

Review

A Review of the Efficacy of Yoga and Meditation-Based Interventions for Rheumatoid Arthritis

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Abstract:

Background: This paper presents a review of the evidence regarding the efficacy and impact of Yoga and mindfulness with meditation among patients with rheumatoid arthritis (RA). Patients who suffer from RA express a variety of symptoms that negatively impact their physical functioning and performance in social roles. Yoga and meditation-based therapies have been previously used to manage chronic pain conditions and other persisting disorders in affected populations. The suitability and effectiveness of these practices in RA should be thoroughly reviewed and assessed to suggest a successful implementation.

Methods: Systematic search of highly recognized medical and alternative therapy databases was conducted. Relevant research papers were screened and selected for review based on a strict set of criteria developed by the authors.

Results: Thirteen articles were included in the review: nine randomized controlled trials and four single-arm trials. All studies revealed promising outcomes for the effectiveness of meditation-based interventions in RA. Improvements were identified in pain symptoms, joint



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inflammation, fatigue, disease activity, and numerous psychological parameters. The lack of standardized research procedures made conclusions across studies challenging to compare.

Conclusions: Yoga and mindfulness with meditation might benefit patients who suffer from chronic physical and psychological RA symptoms. Future research assessing the effects of long term practice is needed to determine the suitability of Yoga and meditation-based therapies in RA.

Keywords

Yoga; meditation; mindfulness; rheumatoid arthritis; chronic pain

1. Introduction

Rheumatoid arthritis (RA) is a common condition and cause for disability in the United States (US) [1]. In 2010-2012, 52.5 million adults in the US (22.7% of all adults) were diagnosed with arthritis, and 22.7 million (9.8%) had arthritis-attributable activity limitation [2]. These numbers are expected to increase over the next 20 years [2]. In light of this, research measuring the effectiveness of therapies and treatments for arthritis is greatly needed. RA is characterized by joint swelling, stiffness, and pain, as well as the destruction of synovial joints [3]. Many treatment guidelines focus exclusively on pharmacological options [4-6] including opioids and narcotics that are prescribed for pain symptoms related to RA [7]. Considering the current opioid epidemic, and the fact that existing conventional treatments are not considered to be definitive or curative in nature [8], there is an interest in non-pharmacological interventions targeting pain related symptoms of RA [9].

Some complementary therapies appear to provide significant benefit to patients with RA [10], and between 28% to 90% of patients turn to integrative health modalities for relief of their symptoms [8]. Given the adverse effects of RA on individuals' physical, emotional, and social functioning [8], further evaluation of complementary therapies such as Yoga (meditation-based and non-meditation-based) and meditation-based mindfulness, for the management of signs and symptoms of the disease is warranted.

In addition to physical symptoms, psychological disorders are highly prevalent among patients with RA [11, 12]. Both body-oriented Yoga (Yoga that does not include meditative practice) and mind-body Yoga (meditation-based Yoga) have been used to effectively manage a wide range of psychosomatic and psychiatric disorders [13, 14]. Yoga is associated with decreases in resting heart rate and normalization of mean daily cortisol levels which has been linked to reduced symptoms of stress and depression, enhanced quality of life levels, and improved physical function [15, 16]. Yoga may also be particularly well-suited to the management of RA because of its ability to promote gentle physical rehabilitation – including ambulation, muscle strength, and balance – along with its proclivity to address psychological risk factors of disability in combination with stress management techniques such as breathing, relaxation, and meditation [17, 18].

In a similar way, mindfulness meditation involves the cultivation of non-judgmental attention to unwanted thoughts, feelings, and bodily experiences, and has been found to improve both the physical and psychological status of patients with chronic pain [19-21]. Mindfulness meditation

can enhance immune function and combat proinflammatory activity associated with stress and depression, which may contribute to the reduction of disease activity in patients with RA [22]. A growing body of literature has underscored the importance of meditation-based therapy in the management of RA, and has highlighted its capacity to interrupt maladaptive automatic responses such as catastrophizing (e.g. negative pain cognitions), as well as enhance positive emotion, and aid in coping with everyday stress and pain [23, 24]. Given the relationship between affective changes and disease progression in RA [25], these therapies have the potential to target physiological aspects of the condition while providing individuals with the tools to effectively manage the emotional demands of their illness [26].

The aim of the present review was to explore the efficacy of Yoga and meditation-based therapies as presented in recent research studies, which measured the outcomes of Yoga or mindfulness meditation among RA participants. This paper discusses the impact of Yoga and similar meditation-based therapies on both physical and psychological outcomes in RA.

2. Materials and Methods

2.1 Overview/ Process Summary

The authors searched and identified potentially relevant research and screened the resulting articles for a list of inclusion and exclusion criteria, designed to filter studies for their level of appropriateness. Next, the authors performed a thorough examination of studies that met the criteria, in order to assess the quality of the data and extract pertinent information. The authors then developed a plan for interpreting the findings from the selected studies. Lastly, the authors agreed upon a structured and feasible method to report their findings.

2.2 Search Terms and Databases

The terms used to identify relevant studies for this review included rheumatoid arthritis combined with Yoga, MBSR, mindfulness, meditation, or yogic. Searches were performed using recognized medical and complementary therapy databases including PubMed, PyscINFO, EBSCO, Web of Science, and Science Direct.

2.3 Screening

Studies that were initially identified as relevant were retrieved and then categorized based on their design and nature of intervention. They were placed into one of the following categories, randomized control trials (RCT), single-arm interventions, literature or systematic reviews, or poster presentations. This review included studies that focus on human subject research only. Two authors were assigned to screen the research papers, which they conducted separately and later compared their notes for similarities and differences.

2.4 Inclusion/ Exclusion Criteria

Studies that qualified for this review were written in English, published between 2008 and 2018, and used Yoga and meditation-based therapies as the intervention for RA. Any forms of meditation-based therapies were included, including Yoga, mindfulness meditation, and

mindfulness-based stress reduction (MBSR) programs. Only randomized control trials or single-arm interventions that implemented a quantitative, or mixed methods, study design and included participants of 18 years of age or older were selected for this review. Only peer reviewed research papers were included in the present review. The authors excluded case studies, literature or systematic reviews, abstracts, qualitative studies, poster presentations, opinion papers, editorial comments, study proposals, or books.

3. Results

A total of eighty-one articles were identified in the original search, and after the first evaluation, ten of those were deemed as duplicates, and thirty did not meet inclusion criteria. After carefully screening the forty-two remaining research articles, the reviewers concluded that thirteen met all inclusion criteria and qualified for review. Out of the eligible papers, nine were randomized controls trials (RCT) [27-35] and four were single-arm intervention studies [36-39]. All of the RCTs followed a quantitative study design, and only one of the single-arm trials implemented a mixed methods design [37]. Among the RCTs six of them employed two arms, in which the intervention group received some form of Yoga or meditation-based therapy. In these studies, the control group was either waitlisted to receive the same intervention at a different time, received educational sessions, or no intervention at all. Three of the RCTs employed three arms, in which two interventions were compared between each other and the control group. All thirteen studies looked at the effects of routine Yoga or mindfulness meditation practice on a range of RA symptoms as identified by the American College of Rheumatology. These studies took place in the United States, Dubai, New Zealand, and India. A summary of all studies reviewed here is presented in Tables 1.1-1.3. Additionally, a list of study-specific interventions and their components is shown in Table 2.

Table 1.1 Yoga interventions without meditation practices for rheumatoid arthritis (RA).

Author	Groups	Outcome Measures	N	Population Sample	Design
Chawla et al., 2015	1) Yoga, Naturopathy, Allopathic Medications 2) Control on Allopathic medications	a) Inflammatory Symptoms b) Joint swelling c) Morning Stiffness d) RA factor e) EST f) KF	N = 72 Yoga = 36	RA Patients	a) Quantitative b) RCT c) 12 months d) 365 sessions, 20-25 minutes each
Evans et al., 2010	Iyengar Yoga	a) PDI b) HAQ c) SF-36 d) BSI-18 e) ASES f) CPAQ g) MAAS	N = 5	RA Patients	a) Mixed Methods b) Single Arm c) 6 weeks d) 12 session, 1.5 hours
Nair et al., 2014	1) Naturopathy and Yoga and Allopathic medications 2) Yoga and Allopathic medication 3) Only Allopathic Medicine	a) Morning Stiffness b) Joint Tenderness c) Fatigue d) VAS e) Sleep f) HAQ	N=134 Group 1 = 39 Group 2 = 36	RA Patients	a) Quantitative b) RCT c) 1 year d) 80 sessions, 20 minutes each
Telles et al., 2011	Yoga	a) HAQ b) Hand Grip - hydraulic dynamometer c) Serum Rheumatoid Factor d) CRP	N=64	RA Patients; right handed	a) Quantitative b) Single arm c) 1 week d) 14 sessions, 2.5 hours each

Randomized control trial (RCT), Health Assessment Questionnaire (HAQ), Liver Function (EST), Kidney Function (KF), Arthritis Self-Efficacy Scale (ASES), Pain Disability index (PDI), Short Form Health Survey (SF-36), Brief Symptom Inventory (BSI-18), Chronic Pain Acceptance Questionnaire (CPAQ), Mindfulness attention Awareness scale (MAAS), C-reactive protein (CRP), and Visual Analog Scale (VAS).

Table 1.2 Yoga interventions with meditation practices for rheumatoid arthritis (RA).

Author	Groups	Outcome Measures	N	Population Sample	Design
Badsha et al., 2009	1) Yoga 2) Control	a) HAQ b) DAS28 c) Disability d) Quality of life e) impact of treatment	N = 47 Yoga = 26	RA patients from Dubai, where patients have high disease activity and little to no exercise	a) Quantitative b) RCT c) 8 weeks d) 12 sessions, 1 hour each
Bosch et al., 2009	1) Hatha Yoga 2) Control	a) HAQ b) BDI c) BBT d) Diurnal Cortisol Variability e) Resting Heart Rate	N=20 Hatha Yoga=11	Postmenopausal females with RA between the ages of 45 and 75 years old	a) Quantitative b) Pilot Pragmatic RCT c) 10 Weeks d) 30 sessions, 75 minutes each
Debnath et al., 2014	Yoga	a) Reduce Disease Fluctuation b) Functional Capacity c) Complete Remission d) Level of improvement	N = 40	RA Patients according to Ayurvedic Classics + ASIA	a) Quantitative b) Single Arm c) 3 weeks d) 21 sessions, @6:00 am on empty stomach
Middleton et al., 2018	Hatha Yoga taught in both Spanish and English	a) Self-Efficacy Exercise Regularly b) HPLP c) Self-Rated Health d) Promis29 e) Single Leg Stance f) Functional Reach g) TUG h) DASH	N=30	RA (88.5%) + OA Patients	a) Quantitative b) Single arm c) 8 weeks d) 16 sessions, 1 hour each
Moonaz et al., 2015	1) Yoga 2) Waitlist control	a) SF-36 b) HRQL c) MCS d) Fitness, psychological function	N=75 Yoga = 40	RA (49%) + OA	a) Quantitative b) Pragmatic RCT c) 8 weeks d) 16 sessions, 1 hour

		<ul style="list-style-type: none"> e) Flexibility f) OLS g) strength (hand dynamometer) h) PANAS i) ASES j) PSS k) CES-D l) Patient global scores (joint pain) 			each
Singh et al., 2011	<ul style="list-style-type: none"> 1) Yogic Package group 2) Control 	<ul style="list-style-type: none"> a) SDPIS b) Fatigue c) Number of Inflamed Joints d) PR e) BP f) LC and CRP g) UA 	<ul style="list-style-type: none"> N=80 Yogic = 40 	RA Patients	<ul style="list-style-type: none"> a) Quantitative b) RCT c) 7 weeks d) 49 sessions, 1.5 hours each

Randomized control trial (RCT), Health Assessment Questionnaire (HAQ), Beck Depression Inventory (BDI), Berg Balance Test (BBT), Arthritis Self-Efficacy Scale (ASES) and Positive and Negative Affect schedule (PANAS), Short Form Health Survey (SF-36), Disease Activity Score (DAS28), C-reactive protein (CRP), Health Promoting Lifestyle Profile (HPLP), Patient-Reported Outcomes Measurement Information System 29 (PROMIS29), Timed Up and Go test (TUG), Disabilities of the Arm Shoulder and Hand (DASH), Health Related Quality of Life (HRQL), Mental Component Scores (MCS), Perceived Stress Scale (PSS), Balance with one leg stance (OLS), Center for Epidemiological Studies Depression Symptoms Index (CES-D), Simple Descriptive Pain Intensity Scale (SDPIS), Palpitation of radial artery (PR), Blood Pressure (BP), Lymphocyte count (LC), and Serum uric acid (UA).

Table 1.3 Mindfulness meditation interventions for rheumatoid arthritis (RA).

Author	Groups	Outcome Measures	N	Population Sample	Design
Davis et al., 2015	1) Cognitive Behavioral Therapy 2) Mindfulness meditation 3) Education control	a) Pain and Fatigue b) Morning Disability c) Interpersonal Stress d) Pain-related cognitions derived from CSQ and ASES e) Serene and Anxious Affects derived from subscales of PANAS	N=144 CBT for Pain = 52 Mindfulness = 48	Women and men with RA	a) Quantitative b) RCT c) 8 weeks d) 8 sessions, 2 hours each
Fogarty et al., 2015	1) MBSR 2) Control	a) Joint swelling b) DAS28 c) Duration of early morning stiffness d) VAS e) CRP	N=51 MBSR=26	Men and women with RA in New Zealand	a) Quantitative b) RCT c) 8 weeks d) 56 sessions, approximately 30 minutes - 1 hour each
Zautra et al., 2008	1) Cognitive Behavioral Therapy 2) Mindfulness Meditation 3) Education control	a) VAS b) PANAS c) Average of 6 item depressive symptoms question d) Coping efficacy for pain e) CSQ f) Pain control g) DAS28 h) IL-6	N=144 CBT for Pain = 52 Mindfulness = 48	Women and men with RA	a) Quantitative b) RCT c) 8 weeks d) 8 sessions, 2 hours each

Randomized control trial (RCT), Coping Strategies Questionnaire (CSQ), Arthritis Self-Efficacy Scale (ASES) and Positive and Negative Affect schedule (PANAS), Disease Activity Score (DAS28), C-reactive protein (CRP), Visual Analog Scale (VAS), and Interleukin 6 (IL-6).

Table 2 Content of Yoga and meditation-based interventions.

Intervention Type/ Name	Description	Studies Using this Intervention
Vishwas-Raj Yoga	Stretching and strengthening exercises, <i>pranayamas</i> , meditation	Badsha et al. 2009
Hatha Yoga	<i>Pranayamas</i> , stretching exercises, floor poses, balance poses, <i>asanas</i> , meditation	Bosch et al. 2009, Middleton et al. 2018
“Yoga Therapy”	Prayer, <i>sudhi kriya</i> (cleansing exercises), stretching and rotation exercises, <i>asanas</i> , <i>mudra</i> , <i>pranayamas</i> , <i>dharana</i> meditation, <i>omkara</i> and <i>shanti</i> mantra	Debnath et al. 2015
Yogic Package	<i>Gayatri</i> mantra, <i>kunjil</i> , <i>jal neti</i> , <i>asanas</i> , <i>pranayamas</i> , meditation with <i>soham</i> , <i>om</i> chanting	Singh et al. 2011
Integral-Based Hatha Yoga	<i>Pranayamas</i> , chanting, <i>surya namaskara</i> , <i>asanas</i> , <i>sivasana</i> relaxation, meditation	Moonaz et al. 2015
Year-Long Yoga Therapy	<i>Pawanmuktasana</i> part I, <i>shavasana</i> , <i>pranayamas</i> including <i>bhramari</i> , <i>kapalhati</i> , <i>nadisodhana</i> , and deep breathing	Nair et al. 2014, Chawla et al. 2015
Iyengar Yoga	<i>Savasana</i> , floor, backbend and forward bend, supine, inversion, twist, seating, and standing poses	Evans et al. 2010
Yoga Camp	<i>Pranayamas</i> , <i>sukshma vyayamas</i> (loosening exercises), <i>asanas</i>	Telles et al. 2011
Mindful Awareness and Acceptance Treatment	Relaxation, autogenic, and cognitive pain coping training, mindful and awareness techniques with breathing meditation, identification strategies	Davis et al. 2015
Mindfulness-Based Stress Reduction (MBSR)	Training through meditation in non-judging awareness of unwanted thoughts and feelings, as well as inner and outer body experiences	Fogarty et al 2015
Mindfulness Meditation and Emotion Regulation Therapy	Training in modules: mindfulness emotion, mindfulness and awareness, emotional clarity and well-being, acceptance of negative thoughts, positive emotions and pleasant event scheduling, social relations, mindfulness on intimacy and stress, maintenance and generalization, sitting meditation training	Zautra et al. 2008

3.1 Yoga, Pain and Physical Functioning

Evans and colleagues [37] explored the impact of Iyengar Yoga (IY) in RA patients. Researchers noted significant physical changes among participants compared to baseline values. Participants showed improvements in pain intensity and had lower disability index scores at the end of the study. Telles and colleagues [39] explored the impact of a Yoga Camp in men and women with RA. Participants showed significant decrease in disability index, rheumatoid factor, and self-reported discomfort related to the disease. Male participants had a significant increase in grip strength, and all male and female participants showed improved levels of daily functioning, in activities such as arising, walking, and dressing, which were associated with positive scores on the Health Assessment Questionnaire (HAQ) upon study completion.

Nair and colleagues [33] tested the effectiveness of naturopathy, Yoga, and allopathic medications in patients with RA over the course of one year. One group received Yoga, naturopathy, and allopathic medications, another group received just Yoga and allopathic medications, and the third group was a control, only taking allopathic medications. Compared to the other two groups, participants who received all three interventions showed the highest significant reductions in joint inflammation and fatigue, and had the strongest improvements in physical functionality and sleep. Chawla and colleagues [29], explored the effects of the same one-year Yoga program in RA patients who simultaneously received naturopathy and allopathic medications. The control group was only taking allopathic medications. Participants in the experimental group demonstrated significant reductions in pain intensity, joint inflammation and swelling, morning stiffness, and creatinine levels compared to the control group. Notably, some participants decided to minimize or discontinue their medication use after participating in the study. Badsha and colleagues [27], studied the effects of Vishwas-Raj Yoga designed to particularly accommodate the needs of RA patients. Participants in the Yoga group had significant improvements in joint tenderness, swelling, and fatigue, and some discontinued their medications as a result of completing the study. Debnath et al. [36] studied the effects of a highly structured Yoga Therapy for women with RA. Significant improvements were observed in the Yoga group in areas of joint tenderness and functionality, pain, and physical parameters such as grip strength, walking time, and foot pressure.

3.2 Yoga, Immunology and Functional Capacity

Singh and colleagues [34], created a Yogic Package that was administered to eligible RA participants. The researchers studied the effects of this Yoga program on a range of RA symptoms including pain intensity, blood pressure, pulse rate, lymphocyte count, C-reactive protein, and serum uric acid. Participants showed improvements on all of the above parameters in the post experimental stage compared to post-controls. There were no significant differences at baseline among the two groups.

Bosch and her lab [28], explored the impact of Hatha Yoga in RA. This study produced significant results for the Yoga group with a 35% reduction in the HAQ disability rating, as opposed to the 22% increase in the control group. The Yoga group had significantly lower pain scores compared to the control group at the end of the intervention. Middleton and her lab [38] also chose to investigate the efficacy of Hatha Yoga in RA, specifically in minority groups. Participants

showed improvements in self-care, physical balance, functional reach, pain interference, and upper body use post therapy. Moonaz and her lab [32], investigated the effectiveness of Integral-Based Hatha Yoga in sedentary adults with RA. In addition to in-person practice, participants were given weekly written instructions with visual illustrations to encourage practice at home. Significant reductions were noted in pain intensity and joint counts. Participants in the intervention group showed increase in walking ability, sitting, reaching, and bodily flexibility.

Fogarty and colleagues [31] offered Mindfulness-Based Stress Reduction (MBSR) therapy to RA participants. The experimental group showed significant reductions in joint count and tenderness, length of morning stiffness, and pain scores compared to the control group. However, the intervention did not affect the frequent re-occurrence of joint inflammation. Davis and colleagues [30] explored the impact of Cognitive Behavioral Therapy (CBT), Mindfulness Meditation, and Education Program control in the RA population. Participants in the mindfulness group experienced significant decrease in morning stiffness and fatigue. Mindfulness group participants significantly improved in their ability to reduce daily pain compared to CBT and education group participants. However, the CBT group and educational control showed greater improvements in limiting negative cognitive reactions to pain symptoms than the Mindfulness Meditation group. Zautra and colleagues [35] compared the effects of Mindfulness Meditation and CBT among RA participants with a history of depression. The intervention groups were controlled by a group receiving education sessions. Participants in the mindfulness group showed greater pre and post improvements in joint swelling and tenderness, compared to participants in the CBT group. However, CBT participants showed higher outcomes in self-reported pain control and levels of interleukin-6. Self-reported daily pain decreased for all three groups, but only participants in the CBT and mindfulness groups showed positive results in coping efficacy.

3.3 Yoga, Anxiety and Depression

In terms of psychological outcomes, Evans and colleagues [37] observed decreases in anxiety and depression levels among study participants, along with improvements in self-efficacy, mood, and energy levels. Moonaz et al. [32], also reported significant improvement in mental health and depression. Upon data analyses, Middleton and her lab [38] found higher scores on the Health Promoting Lifestyle Profile (HPLP) questionnaire and higher self-reported levels of social support post intervention, in the Yoga group.

Bosch and colleagues [28] noted that Yoga participants reported significantly lower depression and pain scores at the end of the intervention compared to baseline scores, whereas the control group showed no effect in those areas. Badsha et al. [27] found that the Vishwas-Raj Yoga had no effect on the participants' quality of life, according to self-reports. However, participants in the Yoga group reported improvements in social role and responsibility that were previously limited by disease-related emotional impairment. Davis et al. [30] found that participants in the mindfulness group experienced significant decrease in catastrophizing and stress levels. While the CBT group did experience a significant decrease in catastrophizing, the decrease exhibited in the mindfulness group was greater. However, the education control group indicated a worsening of catastrophizing levels post intervention.

4. Discussion

This review concludes that different types of Yoga and mindfulness meditation-based therapies can be a useful tool for patients who suffer from chronic RA symptoms and their psychological comorbidities. However, it is impossible to compare the efficacy of body-oriented Yoga, Yoga with meditation, and mindfulness-meditation interventions based on the current literature available because the studies reviewed did not all include the same outcome measurements. While this review was able to identify promising evidence for the use of both types of Yoga and mindfulness with meditation for RA, the scarcity of articles for review in this paper highlights the lack of definitive evidence regarding the efficacy of Yoga and mindfulness with meditation on RA symptoms and psychological factors.

This paper reviews multiple types of Yoga and mindfulness with meditation interventions over varying durations, from one week to one year. Although timelines differed, positive effects of body-oriented Yoga and meditation-based Yoga and mindfulness on pain outcomes could be seen in as little as one week of practice of some programs, with subjects even reducing medications [27, 29, 39]. However, we are unable to conclude any permanent positive outcomes based on the research available. Evan and collages [37] indicated that pain scores return to baseline when subjects discontinue practice of body-oriented Yoga after the initial instruction. When subjects were interviewed in a follow-up session, the majority expressed the need for a long-term intervention, or continuation of practice beyond the study, in order for pain symptoms to noticeably improve [37]. In the future, research studies that evaluate the impact of meditation-based therapies in the RA population, should consider comparing duration of intervention to determine whether it significantly affects intervention efficacy for short and long term RA outcomes.

In addition to pain score improvements, subjects in meditation-based interventions also reported lower levels of morning stiffness, joint inflammation and tenderness, and disability, as well as, higher walking capacity, functional abilities, and self-efficacy across all three intervention categories [28, 30-33, 37, 38]. Davis and colleagues [30] found that when compared to controls or other intervention groups, participants in the mindfulness meditation group showed significant improvements in disease disability, that were not evident in the other groups. These findings suggest promising outcomes for improvements in overall functionality among patients with RA, which may have important clinical implications.

Meditation-based therapies not only seem to have efficacy for the physical symptoms of RA, but also the psychological comorbid conditions related to this chronic pain condition. While not all studies included in this review examined psychological effects, the ones that measured them found some promising results. Patients that attended a Yoga with meditation intervention reported significant improvements in social life and support from friends and family [38]. RA patients also reported improved levels of fatigue and energy, depression, anxiety, and pain related catastrophizing after either a Yoga with meditation or mindfulness-meditation intervention [27, 28, 30, 32, 37, 38]. Positive outcomes in these psychological conditions have particularly important implications for subjects' ability to manage their pain. People that rate highly for catastrophizing and depression are at greater risk for long term pain related disability and increased pain sensitivity and intensity [40]. When psychological conditions, specifically depression and anxiety, are absent in patients with RA, they are more likely to achieve significant clinical remission of RA symptoms [41]. Therefore, it is important to continue to identify techniques and practices that are

likely to positively impact those types of symptoms, and implement them into RA patients' daily routine.

Yoga and mindfulness with meditation also showed benefits for biological symptoms of RA. Disease activity significantly reduced in patients practicing Yoga with meditation or MBSR programs with meditation [27, 31, 32]. Subjects practicing Yoga with meditation also reported improved balance scores compared to the control groups [28], as well as improved physical functioning and healthy lifestyle changes in both body-oriented Yoga and Yoga with meditation [36, 38, 39]. Both body-oriented Yoga and Yoga with meditation groups appeared to have less joint swelling, stiffness, and inflammatory markers than control groups [29, 33, 34]. Interestingly, one of the studies included in this review found that CBT groups reported some more significant benefits than mindfulness meditation groups. Zautra and colleagues [35] found that participants who underwent a CBT intervention had the greatest decrease in IL-6 levels. They also found that CBT groups showed greater improvements in pain coping mechanisms for patients without recurrent depression. This suggests that while mindfulness meditation therapies can be beneficial for chronic RA symptoms, other comorbid conditions might influence the efficacy of meditation therapies compared to other complementary methods. This finding implies that a combination of complementary and integrative health medicine approaches might be more appropriate for patients with RA. Patient-specific profiles and phenotyping may also play a significant role in identifying the type of therapy that is likely to produce the highest improvement in patients suffering from RA. Further research of such practices and patient phenotyping is necessary for the improvement of and implementation of complementary therapies in RA.

Although pain relief and clinical outcomes varied across studies, none of them reported any negative physical or psychological side effects of the different types of Yoga or mindfulness with meditation interventions. The findings of this review suggest that body-oriented Yoga and meditation-based therapies could be beneficial complementary options for RA sufferers in addition to their existing treatments. However, limitations should be considered when interpreting the results. The recent literature on body-oriented Yoga and meditation-based interventions in RA samples seems promising but quite limited including small to medium sample sizes. In addition, each study had a variation of a Yoga or mindfulness meditation, making the interventions challenging to compare. Future research studies, with larger sample sizes, comparing effectiveness of various body-oriented Yoga and meditation-based therapies to determine the most appropriate practices to manage RA symptoms are needed. Despite these limitations, body-oriented Yoga and meditation-based therapies appear to have a positive effect on pain intensity, psychological, and biological symptoms in RA patients, and do not appear to have any side effects or contraindications. Body-oriented Yoga and meditation-based therapies may not be the most efficacious form of pain management for all RA sufferers, but they seem to provide an effective supplement to pharmaceutical interventions.

5. Conclusions

The purpose of this review was to offer an overview of the effects of Yoga and mindfulness with meditation interventions in the RA population, the efficacy of their implementation, and relevant limitations associated with the introduction of Yoga and mindfulness meditation. Apart from three studies, which did not measure psychological outcomes [29, 31, 36], the rest revealed that body-

oriented Yoga and meditation-based therapies, aiming at the alleviation of RA symptoms, can have a positive impact on both physical and psychological levels. Of note, with some subjects discontinuing medications [27, 29], these results encourage future research assessing the effectiveness of complementary and integrative health therapies among patients that are willing to explore non-pharmacological ways of managing chronic pain.

Author Contributions

Alexandra Koulouris and Kathleen Dorado searched review articles, interpreted the data, wrote the manuscript and provided content for tables 1 and 2. Christina McDonnell searched and wrote up to date information in the literature for the introductory section. Robert R. Edwards revised and edited the paper. Asimina Lazaridou supervised the manuscript preparation, provided a critical review of the review article, and acted as the corresponding author.

Competing Interests

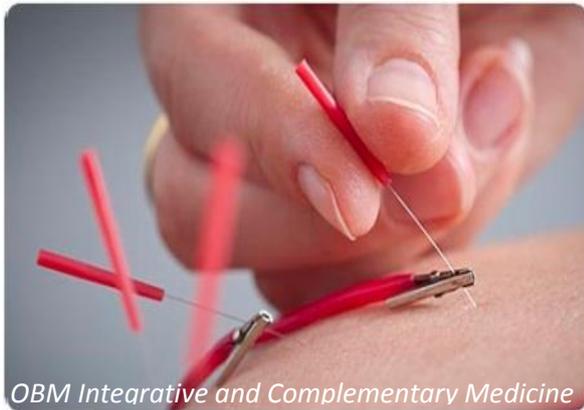
The authors have declared that no competing interests exist.

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