched Mediterranean diet and found beneficial effects on anxiety, mood status, and eating disorder. However, no impact on sleep quality was detected [91].

There are promising results that various dietary interventions can be beneficial for AS, RA, and FMS. However, it is challenging to recommend a uniform diet. The methodological quality of the studies in the literature is poor, and the bias risk is remarkable. Studies with higher methodological quality and larger samples are needed in this area.

Hypnotherapy

There is inadequate data to assess the efficacy of hypnotherapy in AS. Horton-Hausknecht et al. [92] evaluated the effectiveness of hypnosis therapy in RA patients. Although hypnosis therapy was observed to positively impact objective and subjective findings, the results should be interpreted with caution. First, the sample size is limited. In the article, three groups were formed hypnotherapy, relaxation, and control. There was a statistically significant difference between the three groups regarding age, education level, and disease duration.

Bernardy et al. [93] conducted a systematic review and meta-analysis evaluating the efficacy of hypnotherapy in FMS. Unfortunately, the evidence for the effectiveness of hypnotherapy in reducing pain at the end of therapy was not robust against methodological bias risks. Furthermore, it was linked with poor methodological research quality. Nevertheless, a randomized controlled trial evaluating hypnosis therapy in FMS patients found improvement in pain, fatigue, and depression [94]. Another systematic review supported using a combination of hypnotherapy and cognitive

behavioral therapy to manage FMS core symptoms. However, it was presented with a low level of evidence that hypnotherapy effectively reduces pain and improves psychological state [95].

Physical medicine-rehabilitation and rheumatology clinics collaboration

Pharmacological interventions are at the center of the treatment of rheumatic diseases. Unfortunately, despite the significant advances of recent years, it is still not possible to achieve favorable outcomes for all patients. Therefore, it is preferable not to rely solely on pharmaceutical treatment alternatives. Exercise is essential to preserving and improving general health and quality of life, not only in rheumatic diseases but also in many other diseases and even in healthy people. Furthermore, it is impossible to discontinue exercise practices to treat rheumatic diseases such as AS, FMS, and osteoarthritis. Therefore, it is appropriate to implement individualized exercise programs or recommend home programs in physical medicine and rehabilitation clinics after gathering necessary information about the patient's medical condition from the rheumatology clinic and physician while adhering to the principles of FITT. In addition, some patients with rheumatic diseases may require individualized rehabilitation applications and orthotics–prosthesis recommendations due to contracture, respiratory–cardiac function impairment, and gait disruption. Rheumatologists can obtain views regarding CAM applications from physical medicine and rehabilitation clinics for patients they deem appropriate. Given all of these considerations, it is evident that physical medicine—rehabilitation, and rheumatology clinics should be in constant communication and collaborate as needed. Due to the predominant involvement of the musculoskeletal system, exercise, rehabilitation interventions, and CAM applications should be positioned appropriately within the treatment programs for rheumatic diseases.

Conclusion, limitations, and future suggestions

Physical medicine and CAM methods are safe approaches to managing AS, RA, and FMS. Although favorable results have been reported, the level of evidence for many CAM methods is low. The main reasons for this outcome are methodological flaws such as limited sample size, bias risk, short follow-up periods, and challenges in creating control groups. Another issue is that there is no agreement in CAM approaches on the frequency of interventions and the number of sessions. This situation causes heterogeneity in systematic reviews and meta-analyses. To overcome these obstacles, researchers should focus on studies that reduce methodological flaws. Furthermore, researchers should concentrate on the mechanisms of action of these approaches and attempt to understand the biological basis for their impacts on inflammation and pain. Although pharmacological treatments are at the core of managing AS, RA, and FMS, exercise-based interventions and CAM methods should be placed in appropriate positions within the treatment programs.

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Declarations

Conflict of interest The authors declare no conflict of interest.

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REVIEW

The effectiveness of yoga as a form of exercise in the management of rheumatic diseases

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Abstract

Yoga, a long-standing Indian tradition, has gained popularity globally, inspiring many different disciplines to employ it as a complementary treatment for various diseases. Yoga is primarily composed of numerous physical poses and positions that are coupled with breathing techniques, profound relaxation, and meditation. There are many types of yoga with varying levels of difficulty. Yoga, consisting of various poses and postures with distinct postural mechanics, is frequently highlighted as an exercise that improves both physical and mental health. Applying the proper techniques to yoga poses can boost balance, strength, and flexibility while also improving general health and quality of life. In addition to its physical benefits, it is recognized that yoga enhances an individual's mood, anxiety, and depression levels and their ability to deal with stress. Rheumatic diseases affect many different organs, particularly the musculoskeletal structures, and negatively impact patients' quality of life. Maintaining a sufficient level of exercise is essential to preserve and enhance physical function in addition to pharmaceutical therapy, the mainstay of rheumatic disease treatment. In treatment guidelines for many rheumatic diseases, exercise, and physiotherapy techniques are stressed as the most substantial component of non-pharmacological treatment. This review considered yoga a form of exercise outside of traditional practices. From this perspective, we aimed to summarize the efficacy of yoga practices on various rheumatic diseases. Additionally, we aimed to highlight possible mechanisms of action.

Keywords Yoga · Arthritis · Rheumatology · Osteoarthritis · Fibromyalgia · Rheumatoid arthritis · Ankylosing spondylitis

Introduction

Yoga is a set of practices with Indian origins that was created to integrate the mind, body, and spirit. Its roots date back thousands of years [1]. Yoga consists principally of various physical poses and positions (asana) linked with breathing approaches (pranayama), profound relaxation, and meditation. Although many distinct varieties of yoga exist, Hatha is the most well-known in western society. The numerous poses, positions, and postures of yoga are frequently stressed as a form of exercise that enhances both physical and mental well-being [2] (Fig. 1). The musculoskeletal system and respiratory mechanics work in greater harmony through yoga, and whole-body functions are optimized by promoting steadiness and relaxation [3].

Correctly executing physical poses, postures, and positions improves balance, strength, and flexibility while also positively impacting overall health and quality of life [4]. Slow, continuous movement sequences are often used to enhance blood flow and prepare the muscles for yoga practice. After that, the body progresses into a series of positions that can work the muscles in various body sections through different joint movements. In addition to the benefits of various yoga poses on muscle strength and endurance, standing positions promote proprioception and balance [5, 6]. It is known that yoga provides improvements in individuals' mood, anxiety, and depression levels and their ability to cope with stress. Yoga is considered an efficient and simply practiced way to enhance mindfulness, emotional intelligence, and mutual satisfaction in heterosexual couples [7]. There is evidence that yoga affects the hypothalamic–pituitary–adrenal axis and favors parasympathetic system dominance. There is also the view that yoga may have a complementary effect in lowering inflammatory markers [8–11].

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Fig. 1 Demonstration of yoga practice with different poses

Rheumatic diseases typically present with joint stiffness, degeneration, wear in cartilage, connective tissue, and bones, as well as pain and inflammation that restrict daily living activities [12]. In addition to pharmacological therapy, the cornerstone of rheumatic disease care, it is crucial to maintain adequate physical activity to preserve and improve physical function [13]. Consequently, exercise and physiotherapy interventions are helpful therapeutic options for this patient population. Yoga and other forms of exercise benefit patients with rheumatic diseases due to their positive impacts on strength, flexibility, balance-coordination, and endurance [14].

Spiritual, mental, and psychological aspects of yoga are beyond the scope of the current review. Yoga was considered a form of exercise, and we aimed to comprehensively present the effectiveness of yoga practices on various rheumatic diseases.

Search strategy

A search strategy was devised before the literature review. This process followed the recommendations of Gasparyan [15]. Initially, search term combinations were identified as 'Yoga and Rheumatology' or 'Yoga and Arthritis' or 'Yoga and Osteoarthritis' or 'Yoga and Fibromyalgia' or 'Yoga and Rheumatoid Arthritis' or 'Yoga and Ankylosing Spondylitis' or 'Yoga and Spondyloarthropathy' or 'Yoga and Idiopathic Inflammatory Myopathy'. Articles were listed in Web of Science, Scopus, PubMed/MEDLINE, and DOAJ using these combinations. English-language articles were evaluated. Additionally, controlled clinical trials, observational studies, and reviews were examined. Articles not clearly relevant to the subject and those other than the specified article types were excluded. There was no time frame restriction for the literature review.

Osteoarthritis

Osteoarthritis (OA) is a rheumatic disease characterized by degenerative joint destruction and associated with pain, stiffness, swelling, limitation of joint motion, impaired ambulation, and deteriorated quality of life [16]. Although no treatment exists to eliminate OA, physical activity and regular exercise are at the center of non-pharmacological treatment. In addition to typical approaches such as aerobic, strengthening, flexibility, and stretching exercises, it has been reported that multifaceted activities, including yoga and Tai Chi, can be beneficial [17, 18].

Cheung et al. [19] conducted a randomized controlled trial on knee OA in elderly female patients and compared the eight-week Hatha yoga training group to the controls. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)-total score, sleep disturbance, quality of life, and some performance indicators did not significantly differ. However, WOMAC-pain and WOMAC-stiffness scores and short physical performance battery-repeated chair stands subscale measurements improved considerably in favor of the yoga group. Another randomized controlled trial comprised three arms: Hatha yoga, aerobic/strengthening exercises, and control groups. Two interventions (Hatha yoga and aerobic/strengthening exercises) positively impacted OA-related symptoms and functionality, but Hatha yoga was superior in certain parameters [20]. Kuntz et al. [21] devised a modified exercise regimen based on yoga postures to reduce knee loading and compared this program to standard exercise and control groups in a randomized controlled trial. Although there was a significant improvement

compared to the control group, modified yoga exercises were not superior to the standard exercise program.

In a systematic review, Kan et al. [22] evaluated yoga's effects on pain level, mobilization, and quality of life in knee OA. Although yoga was reported to have positive impacts on pain and mobilization, its influence on the quality of life was noted to be unclear. Launch et al. [23] conducted a meta-analysis on the efficacy of yoga for OA, focusing on lower extremity OA. The meta-analysis results indicated that yoga, as compared to the exercise and non-exercise groups, may have favorable impacts on pain level, functionality, and stiffness. However, an important point emphasized by the authors is that a weak recommendation can be provided for yoga in light of the available publications due to the poor methodological quality and suspicion of bias.

Given the beneficial effects of yoga on OA, its relatively low risk, and its rising popularity, it can be recommended to patients who prefer yoga-based exercise practices or do not wish to adhere to conventional exercise regimens. There are numerous styles of yoga available. However, some popular, dynamic, and mechanically demanding types (such as hot yoga and power yoga) may not be appropriate for OA sufferers. Therefore, a healthcare practitioner with yoga experience should design a tailored program.

Fibromyalgia syndrome

Fibromyalgia syndrome (FMS) is a rheumatic disease with a relatively high prevalence in the population. While pain dominates the clinical picture of FMS, other symptoms such as fatigue, stiffness, sleep issues, psychiatric alterations, and cognitive dysfunction are also frequently present. This spectrum of symptoms substantially impacts the quality of life of FMS patients [24, 25]. In managing FMS, a wide range of pharmacological and non-pharmacological therapeutic options are available, with exercise-based treatments at the forefront of non-pharmacological treatment [26].

The need for more randomized controlled clinical studies evaluating the effectiveness of yoga in FMS patients is noteworthy. Carson et al. [27] divided FMS patients into two groups: yoga intervention and control (covering wait-listed patients under standard care). After eight weeks of intervention, the yoga group showed more significant improvements in FMS core symptoms such as pain, functionality, fatigue, and mood disturbance. In their randomized controlled trial, da Silva et al. [28] created two groups: relaxing yoga and relaxing yoga plus touch. It was reported that yoga-based therapies have beneficial effects on FMS severity and pain. Langhorst et al. [29] conducted a meta-analysis on meditative movement techniques (yoga, Tai Chi and Qigong) in FMS patients. The results supported that yoga has beneficial short-term effects on FMS core symptoms.

Another major shortcoming is the lack of high-quality articles comparing the effectiveness of yoga with aerobic exercise, an established method for managing FMS. The POYSE study has been planned for this aim, and its methodology has been revealed [30]. The results of this article have the potential to fill a significant gap in the literature.

Rheumatoid arthritis

Patients with rheumatoid arthritis (RA) have impaired health-related quality of life due to pain, stiffness, contractures, difficulty in mobility, and disability. The underlying causes are joint inflammation and destruction [31]. In addition to the promising developments in the medical treatment of RA in recent years, various non-pharmacological treatment options have been investigated. Physical activity and exercise practices are the most widely emphasized strategies, with several well-known health benefits [32].

Several studies have been conducted to reveal yoga's complementary role in managing RA. Badsha et al. [33] assessed the efficacy of yoga in a controlled clinical trial. They found that yoga significantly improved the disease activity score in 28 joints (DAS-28) and the health assessment questionnaire in RA patients. However, no effect on the quality of life was detected. Ganesan et al. [34] conducted a randomized controlled trial and investigated the impacts of yoga on disease activity, inflammation markers, and heart rate variability in RA patients. Patients newly diagnosed with RA were enrolled in the trial, and medical treatment was initiated. The control group received standard medical treatment, whereas the intervention group underwent an additional 12-week yoga program. After 12 weeks, disease activity decreased considerably in both groups, but the decrease was more pronounced in the yoga group. In addition, IL-1a, IL-6, TNF-a, and cortisol were reduced in the yoga and control groups, while the reductions in IL-1A and cortisol levels were more dramatic in the yoga group. Finally, positive results were observed in sympathovagal balance data favoring the yoga group. Pukšić et al. [35] evaluated yoga in daily life program in a randomized controlled trial. The intervention group participated in a 12-week yoga in daily life program involving 2 × weekly/90-min sessions. The control group received an educational program. Although there was no significant difference between the groups in the quality of life parameters, the favorable effects of the yoga program on fatigue and mood were determined. A randomized controlled trial investigated the impact of yoga intervention on psycho-neuro-immune determinants, disease activity, and quality of life in RA patients. It was determined that yoga practice reduced disease activity and various inflammatory markers. In the same study, significant improvements were found in markers affecting the psycho-neuro-immune axis and quality of

life parameters in favor of the yoga group [36]. In addition, yoga has been demonstrated to improve hand grip strength in RA patients [37].

The effect of yoga on RA was investigated in a meta-analysis that comprised randomized controlled studies. The meta-analysis demonstrated that yoga substantially improved physical function, disease activity, and grip strength. There were no impacts on pain, tender-swollen joint count, or inflammatory markers [38]. The meta-analysis emphasized poor methodological quality, methodological limitations, small sample sizes, and heterogeneity. Therefore, the results should be viewed with suspicion. Researchers should be encouraged to conduct research with high methodological quality and large sample sizes.

Ankylosing spondylitis

Ankylosing spondylitis (AS) is a rheumatic disease of a chronic and progressive nature, with the axial skeleton and sacroiliac joints as the primary targets. Inflammation and various immune-mediated mechanisms are central to the process. AS causes stiffness, pain, and reduced flexibility in the spine and is associated with severe impairment in daily living activities and occupational tasks [39]. Therefore, physiotherapy and exercise are the most crucial components of non-pharmacologic treatment [40].

The number of yoga-related articles on AS is limited in the literature. In their retrospective article, Singh et al. [41] evaluated the effectiveness of yoga without a control group. Improvements were detected in the symptom score, spine flexibility, and analgesic use following yoga. In addition, Singh et al. [42] conducted a randomized controlled trial to investigate the effectiveness of tele-yoga on AS patients under COVID pandemic conditions. The tele-yoga group showed significant improvements in the Bath Ankylosing Spondylitis Disease Activity Index, Bath Ankylosing Spondylitis Functional Index, quality of life, and anxiety.

Idiopathic inflammatory myopathies

The musculoskeletal system is the most common site of idiopathic inflammatory myopathies (IIM) involvement; more than three-quarters of patients present with muscle-related symptoms. Muscle weakness causes inadequacy in routine daily activities and impaired quality of life. Even patients under appropriate treatment may experience persistent muscle weakness, low endurance, tiredness, and pain clinic due to ongoing inflammation and muscle damage [3].

One article investigated yoga's complementary role in patients with IIM. Kong et al. [43] enrolled patients with dermatomyositis and polymyositis in an 8-week yoga program. Participants were evaluated with Myositis Activities Profile and Manual Muscle Test before and after the yoga program. The Myositis Activities Profile is a questionnaire that assesses restrictions in daily activities. The Manual Muscle Test was used to determine the participants' muscle strength in detail. There was no significant difference in Myositis Activities Profile total score before and after yoga. However, improvement was found in the personal care and hygiene and domestic activities subcategories. In addition, no significant difference was detected in the Manual Muscle Test scores before and after yoga.

Although it is the only study in the literature, it is the right approach to consider these results doubtful. There is no control group in the study. The sample size is insufficient, and some participants could not complete the study. It is obvious that studies with larger samples, control groups, and high methodological quality are needed.

What are the mechanisms of action of yoga?

Yoga can increase muscle strength, particularly the muscles that support the joints, reducing the loading on the joints. In addition, yoga programs involve a variety of poses comparable to static stretching, which can improve stiffness and joint range of motion [44]. Thus, an effect similar to stretching exercises in physiotherapy practice emerges. Yoga programs frequently include breathing and relaxation techniques. These techniques increase the activity of the parasympathetic nervous system and can help interrupt the stress-pain connection that occurs in chronic pain conditions [45]. There is mounting evidence that yoga programs influence the modulation of numerous inflammatory indicators. Considering the effect sizes of research examining alterations in inflammatory markers, the data support the more substantial influence on interleukin-1β and interleukin-6 levels [46]. Yoga has an influence on the immune system by reducing stress levels. Thus, the concentrations of various inflammatory mediators, including interleukin-6, decrease [47]. Additionally, yoga has been reported to affect the hypothalamic–pituitary–adrenal axis, lowering cortisol levels and enhancing immunological function [48]. Furthermore, evidence supports that mind–body therapies like yoga raise endorphin levels in different regions of the central nervous system and lessen pain perception [49].

Implications for clinicians – researchers and limitations

There are no yoga-related articles with a high level of evidence, particularly for some rheumatic diseases. However, given the relatively low risk and increased popularity of

yoga practices, they can be suggested for patients who prefer yoga programs and do not want to adhere to routine exercise and physiotherapy practices. Yoga is becoming more popular among the general population [50]. There are various types of yoga available. However, some energetic and high-effort styles, such as hot yoga and power yoga, may not be appropriate for a subset of patients (with high fracture risk, low endurance, and geriatric). Yoga therapists experienced working with patients with rheumatic diseases should be favored; yoga programs should be created in close collaboration with the patient's rheumatologist or physical therapy and rehabilitation specialist to prevent worsening symptoms. Each patient's medical history and current condition should be examined, and individualized programs should be developed.

One of the prominent shortcomings is the limited number of yoga-related articles on some rheumatic diseases, such as AS and IIM. Another limitation is the heterogeneity among yoga practices. FITT (frequency, intensity, time, and type) principles are essential for exercise-based research. There are many types of yoga, and other parameters vary between articles. The sample sizes of articles in this field were often limited, and some articles did not provide sufficient information on randomization. Standardized outcome measures were not used in the articles.

Considering all these limitations, researchers should prioritize increasing the sample size and improving methodological quality when planning yoga-related articles on rheumatic diseases. Standard reporting guidelines such as CONSORT statement should be strictly followed to ensure clear methodological transparency. Yoga practices should be presented in detail. For this purpose, figures, images, and supplementary materials should be provided if necessary. Long-term follow-ups should be planned, and efforts should be made to establish standardized outcome measures. Comparing yoga programs with established exercise practices such as aerobics, strengthening, and stretching exercises will provide useful data. Safety data should be provided in yoga studies, and if there is an adverse effect-event, it should be presented.

Conclusion

While this review presents some benefits in reducing disease activity and musculoskeletal complaints, promoting psychosocial well-being, improving disability and quality of life in rheumatic disorders, the evidence on the efficacy of yoga remains controversial. Particularly in some rheumatic diseases, the lack of articles with high methodological quality and large samples is noteworthy. However, the popularity of yoga is likely to grow steadily in the near future. Considering its high safety profile, yoga will likely find its place among non-pharmacological treatment options in managing rheumatic diseases.

Author contributions Study design: BFK, ZS, and MY. Data acquisition and review of the literature: BFK. Making interpretations: BFK, ZS, and MY. Drafting the manuscript: BFK. Critically reviewing the manuscript: BFK, ZS, and MY. Final approval: BFK, ZS, and MY.

Data Availability Data will be shared upon reasonable request of the corresponding author.

Declarations

Conflict of interest The authors declare no conflicts of interest.

Informed consent Informed consent has been obtained for yoga photos.

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CASE BASED REVIEW

Yoga as a complementary therapy for rheumatoid arthritis: a case-based review

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Abstract

Rheumatoid arthritis (RA) presents patients with chronic pain and functional limitations due to its autoimmune nature. Despite symptomatic and pharmaceutical interventions, many patients experience inadequate relief, prompting exploration into non-pharmacological approaches such as yoga. This study aims to evaluate the effectiveness of yoga as an adjunctive therapy for RA by examining clinical data from patients experiencing chronic pain and limitations. This study analyzed several clinical cases at the Shymkent City Regional Clinical Hospital. Ten RA patients, irrespective of various demographic factors, were enrolled. Parameters including pain intensity, inflammation activity, systolic blood pressure, joint function, and morning stiffness were assessed to gauge the impact of yoga. The findings demonstrated notable positive changes following a three-month yoga program. These changes encompassed enhanced joint health, reduced pain severity, and decreased disease activity. Particularly noteworthy was the reduction in morning stiffness by an average of 31 min, alongside a decrease in the average pain index from 80 mm to 41.5 mm. The mean RA activity level decreased from 5.8 to 4.7. Furthermore, mean systolic blood pressure decreased by 15.5 mmHg, and mean cholesterol levels decreased from 5.3 mmol/L to 4.8 mmol/L. These results underscore the potential significance of yoga as a supplementary intervention for RA. Yoga practice may enhance patients' quality of life and alleviate disease symptoms. Nevertheless, the study's limited sample size necessitates caution, and further research is warranted to validate these findings.

Keywords Rheumatoid arthritis · Physical and rehabilitation medicine · Yoga · Complementary therapies · Case-based review

Introduction

Rheumatoid arthritis (RA) is an autoimmune inflammatory condition characterized by chronic pain and joint swelling [1]. Its prevalence ranges from 0.1 to 1% globally [2]. RA patients often endure compromised health-related quality of life due to pain, restricted movement, and impaired joint function stemming from inflammation and damage [3]. As RA progresses, joint deformities and ankylosis may develop [4], leading to physical challenges and, eventually, temporary or permanent disability, accompanied by psychological and economic burdens [5]. Treatment primarily focuses on symptom relief, such as pain management or cytotoxic drug usage for severe cases, often entailing significant side effects [6]. Patients frequently explore non-pharmacological interventions to mitigate potential adverse effects [7], including relaxation, meditation, and physical activity [8]. According to EULAR guidelines [9], physical activity should be integrated into the standard treatment regimen for inflammatory joint diseases [3]. Reports indicate that 60–90% of RA patients in various countries utilize complementary and alternative physical therapies [10], with yoga garnering increasing attention [11].

The term "yoga" originates from Sanskrit, translating to "union" or "harmony" [12]. Presently, yoga embodies the integration of mind and body in daily life to achieve inner and societal harmony [13]. Dating back thousands of years in India, yoga's practice demonstrates potential benefits for

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various conditions associated with pain, with even brief sessions showing promise [14]. Known for enhancing physical well-being and purportedly alleviating inflammation symptoms in RA patients [15], yoga sessions incorporate diverse elements, including yoga exercises (asanas), breathing techniques (pranayama), and meditation (dhyana) [16]. Its effects are linked to muscle strengthening, stretching, relaxation, and breath control [17], contributing to pain relief by reducing muscle tension and triggering the release of internal neurotransmitters [18]. Additionally, yoga is believed to bolster joint preservation by enhancing muscle tone [19]. Despite substantial research supporting yoga's positive effects, its efficacy in RA treatment necessitates further investigation [20–26]. This study assesses yoga's efficacy as a non-pharmacological intervention for RA by evaluating changes in pain intensity, joint functionality, morning stiffness, and disease activity.

Search strategy

The study design involved analyzing a series of clinical cases at the Regional Clinical Hospital of Shymkent City, Kazakhstan. We examined ten clinical cases of rheumatoid arthritis patients undergoing yoga-based rehabilitation. Inclusion criteria encompassed patients with confirmed rheumatoid arthritis and no exercise contraindications. Patients were selected regardless of disease stage, duration, frequency of yoga sessions, sex, age, nationality, or race. All patients had varying degrees of arterial hypertension alongside rheumatoid arthritis.

A literature search for the study was conducted across Scopus, Web Of Science, and PubMed databases. No specific time frame was set for the literature search. The search utilized the keywords "Yoga" AND "Rheumatoid arthritis" to gather relevant information. Scientific publications employing yoga as an intervention for rheumatoid arthritis were included. Only full-text articles were considered in the search. Conference proceedings, abstracts, and preprints were excluded from the literature search. Systematic search guidelines [27] were adhered to throughout the search strategy.

Results

Among the ten patients studied, 8 were females, and 2 were males, with ages ranging from 41 to 69 years and a mean age of 52.6. Disease duration varied from 24 to 204 months. All patients underwent regular baseline therapy and received consistent care from a rheumatologist. They all adhered to a three-month yoga program, attending sessions two to three times per week, with 70% attending three times weekly. Session durations ranged from 30 min (n = 2) to one hour (n = 3), averaging 45 min. Yoga postures and techniques were standardized and consistent across all sessions.

Before starting yoga, morning stiffness lasted over 100 min for 70% of patients. After participating in yoga, morning stiffness decreased by 31 min (from 132 to 101 min), with half of all patients experiencing less than 100 min of stiffness. The Visual Analog Scale (VAS) pain index was consistently 80 mm for all patients before yoga, decreasing to a mean of 41.5 mm afterward. The mean Disease Activity Score-28 (DAS-28) for rheumatoid arthritis decreased from 5.8 to 4.7 after the yoga course.

Analysis of joint symptoms revealed that 90% of patients had more than ten painful joints before yoga, which reduced to less than ten for all patients after yoga. Similarly, 60% had more than five swollen joints before yoga, with this decreasing post-yoga. The mean number of swollen joints decreased by four for all patients.

Ten patients with rheumatoid arthritis had a history of arterial hypertension. Additionally, 70% of the patients had experienced arterial hypertension for five years or less. Baseline therapy for arterial hypertension was taken by less than half of the patients (n = 4). After yoga, mean systolic blood pressure decreased by 15.5 mmHg, and mean cholesterol levels decreased from 5.3 mmol/L to 4.8 mmol/L after yoga classes. Detailed clinical data before and after yoga classes are presented in Tables 1 and 2.

Discussion

Our study, investigating the effects of a three-month yoga program on patients with rheumatoid arthritis, revealed significant positive changes in their condition. We considered various parameters, including the duration of morning stiffness, pain index, rheumatoid arthritis activity index (DAS-28), and the number of painful and swollen joints. After completing the yoga course, patients exhibited an average reduction in morning stiffness by 31 min, indicating an improvement in their overall condition and a reduction in inflammation. The pain index decreased by an average of 38.5 mm, reaching a value of 41.5 mm post-yoga. Moreover, the rheumatoid arthritis activity index decreased, with the average DAS-28 level dropping from 5.8 to 4.7. These changes suggest a decrease in inflammatory processes and an enhancement in joint functional status.

Furthermore, the number of painful joints decreased in all patients, with 60% experiencing fewer than five painful joints. Similarly, the number of swollen joints decreased by an average of four. Additionally, a positive trend was observed in the reduction of systolic blood pressure and

Table 1 Clinical data of patients with rheumatoid arthritis before participating in the three-month yoga program

Gender/age	RA duration (months)	Duration (min) and frequency of sessions (per week)	Morning stiffness (min)	VAS pain index (mm)	DAS-28	Number of painful joints	Number of swollen joints	Systolic BP (mmHg)	Cholesterol (mmol/l)
F/57	108	40 min/3 p. w.	90	80	5,7	11	5	130	4,3
F/52	84	30 min/3 p. w.	120	80	6,08	12	7	140	6,1
M/54	24	60 min/2 p. w.	120	80	5,92	11	6	150	6,2
F/41	144	40 min/3 p. w.	120	80	6,13	13	8	130	4,7
F/58	204	30 min/3 p. w.	120	80	6,47	12	7	130	4,52
M/51	60	40 min/3 p. w.	240	80	5,34	14	6	150	6
F/46	24	60 min/3 p. w.	90	80	5,37	10	6	130	5,65
F/46	48	40 min/3 p. w.	120	80	6,47	11	5	120	3,56
F/52	120	60 min/2 p. w.	120	80	5,2	11	6	160	5,49
F/69	108	50 min/2 p. w.	180	80	5,48	19	8	150	6,32

Table 2 Clinical data of the same patients with rheumatoid arthritis after completing the three-month yoga program

Gender/age	RA duration (months)	Duration (min) and frequency of sessions (per week)	Morning stiffness (min)	VAS pain index (mm)	DAS-28	Number of painful joints	Number of swollen joints	Systolic BP (mmHg)	Cholesterol (mmol/l)
F/57	108	40 min/3 p. w.	50	40	3,92	2	0	120	4,0
F/52	84	30 min/3 p. w.	90	45	5,34	6	4	125	5,3
M/54	24	60 min/2 p. w.	100	40	5,6	5	3	130	5,7
F/41	144	40 min/3 p. w.	100	45	5,02	8	5	110	4,6
F/58	204	30 min/3 p. w.	90	30	5,83	6	3	120	4,3
M/51	60	40 min/3 p. w.	200	50	3,64	7	2	130	4,8
F/46	24	60 min/3 p. w.	60	45	3,7	5	4	120	5,05
F/46	48	40 min/3 p. w.	80	30	5,82	2	1	120	3,2
F/52	120	60 min/2 p. w.	100	50	4,42	7	3	130	4,9
F/69	108	50 min/2 p. w.	140	40	3,9	8	4	130	5,8

cholesterol levels. These findings indicate a favorable effect of yoga in reducing inflammation and pain among patients with rheumatoid arthritis.

Chronic pain in RA can diminish sensitivity to pain over time, potentially increasing sympathetic nervous system activity and triggering the release of inflammatory markers such as interleukin-6 (IL-6), thereby exacerbating inflammation [16]. Scientific studies suggest that yoga can mitigate chronic pain, enhance joint mobility, and improve overall quality of life [28, 29]. Dash M. and colleagues' study demonstrated that combining yogic techniques improved hand grip strength among healthy volunteers and RA patients [30]. The synergistic effects were most notable when yoga was combined with exercise, controlled breathing, and meditation [31]. Similarly, Telles S. and colleagues found that yoga reduced rheumatoid factor levels in both sexes and increased bilateral hand grip strength in men [32]. Recent research reported significant improvements in epigenetic and inflammatory markers in RA following an 8-week yoga program. Moreover, yoga facilitated immune system balance, evidenced by increased Treg cells and decreased Th17 cells [33].

A meta-analysis involving 550 RA patients showed significant benefits of yoga and acupuncture in reducing DAS 28 scores [17]. The improvement in disease status post-yoga practice correlated with a notable decrease in inflammatory cytokines, heightened mind-body connection scores, and enhanced quality of life [34]. Individuals engaged in yoga were more likely to be employed full-time and less likely to experience disability [35].

Therefore, it is crucial to emphasize that our study's findings have direct implications for the work of medical professionals, researchers, and healthcare providers involved in the treatment of rheumatoid arthritis. The inclusion of a yoga program in a comprehensive treatment regimen for patients with rheumatoid arthritis, as our study suggests, has the potential to significantly improve their quality of life and alleviate symptoms. However, it is important to recognise the limitations of our study, namely the small sample size and recruitment of patients from a single clinic. Another limitation is that the influence of all contributing factors has not been considered. Further studies involving larger cohorts from different clinics are needed to confirm the compelling benefit of yoga in the treatment of rheumatoid arthritis.

Conclusion

The study highlights the potential benefits of yoga as a non-pharmacological intervention for rheumatoid arthritis (RA) patients. The findings indicate significant improvements in several key areas, including reduced morning stiffness, decreased pain intensity, and lower disease activity. These results suggest that incorporating yoga into the standard care regimen for RA can enhance patient outcomes. To validate and expand on these findings, further research with larger sample sizes and rigorous control of various exposure factors is warranted.

Author contributions All co-authors contributed substantially to the concept, formulation, searches of relevant articles, and revisions. They approve the final version of the manuscript and take full responsibility for all aspects of the work.

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Declarations

Ethical approval This study was approved by the Local Ethics Committee at South Kazakhstan Medical Academy, Protocol №1, issue date 21 February 2024.

Informed consent Written informed consent was obtained from all patients for the publication of this case-based review.

Conflict of interest The authors have no conflict of interest to declare.

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OBSERVATIONAL RESEARCH

Managing rheumatoid arthritis and cardiovascular disease: the role of physical medicine and rehabilitation

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Abstract

Introduction: Cardiovascular disease (CVD) presents a significant challenge in rheumatoid arthritis (RA), a systemic chronic ailment affecting the joints and causing systemic inflammation. Effective RA management, including pharmacological and non-pharmacological interventions, is crucial for mitigating cardiac risk. Pharmacotherapy, though effective, can have adverse effects, leading many patients to seek complementary therapies. This study investigates the impact of physical medicine and rehabilitation on RA management in patients with cardiovascular disease, analyzing clinical data to assess the efficacy of integrated therapeutic approaches. Methods: This retrospective monocentric study draws upon data from patient records at the Rheumatology Department of the Regional Clinical Hospital of Shymkent, Kazakhstan, spanning 2019 to 2022. Data collected included demographic information, diagnoses, comorbidities, medical anamneses, lab results, and treatment regimens, including physical medicine and rehabilitation interventions. Data were summarized in Microsoft Excel. Statistical analysis was performed using IBM SPSS Statistics (version 26.0). Results: An analysis of 350 patients with RA identified 143 cases of concomitant CVD, with arterial hypertension being the most common cardiovascular disease. The prevalence of CVD among patients with RA was 40%, with a mean age of 58 years, peaking between 50 and 65 years. The majority of patients were women. A strong association was found between increased RA activity and elevated cardiovascular risk. Despite the widespread use of glucocorticosteroid therapy, rehabilitation coverage remained limited. A significant proportion of patients had elevated cholesterol and C-reactive protein levels, while those who engaged in physical therapy and rehabilitation had lower cholesterol levels. Comparative analysis of yoga integration into rehabilitation programs for patients with RA, alongside other modalities (kinesiotherapy, balneotherapy, and pilates), showed that yoga participants exhibited lower pain levels, reduced morning stiffness duration, and lower mean DAS-28 scores compared to those using alternative rehabilitation methods. Conclusion: Integrating physical medicine and rehabilitation, particularly yoga, with pharmacological treatments appears promising for improving patient outcomes. Yoga has demonstrated benefits in reducing pain, morning stiffness, and disease activity. Continued research is essential to refine these approaches and enhance RA and CVD management in patients.

Keywords Cardiovascular diseases · Rheumatoid arthritis · Comorbidity · Retrospective studies · Physical and Rehabilitation Medicine

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Introduction

According to the Medical Subject Headings (MeSH) thesaurus, cardiovascular diseases encompass pathological conditions affecting the heart, blood vessels, and pericardium [1]. As defined by the World Health Organization (WHO), this category of diseases includes coronary heart disease, cerebrovascular disease, rheumatic heart lesions, and other related pathologies. Cardiovascular diseases make a significant contribution to the global mortality rate, accounting for approximately 17.9 million deaths annually worldwide [2].

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They can arise independently or as a consequence of other underlying conditions. In recent years, particular attention has been given to the association between cardiovascular diseases and autoimmune disorders, notably rheumatoid arthritis [3, 4].

RA is a systemic chronic disease characterized by inflammatory joint and surrounding tissue alterations [5]. Initially, RA triggers inflammation in the joints of the hands and feet, potentially leading to joint deformity and complete immobility [6]. Furthermore, systemic inflammation associated with RA affects various tissues and organs, including the heart and vascular system [7, 8]. Cardiovascular manifestations in rheumatoid arthritis encompass pericarditis, myocarditis, coronary vasculitis, diastolic dysfunction, accelerated atherosclerosis, and heart valve abnormalities [9]. Patients with RA face an elevated risk of coronary heart disease, stroke, and heart failure [10, 11]. This risk closely correlates with clinical factors such as hypertension, dyslipidemia, and obesity, which are more prevalent in this demographic compared to the general population [12]. Atherosclerotic processes driven by systemic inflammation play a pivotal role in developing cardiovascular diseases in RA [13–15]. Notably, the incidence and progression of cardiovascular disease in rheumatoid arthritis align with disease activity [16], with patients exhibiting heightened RA activity being more susceptible to hospitalization due to acute myocardial infarction and congestive heart failure [17]. Cardiovascular disease stands as the foremost cause of mortality among patients with RA [18]. Effective management of the underlying disease is imperative to mitigate cardiac risk in these individuals.

Treatment modalities for rheumatoid arthritis encompass both pharmacological and non-pharmacological approaches. Pharmacotherapy for RA involves disease-modifying antirheumatic drugs, as well as steroidal and non-steroidal anti-inflammatory drugs [19]. However, prolonged usage of these medications may yield adverse effects, including immunosuppression, hypertension, hyperglycemia, and hepatic impairment, prompting patients to seek complementary therapies [20]. Consequently, around 47% of RA patients resort to adjunctive treatments universally, albeit only a third report this to their healthcare provider [21].

Non-pharmacological interventions for RA encompass physical and rehabilitative measures, including patient education, exercise, physiotherapy, orthotic support, and dietary adjustments [22, 23]. Recent evidence suggests that increasing physical activity levels can markedly ameliorate the condition of individuals with RA by reducing fatigue, functional disability, inflammation, and cardiovascular risk [24–26]. Previous research also indicates that exercise in RA yields substantial benefits, such as enhanced quality of life, diminished pain, and reduced joint inflammation [27–30]. To optimize outcomes in RA patients, a diverse range of exercises tailored to specific symptoms is recommended [31]. Hence, ongoing research into the application of physical medicine and rehabilitation is pivotal for crafting a comprehensive approach to managing RA and its concomitant cardiovascular complications. The objective of the present study was to investigate the impact of physical medicine and rehabilitation on RA management in patients with cardiovascular disease and analyze the clinical data of these cohorts.

Methods

This study employed a retrospective monocentric design to analyze case histories of patients treated in the rheumatology department of the Regional Clinical Hospital of Shymkent, Kazakhstan, from 2019 to 2022. The inclusion criteria encompassed case histories of patients aged 18 years and older diagnosed with rheumatoid arthritis (regardless of disease duration) accompanied by concomitant cardiovascular pathology. Patients of any gender, race, and nationality were included in the study. The exclusion criteria were case histories indicating other rheumatic diseases. The effect of the COVID-19 pandemic was not considered during the data collection process.

Data for each patient were collected using a specialized chart that recorded demographic data, principal diagnosis, comorbidities, medical and personal life histories, laboratory results, and treatment regimens. We also noted the types of physical medicine and rehabilitation in patient management. For patients with arterial hypertension, we recorded the degrees of arterial hypertension and their regular antihypertensive therapy intake. Subsequently, the data from the completed charts were summarized in a comprehensive table using Microsoft Excel software.

Statistical analysis

Descriptive statistical analysis was conducted utilizing the IBM SPSS Statistics program (version 26.0, SPSS Inc., Chicago, IL, USA). Quantitative data were assessed for normal distribution using the Kolmogorov-Smirnov criterion. Categorical data were summarized using absolute values and percentages.

Quantitative data conforming to a normal distribution were presented as the mean (M) ± standard deviation (SD) with 95% confidence interval (95% CI) limits. Non-normally distributed quantitative data were described using the median (Me) and interquartile range (IQR: Q1 - Q3). Categorical data were presented as absolute values and percentages. The Mann-Whitney U test was employed to compare

Table 1 Distribution of Patients with Cardiovascular Disease according to the Rheumatoid Arthritis Activity Index

Indicators	Categories	Absolute numbers	%	95% CI
DAS-28 above than 5.1 (high activity)	Lack of high activity	7	4.9	2.0–9.8
	Presence of high activity	136	95.1	90.2–98.0
DAS-28 above than 3.1 (medium activity)	Lack of medium activity	135	94.4	89.3–97.6
	Presence of medium activity	8	5.6	2.0–9.8
DAS-28 less than 3.1 (low activity)	Lack of low activity	142	99.3	96.2–100.0
	Presence of love activity	1	0.7	0.0–3.8

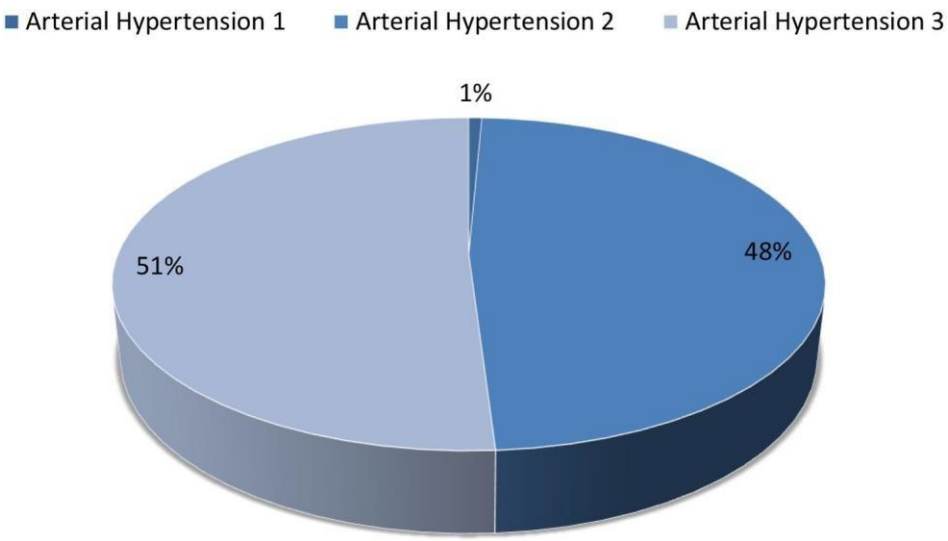

Fig. 1 Degrees of arterial hypertension in patients with rheumatoid arthritis

two groups with non-normally distributed quantitative variables. Comparison of percentages in four-field contingency tables utilized Pearson's chi-square test (for expected phenomenon values > 10) or Fisher's exact test (for expected phenomenon values < 10). Similarly, comparisons in multipole contingency tables were conducted using Pearson's chi-square test. Statistical significance was set at $p < 0.05$.

Results

A total of 350 patients with rheumatoid arthritis were included in the study, revealing 143 cases of concomitant cardiovascular disease. Arterial hypertension emerged as the most prevalent cardiovascular condition. Most of the cohort with cardiovascular diseases were female (n = 108, 75.5%). The mean age of the patients was 58 years, ranging from 41 to 81 years, with the highest prevalence of cardiovascular diseases observed in the 50–65 age group (68.5%). A minority of patients (3.5%) reported a history of heart attack or stroke, while 16.1% had comorbid diabetes mellitus. The average duration of rheumatoid arthritis was 108 months, ranging from 2 to 374 months. The vast majority of patients (n = 136) with cardiovascular disease exhibited high DAS-28 rheumatoid arthritis activity (> 5.1). Detailed distribution data of patients with cardiovascular disease according to the rheumatoid arthritis activity index are provided in Table 1.

Most patients (87.4%) with cardiovascular disease were undergoing glucocorticosteroid therapy, while 19 patients (13.3%) were prescribed weekly doses of Methotrexate. Elevated cholesterol levels (above five mmol/l) were noted in 74 patients (51.7%), while elevated C-reactive protein levels (above five mg/L) were detected in 71 patients (49.7%). The vast majority of patients (91.6%) received regular baseline therapy for rheumatoid arthritis. Regarding arterial hypertension, nearly half of the patients exhibited grade 3 AH (51%), with detailed data provided in Fig. 1. Furthermore, 86 patients (60.1%) adhered to regular baseline therapy for arterial hypertension.

Among the patients included in the study, most adhered to a specialized diet low in carbohydrates and cholesterol, totaling 111 patients (77.6%). Additionally, less than half of the patients underwent physical rehabilitation, with 58 individuals (40.6%) participating in such programs. Further details regarding treatment adherence among men and women are depicted in Fig. 2.

Statistically significant differences ($p = 0.035$) were observed when comparing the degrees of arterial hypertension based on participation in physical rehabilitation, analyzed using Pearson's chi-square test. Notably, a higher proportion of patients with grade 3 arterial hypertension

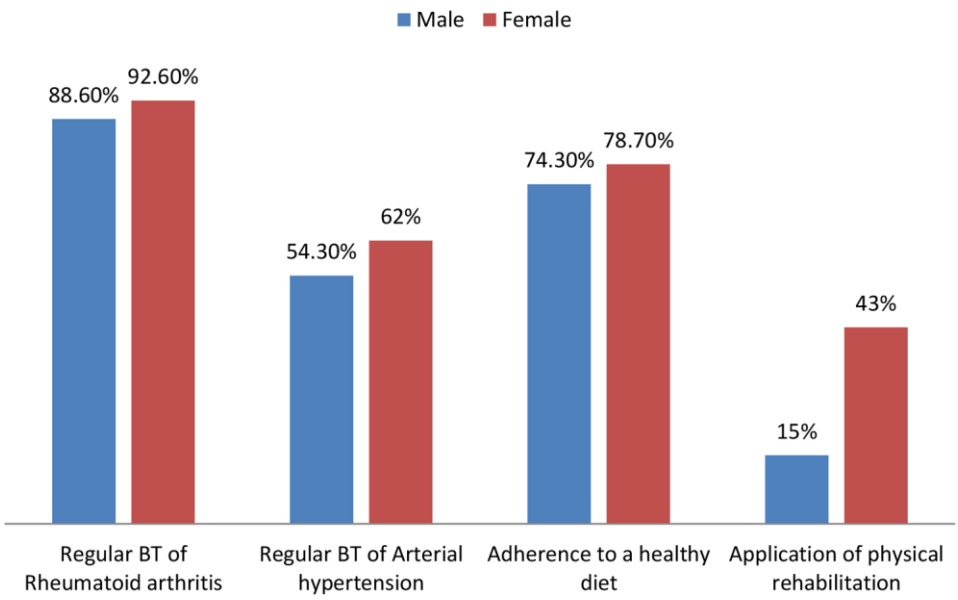

Fig. 2 Therapy adherence by gender. *BT – baseline therapy

Table 2 Analysis of Arterial Hypertension Degree in Patients with Rheumatoid Arthritis based on Participation in Physical Medicine and Rehabilitation Sessions

Indicator	Categories	Physical Medicine and Rehabilitation		p
		Absence	Presence	
AH (degree)	degree 2	48 (56.5)	21 (36.2)	0.035*
	degree 1	0 (0.0)	1 (1.7)	
	degree 3	37 (43.5)	36 (62.1)	

* - differences are statistically significant ($p < 0.05$)

(62.1%) engaged in physical rehabilitation compared to others. Complete data are provided in Table 2. The median age of patients in the exercise group was 58 years, compared to 57 years for those in the non-exercise group. Additionally, among patients undergoing physical rehabilitation ($n = 58$), more than one-third favored yoga (41.4%) and kinesiotherapy (34.5%), as depicted in Fig. 3.

The assessment of cholesterol levels based on exercise revealed statistically significant differences ($p < 0.001$), analyzed using the Mann-Whitney U-test. Patients who exercised exhibited a median cholesterol level of 4.27, whereas those who did not exercise had a median cholesterol level of 5.65. Complete data are provided in Table 3.

Four groups of rehabilitation patients ($n = 58$) were assessed: yoga (41%), kinesiotherapy (35%), balneotherapy (15%), and Pilates (9%). Each group was evaluated using measures such as the Visual Analog Scale (VAS) pain index (mm), duration of morning stiffness (minutes), and the Disease Activity Score 28 (DAS-28).

Significant differences ($p < 0.001$) were observed in the VAS pain index when comparing patients who practiced yoga versus those undergoing other forms of rehabilitation (a method employed: Mann-Whitney U-test). Patients engaging in yoga exhibited a lower median (Me) VAS pain index (30.00 [20.00–30.00]) compared to individuals utilizing alternative rehabilitation methods (40.00 [32.50–50.00]). Refer to Table 4 for detailed data.

Similarly, statistically significant differences ($p < 0.001$) were noted in the duration of morning stiffness between patients practicing yoga and those undergoing other forms of rehabilitation (method utilized: Mann-Whitney U-test). Patients engaged in yoga demonstrated a lower median duration of morning stiffness (70.00 [60.00–70.00] minutes) compared to counterparts utilizing alternative rehabilitation modalities (90.00 [80.00–100.00] minutes). Detailed data can be found in Table 5.

Furthermore, a significant contrast ($p < 0.001$) was observed in the DAS-28 scores when comparing patients practicing yoga to those undergoing other forms of rehabilitation (a method employed: Mann-Whitney U-test). Patients engaged in yoga exhibited a lower median DAS-28 score (5.67 [5.25–5.85]) compared to individuals utilizing alternative rehabilitation methods (6.34 [6.11–6.78]). Detailed data can be found in Table 6.

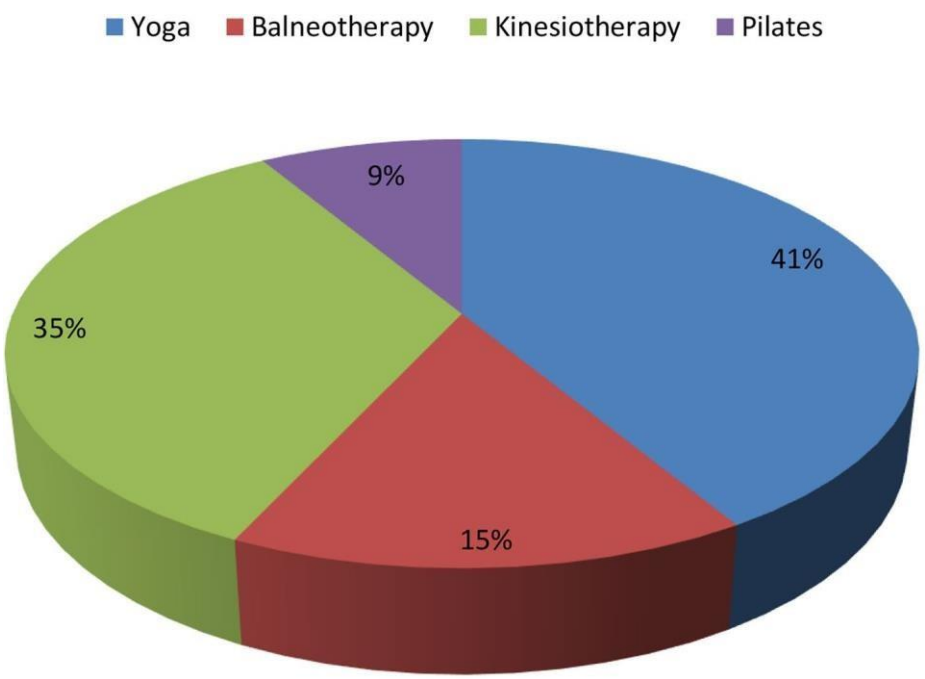

Fig. 3 Types of physical rehabilitation utilized by patients with rheumatoid arthritis

Table 3 Analysis of Cholesterol Levels in Relation to Physical Medicine and Rehabilitation in Patients with Arterial Hypertension in Rheumatoid Arthritis

Indicator	Categories	Cholesterol level			p
		Me	$Q_1 – Q_3$	n	
Physical medicine and rehabilitation	Absence	5.65	5.19–6.37	85	< 0.001*
	Presence	4.27	3.72–4.60	58	

* - differences are statistically significant ($p < 0.05$)

Table 4 Analysis of VAS pain index (mm) as a function of yoga practice

Indicator	Categories	VAS pain index (mm)			p
		Me	$Q_1 – Q_3$	n	
Yoga	Presence	30,00	20,00–30,00	24	< 0,001*
	Absence	40,00	32,50–50,00	34	

* - differences of indicators are statistically significant ($p < 0.05$)

Table 5 Analysis of morning stiffness according to yoga practice

Indicator	Categories	morning stiffness (minutes)			p
		Me	$Q_1 – Q_3$	n	
Yoga	Presence	70,00	60,00–70,00	24	< 0,001*
	Absence	90,00	80,00–100,00	34	

* - differences of indicators are statistically significant ($p < 0.05$)

Table 6 DAS-28 analysis after yoga classes

Indicator	Categories	DAS-28			p
		Me	$Q_1 – Q_3$	n	
Yoga	Presence	5,67	5,25–5,85	24	< 0,001*
	Absence	6,34	6,11–6,78	34	

* - differences of indicators are statistically significant ($p < 0.05$)

Discussion

Rheumatoid arthritis is an autoimmune inflammatory disease affecting 0.1-1% of the world's population [32, 33], impacting roughly 14 million individuals [34]. In this study, 40% of RA patients were diagnosed with cardiovascular disease, with the majority (75.5%) being women. Previous studies have also confirmed the higher prevalence of RA in women: 1.16% compared to 0.44% in men [9]. Moreover, women with RA face a two- to threefold increased risk of myocardial infarction, even without typical cardiovascular risk factors such as smoking, hypertension, dyslipidemia, and insulin resistance [36]. RA patients commonly exhibit elevated blood pressure, particularly diastolic blood pressure [37]. Our findings reveal arterial hypertension as the predominant cardiovascular comorbidity among RA patients, with nearly half experiencing grade 3 hypertension. Alarmingly, only 60.1% of these patients adhered to regular antihypertensive therapy, reflecting a gap in treatment adherence. A study by Ladak and colleagues noted a high prevalence of arterial hypertension in patients with RA, which is often exacerbated by inadequate treatment [38]. Alongside arterial hypertension, dyslipidemia prevails as a comorbidity in RA [39], exacerbated by increased insulin resistance and metabolic syndrome [40]. Notably, 16.1% of our study participants had concomitant diabetes mellitus. Furthermore, almost half of the patients had elevated cholesterol levels (above five mmol/l), with 49.7% exhibiting elevated CRP levels (above five mg/l). Literature supports the association between carotid plaque presence, joint inflammation, and elevated CRP levels in RA patients [35]. Inflammatory cytokines like TNF-α, IL-β, and IL-17 may contribute to arterial plaque formation [41], exacerbating atherosclerosis and cardiovascular risk [42]. RA also fosters atherogenesis, encompassing endothelial dysfunction, arterial stiffness, vascular inflammation, and plaque formation [43]. Observational studies demonstrate a correlation between increased disease activity and elevated cardiovascular risk, with each point increase in the DAS-28 index associated with a 28% rise in risk [44]. Patients in RA remission typically exhibit better left ventricular function than those with active disease [45]. However, dysregulation of lipid metabolism further propels RA progression [3]. Most patients in our study had high RA activity (DAS-28 > 5.1), with 87.4% of patients receiving glucocorticoid therapy and 13.3% of patients using methotrexate. Glucocorticoid use in RA patients may heighten cardiovascular event risk [46], with cardiovascular mortality linked to a threshold prednisolone dose of 8 mg daily [47]. Both current and cumulative steroid administration increases myocardial infarction risk [48]. Hence, inflammation-targeted therapy plays a pivotal role in averting cardiovascular events. Additionally, managing hyperlipidemia, hypertension, and hyperglycemia, along with lifestyle changes like smoking cessation, weight loss, and cardiovascular conditioning, are imperative [49]. Patients should also consider physical medicine and rehabilitation techniques that may positively impact disease progression. Current research has confirmed that participation in rehabilitation correlates with cholesterol reduction, and incorporating yoga into rehabilitation programs may provide additional benefits. Yoga, encompassing breathing exercises, physical activity, and meditation, is deemed a safe and beneficial treatment modality [50], enhancing physical activity levels and stress reduction [51]. Literature corroborates yoga's efficacy in managing RA symptoms like pain, functional capacity, and quality of life [52, 53]. Our comparative study incorporating yoga, kinesiotherapy, balneotherapy, and pilates unveiled significant differences between patient groups. Yoga participants reported lower pain levels and reduced morning stiffness duration compared to alternative rehabilitation methods. Moreover, patients incorporating yoga into their regimen exhibited lower mean DAS-28 index scores than other groups. Hence, this study underscores the intricate interplay between RA and cardiovascular disease, underscoring the necessity for comprehensive treatment encompassing risk factor management and rehabilitation. However, it is essential to recognize the limitations of the study, which include its single-center, retrospective design and the constraints of data collection limited to the tertiary care level.

Conclusion

In conclusion, this study illuminates the profound connection between rheumatoid arthritis and cardiovascular disease, elucidating shared risk factors and intertwined pathophysiological mechanisms. Individuals with RA confront an escalated risk of developing CVD due to inflammation and prevalent factors such as arterial hypertension, dyslipidemia, and insulin resistance. Effective therapeutic strategies aimed at curbing inflammation and managing these risk factors emerge as pivotal in averting cardiovascular complications in RA patients. Furthermore, integrating physical medicine and rehabilitation, including exercises like yoga, emerges as a promising adjunct to pharmacological therapy, fostering improved quality of life, reduced pain, and ameliorated RA symptoms. Continued research in this domain is imperative to devise optimal approaches for RA management and CVD prevention in this patient cohort.

Author contributions All co-authors contributed substantially to the concept, formulation, searches of relevant articles, and revisions. They approve the final version of the manuscript and take full responsibility for all aspects of the work.

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Data availability The data that support the finding of this study are available on a reasonable request from the corresponding author.

Declarations

Ethical approval This study was approved by the Local Ethics Committee at South Kazakhstan Medical Academy, Protocol №1.

Informed consent The requirement for additional written informed consent was waived because of the retrospective design of this study and the use of anonymous patient data.

Conflict of interest The authors have stated that there are no conflicts of interest in connection with this article.

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CASES WITH A MESSAGE

Complex rehabilitation of patients with rheumatoid arthritis

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Abstract

Rheumatoid arthritis (RA) is a common chronic autoimmune disease characterized by symmetrical polyarthritis, joint pain, and morning stiffness. It significantly impairs physical condition and increases the risk of functional disability. While conventional treatments include drug therapy, many patients continue to experience symptoms and seek alternative therapies to improve their condition. This article describes two clinical cases of RA patients treated with a comprehensive rehabilitation program, including moderate-intensity walking, yoga, and nutritional therapy. The study aimed to evaluate this approach's effectiveness in improving the patients' functional capacity and quality of life. The first patient (50 year-old female) noted a significant reduction in the number of painful joints (by 14) and swollen joints (by 12) after a three-month rehabilitation course. The visual analog scale (VAS) pain level decreased from 80 mm to 50 mm, and the duration of morning stiffness decreased from several hours to 80 min. The second patient (45 year-old female) also showed improvement: painful joints decreased from 13 to 2, and swollen joints from 7 to 1. VAS pain level decreased from 80 mm to 40 mm, and morning stiffness decreased by 50 min. Both patients reported an average reduction in excess weight by 1.65 kg/m², along with improvements in general well-being and mood. The results confirm that a comprehensive rehabilitation approach, including physical activity, yoga, and diet therapy, significantly improves the condition of RA patients. This approach helps reduce pain, decrease the number of inflamed joints, and improve overall functionality. Further studies with a larger sample are needed to determine the optimal rehabilitation strategies and the most impactful interventions.

Keywords Rheumatoid arthritis · Case reports · Rehabilitation · Exercise · Physical and rehabilitation medicine

Introduction

Rheumatoid arthritis is a chronic, inflammatory autoimmune disease [1], affecting 14 million people worldwide [2]. Although RA is characterized by significant extra-articular manifestations [3], it primarily involves the small joints of the hands and feet [4]. The pathology of RA includes damage to the synovial membrane, bone degradation, and cartilage destruction. Dendritic cells, macrophages, and mast cells play crucial roles in interacting with autoantigens and triggering joint inflammation [5]. The clinical diagnosis of RA is based on the presence of symmetrical polyarthritis, prolonged morning stiffness lasting more than an hour, and the onset of subsequent deformities [6]. This joint syndrome is associated with joint pain and swelling, which can significantly impair physical function [7]. Additionally, RA patients are prone to adverse changes such as muscle atrophy and increased fat mass, leading to more significant functional disability [8]. Furthermore, systemic inflammation in rheumatoid arthritis increases the risk of developing cardiovascular disease, which is the leading cause of mortality in these patients [9].

While strictly controlled treatment strategies and significant advancements in disease-modifying anti-rheumatic drugs have substantially improved the condition of RA patients [10], many still do not achieve remission and continue to experience progressive functional impairment [11]. Consequently, almost one in three RA patients face employment difficulties, and the disability rate among them is ten times higher than in the general population [12].

In this context, non-pharmacological methods for managing RA, such as massage, acupuncture, healthy sleep, and

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exercise, warrant closer attention [13]. Regarding exercise, the World Health Organization recommends that adults aged 18–64 engage in at least 150–300 min of moderate-intensity aerobic physical activity each week to maintain good health [14]. Exercise is essential as it can slow the progression of RA and prevent disability [15]. Physical activity helps reduce the expression of systemic inflammatory genes [16], improves cardiovascular health, increases muscle mass, reduces obesity, and enhances strength and physical functionality without exacerbating the disease or causing joint damage [17]. In addition to physical exercise, RA complex therapeutic strategies often focus on electrophysical methods, healthy diet, and psychological well-being [18]. Yoga is an intriguing approach that simultaneously addresses mental and physical health by combining meditative breathing with physical activity [19, 20]. Several studies have evaluated the effectiveness of different rehabilitation methods separately [21–24]. However, the additive effects of rehabilitation approaches on RA patients, which require multidisciplinary collaboration [25], need further evaluation. This article describes two clinical cases of RA patients undergoing comprehensive rehabilitation, including moderate-intensity aerobic exercise, yoga, and nutritional therapy. This study aims to evaluate the effectiveness of integrated rehabilitation on the condition of RA patients, focusing on the impact of these methods on their functional capacity and quality of life.

Case reports

A 50-year-old female patient complained of pain in the small joints of her hands, wrists, and ankles, symmetrical swelling of her ankle joints, increased pain with movement, morning stiffness lasting several hours, headache, dizziness, and general weakness. She was diagnosed with RA in 1984. Initially, she was treated with Methotrexate (15 mg/week), but due to side effects, her medication was switched to Leflunomide (20 mg/day). Her medical history revealed no tuberculosis, hepatitis, or skin diseases. She did not consume alcohol did not smoke. Her family history was remarkable since her sister was also diagnosed with RA. She was hypersthenic with height of 166 cm, weight of 80 kg, and body mass index (BMI) of 29.0 kg/m². Her skin was pale, and her peripheral lymph nodes were not enlarged. The musculoskeletal examination revealed painful proximal interphalangeal joints of the hands, small joints of the feet, ankles, and knees, along with hypotrophy of the interosseous muscles of the hands. Her fingers were deformed with swan-neck pattern, and palpation of these joints revealed local hyperthermia, hyperemia, and increased pain. The hand compression symptom was positive bilaterally. Palpation of the knee joints revealed crepitation bilaterally. Her pain level, measured by the Visual Analog Scale (VAS), was 80 mm, with 22 painful joints and 16 swollen joints. The duration of morning stiffness was 150 min. Her respiratory system was unremarkable. Cardiovascular examination revealed regular heart borders, rhythmic but muffled heart tones, blood pressure of 120/70 mm Hg on both sides and heart rate of 76 bpm. The digestive and urinary systems were without abnormalities.

The second patient, a 45-year-old woman, complained of pain in the small joints of both hands, wrists, elbows, shoulders, and feet, along with morning stiffness. She suffered from RA since 2013, and she was treated with Methotrexate 15 mg/weekly. Her medical history showed no significant family history of RA. She did not smoke and did not consume alcohol. She was hypersthenic with height of 160 cm, weight of 76 kg, and BMI of 29.7 kg/m². Examination revealed seven swollen and 13 painful joints, with morning stiffness lasting 120 min. Her VAS pain index was 80 mm.

To improve their conditions, a comprehensive rehabilitation program was recommended, in addition to essential drug therapy. The complex rehabilitation program included the following:

Diet therapy

A nutritionist developed a diet plan rich in omega-3 fatty acids, antioxidants, and vitamins. The diet included fish, nuts, fresh fruits, vegetables, limited sugar, and processed foods.

Aerobic exercise

Patients were encouraged to walk at a moderate intensity, averaging 8,000 steps per day.

Relaxation techniques

Patients engaged in yoga sessions twice a week for 40 min.

Sleep and Rest: Patients were advised to adjust their daily routine to include 7–9 h of sleep each night and short rest periods during the day.

Three months after starting the rehabilitation program, both patients reported significant improvements in their general condition and mood. The first patient's condition improved with the number of painful joints decreasing to 8 and swollen joints to 4. The VAS pain index decreased to 50 mm, and the duration of morning stiffness reduced from 150 min to 80 min. Additionally, she reported a weight loss from 80 kg to 74 kg, and her BMI decreased to 26.9 kg/m². The second patient also showed improvement, with her weight decreasing from 76 kg to 73 kg and her BMI to

28.5 kg/m². The number of painful joints decreased to 2, and the number of swollen joints to 1. Her VAS pain index decreased to 40 mm, and the duration of morning stiffness reduced from 120 min to 70 min.

Discussion

Some medications can reduce rheumatic symptoms [26], but the side effects are increasingly prompting patients with RA to choose alternative therapies to alleviate their condition. Regular physical activity is recommended for people with RA to help reduce disease activity and systemic inflammation [27]. The positive effects of physical activity and exercise on clinical, metabolic, and cardiorespiratory parameters in patients with RA have been documented in several studies [28].

A recent study by Peres and colleagues found that people with RA often have a fear of movement, which increases disease activity [29]. This fear partly explains this group's lack of physical activity and difficulty managing exercise at the required intensity [29]. In the current study, both patients with RA were engaged in exercising, including yoga sessions and daily walking of moderate intensity. Walking is an accessible, low-trauma exercise requiring no specialized training and is crucial in maintaining patients' independence. A study by Baxter and colleagues showed that participants in a walking program improved their self-efficacy and general well-being [30]. Another study by Bartlett et al. found that a ten-week course of high-intensity interval walking decreased disease activity, increased aerobic capacity, and improved antibacterial innate immune defence in patients with RA [31]. Individually adapted moderate-intensity exercise, under personalized guidance, reduced fatigue, improved symptoms of depression, and induced metabolic changes in older adults with RA [32].

In addition to exercise, patients often resort to dietary therapy to alleviate their symptoms. Some dietary choices can increase inflammation (e.g., red meat, salt, excessive calorie intake), while others, such asoily fish and fruits, can help reduce inflammation [33]. Diet significantly affects the human intestinal microbiota, crucial in modulating the immune response and the development of RA[34]. Therefore, choosing the proper diet is crucial as it can influence the disease manifestation, course, and outcome [35]. Popular dietary approaches include vegetarian and gluten-free diets, the Mediterranean diet, elemental and elimination diets, and fasting, with widely used supplements [36]. A study evaluating the effects of combined diet and exercise showed improvements in physical activity, lower low-density lipoprotein cholesterol levels, and increased nutrient intake [37]. In our study, both patients were recommended a healthy diet supplemented with antioxidants, vitamins, and omega-3 fatty acids. A systematic review showed that supplementation with omega-3 polyunsaturated fatty acids significantly improved the duration of morning stiffness, pain levels, erythrocyte sedimentation rate, and physical function [38].

Sleep is also crucial for the functioning of the immune system and is essential for restoring and maintaining homeostasis [39]. A 16-week lifestyle program significantly reduced disease activity (mean reduction in DAS 28 by 0.9 points) and improved metabolic status in people with RA who had low to moderate disease activity [40].

This article described two clinical cases of a comprehensive rehabilitation program, including moderate-intensity walking, yoga, and nutrition therapy. The results showed improvement in the patients' conditions, with a reduction in the number of painful and swollen joints, and a decrease in pain and morning stiffness. In the first patient, after the rehabilitation course, the number of painful joints decreased from 22 to 8, swollen joints from 16 to 4, VAS pain level decreased from 80 mm to 50 mm, and morning stiffness decreased by 70 min. In the second patient, the number of painful joints decreased from 13 to 2, swollen joints from 7 to 1, the VAS pain level decreased from 80 mm to 40 mm, and morning stiffness decreased by 50 min. Additionally, physical activity combined with a healthy diet helped the patients reduce their body weight by an average of 4.5 kg (average BMI decreased by 1.65 kg/m²).

The main message of the study is to show the effectiveness of a comprehensive rehabilitation program, including moderate-intensity walking, yoga, and nutrition therapy, in improving the functional capacity and quality of life of patients with RA. The study presented two clinical cases of long-lasting RA patients who experienced significant reductions in painful and swollen joints, improvements in pain levels and morning stiffness, as well as general well-being and mood enhancements after undergoing the comprehensive rehabilitation program. The study emphasizes the potential benefits of non-pharmacological approaches, such as exercise and yoga, in managing RA and improving patients' overall well-being. However, because we described the effects of rehabilitation measures in an integrated manner, it is unclear which interventions had the most significant impact on joint syndrome regression and overall improvement.

Conclusion

The described clinical cases demonstrate the effectiveness of a comprehensive approach to the rehabilitation of patients with RA. Incorporating yoga, physical activity, and dietary

changes into the treatment plan may significantly improve the quality of life for patients and slow disease progression. Applying such multifaceted approaches in clinical practice is recommended to achieve better results in treating RA.

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Declarations

Informed consent Written informed consent was obtained from both patients.

Conflict of interest None declared

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