

## Physiotherapy and Yoga for Joint Pain Treatment: A Review

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### Abstract

**Background:** The synergies in principles of physiotherapy and yoga are discussed and documented in scientific studies. However, there are limited research studies about efficacy of yoga as complementary /adjunct therapy to physiotherapy, specifically the randomized control trials that enhance the clinical efficacy of the integrated approach. The aim of the study is to conduct an exploratory review of clinical trials and cohort studies for application yoga and physiotherapy as integrated therapy for joint treatments.

**Methods:** A search of electronic databases, from Jan 1985 up to Jan 2016 was conducted for relevant open access randomized control trials, cohort and pilot studies documented in English.

**Results:** Yoga as an exclusive intervention and as an integrated approach with Physiotherapy has found to enhance alignment, flexibility, mobility of joints, muscles and thus offers significant value to the non-pharmacological intervention in joint treatments.

**Conclusions:** There is potential for further clinical trials for integrated approaches of yoga and physiotherapy in joint injuries.

**Keywords:** Yoga; Physiotherapy; Joint/s; Treatment

### Introduction

The normal function of most healthy joints is to allow a full-range of motion to the adjacent bones. A joint dysfunction directly can lead to muscle and nerve dysfunctions; joint immobilization can also have a negative effect on muscular and neural functions. Musculoskeletal conditions are a leading cause of disability, constituting a substantial, and increasing, health and economic burden (P.M. Brooks - Burden of musculoskeletal disease - 2006; C.J. Murray et al. - UK health performance: findings of global burden of disease study 2010).

Yoga may provide a feasible treatment option and offer potential reductions in pain and disability [1,2]. While both Physiotherapy interventions and Yoga stretch muscles, soft tissue, and increases the range of motion in joints, yoga practice includes the philosophy of taking care of one's body, and teaches one how to take charge of their experience even when one is in pain [3]. With yoga practice we can relax many physical dysfunctions and improve the flexibility of the body. Compared to physiotherapy procedures, yoga, with its static-dynamic procedures, can also be discussed as a means of "self-mobilization" of the nervous system and joints of spine and extremities [4,5].

The scientific study of yoga has increased substantially in recent years and many clinical trials have been designed to assess its therapeutic effects and benefits [4]. There are studies on additional exercises to physiotherapy and acupuncture to physiotherapy as adjuvant therapies [6,7]. There are limited research studies about integrated approaches of yoga and physiotherapy, specifically the randomized control trials that enhance the clinical efficacy of the integrated approach.

### The study questions were

How different is the physiological mechanism affecting the individual with the combined (Integrated) approach of physiotherapy and yoga? How significantly can the integrated approach benefit the individual and public health system?

### Search methodology

A search of relevant open access content was conducted in databases including Web of Science, MEDLINE, SCIENCE DIRECT, EBSCO, PubMed, etc. The keyword searches for 'Yoga for joint treatments', 'Integrated yoga and physiotherapy for joint pain rehabilitation', 'Yoga and Physiotherapy' for joint treatment yielded 712 potential articles including randomized control trials, review articles, case reports, pilot studies. Inclusion criteria: randomized control trials, pilot studies, case reports, published from 1985 up to 2016 and those studies that considered rehabilitation therapy to patients with conditions / injury, integrated approaches of physical therapy with yoga were included in the current review. All types of yoga were considered.

### Exclusion criteria

Randomized control trials with healthy subjects and review of literature were excluded from the review.

### Results

- \* Details of selection of articles for review are depicted in Figure 1.
- \* Results of the selected studies are presented in Table 1a.
- \* Demographics and condition of treatment of selected studies are given in Table 1b.

### Discussion

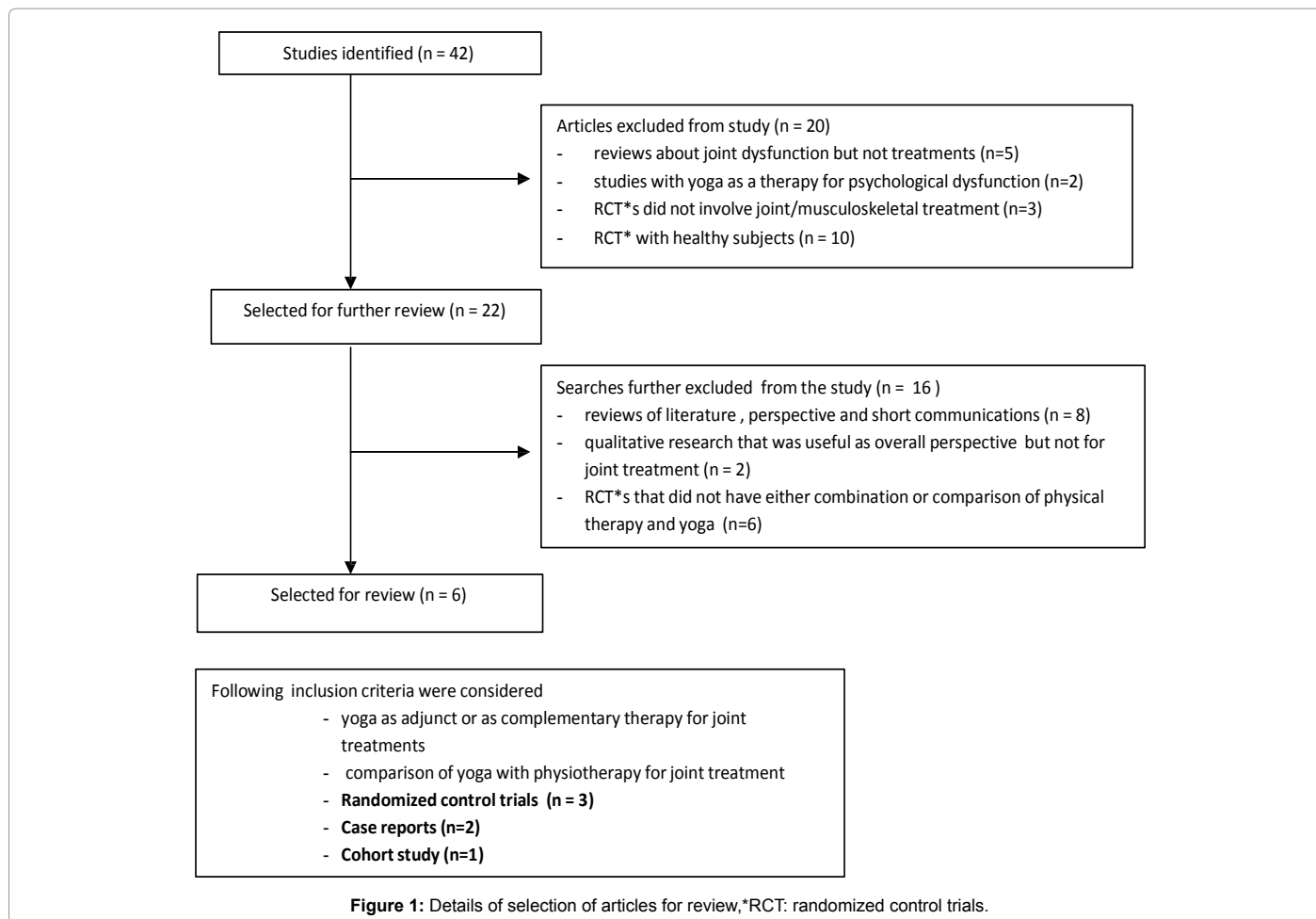
The signs and symptoms of a joint disability include reduced range of movement (hypo mobility), increased range of movement

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(hypermobility), altered quality of movement and production of symptoms.

There is literature about yoga therapy for musculoskeletal, orthopaedic, neurological, psychosocial conditions, quality of life et al. [2,8,9]. However mechanisms of therapeutic effects of yoga either as an exclusive or as an adjunct therapy with conventional physical therapy are under-researched.

All studies in the review address common public health issues. Among the 6 studies selected for review, 1 randomized control trial (RCT) and 1 case report integrate yoga with therapeutic exercises; 2 RCTs and 1 case report includes yoga with physical therapy. All studies are conducted for back pain and knees. Sans the case report about integrated therapy for an incomplete spinal cord injury (SCI), all other studies address musculoskeletal conditions affecting the joint (low-back pain and arthritis) that are common in the public health system.

John Ebnezar et al have observed in their research study that integrated therapy of hatha yoga therapy (IAYT) as an add-on to conventional physiotherapy improves walking pain, knee disability, range of knee flexion, tenderness, swelling and walking time in patients with OA knees [10]. The programmed practice included a set of repetitive select movements with synchronized with breathing, a set of postures to relax and strengthen the knee joints, combined with voluntary regulated breathing and meditation. The subjects were also presented through theory sessions about concepts of yoga with the aim

to understand lifestyle, yogic self-management etc.

The yoga intervention has emphasized the positioning of the body at rest in supine and seated positions and in motion. The study compares outcome variables with other research studies and includes pain, disability and range of motion as key outcome.

With reference to pain, the study observes the actual experience of pain is a psychological phenomenon that has several additional central processes that include affective, behavioural, and cognitive factors. Earlier studies by Jensen et al. who used this term 'No brain, no pain' and by Beecher who observed the absence of pain in injured soldiers are great explanations in literature that is re-emphasised by the study [11,12].

This study emphasises muscle strengthening as the key components of exercises as muscle weakness is a major cause of pain. However, it does not delve into the mechanism of flexion, range-of-motion et al. that might possibly enhance flexibility and muscle strengthening. According to the American College of Rheumatology, both range-of-motion (ROM) and stretching exercises help to maintain or improve the flexibility in affected joints and surrounding muscles. This contributes to better posture, reduced risk of injuries and improved function. They recommend activities such as yoga because it incorporates both ROM and stretching movements [13]. Yoga may be suited to help prevent or minimize the erosion of cartilage that causes the joint pain of OA, to create greater ease of movement and decrease pain within joints that

Study Reference	Yoga intervention / practice duration	Intensity	Yoga type	Comparing	Measurement
Ebnezar J et al. For Knee OA	Guided practice - 2 weeks and home practice - 12 weeks	20 minute PT per week for + 40 minute Yoga (for 2 weeks). Yoga continued as home practice for 12 weeks	Electrical stimulation , ultrasound (2 weeks) + hathayoga (asana with meditation and relaxation)	TENS + Ultrasound + physical exercise	Pain while walking scale (WNRS) ; Knee disability score (WOMAC) ; Active Range of Movements (Goniometer)
<p><b>Finding:</b> Walking pain in the yoga (37.3%, 64.9%) and control (24.9%, 42%), knee disability in the yoga (59.7%, 83%) and control (32.7%, 53.6%), range of knee flexion in yoga (12.7%, 26.5% right, 13.5%, 28% left) and control (6.9%, 13.3% right, 5.6%, 11.5% left), joint tenderness in yoga (52.3%, 86.1%) and control (28%, 57.1%), and walking time in yoga (26.6%, 52.8%) and control (9.3%, 21.6%), all improvement in the yoga than the control groups on the 15th and 90th day, respectively</p>					
Gabriele Moriello, et al.) For incomplete SCI	12 weeks	60 minutes per day	Hatha yoga asana with relaxation and meditation	Not applicable	BBS for balance, Gait velocity, 6MWT to measure endurance, Sit and Reach Test (SAR), Apley's back scratch test
<p><b>Finding:</b> BBS score increased from 39/56 to 45/56; was able to walk 55.2 m further during the 6MWT; able to 10.3" further during sit and reach test; Hamstring flexibility as measured via goniometer increased bilaterally, from 65 at baseline to 80 at discharge; The total performance score on the COPM improved from 1.8 at baseline to 4.6 at discharge while his total satisfaction score was 1.4 at baseline and 2.8 at discharge. The overall QOLP-PD score was 5.04 at baseline and 5.00 at discharge</p>					
Ebnezar J et al. For failed TKA	4 weeks	20 minutes per day	ultrasound, interferential therapy and moist heat and integrated yoga therapy practices (IAYT)	Not applicable	Pain, disability, walking time, movement
<p><b>Finding:</b> Pain score reduced from 9 to 2 points, hip disability reduced from 86% to 42% , walking time reduced from 2 min 20 s with support to 1 min 80 sec without support, right flexion increased from 5 deg to 20 deg, left flexion from 10 to 30 deg; right extension from 0 to 10 deg, left extension from 10 to 20 deg; right abduction from 10 to 20 deg; right adduction from 5 to 10 deg, left adduction from 5 to 10 deg</p>					
P Tekur et al. For CLBP	7 days residential	Residential program (5 am to 10pm each day)	Hatha yoga postures, meditation, relaxation along with lecture and counseling	Physical therapy exercises with lecture and counseling	STAI (state anxiety scores) state and trait anxiety; BDI (Beck's anxiety score) for cognitive and vegetative depression symptoms; NRS (Numerical rating score) for pain, SAR (sit and reach) for flexibility
<p><b>Finding:</b> STAI (state anxiety scores) decreased 20.4% in yoga group (difference between groups P&lt;0.001) ; trait anxiety score decreased 16% in yoga group (difference between groups P&lt;0.001) ; BDI (Beck's depression inventory) yoga group reduced 47% and control group 19.9% (difference between groups p&lt;0.001); numerical rating scale (NRS) yoga group 49% and control 17.5% ; SAR (sit and reach) yoga group increased 49.5% and control 34.6% (difference between groups not significant)</p>					
Bedekar N et al. For post TKR	3 months	3 days / week after discharge from hospital	Hatha yoga postures with meditation and relaxation	Conventional	WOMAC (for pain and stiffness)
<p><b>Finding:</b> pain and stiffness improved by 17.5% after 6 weeks and 12.9% after 3 months in conventional group, it improved by 23.85% after 6 weeks and 28.10% after 3 months in experimental group; Improvement in function was 14.55% in conventional group and 26.45% in experimental group after 3 months</p>					

**Table 1a:** Results of the selected studies, OA - Osteoarthritis; SCI - Spinal cord injury; CLBP - Chronic low-back pain ; TKR - Total knee replacement; TKA - Total knee arthroplasty, \*\*: Content of table is from the chosen research studies for review.

Study Reference	Sample Size (start and final study)	Gender (M/F) and Age (years)	Joint / musculoskeletal condition of treatment
Ebnezar J et al.	Initial - 250 final - 235	M = 76 ; F = 174 Age : (35 - 80 years)	OA of Knee joints
Gabriele Moriello, et al.	1	M = 1 Age: (59 years)	With Spinal cord injury (C3-C6 ASIA D SCI) in a cord pattern 32 months prior to the program
Ebnezar J et al.	1	F = 1 Age - (52 years)	Failed TKR
P Tekur et al.	80	F = 36 M = 44 Age : ( 18 - 60 years )	CLBP
Bedekar N et al.	Initial = 56 Final = 51	F = 36 ; M = 15 Age : (38 - 77 years)	Post TKR Surgery

**Table 1b:** Demographics and condition of treatment of selected studies,OA: Osteoarthritis; SCI - Spinal cord injury; CLBP - Chronic low-back pain ; TKR - Total knee replacement; TKA - Total knee arthroplasty; \* \* Content of table is from the chosen research studies for review.

have already sustained damage [14].

The integrated therapy for musculoskeletal conditions like OA, low-back pain, etc. includes muscle strengthening as a key component in the therapy as a muscle weakness is one of the major causes of pain. Yogasanas involve passive stretching where muscular tensions are reduced and associated nerves are tranquilized and soothed [15].

Yoga, with the postures, breathing techniques and meditation, adds mindfulness to the therapy which can reduce pain and stiffness associated with OA by realigning the skeletal structure, strengthening muscles around the joints and stretching tight joint structures [16]. It is believed that frequent joint motion during yoga practices has physiological effects at the cellular level.

Wren A et al (Yoga for persistent pain: new findings and directions for an ancient practice - 2011) have observed in their new study that yoga can produce physiological changes that alter the pain experience: decreases in sympathetic nervous system activity, reductions in inflammatory markers (tumour necrosis factor, interleukin-II, CRP etc.) and stress markers (cortisol etc.), increases strength, flexibility, circulation and cardiorespiratory capacity, reduces social isolation, fosters networks that reinforce physical activity, increases awareness of physical and mental states.

Hegde et al (Effect of 3-month yoga on oxidative stress in type2 diabetes with or without complications - 2011) in their control trial for diabetes management have observed yoga intervention reduces body mass index, improves glycemic control, levels of malondialdehyde, glutathione and vitamin C. Gabriele Moriello et al. in their case report about the positive yoga therapy intervention for spinal cord injury (SCI), report beginning each yoga session with meditation (breathing techniques) to deepen awareness and center the mind and body [8]. Yoga postures were modified to suit the subject's capability.

This study is significant for 2 reasons. The study is about injury rehabilitation using yoga as an adjunct therapy with conventional physical therapy and that the outcome assessor (primary investigator) is a physiotherapist. Scott et al, Field-Fote have earlier observed that individuals with SCI are at increased risk for developing a number of secondary conditions such as muscle atrophy, muscle spasms, spasticity, limitations in flexibility, joint contractures, bone loss, chronic pain, fatigue and impairments in respiratory capacity [17,18]. Marie Janisse has mentioned in her book that Physical therapists are movement experts, whereas the training of Yoga teachers and Yoga therapists does not include patho kinesiology or kinematics. By blending the strengths of Yoga with the knowledge of Physical therapy, we open our profession to learning new treatment methods and gain valuable insights from an ancient wisdom tradition.

The outcome measures included the ability to maintain balance (BBS), gait velocity, endurance, hamstring and upper extremity flexibility. While there were inconsistent changes in the muscle strength changes and there was no change in gait velocity, the BBS and flexibility scores improved. Schmid et al 2010; Tatum et al 2011; Hakim et al 2010; Field T 2011; Tiedemann have earlier studied and observed that yoga intervention improves balance [19]. Balk et al. (Using Yoga to Promote Bone Health and Reduce Fracture Risk in the Geriatric Population 2011) have observed that the mechanisms in yoga likely include improving balance and fear from falling, improving bone density via strength training. Yoga is likely a safe and effective means to improve bone health in an older population. Kelly et al. (The effects of a therapeutic yoga program on postural control, mobility, and gait speed in community-dwelling older adults - 2014) have a similar observation

in their quasi experimental study that yoga program may be effective in improving mobility, postural control, and gait speed in community dwelling older adults.

Tekur et al. have observed through the RCT, that integrated yoga with physiotherapy relieves the pain and stiffness in the hip, knee and back, that had developed due to immobility and disease [19]. The study is significant as the short term (seven days) yet intensive residential program for 80 subjects (both genders) and comparison of results with other similar studies enhances the quality of the study. The program incorporates meditation, lecture and counseling, asanas (postures), relaxation techniques which address the pain and functional disability of CLBP. The study mentions about a vegetarian diet served to the subjects during the program. There is potential to consider this dimension of diet in study about rehabilitation programs.

The control study attempts to explain the possible mechanisms for pain reduction. The study observes consistent reduction in anxiety with non-significant changes in physical exercise. The study has calibrated trait anxiety (one of the stable components of a personality). However, it is beneficial if there is in-depth study of mechanisms of yoga as a non-pharmacological intervention with conventional physiotherapy.

McCall MC has mentioned in an overview (How might Yoga work 2013) that yoga's capacity to regulate hormones is a factor in providing health benefit evidence, with a decrease in cortisol and increase serotonin and melatonin levels following regular practice.

Compared to physiotherapy procedures, yoga, with its static-dynamic procedures, can also be discussed as a means of "self-mobilization" of the nervous system and joints of spine and extremities [4]. Bauer-Wu et al. in their earlier studies (Prevalence and predictors of complementary and alternative therapies use by women with advanced breast cancer - 2006) mention that potentially, yoga addresses the limitations of the traditional therapy model that lacks the mind-body component.

Ebnazar et al. have studied a case of failed post-total knee replacement in arthroplasty [10]. This study is significant as it is a global public health concern. One of the researches (International survey of primary and revision total knee replacement - Steven M Kurtz et al.) comprising 18 countries with a total population of 755 million has recorded an average of 149 total knee replacement procedures per 100,000 population. The study has observed the increased demand of total knee arthroplasty over the past decade in several countries around the world. This study has examined nuances in the clinical diagnosis and surgery which is a very important part of the design of integrated intervention in this case. The case report also documents an interesting aspect about the financial implication of patient for knee arthroplasty. This provides an insight into importance of a cost-effective treatment for joint conditions and injury rehabilitations.

Yoga has the potential for self-practice after learning. The study also suggests that patients diagnosed with OA and recommended for surgery should undergo an integrated yoga therapy, failing which could opt for surgery, thus providing patient a choice for holistic care before invasive treatments.

The study by Nilima Bedekar et al has compared conventional therapy to additional yogasanas for knee rehabilitation in total knee replacement (TKR) patients and has found that a combination of yoga and physiotherapy works better than only physiotherapy [22]. The cohort study observes that patients practicing yoga had better pain relief, less stiffness and better function. The muscle strengthening and

relaxation of the muscles was better in yoga group allowing for faster recovery from pain. The study explains the modalities of physiotherapy protocol to reduce muscle stiffness. It also explains the mechanism of muscle movements in yogasanas and their importance in joint stability and overall improvement in function and reduction of pain.

Posadzki in their review, mention that conceptually, both physiotherapy and yoga, each through their own procedures, improve muscle strength, increase joint mobility and soft tissue flexibility, mobilize the nervous system, improve body posture, improve proprioception and thereby encourage better awareness of the body, releasing trigger points and relieving pain [4].

Karen Sherman et al. have compared effectiveness of yoga with exercises and use of a self-care book. They have assessed responses from questionnaires administered after 6, 12 and 26 weeks [23]. This study also has addressed pain and functionality as outcome measures. The study is significant because it has documented follow-up about effectiveness of the interventions up to 26 weeks after the sessions. The study found out that the medication which was similar in all groups decreased sharply in the yoga group {21% of participants in the yoga group reported reduced medication use during the week before the 26-week interview compared with 50% in the exercise group (relative risk, 0.41 [CI, 0.20 to 0.87]) and 59% in the book group (relative risk, 0.35 [CI, 0.17 to 0.73])}.

This study also contemplates about the possibilities of variation in results with various styles of yoga that differ in style and approach to practice. All selected studies in the review are insightful and consider aspects of safety, pain reduction, joint flexibility strengthening and relaxation of muscles using yoga. It might have been more insightful for future researchers if physiological mechanisms of the integrated yoga and physiotherapy were also documented. Nevertheless, there is enough scope for future studies.

## Limitations

The current study considered only open access sources and clinical trials that either compared yoga and conventional physiotherapy or had integrated yoga with physiotherapy. There is potential to search more sources for randomized control trials of yoga and physical therapy. Since the study also addresses the question about mechanism of the therapy, there is scope for further in-depth study about the underlying mechanism for clinical effectiveness of combined therapies of yoga and conventional physical therapy.

## Recommendation for future research

The evidence-based researches in the current study account for clinical efficacy of yoga as a complementary intervention. It will be more beneficial if further researches can specify and detail the underlying physiological mechanisms in the application of yoga as an adjunct therapy with conventional physical therapy treatments for specific joint conditions or neuromusculoskeletal conditions.

It might help to conduct more clinical trials about the application of yoga in joint injury rehabilitation as it is one of the major concerns of public healthcare. The perceptions and behaviour of the therapist and the patient have significant impact on the recovery process; it could be worth-while to deliberate clinical studies about the psychosocial mechanism in 'patient-care'. The authors, Gabrielle et al [8]. feel the need to conduct more randomized trials to determine cause-effect relationships, blinding and more objective postural analysis.

Researchers of these current selected studies also feel the need

to evaluate yoga interventions and investigate its mechanisms of action so results can be compared for effectiveness in more diverse populations and in patients. They also suggest including EMG (electromyography). Few studies consider EMG feedback to evaluate muscle activation patterns during yogasanas (Core muscle function during specific yoga poses by Meng Ni et al 2014). Insights about motor and muscle mechanisms are potentially significant to incorporate yoga interventions in rehabilitation programs.

## Conclusion

Physiotherapy is a conventional treatment that is popularly considered for injury rehabilitation, and Yoga is considered to influence positive and holistic mind-body coordination. The texts of Yoga (Hatha Yoga Pradipika, Gheranda Samhita et al) have detailed health benefits of yoga. Randomized control studies have been conducted for various neuro musculoskeletal, psychological conditions.

Back pain, Arthritis etc is among the common public ailments and the current study has reviewed the randomized control studies. Integrated yoga with conventional physiotherapy has the potential to enhance quality of life of the individual. Paul Posadzki and Sheetal Parekh, in their speculative review, observe that principles of yoga resonate with the principles of the physiotherapeutic process as in their holistic approach towards health and well-being of an individual and that the essence of physiotherapy as a multifaceted process requires teamwork and efforts of various specialists like psychologists, sociologists, occupational therapists and nurses if patients are to benefit [4].

Evidence-based research studies that investigate physiological mechanisms of yoga might emphasise clinical efficacy of yoga as a complementary or adjunct or integrated therapy with physiotherapy.

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