



A mixed methods evaluation of an individualised yoga therapy intervention for rheumatoid arthritis: Pilot study



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ABSTRACT

Objectives: to explore patients' experiences of an individualised yoga therapy intervention for rheumatoid arthritis (RA), specifically in terms of its acceptability and impact on patient-reported outcomes.

Design: Ten patients took part in a 16 week yoga therapy intervention in a hospital setting, consisting of 10 one-to-one consultations with a yoga therapist followed by two group review sessions. Changes in health (EQ-5D, HADS) were assessed pre- and post-intervention and at 12-month follow-up. In-depth interviews were conducted post-intervention and analysed using thematic analysis.

Results: Attendance of the 1-to-1 sessions was high (98 %) and all participants reported strong commitment to their personalised home practice. There were significant improvements in measures of depression, anxiety, pain, quality of life and general health at post-intervention and 12-months ($p < 0.05$). In interviews, all but one participant reported positive changes to their symptoms and several reported reductions in their medication and broader benefits such as improved sleep, mood and energy, enabling re-engagement with life. The personally tailored nature of the practice and perceived benefits were key motivational factors. Particular value was placed on the therapeutic function of the consultation and provision of tools to manage stress and build resilience.

Conclusion: This yoga therapy intervention was positively received by patients with RA, with high levels of adherence to both the treatments and tailored home practice. The findings suggest that yoga therapy has potential as an adjunct therapy to improve RA symptoms, increase self-care behaviours and manage stress and negative affect such as anxiety. A larger multi-centre study is therefore warranted.

1. Introduction

Rheumatoid arthritis (RA) is one of the most prevalent chronic inflammatory diseases, affecting around 1 % of the population worldwide,¹ including 1.5 million in the US,² with women three times as likely to be affected as men.³ RA is characterized by synovial inflammation in the joints resulting in cartilage degradation and bone destruction.⁴ Despite pharmacological advances, many continue to suffer from pain, fatigue, functional disability, and poor quality of life.⁵ Additionally co-morbid mental health conditions, such as anxiety and depression, are highly prevalent and associated with poorer outcomes and higher health care costs.⁶ Estimates of lost productivity associated with RA are high due to disease related absenteeism and inability to work due to disease progression.⁷ There is thus increasing recognition of the need to adopt more proactive, patient centred approaches to complex disease management, including the provision of non-pharmacological interventions which enable patients to manage their medications, cope with pain and stress, and adapt their lifestyle.^{8,9}

Current guidelines recommend exercise as a key component of disease management to maintain mobility as well as reduce pain and fatigue.¹⁰ Additionally, the well documented psychological benefits of exercise are

particularly relevant to RA given the high rates of psychological comorbidity. Stress is associated with both mood disorders and activation of neural inflammatory responses,¹¹ whilst physical activity is associated with stress reduction and physiological benefits for inflammation and immune function,¹² both crucial to RA management. However, people with RA are less likely to be physically active than the general population,¹³ with the symptoms of RA serving as a barrier to exercise uptake.¹⁴

Yoga offers a complementary approach to the management of RA with its unique feature of combining physical activity and stress management techniques of breathing, mindfulness and relaxation.¹⁵ The prevalence of yoga in the west has more than doubled in the past decade¹⁶ and surveys suggest that yoga is increasingly used to manage health conditions, including arthritis.^{17,18} Reviews of yoga for arthritis provide preliminary evidence of a positive effect on symptoms (pain, stiffness, tenderness), functioning, and mood.^{15,19–21} A more recent randomized pragmatic trial of an 8-week hatha yoga intervention for sedentary adults with RA or osteoarthritis found improvements to physical health, walking capacity, pain, energy and mood.²² Mechanistic explanations for yoga's potential mental and physical health benefits include down-regulation of the hypothalamic-pituitary adrenal (HPA) axis and sympathetic nervous system^{23–25} together with psychological strategies such as increased mindfulness, self-regulation

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and self-awareness,²⁴ important qualities in pain and disease management.

However, group yoga classes may not be appropriate for some people with RA, particularly those with restricted mobility and other comorbidities. Additionally, engagement with yoga classes may be particularly challenging for those with depression²⁶ as well as minority and low income groups due to accessibility and beliefs about the suitability of yoga for arthritis and other health limitations.^{27,28} In contrast, individualised yoga therapy is specifically tailored to individual needs and abilities, adapting traditional practices of physical postures, breath control, meditation, visualisation and yogic philosophy to suit each patient.²⁹ Yoga therapy also focuses on the behavioural and psychosocial aspects of a patient's life, adopting a biopsychosocial approach well-suited to addressing complex long-term conditions such as RA. The emphasis on a regular home practice aims to empower patients to make sustainable improvements to their health and develop long-term self-care behaviours, consistent with evidence that suggests yoga is most effective when it is integrated into patients' daily routine.³⁰

Yoga therapy thus promises to combine the benefits of currently recommended non-pharmacological treatments for RA.⁸ Psychological therapies such as cognitive behavioural therapy demonstrate improvements in pain and psychological outcomes but do not reduce the progressive course of RA,^{31,32} whilst physiotherapy addresses functional limitations to reduce disability.³³ As far as we are aware, there have been no previous published studies evaluating the effectiveness or acceptability of individualised yoga therapy for RA as part of a multidisciplinary package of care. This is the focus of this pilot study which uses a mixed methods approach to investigate: a) the acceptability and experience of individualised yoga from the patient's perspective; b) the impact of yoga therapy on patient outcomes including anxiety, depression and quality of life.

2. Methods

2.1. Design

This pilot study used a single-group pre-, post (4 months) and follow-up (12 months) design, with in-depth interviews conducted post-intervention. Mixed methods designs are particularly relevant in health service evaluations to capture the complexities of interventions in real world contexts,³⁴ bringing together the strengths of qualitative methods to understand patient perspectives and quantitative measures to assess impact.³⁵ Ethical approval was granted by University of Westminster ethics committee (ETH1718-0103).

2.2. Participants

Ten participants were recruited consecutively from a Rheumatology clinic at a UK hospital by their Consultant Rheumatologist following discussions and advertisement of the study at hospital rheumatology patient group meetings. To be included, patients had to be 18 years or older and have a diagnosis of RA by ACR criteria³⁶ greater than three months. Those with juvenile onset disease and recent modification (< 2 months) of pharmacological treatment were excluded. All eligible patients approached agreed to participate and provided written informed consent, with recruitment taking place over a seven day period.

2.3. Intervention

The yoga therapy (YT) intervention consisted of 10 one hour 1-to-1 consultations over a 16 week period followed by two group review sessions (at five and nine months). It was delivered by a yoga therapist (VS) with 15 years of teaching experience, registered with the Complementary and Healthcare Council. The first consultation included an evaluation and assessment followed by three weekly sessions, then six biweekly follow-up sessions. The evaluation consisted of a review of current disease state and treatments (from rheumatologist) and patient perspectives on symptoms and disease impact. The YT assessment was based on principles of

Table 1
Participant characteristics.

Participant	Age	Gender	Ethnicity	Time since diagnosis (years)
1	60	F	Afro Caribbean	< 1
2	59	M	Indian	15
3	59	F	Indian	1
4	70	F	Sri Lanka	13
5	70	F	Indian	2
6	55	F	White British	12
7	29	F	Indian	10
8	49	F	Indian	14
9	48	F	Afro Caribbean	6
10	37	F	Indian	1.5

traditional yoga therapy, acknowledging the role of mental, emotional and social context on participants' beliefs, thoughts, feelings and physiology. Individualisation of yoga courses were then designed to address imbalances within any of these dimensions.

YT sessions were structured using principles of Viniyoga[®]³⁷ and included: breath centred physical yoga postures (both dynamic and static), breathing techniques (e.g. focusing on exhalations, alternate nostril breathing), visualisation techniques, chants and meditation (see Supplementary Tables 1 and 2). These were tailored to the needs and abilities of each patient. These sessions also included cognitive reframing concepts drawn from yogic philosophy to address dysfunctional thoughts and the identification of stressors and pain-provoking cues. Lifestyle and behavioural strategies included activity pacing and promotion of physical activity such as walking. The sessions placed considerable focus on experiential learning through daily home practices in order to increase confidence in self-care. A tailored home practice, typically lasting 15–30 min, was taught during each 1-to-1 session with handouts/recordings to enable self-practice between sessions. Home practice consisted of postures, pranayama and chanting designed according to individual needs and preferences. Patients were encouraged to maintain self-introspective logs after each home practice.

2.4. Evaluation

Standardized measures were obtained at baseline, following intervention completion and at 12-months post-treatment. EQ-5D³⁸ is a generic health-related quality of life measure consisting of five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Using established algorithms, these were translated into index-based scores ranging from -0.594 to 1.0, with lower values signifying worse health.³⁹ An additional item asks the patient to rate their own health on a visual analogue scale ranging from 0 (best health) to 100 (worst health). Pain was assessed on a visual analogue scale from 0 (no pain) to 100 (severe pain). Hospital Anxiety and Depression Scale (HADS)⁴⁰ is an established 14-item scale to identify anxiety and depression in people with physical health problems.

All participants agreed to participate in a semi-structured interview with a researcher (MC) on completion of the yoga therapy intervention. Interviews were conducted in a quiet room at the hospital at a time convenient to each participant. The interview schedule was designed to capture patients' experiences of the intervention and any perceived impact. Topic areas included: pre-intervention expectations, experiences of therapy process and home practice, and perceived impact on health and lifestyle. Interviews lasted 43–68 min (mean = 50). Interviews were audio-recorded and professionally transcribed verbatim.

2.5. Analysis

Quantitative analysis included descriptive statistics (mean, SD) for all outcome variables. Percentage change was calculated to explore trends in the data across the three time points (baseline, post

Table 2
Mean (\pm SD) scores for outcome measures at baseline, post intervention and 12-month follow-up.

Measure	Baseline	Post-intervention	% change	12 month follow-up	% change†	p-value‡
Depression	6.7 \pm 4.5	2.3 \pm 3.3	−65%	1.9 \pm 2.8	−72%	0.016*
Anxiety	9.4 \pm 6.0	4.8 \pm 3.1	−48%	4.3 \pm 5.0	−54%	0.012*
Pain	57.0 \pm 31.3	24.0 \pm 25.9	−58%	29.0 \pm 27.4	−48%	0.010*
General Health	51.0 \pm 29.9	17.2 \pm 18.0	−66%	21.0 \pm 23.9	−59%	0.009*
EQ-5D Utility	0.60 \pm 0.28	0.84 \pm 0.26	+40 %	0.72 \pm 0.21	+20 %	0.011*

HADS cut-off scores: No anxiety/depression (0–7); low anxiety/depression (8–10); moderate anxiety/depression (11–15); severe anxiety/depression (16–21) (39). ‡ change in scores from baseline to 12 month follow-up. † change in scores over the 3 time points (Friedman test). * Significantly different from baseline scores ($p < 0.05$).

Table 3
Illustrative quotes relating to perceived impact of yoga therapy.

Subthemes	Participant quotes
Physical health benefits	<p>P2: “Pains started reducing and before it used to be eight, nine, level nine and then it started coming down three, four to two now or sometimes, some, sometimes it’s just gone completely like now, I’ve got nothing, no pain whatsoever.”</p> <p>P1: “I’m sleeping without pain because I’m not in pain, so I can lie down and just sleep and get up when the time comes to get up without being just exhausted for the whole day.”</p> <p>P7: “Halfway through this we reduced my dose from 15 to 7.5mgs so I’m on half the dose of methotrexate and I’m doing fine on it.”</p> <p>P2: “I went to see the doctor a couple of weeks ago and she said your blood, we, we took a blood test before that so they were analysing my bloods, she said your diabetes has gone down, your blood pressure has gone down so I was really chuffed. I can only put it down to the therapy.”</p>
Rediscovery: ‘I’ve got my life back’	<p>P1: “I feel my normal self. And I’ve been going out with friends and family now. We’re going to, this one’s having a party, birthday party, 60th party, I’m gone. Before, no I can’t make it, I can’t, I’m too tired and but now it’s like I’ve got my life back in a sense.”</p> <p>P2: “It’s changed me completely, my, my energy levels are quite high, the concentration is quite, is a lot better, my strength is there. I even read now and I never used to read and now I’ve started reading.”</p> <p>P3: “You start admiring things you don’t even realise that they’re there and I think you look at a different aspect when it comes to looking at. When we were on holidays in Dubai and I went to a garden I took pictures and all the nice pictures and I brought it back to show it to her, and you see, this kind of things, you don’t realise something might be here and I’d say, oh god that’s a yellow colour and I might start appreciating the colour rather than, that’s how the positivity in the mind as such, yeah.”</p> <p>P10: “I changed a lot. I don’t want to stress myself so time management, going to gym & swimming, eating more healthy, doing art, enjoying drawing.”</p>

intervention and 12 month follow-up), with non-parametric tests (Friedman) used to assess statistical significance to ensure a conservative analysis given the small sample size.

Qualitative interview data were analysed inductively using thematic analysis.⁴¹ An experiential or realist approach was adopted to identify patterns in participants’ accounts of their experiences of taking part in the intervention.⁴¹ One author (MC), a qualitative researcher with a nursing background, conducted the initial analysis by reading through all interviews several times and undertaking detailed coding, noting key words and sections of text. Subsequently, this was refined to develop an initial list of codes and broader themes that represented recurrent patterns in the data. Several steps were taken to ensure the ‘trustworthiness’ or rigour of the analysis. In a process of analyst triangulation,^{42,43} a senior qualitative researcher specialising in long-term conditions (TC), independently coded half the transcripts and both authors compared coding frameworks to debate and arrive at a final thematic structure. A final list of core themes and subthemes with illustrative quotes and participant prevalence was discussed with the research team, which included a rheumatology consultant and yoga therapist (VS). Initial findings were discussed informally with an RA patient group at the end of the study to ensure the analysis was relevant to patient experiences. Reporting guidelines were followed to enhance the rigour and transparency of the qualitative research.⁴³

3. Results

3.1. Participant characteristics

The sample (Table 1) were predominately female, with a wide age range (29–70 years, $M = 54.1 \pm 13.3$) and time since diagnosis (0.5–15 years, $M = 7.5 \pm 5.9$). The ethnic distribution broadly reflected the local population, with 60 % Indian, 30 % Afro Caribbean, and 10 % White British.

3.2. Outcome data

There was 98 % adherence to the intervention (for one-to-one sessions). All patient reported outcome measures demonstrated significant improvements post-intervention from baseline, and these were sustained at one year follow-up (Table 2).

3.3. Patient experiences: qualitative findings

All participants discussed the disabling impact of pain on daily functioning (“a hot poker digging in my joints” P6), particularly the restrictive effect on daily activities like walking, sleeping, driving and self-care. For many this led to emotional distress, fatigue and impaired quality of life (“I was at my wits end”, P1). Given this backdrop of restrictive functioning, the majority of participants’ expressed gratitude for the opportunity to take part in any intervention offering the potential to improve their symptoms. Most had no prior experience of yoga so had few expectations (“nothing to lose”), although a few expressed some apprehension, for example concerns about conflict with religious beliefs. Two overarching themes were identified that represented participants’ accounts of the personal impact of the intervention (Table 3) and mechanisms of action (Table 4).

3.3.1. Perceived impact

3.3.1.1. Physical health benefits. Consistent with the quantitative findings, participants reported positive changes to their RA symptoms, including pain reduction, greater mobility and joint flexibility (Table 3). Half reported reductions to their medication over the course of the intervention. Additionally, the majority discussed the impact of broader benefits such as improved sleep, weight loss, and energy. Some participants attributed measurable improvements to other conditions – diabetes, high blood pressure, migraines – to YT. However, several acknowledged the difficulties of attributing

Table 4
Illustrative quotes relating to therapeutic functions of yoga therapy.

Subthemes	Participant quotes
The therapeutic function of the consultation: 'like counselling'	<p>P7: "It was a bit like a counselling session...where we would find triggers as to what is going on in my life, in my mind that would have a negative impact on my health, so pinpointing those areas and working on that, I feel has had a massive difference."</p> <p>P4: "I think I was actually wanting to see her because I was able to chat to her, I was able to chat to her whereas to a GP you can't sit and chat. With the therapist you are able to sit down and pour out all what you feel."</p> <p>P8: "When you're struggling and suffering, the fact that you've got, that you can talk to her and she can give you advice that you can't get it from anywhere else."</p> <p>P10: "Stress management is the key for this disease. I used to get stressed out...then once stress, trickle trigger I'll start getting pain...now I've started to control the situation".</p>
Personally tailored practice: 'a different kind of yoga'	<p>P7: "Tailored the routine to suit me and how my health was at that time. If I couldn't do something because of a certain movement then we'd take that bit out."</p> <p>P10: "We will discuss like what is going good what is not going good then accordingly she will change my practice."</p> <p>P4: "Dr will only give you the tablets by telling my knees paining or my hand is paining, he can't do more than that can he? So he looks at it and he tells me, yes continue with your tablets or let's do an x-ray and see where they have gone, see whether it is inflamed. Whereas [therapist] is asking you to, she targets the pain, where the pain is and gives you exercises to do on that part."</p> <p>P1: "I did do them because I promised to do them, and you do feel, you can't explain it, but you do feel different when you, you feel better."</p>
Building coping skills	<p>P9: "It tuned me into coping, it tuned into my mind in how I deal with situations... I had to help myself which she taught me to do."</p> <p>P8: "It provided me with some tools that I didn't know I would need and now I've got them and I can apply them and it's made a difference... People think of yoga as just being exercises, but it's more into your mindset."</p>
Reframing and taking control	<p>P10: "I don't want to be a victim of this, if my mind is set for that, then I can overcome, I can live a happy life with this RA."</p> <p>P1: "instead of lying down and forget about the rest of the day, I do those [breathing and gentle exercise] and then I can continue with the rest of the day."</p>
Tools of yoga: breathing and mantra	<p>P4: "You know when you wake up in the night? You have so many thoughts come into your mind you can't sleep because you're think, you're stressed out, oh I have to do this or this or this. And you know once you start breathing your thoughts all goes away, you're concentrating on your breathing and you just fall asleep."</p> <p>P2: "before I was out of breath very quickly. But after breathing exercise, these are breathing exercises so yes it's helped me quite a bit in breathing and regulating my breathing".</p> <p>P5: "It's good. Breathing techniques you learn. You learn mindfulness so you've got, you wake up in the morning you think, OK let's do this."</p> <p>P9: "the chants, the mind mantra is the thing that resonates with me"</p> <p>P2: "The effect (of mantra) is really, really, calmful, I can, concentration is there, I, you concentrate a lot more. And without concentration you're just moving around that's now, you have to concentrate. And this has helped me to concentrate in my job, in my social life."</p>

improvements specifically to YT, particularly in the early phase of diagnosis: "Sometimes you don't know where the medication starts or stops and where the yoga starts and stop" (P1). Only one participant did not attribute benefit to the intervention (P5). Nevertheless, perceived improvements to health strongly motivated all patients to continue with their yoga practice both during the intervention period and beyond: "it's really inspired me to do the exercises regularly" (P3).

3.3.1.2. Rediscovery: 'I've got my life back'. The intervention had a transformative impact on patients' quality of life with the majority reporting significant increases in mood and mental well-being: 'I'm just happy and everybody can see that I'm happy' (P1). Participants talked enthusiastically about how YT had "changed my whole outlook" (P9), facilitating a positive attitude ("made me feel good about myself", P6) and instilled confidence to deal with everyday life when RA "can emotionally break you down" (P9). The majority discussed how they were now able to re-engage in a range of highly pleasurable activities, for example reading, gardening and socialising, often after many years of neglect. One participant had started driving lessons due to increased joint flexibility.

Several participants also discussed broader lifestyle changes, particularly exercise, both as a result of YT recommendations and due to increased mobility and energy. Central to behaviour change was the increased agency arising from participants' confidence in taking charge of their health ("I like to walk everywhere now", P1).

3.3.2. Therapeutic mechanisms

Participant narratives revealed high satisfaction with the treatment they had received ("I can't rave enough about it", P6). Contrasting with

the biomedical approach, YT was described as applying a holistic approach which sought to understand and treat the individual. This was reflected in three key mechanisms: the support and understanding provided by the therapeutic consultation; the enabling quality of a personally tailored practice; and the empowering function of developing new coping skills to manage RA and broader life stressors (Table 4).

3.3.2.1. The therapeutic function of the consultation: 'like counselling'. The quality of the relationship between therapist and participant was particularly evident in patients' accounts. Mutual respect, having a voice and being listened to afforded highly valued psychosocial support which was missing from other professional interactions. Participants reported that yoga gave them greater insight into the mind-body connection and a deeper understanding of how their thoughts affected their physical state, with particular reference to the debilitating impact of stress. Importantly, this insight provided agency through an increased capacity to observe rather than immediately react to physical and emotional experiences. However, one participant did not find talking useful or appropriate stating "it gave me so much stress... [The therapist] was trying to find out, like you know like something like, something in my life which has caused this thing" (P5).

3.3.2.2. Personally tailored practice: A 'different kind of yoga'. The individualised nature of the yoga intervention which was adapted to patients' current needs, preferences and physical capabilities was highly valued by all participants. This alleviated any physical or cultural concerns and appeared to empower patients who appreciated the

targeted and personally relevant approach. This also resulted in high levels of commitment and adherence to the home practice, with all providing detailed accounts of their daily practice during their interview. The therapeutic bond and perceived health benefits were also key motivational factors underlying adherence. Participants acknowledged the challenges of integrating a daily yoga practice into busy schedules but “prioritised and made time because it’s my health” (P9), which was now given greater priority.

3.3.2.3. Building coping skills: ‘It tuned me into coping’. One important mechanism discussed by participants was the value placed on developing mental coping strategies to “put me in a mode of command” (P3), and using yoga-specific tools to manage stress and build resilience.

3.3.2.3.1. Reframing and taking control. Virtually all participants discussed the empowering nature of discovering personal tools and qualities to manage stressors and overcome difficulties through mental reframing (“the strength you have within yourself to make a difference”, P8). Participants began to regulate their behaviour by being less passive (‘I’m pushing myself now’, P4) and became increasing confident in their own ability to deal with pain and broader problems independently. This re-evaluation of personal capabilities also led to greater appreciation for the value of self-care: “what’s number one is me and I need to look after myself” (P3). This included slowing down, taking time out for oneself and effectively managing one’s environment by taking control of situations that would once have been overwhelming (“now I go with the flow”, P7).

3.3.2.3.2. Tools of yoga: breathing and mantra. Whilst participants referred to physical yoga postures when describing their home practice, greatest emphasis was placed on the application of breathing techniques and mantra/chanting to everyday situations to manage stress and symptoms. Focused breathing enabled them to reduce their anxiety in multiple situations and this transferability helped develop their resilience: “when you do deep breathing your mind is somewhere else, you forget about your worries or whatever” (P3).

Many patients were given a recording of ‘a chanting mantra’ which was described as particularly ‘soothing and calming’ (P2), helping participants to immediately feel more relaxed but also enabled them to ‘cope better with the day’ (P6). For some, the mantra enabled entry into ‘a different world’ (P3), replacing anxiety provoking thoughts with ‘good thoughts’. One participant used the analogy of being uplifted “by a force” (P9), another likened stress to a ball in her stomach and by chanting, “the ball was lifted and came out” (P6).

4. Discussion

To our knowledge, this is the first study to evaluate the acceptability and impact of individualised yoga therapy delivered as part of multidisciplinary rheumatology care. The ease of recruitment and high adherence to both the course of treatments and the tailored home practice demonstrated that a 12 week YT intervention had high acceptability with patients and was feasible to implement within a hospital environment. Although a small pilot study, patient reported outcomes assessing depression, anxiety, quality of life, pain and overall health showed a significant change from baseline to post-intervention and, moreover, were sustained at 12 month follow-up. Qualitative findings provided greater insight into the broader, often transformative, impact of improved health, energy and self-confidence which enabled re-engagement with pleasurable activities. Importantly, it highlighted therapeutic mechanisms which both enhanced patients’ motivation to engage with the intervention and empowered patients to make psychosocial, emotional and behavioural changes to effect long-term change. These findings suggest that yoga therapy has potential as an adjunct treatment to reduce the physical symptoms and psychological comorbidities of RA and develop coping mechanisms to support self-management, in line with NICE guidelines regarding non-pharmacological management of RA.⁸

All patients’ narratives detailed the considerable impact of RA on their quality of life, including debilitating pain, reduced mobility,

fatigue and emotional distress, consistent with previous research.⁵ At baseline, 60 % reported mild to severe anxiety and 40 % mild to moderate depression, slightly higher than previous estimates of depression (34.2 %).⁶ Anxiety and depression scores significantly decreased immediately following the intervention and continued to reduce at 12-month follow-up. Improvements in mood and psychological wellbeing were also evident in qualitative findings, which together with physical improvements, enabled a reconnection with both self and the wider environment (e.g. socialising and taking up hobbies), positively impacting on quality of life. Outcome measures also demonstrated sustained changes in quality of life, self-reported pain and general health at follow-up. Whilst improvements in mood, functioning and RA symptoms following yoga have been noted in previous studies,^{15,19} few assess long-term maintenance of change. In a larger study, Moonaz et al.²² similarly found sustained changes at nine month follow-up for positive affect, depressive symptoms, physical functioning, pain, perceived stress and vitality. Our study further suggests that yoga therapy led to cognitive reframing and development of coping skills to support RA self-management and build resilience, enabling long-term maintenance of patient outcomes.

Qualitative findings also revealed broader benefits to health and lifestyle, including improvements to other health conditions and changes arising from reductions in pain and stress management. Reductions in medication have not been recorded in previous studies and deserves inclusion in future longitudinal studies particularly given the consistent findings that yoga leads to reductions in pain.^{15,19,22} Previous studies of the impact of yoga on sleep in arthritis are mixed⁴⁴ so require further investigation, particularly the association between sleep improvement and anxiety reduction. Overall, transformations to quality of life reflected both improvements in physical health (greater mobility, more energy, less pain) and application of tools such as regulated breathing to reframe stress and anxiety. Importantly, increases in physical activity (walking, swimming, gym) were reported by the majority of participants, as evidenced in other psychological interventions⁴⁵ and associated with optimal disease management.⁸ Indeed, yoga has been consistently associated with positive health behaviours in both non-clinical and patient populations.^{18,46,47}

Improvements to health and wellbeing were clearly an important motivator underlying the high levels of adherence, as found previously in relation to both exercise and yoga.^{14,27} Whilst adherence to yoga programmes is typically higher than physical activity programmes,⁴⁸ adherence to home practice is often low.⁴⁹ Our study is thus unusual with all participants describing the regularity (usually daily) of their home practice, including the participant who reported minimal benefit to symptoms. Here our findings highlight the difference between yoga therapy (‘a different kind of yoga’) and group yoga interventions. The personally tailored practice, both within sessions and at home was key to both acceptability and engagement, enabling patients to feel that techniques were safe and appropriate to their own needs, cultural background and abilities, concerns highlighted previously.^{27,28} Additionally, this was underpinned by the quality of the therapist-patient relationship which was perceived as having an important therapeutic function and increased motivation to practice.

Therapeutic mechanisms thus reflected tailored physical practices to address functional limitations and pain alongside psychosocial techniques which promoted psychological wellbeing and increased perceptions of control and self-efficacy. That positive shifts in patient reported outcomes were sustained one year post-intervention supports the patient-centred focus of yoga therapy, empowering patients with personalised tools to self-manage their health.²⁹ This aligns with ‘patient activation’, which is associated with better health outcomes and reduced healthcare costs.⁵⁰ Yoga therapy also implicitly incorporates well established mechanisms of behaviour change; with goal setting and self-monitoring key to developing healthy behaviours, whilst internal motivation and autonomy central to behavioural maintenance.⁵¹ Future studies might compare one-to-one yoga therapy with RA-specific

group yoga to understand any differences in acceptability, long-term patient outcomes and overall cost-effectiveness.

The debilitating impact of stress on RA symptoms and psychological state was widely discussed in our study. The relationship between stress, mood disorders and other health risk factors is well established,²⁵ and is particularly relevant for autoimmune conditions. Psychological and neurobiological mechanisms through which yoga may reduce stress have been discussed in several recent reviews and were evident in our findings^{23–25} Key psychological mechanisms included positive affect, increased self-awareness, emotional regulation and reduced reactivity to stressors, promoting resilience.²⁴ Physiological mechanisms by which yoga leads to improved regulation of the sympathetic nervous system and HPA axis may have favourable endocrine and immune consequences and reduce inflammation.^{23,25,52} Additionally yoga, particularly breath regulation, may increase vagal tone, regulating the autonomic nervous system and decreasing perceived stress.^{24, 52}

There are several limitations to consider when interpreting the findings. Most importantly, this was a small pilot study without a control or comparator group, so the quantitative findings should be interpreted with caution. The ease of recruitment may reflect the enthusiasm of the referral consultant and support of the rheumatology patient group through which the study was advertised. Indeed, use of patient advocacy and engagement may be an important avenue to increase recruitment to interventions. However, a larger multi-centre trial is needed to test whether engagement and changes in outcomes are replicable across centres and therapists. Notwithstanding these limitations, a particular strength of the study was the triangulation of qualitative and quantitative methods and use of 12-month follow-up data. The sustained impact on patient reported outcomes is particularly notable given the small sample and supports the qualitative findings regarding long-term shifts in self-care.

To conclude, the findings suggest that yoga therapy has potential as an adjunct therapy to improve RA symptoms, increase self-care behaviours and manage stress and negative affect such as depression and anxiety. The ‘whole package’ care appears to have a particular advantage in targeting both physical and psychological health whilst serving to empower patients to prioritize and manage their health. Although a pilot study, the high level of acceptability and sustained impact on key patient outcomes, warrant a larger multi-centre trial with a control arm to evaluate the therapeutic and cost-effectiveness of yoga therapy as part of the multidisciplinary RA programme.

Credit author statement

Cartwright: Conception, design, analysis and interpretation, drafting of article;

Cahill: Design, data acquisition and analysis;

Sadana: Conception, project administration, funding and Intervention delivery.

All authors contributed to and approved the final version to be submitted for publication.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ctim.2020.102339>.

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