

A Systematic Review of Mindfulness Practices for Improving Outcomes in Chronic Low Back Pain

Abstract

Background: Chronic pain is a serious public health problem that affects people of all ages and backgrounds. Mindfulness-based stress reduction (MBSR) techniques offer an accessible treatment modality for chronic pain patients that may complement or replace pharmacological treatment. This article reviews the literature on the efficacy of MBSR training in patients with back chronic pain syndromes for the outcomes of pain measures, quality of life (QOL), mental health, and mindfulness. **Methods:** A systemized search was conducted in September of 2018 for studies published between 2008 and 2018 on mindfulness and chronic low back pain. Out of 50 articles on mindfulness and chronic pain, 12 empirical studies were selected for the inclusion in this review. **Results:** Subjective pain scores and QOL improved for chronic pain patients after mindfulness interventions, compared to control groups, in most of the studies reviewed. Limitations of the studies reviewed included the varied pain measurement instruments, the small sample sizes, and the inability to blind participants to MBSR intervention. **Conclusions:** MBSR interventions show significant improvements in chronic pain patients for pain measures, QOL, and mental health.

Keywords: Back pain, chronic pain, meditation, mindfulness, mindfulness-based stress reduction, yoga

Introduction

Chronic pain afflicts 100 million adult Americans and 1.5 billion people worldwide.^[1] Annual costs are estimated at \$635 billion nationally in medical care expenditures and missed work.^[2] In 2010, chronic pain was declared to be a public health problem and considered to be a unique disease entity in and of itself.^[2] By definition, chronic pain persists for 6 months or more and/or continues beyond the limits of the normal healing time for a given injury.^[3] Chronic back pain is the most common chronic pain complaint and is the leading cause of disability in the United States.^[4,5]

Background

Several factors make chronic pain difficult to treat. Chronic pain is associated with the following: Sleep disturbance, obesity and weight gain, chronic fatigue, limited physical functionality, and decreased quality of life (QOL).^[3,5,6] Physically and psychologically, pain is a complex construct. It is mediated by sensory,

cognitive, and emotional elements that are unique to each individual.^[1] Most commonly in the traditional Western medicine, pharmacological interventions are utilized, with long-term treatment comprising mostly analgesic and opioid medications.^[3] Although beyond the scope of the present review, it is important to note that pharmacologic pain treatment has contributed to an epidemic of opioid misuse and addiction, a public health crisis seen worldwide.^[1]

Because of the intractable nature of chronic back pain, complementary and nonpharmacological treatments are of interest. One such treatment is cognitive behavioral therapy (CBT), which has been shown to have some efficacy for relieving chronic pain.^[4] However, access to CBT is limited for many patients for various reasons, such as the costliness and lack of availability in some areas.^[4] Another drawback of CBT as a stand-alone therapy is that it does not include a physical exercise component.^[4] Activity is especially important in the treatment of back pain since

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inadequate strength of torso muscles may exacerbate the pain and dysfunction of chronic back pain.^[7] Management modalities of chronic pain that include exercises, such as yoga and stretching, are attractive due to their relative ease of accessibility and low cost. Furthermore, exercise may include benefits beyond pain relief, such as weight loss.^[8]

Mindfulness-based stress reduction therapy

Another promising therapy for chronic pain is mindfulness therapy, often referred to as mindfulness-based stress reduction (MBSR). The origin of mindfulness as it relates to the experience of pain may have roots in Buddhist Vipassana philosophy. Buddhist monks have claimed for centuries that mindfulness meditation can significantly alter the perception of pain.^[1,6] More recently, the practice of mindfulness and its utility as a treatment modality has been gaining recognition in the research and medical community.^[9] Aside from reported psychological benefits, such as alleviating distress, mindfulness therapy is appealing in its nonpharmacological long-term solution for the management of chronic pain.^[8] The manner of mindfulness therapy employed may show slight variation across studies, but the underlying goal of these interventions is universal: For the patient to gain control of the experience of mind and body through increasing awareness and nonreactivity.^[9]

In general, MBSR techniques embrace the whole person and employ capacities along a spectrum from the purely cognitive to the purely physical. The cognitive end of mindfulness is meditation. It is the practice of conscious the awareness of one's own thoughts, then the observation of those thoughts without judging them or experiencing them in a subjective manner.^[10] Kindly awareness is designed to develop compassion toward oneself and others.^[9] Encompassing both cognitive and physical features, mindfulness breathing involves directing attention to the experience, and control of breathing.^[9] If one loses focus or finds the mind has wandered, the practitioner is taught to acknowledge the event, but not to judge it, and instead to simply return focus to the breath.^[11]

Additional techniques include body scan, used in many yoga practices. Body scan involves systematically concentrating on a single body part at a time. Sequentially, usually beginning with the toes, attention is moved from one body part to the next and any tension perceived in each part is acknowledged, then imagined to disincorporate and escape.^[9,11] Sitting and walking meditation are practices whereby participants are asked to breathe in and out, attending to the sounds of their bodies and the environment, as well as their own thoughts.^[11] One is supposed to learn to simply observe and then let go, rather than attach feelings or judge sensations and thoughts. Yoga and stretching emphasize increasing strength, improving balance, awareness of breathing, and proper alignment of the body through postures.^[7] Yoga possesses an inherent mental component as well, which calls for concentration

and awareness, rendering it a desirable mindful treatment modality for those with chronic pain.^[8]

Mindfulness-based stress reduction therapy and the experience of pain

MBSR is based upon the theory that practicing mindfulness will allow for the “uncoupling” of the bottom-up, afferent, sensory driven from the top-down, psychological, cortically-driven components of pain.^[12] It has been suggested that the awareness can lead to a dissociation between the sensation of pain from the emotions and thoughts the subject previously attached to such pain.^[6] MBSR techniques focus on the psychological sequelae of pain and decrease suffering and improve functionality rather than decrease pain severity.^[12] In other words, pain is not removed; rather the perception of pain is altered. For example, mindfulness training may help those who suffer from chronic pain learn to accept pain. Consequently, is it conceivable that acceptance leads to a decrease in the need to control or evade pain, thereby allowing more time and energy to be allocated toward more positive, goal-directed activities.^[12]

The present literature review will examine the utility of MBSR techniques for chronic back pain, primarily in pain measures, and functionality outcomes. It will also examine the secondary measures such as subjective QOL, including mental health sequelae and mindfulness. The literature reviewed data from clinical trials as well as mindfulness-based programs. Note that outcomes are the variables of subjective measures, which are invaluable in pain research due to the qualitative nature of pain. The purpose of this review is to gain understanding of the efficacy of mindfulness therapy in persons suffering from chronic pain.

Methods

A literature search was conducted using the key terms Mindful* (Title) OR Yoga (Title) AND Chronic Back Pain. The key term Yoga was included so that the search would include a variety of mindfulness practices. Between September 7 and 8, 2018, an electronic search was conducted in the databases Medline Complete (EBSCO) and PubMed for journal articles with these key words: (Mindful* [Title] OR Yoga [Title] AND Chronic Back Pain [Title] NOT CBT [Title]). In both searches, additional filters of “Full Text”, “abstract available”, “January 1, 2008–2018” (past 10 years), and “English” were applied. The search identified a total of 1247 (Medline) and 9 (PubMed) articles. Five additional articles were found through the reference lists from relevant reviews, arriving at a total of 1261 articles.

Next, 1211 articles were eliminated due to various reasons, including population sampled was not of interest in this review (most common reason, cancer patients),

employment of a nonmindfulness-based treatment (e.g., the use of CBT), measuring outcomes other than pain (e.g., lack of posttreatment pain ratings), and/or full text of the article was not available. Then, 50 full-text articles were examined more closely for eligibility. Of these, 34 were further excluded for reasons mentioned above and also because the work was a review or meta-analysis. The screening process was conducted by the two authors without the use of software.

Thus, the second exclusion rendered a total of 12 acceptable articles. The desired inclusion criteria were:^[1] independent variable of mindfulness-based intervention such as meditation, body scan, yoga, breathing exercises, and awareness training and^[2] patient group, all or majority of participants suffering from chronic back pain without significant concomitant comorbidities such as cancer. Although the initial intent was to locate the research that measured physiological variables such as heart rate or blood pressure pre- and post-treatment, perusal of the published data indicated a dearth of information. Therefore, the primary outcome of interest for the present search was posttreatment pain levels. All studies reviewed quantified pain severity. The secondary outcomes of interest were overall QOL and posttreatment mindfulness. Studies were evaluated for quality by assessing the number of subjects, the study methods, and inclusion of a pain severity measure.

Results

The present report reviewed a total of 12 studies with sample sizes varying between 16 and 341 patients [Table 1]. Out of 12 studies, 9 were randomized controlled trials, 2 were nonrandomized but included matched controls, and 1 was longitudinal [Table 1]. The population consisted of patients suffering from chronic back pain.^[4-11,13,14] Some of the reviewed studies also included pain syndromes such as fibromyalgia,^[3,10,11] arthrosis,^[3,10] migraine headaches,^[10] and unspecified chronic pain.^[10,15] Both women and men of varied ages participated in the reviewed studies. With a single exception which examined the effectiveness of a brief 10 min intervention,^[14] mindfulness training was given for several hours per week, with additional at home meditation practice, and lasted an average of 8 weeks in all studies. In all studies, mindfulness training comprised a variety of techniques including body scan, yoga/stretching, walking/sitting meditation, and breathing exercises. For most of the studies, mindfulness training was performed in person; in 2 cases, it was provided online.^[3,10] The results are organized by the outcome variable of interest. These are broadly grouped into pain measures (severity and dysfunction), and QOL (physical and social functioning and vitality)

Mindfulness-based stress reduction therapy and pain measures

Most of the studies included for review assessed pain severity on a standardized scale before and after MBSR

intervention. One pseudorandomized study with over 200 participants showed that pain severity scores were significantly improved in both the present and distant mindfulness training groups compared with controls.^[10] In another smaller study with 25 participants, pain severity and dysfunction (due to pain) were significantly improved for the MBSR group over controls.^[13] Yoga and stretching were also shown to significantly improve back function compared to self-care book controls at the long-term follow-up in another study with over 200 participants.^[8] These results are consistent with a study that demonstrated yoga therapy produced significantly improved pain intensity ratings and less physically unhealthy days compared with the stretching only exercise controls.^[7]

In a study of 88 women, participants' subjective sense pain quality and severity improved in a MBSR group compared with controls.^[6] In a smaller study that included the measure of cortisol levels, subjective pain severity was significantly lesser for participants receiving MBSR training than for controls.^[11] Similarly, the outcomes of pain intensity and suffering were significantly lower for online MBSR groups over the control groups.^[3] In terms of functionality, another MBSR group showed significantly less limitation in activity due to pain than controls.^[15] In addition, in another study with 282 participants, the MBSR study group demonstrated significant short-term functional improvement and increased pain self-efficacy at 8 weeks compared to controls, but these improvements were not maintained through to 6 months.^[5]

Mindfulness-based stress reduction therapy and quality of life

In a study with both present and distant mindfulness training groups, posttreatment mental health was self-rated as significantly healthier than the control group.^[10] Pain catastrophizing is defined as an exaggerated negative response toward anything that provokes pain and the experience of pain itself.^[10] The results showed that both the present and distant mindfulness training groups catastrophized significantly less than controls.^[10] In another study, all QOL measures, including distress and relations with others, were rated significantly improved for the brief intervention groups over control groups.^[14] In an examination of a brief body-scan mindfulness training, participants in the intervention group reported significant reductions in pain-induced distress and pain-induced social dysfunction.^[15] Yoga therapy produced significantly fewer mentally unhealthy and limited activity days over stretching exercise controls.^[7] QOL also improved for MBSR therapy groups over controls.^[6,15] MBSR therapy improved depression and mental health function scores over usual care controls.^[4] In a similar study, life satisfaction was significantly improved after an online MBSR intervention, but the sense of life control did not differ from a control group.^[3] Participants in the MBSR groups reported improved physical and mental QOL ratings than controls,

Table 1: Studies Included in the Present Review in Order of Year Published 2008-2017

Author(s)	Date	Study type	n	Dependent variable	Comment
Gardner-Nix-Nix <i>et al.</i> ^[10]	2008	Pseudo-random	215	QOL Pain catastrophizing Pain severity	Assignment based on location; online
Esmer and Blum ^[13]	2010	RCT	25	Pain severity, functionality, sleep, and medication use	Small sample size
Sherman <i>et al.</i> ^[8]	2011	RCT	228	Functionality and Pain Bothersomeness	Use of 2nd exercise modality further delineates results
Ussher <i>et al.</i> ^[14]	2012	RCT	55	Pain severity, pain-related distress Perceived ability to perform ADLs, social functioning	Brief intervention
Doran ^[9]	2014	Longitudinal	16	Subjective sense of control over and relationship to pain	Longitudinal design, small sample size
Nambi <i>et al.</i> ^[7]	2014	RCT	60	Pain intensity, health-related QOL	Nonyoga exercise group not included
Banth and Ardebil ^[6]	2015	RCT	88	Pain quality and intensity	All female participants
la Cour and Petersen ^[15]	2015	RCT	107	Pain, functionality, mental function, pain acceptance, and QOL	Long follow-up with high completion rate
Cherkin <i>et al.</i> ^[4]	2016	RCT	341	Pain severity, functionality, depression, anxiety, pain improvement, physical and mental general health	Large sample size; 20% loss of participants at follow-up
Henriksson <i>et al.</i> ^[3]	2016	RCT	107	Mindfulness skills, pain level, severity, interference, suffering, acceptance, life satisfaction	Online training
Morone <i>et al.</i> ^[5]	2016	RCT	282	Pain severity, QOL, depression, pain self-efficacy, pain catastrophizing, mindfulness	Low follow-up attendance
Ardito <i>et al.</i> ^[11]	2017	Pseudo-random	28	Pain severity, depression, and cortisol levels	Group assignment based on enrollment date; cortisol only measured in MBSR group; not clinically meaningful

RCT=Randomized control trial, QOL=Quality of life, ADL=Activities of daily living, MBSR=Mindfulness-based stress reduction

with the exception of depression ratings, which did not differ between treatment groups.^[11]

In a 4-year longitudinal analysis that included observation and interviews, it was reported that participants who completed MBSR training learned to recognize early warning signs within their bodies that a pain crisis was imminent.^[9] Through enhanced awareness, pain patients were able to breathe into and accept pain, with less negative coping responses, such as becoming fearful or anxious.^[9] Contrastingly for the study of a brief mindfulness intervention, there were no significant changes in mindfulness measures between the body scan and control groups.^[14] In another study with a long-term follow-up, the severity of pain did not significantly improve; however, the MBSR therapy group reported improved impact of pain on daily living and pain acceptance when compared to controls.^[15] The results were consistent with the study indicating an online MBSR intervention improved mindfulness skills.^[3]

Discussion

Summary of findings and implications

Overall, the outcomes of pain measures were significantly improved for participants practicing MBSR techniques

as therapy for chronic pain when compared to matched control groups.^[3-8,10,11,13,15] In addition, QOL and mental health measures were significantly better over controls after MBSR therapy.^[3,4,6,7,10,11,13-15] For posttreatment mindfulness measures, MBSR therapy produced promising, positive changes in pain acceptance and daily living over controls.^[3,15] By measuring multiple mindfulness variables before and after an intensive course of MBSR therapy and training, it was found that patients with chronic pain were able to find new ways to live with and accept pain, with less negative impact on daily life.^[9]

Although pain ratings were immediately decreased for the body scan group compared with control group after a brief intervention, the groups did not differ from one another over time.^[14] The lack of lasting effect could have been due to the fact that the body scan technique was a brief 10 min intervention, rather than a skill practiced over many weeks. However, these results indicate that body scan may be a useful intervention in an acute, clinical setting to reduce pain-related stress. It was found that pain-related distress, rather than pain intensity, was significantly lessened by the brief body scan intervention.^[14] Body scan may provide a means of directly experiencing one's body in the moment,

and thus, increase the sense of self-control over perception of pain.^[6]

Furthermore, although in general participants, MBSR groups reported significantly less pain intensity and suffering than controls, one MBSR group did not differ from the CBT group.^[4] CBT is known to be an effective modality for pain control in some patients.^[4] However, CBT can be a costly and lengthy commitment, which renders it inaccessible for many people. CBT also lacks a physical exercise component.^[4] Exercise, especially yoga therapy, may be superior because the effort of practice necessary to achieve the proper alignment of the spine and body required of standing yoga poses may confer greater benefits to physical well-being.^[7]

There were more discrepancies in QOL outcomes across the studies reviewed. On some of the QOL and mental health measures, no differences were seen between MBSR and control groups.^[3,5,11] The amount of pain catastrophizing disproportionate responses to pain stimuli showed mixed results between the groups. It was decreased in MBSR groups when compared to controls in one study,^[10] but showed no significant differences in another.^[5] The MBSR intervention produced an immediate, posttreatment decrease in pain and dysfunction; however, the effect was not maintained at the long-term follow-up compared to the control group.^[5] One suggestion that applies to all the research that reported discrepancies in QOL outcomes is that further research could investigate the ways of improving long-term patient compliance. Improvements to the mindfulness intervention program could increase the duration of the improvement experienced by the participants in the treatment groups.^[5]

In a study of online versus present intervention, participants in the present mindfulness training group had significantly higher physical QOL scores than participants receiving distant mindfulness training through video conferencing.^[10] Although not all measures were diluted by delivery through distance, the findings suggest that some of the effectiveness of mindfulness training is diminished if not delivered in person. Nevertheless, participants undergoing mindfulness training online reported overall physical and mental health improvement. If receiving mindfulness training online is an effective way to provide therapy, then these findings show promise for chronic pain sufferers who live in the rural areas or are otherwise unable to travel to therapy clinics.^[3,10]

The desired outcome of learning mindfulness techniques with respect to chronic pain is to afford tools that allow coping with unavoidable pain.^[13] Interestingly, pain acceptance has an inverse relationship with the rates of depression, psychosocial dysfunction, pain intensity, and anxiety; acceptance also has a direct correlation to improved physical activity.^[13]

Mindfulness practice may provide a conduit through which chronic pain sufferers may become more corporally-attuned. In a longitudinal study, the evolution of the participants' self-awareness of the sensation of pain and their cognitive reaction to pain changed throughout the course of MBSR.^[9] In what was referred to as "unpacking the pain experience," it was noted that participants eventually learned to recognize whether they perceived tension or relaxation with pain; they were trained to recognize the warning signs of an impending pain crisis early on order to diminish the anxiety and tension related to pain.^[9] It was posited that participants were able to get away from feeling "stuck" in their pain and move toward compassion and acceptance of themselves.^[9] In turn, feelings of helplessness or being at the mercy of chronic pain were reduced or eradicated.^[9] Although anecdotal, the sentiments of one participant who underwent 8 weeks of intensive mindfulness training were straightforward, yet poignant: "I had greater expectations about the pain relief the mediation would bring. The pain is acute, it is strong, but now I feel less afraid of it."^[11] Perhaps, through the use of awareness of sensations, thoughts, and emotions, the illness self-narrative previously associated with the sensation of pain is altered, thus the perception of pain is as well.^[9]

Mindfulness and biological underpinnings of pain attenuation

It is known that mindfulness practices engage various, discrete brain regions that unite to diminish the subjective pain experience.^[1] Cognitively, it has been suggested that meditation creates a kind of objective awareness that allows for the acknowledgement of a noxious sensation (i.e., pain) without the self-referential feeling or evaluation placed upon it.^[1] Neuroimaging data support such hypotheses; it has been reported that during meditation, top-down, cortically-driven brain regions are activated through directed attention.^[1] During pain episodes, meditation may interfere or disrupt the afferent, nociceptive signals.^[1] Therefore, even brief MBSR training may intervene in afferent pain sensation through cortically-driven neural circuits, thus inhibiting pain information.^[1] The longer mindfulness is practiced, the more the areas of the brain associated with pain-mediating analgesia are developed.^[1]

Limitations and future directions

The research in the present review included several studies with small sample sizes between 16 and 341, which can make generalization of findings to the population at large somewhat problematic.^[9,11,13] There was also a wide variability in the timeframe during which postintervention outcomes were measured, which ranged from immediate to as long as 1 year, with most measured at approximately 6 months.^[4,9,14] Furthermore, lack of long-term functional improvement could have been due to lack of at-home compliance with mindfulness techniques.^[5] Therefore,

investigating ways to increase long-term compliance with mindfulness practices remains of interest for chronic pain patients

Studies of pain are also limited by participants' subjective reporting of pain. Although there is difficulty establishing validity and reliability, instruments to measure the subjective perceptions of pain and QOL should be improved. In addition, although subjective outcome measures are very important data to collect in chronic pain research, future studies should include the physiological measures of chronic stress to corroborate the subjective pain outcomes. For example, pre- and post-treatment blood pressure readings, heart rate, and cortisol levels are the physiological variables affected by pain; these are objective, numerical, and are easily obtained.

This review is limited for several reasons. Only two authors participated in the screening of studies for inclusion, without the use of software. Quality appraisal of included studies is unavailable. Finally, the studies in the present review were limited in that they could not be double blinded. Participants could not be blinded to the treatment group since mindfulness training is apparent to the participants.

Conclusions

Mindfulness may provide long-term relief from pain, improve subjective QOL, and increase mindfulness. Future studies should include more subjects, physiological measures associated with pain, and possibly sham mindfulness training control groups. The practice of MBSR techniques should be included in the treatment and management of chronic pain. For pain sufferers, MBSR holds the promise of long-lasting relief from pain.

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Conflicts of interest

There are no conflicts of interest.

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