



Mindfulness Intervention for Chronic Low Back Pain: A Systematic Review

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ABSTRACT

Aims: This systematic review was performed to find the effectiveness of mindfulness interventions for outcomes such as pain, physical function, and cost-effectiveness in Chronic Low Back Pain (CLBP) patients.

Methods: Articles published in peer-reviewed journals till February 2019, were used through searches of three electronic databases (PubMed, EMBASE, and Web of Science). Keywords including mindfulness, mindfulness-based intervention, mindfulness meditation and CLBP were used in search strategy. At last, a total of 8 articles were included in the final analysis.

Findings: All included studied studies were high qualified by which physical function was being measured as their outcome. The Short-Form Health Survey was the most frequently used measure of physical function in the studies. Anxiety and depression were as secondary outcomes in four of eight studies. The Mindfulness Based Stress Reduction (MBSR) method was the main intervention that was used in the studies. Most of the studies utilized at least six sessions and 2 hours (30 minutes for each session) weekly. Sessions were managed by experienced person in MBSR field. Five out of eight studies approved MBSR for pain improvement compared to usual cares.

Conclusion: This study supported the strategy of applying non-pharmacological therapies for CLBP which are effective in managing pain among adults. However doing more researches to evaluate the persistent long effects of this therapy and its cost-effectiveness in comparison to medications is strongly recommended.

Keywords: Low Back Pain, Mindfulness, Physical Function, Cost-effectiveness.

Introduction

Globally, approximately 577.0 million people living with Low Back Pain (LBP) worldwide. It has been estimated that LBP caused more health care utilization and reduced occupational activity capacity leading to annually huge cost in United States [1]. Low back pains which last for more than 3 months (despite underline etiology or inappropriate treatments) causing CLBP which followed by psychological distresses and decreased Quality of Life (QoL) [2, 3]. Although, analgesic drugs are still first choice in reducing pain, their side effects such as gastritis, constipation, nausea, and dizziness caused some challenges in clinical settings [4]. Additionally, some analgesics such as opioids have their own potentially ad-

dictive effects which should be paid attention [5]. In this regard, non-pharmacological treatments may attract special consideration due to their negative side effects. One of recently introduced types of Cognitive Behavioral Therapy (CBT) is mindfulness which is a non-pharmacological and non-invasive method of pain management. Techniques such as breathing meditation, yoga, Mindfulness-Based Stress Reduction (MBSR), and Mindfulness-Based Cognitive Therapy (MBCT) are CBT subtypes [6, 7]. The recent meta-analyses showed that both MBSR and MBCT influence depression, anxiety, and QoL. However, they recognized a knowledge gap on the effectiveness of a mindfulness-based intervention for de-

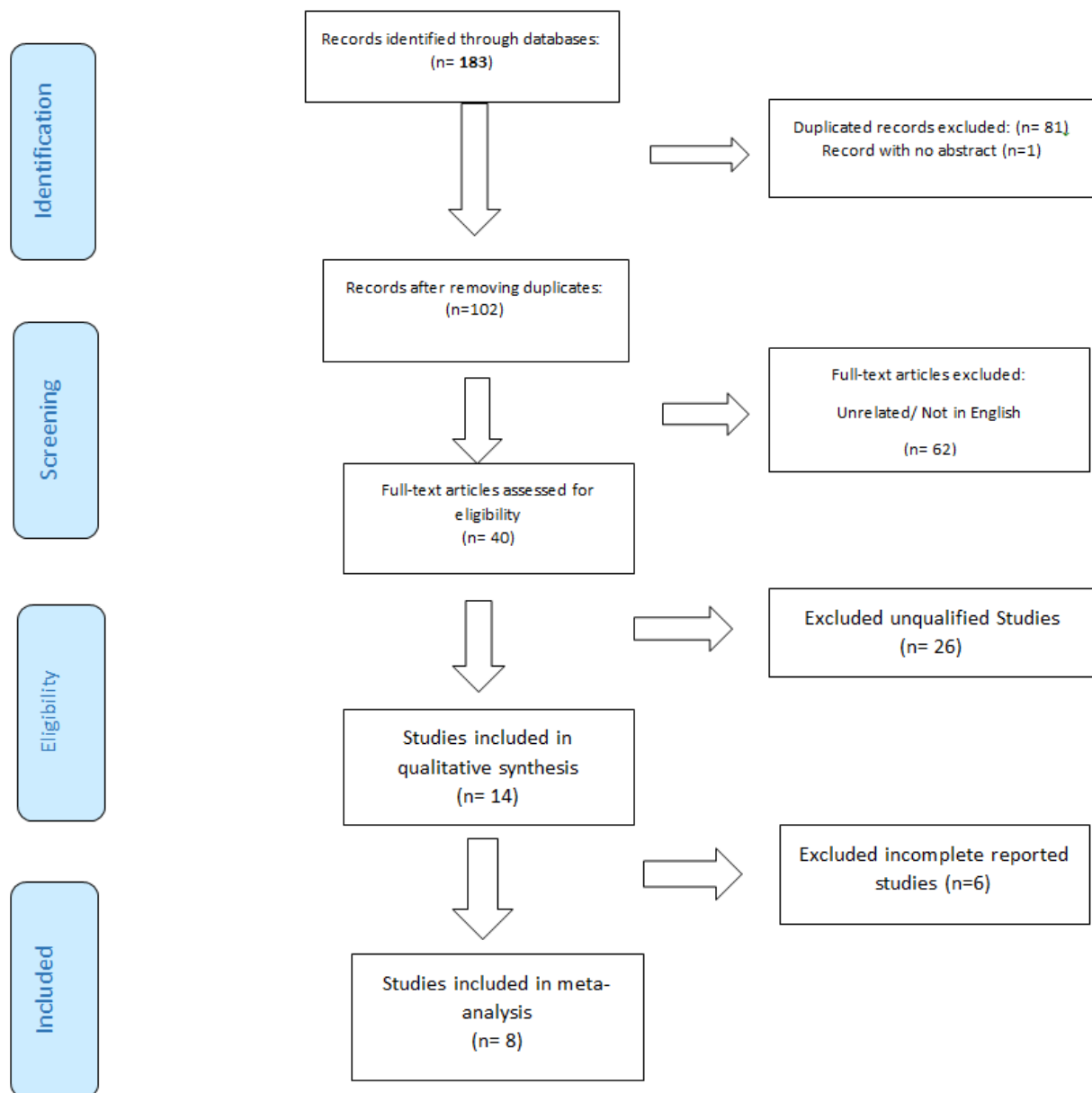


Figure 1) Standard Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) study flow-diagram

creasing pain as the primary outcome which has not been adequately explored [8, 9]. This systematic review was performed to evaluate the effectiveness of mindfulness interventions for pain-related outcomes, functional outcomes, medication-related outcomes and cost-effectiveness in LBP patients.

Method and Materials

Search strategy Articles which were published in peer-reviewed journals till February 2019 were identified based on searching in three major electronic databases including

PubMed, EMBASE, and Web of Science. The search was executed through using keywords such as mindfulness, mindfulness-based intervention, mindfulness meditation and CLBP.

To collect data, a total of 183 study abstracts were initially retrieved. Eighty-one duplicate records were detected and removed, so 82 study records maintained to be assessed. Furthermore one study was omitted because of having no abstract that caused 101 studies were screened by abstract for eligibility based on selection criteria. After abstract

review, 40 studies were appropriate and related for full-text evaluation. After full-text evaluation by more details, only 14 studies were selected for qualitative synthesis. Following eliminating of 6 studies because of incomplete report of statistical data, finally 8 articles were included in this study for assessment. Figure 1 shows the procedure of the assessment.

Based on inclusion criteria, the studies which evaluated Mindfulness Skills Training (MST) as intervention with presence of a control group, studies with design of Randomized Control Trial (RCT), studies in which the intervention lasted at least one month with regular mindfulness practice (eg, MBSR, MBCT) with at least 6 sessions participation were included in the study. In addition, studies with patients aged at least 18 years old and suffering from CLBP for at least 6 months were another inclusion criteria. Studies were excluded the if they did not report at least one tool for measuring pain or function before and after intervention.

The study selection flowchart is shown in Figure 1. Two independent researcher reviewed articles for inclusion/exclusion criteria. In the situation of disagreements, discussion session was held for final decision. Studies were evaluated by prepared checklist consisting items on population, intervention, outcome, study design, based on systematic reviews commentary. Review of extracted abstracts resulted in inclusion of 40 studies. These articles were retrieved for full-text review, and 26 additional articles were subsequently excluded. Main reasons for exclusion were study design, inappropriate intervention or non-adult CLBP population. Lack of a measure for physical function or pain was the most common reason for studies exclusion after full-text review. Finally, 8 articles were included in the analysis which were described in Table 1.

Data extractions and risk of bias

The extracted variables from studies were study design, target population, study location, age of participants, intervention type, duration of treatment, sample size, function or pain measure, and cost-effectiveness. Characteristics of included studies are presented in Table 1.

Findings

A total of 8 studies were included (Table 1). All studies were RCTs which were published between 2002 and 2019. Studies were implemented in different countries. The sample size ranged from 35 to 342 patients. Only in two studies cost-effectiveness of the intervention were evaluated. Mindfulness and meditation techniques were most frequent intervention applied in the studied studies. Data extractions and risk of bias is shown in Table 2. Considering this Table, regarding random sequence generation, 50% of the studies had unclear risk, 37.5% of them had low risk, and 12.5% had high risk. Regarding allocation concealment, 37.5% of studies had unclear risk, 37.5% had low risk, and 25.0% had high risk. Regarding blinding (participants and personnel), 37.5% had unclear risk, 37.5% had low risk, and 25.0% had high risk. Regarding blinding (outcome assessment), 50.0% had unclear risk, 50.0% had low risk, and 0.0% had high risk. Regarding attrition, 37.5% had unclear risk, 50.0% had low risk, and 12.5% had high risk. Regarding selective reporting, 100.0% had unclear risk.

All included studies were high qualified, with scores of 100% (one study) and 70-80% for other studies. All 8 studies had at least one measure of self-reported physical function. The most frequently used measure of physical function was the Short-Form Health Survey. This measure evaluating QoL with 21 items which assesses role limitations due to physical problems, energy/fatigue,

Table 1) Characterization of the studied studies

Study	Participants	Age	Design	Intervention type	Duration	Control	Measurements	Findings
Jensen MP, et al. ⁽¹³⁾	165	53,15	RCT	Mindfulness meditation intervention	20 wks	Usual care	numerical scale 10–0 of Pain intensity. West Haven-Yale Multidimensional Pain Inventory. Depression Scale short form (CESD). Pain Catastrophizing Scale (PCS). Cognitive process: short form Five Facet Mindfulness Questionnaire	Findings of this study approved impressive roles of cognitive content and cognitive processes in adaptation of the chronic low back pain patients to chronic pain.
Zgierska AE, et al. ⁽¹⁴⁾	35	51.8 ± 9.7	RCT	Mindfulness meditation/ (eight weekly 2-hour group sessions, at-home practice 6 days/week	26 wks	Usual care for opioid-treated CLBP	Direct costs were reported by patients and included healthcare utilization cost, medication use, while indirect cost consisted lost productivity cost, and total costs was calculated using direct plus indirect costs.	Total costs for intervention was calculated as below: \$15,497 ± 13,677 (direct costs: \$10,635 ± 9,897; while indirect costs: \$4,862 ± 7,298) per patient. Intervention group experienced pain reduction and functional improvement No statistically significant differences between both groups based on direct or indirect costs.
Herman PM, et al. ⁽¹²⁾	342	49.5	RCT	CBT and MBSR were offered in 8 weekly 2-hour group sessions.	One year	Usual care	Cost-effectiveness was defined as increase in the sum of healthcare costs such as medication, visits and admission in addition to productivity losses over change in quality-adjusted life-years .((QALYs	The mean cost in CBT group showed \$125 (95% CI: –4103, 4307) increment and in MBSR group, \$724 (CI: –4386, 2778) was calculated to be spent more. These costs (and cost savings) were significant associated with QALYs change over control group: 0.041 (0.015, 0.067) for CBT and 0.034 (0.008, 0.060) for MBSR.”
Zgierska AE, et al. ⁽¹⁵⁾	304	51.8 – 9.7	RCT	Targeted MM-based intervention consisted of eight weekly 2-hour group sessions and homepractice (30minutes/d, 6 days/ wk)	26-wks	Usual care for opioid-treated CLBP with 30 mg of morphine-equivalent dose (MED) per day for 3 months or longer.	Patient adherence to sessions: number of days per week; number of minutes per day (by researcher in hospital). Treatment satisfaction: quantitatively (0–10 Likert scale responses; 10 = “very likely/ very important”) and qualitatively by forms consisting open-ended questions.	Participants reported on average, 164.0 – 122.1 minutes of formal practice per week during the 26-week study. The time duration of 103.5 – 111.5 minutes of brief, informal practice per week was recorded by patients. Considering satisfaction, their qualitative responses approved the course was useful for pain management and they suggested this program for other patients. No serious adverse effects were reported among the intervention participants.

Continue the table 1)

Study	Participants	Age	Design	Intervention type	Duration	Control	Measurements	Findings
Cherkin DC, et al. (16)	342	49.3	RCT	CBT and MBSR and yoga) were delivered in 8 weekly 2-hour groups	52 wks	Medication and at home non-supervised exercises	Co-primary outcomes were the percentages of participants with clinically meaningful ($\geq 30\%$) improvement from baseline in functional limitations (modified Roland Disability Questionnaire [RDQ]; range 0 to 23) and in self-reported back pain bother sameness (0 to 10 scale) at 26 weeks.	RDQ scores showed significant improvements among intervention group with 61% pain control in MBSR group and 58% in CBT group rather than 44% for control group (overall $P = 0.04$; MBSR versus usual care: RR [95% CI] = 1.37 [1.06 to 1.77]; MBSR versus CBT: 0.95 [0.77 to 1.18]; CBT versus usual care: 1.31 [1.01 to 1.69].
Aleksandra E. Zgierska et al. (17)	35	51.8	RCT	The meditation-CBT intervention	26-wks	Medication, treatment management, progress monitoring, Special care, physical therapy, complementary therapy.	Primary outcomes were pain intensity and physical function. Collected data during sessions included a pain, function, general psychological and physical health, medication and other substance use self-reported questionnaire; biomarkers (urine analysis for toxicology; venous blood for biomarkers); and pain psychophysics.	Based on this study, mindfulness meditation and CBT-based interventions are potentially useful options for pain management in patients with CLBP. Growing interest of chronic low back pain patients in meditation and other complementary health options as well as non-invasive modalities are bolded in recent years, therefore, more research is needed to prove effectiveness of above-mentioned issues.
Natalia E. Morone et al. (18)	282	--	RCT	The intervention was modeled on the 8-week Mindfulness-Based Stress Reduction program.	8 wks	Group health education program based on the "10 Keys" to Healthy Aging	The primary outcome was RMDQ scale which contains 24 questions specific for functional limitations in LBP patients. Present pain score, average, and the most severe pain score during the past 7 days was gathered using self-report questionnaire with the Numeric Pain Rating Scale (range, 0-20). Quality of life was measured with the RAND-36 Health Status Inventory.	Teaching of mindfulness meditation methods led to significant improvements in physical function for short period of time and most severe pain intensity in longtime. Unfortunately, the functional improvement was not persisted in comparison to pain. This trial suggests the mindfulness as potential treatment choice of chronic LBP. Some reforms in mindfulness program could enhance its effectiveness in physical function of patients.
Natalia E. Morone et al. (19)	37	74.9	RCT	The intervention was modeled on the work of Jon Kabat-Zinn and the MBSR program	8 wks	Usual care	Pain intensity: McGill Pain Questionnaire Short Form (MPQ-SF) Pain acceptance: Chronic Pain Acceptance Questionnaire (CPAQ). Quality of life (QOL): SF-36 Health Status Inventory and Physical function: the Roland and Morris Questionnaire	8-week mindfulness meditation intervention was effective for older adults with CLBP. Its benefits lasted for 3 months. The participants had tendency to continue the program as it caused sustained physical function improvement and pain acceptance. Mind-body therapies are a promising noninvasive adjuvant therapy to current pain management for older adults.

Table 2) Risk of bias of studies

Study	Random sequence generation	Allocation concealment	Blinding (Participants and personnel)	Blinding (Outcome assessment)	Attrition	Selective reporting
Jensen MP, et al.	Unclear	Low risk	High risk	Unclear	Unclear	Unclear
Zgierska AE, et al.	High risk	Low risk	Low risk	Unclear	High risk	Unclear
Herman PM, et al.	Low risk	High risk	Low risk	High risk	Low risk	Unclear
Zgierska AE, et al.	Unclear	High risk	High risk	Unclear	Unclear	Unclear
Cherkin DC, et al.	Unclear	Low risk	Low risk	Unclear	Unclear	Unclear
Aleksandra E. Zgierska et al.	Unclear	Unclear	Unclear	High risk	Low risk	Unclear
Natalia E. Morone et al.	Low risk	Unclear	Unclear	High risk	Low risk	Unclear
Natalia E. Morone et al.	Low risk	Unclear	Unclear	High risk	How risk	Unclear

bodily pain, and general health perceptions. The Roland-Morris Disability Questionnaire (RMDQ) was used in two studies to assess limitations in physical functioning related to LBP. Although Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) guidelines recommended use of both generic and disease-specific scales, only two studies used both of measures.

Other secondary outcomes

Psychological factors (such as anxiety and depression) as secondary outcomes were expressed in four of eight studies. QoL was assessed in two studies, one of which showed that mindfulness led to statistically significant improvements. Two studies evaluated cost-effectiveness of the intervention and only one study reported quality-adjusted life-years (QALYs).

Types of mindfulness interventions

The MBSR method was the main intervention that was used in the studies. Most of the studies utilized at least six sessions and 2 hours (30 minutes for each session) weekly. Duration of intervention varied between 8 to 26 weeks, while one study - in which

cost-effectiveness was evaluated - conducted during one year. Mindfulness-Based Stress Reduction defines the practice of mindfulness as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment”. Using MBSR in chronic pain treatment, causes acceptance of pain as usual reaction of body and control of thoughts about pain. This method is performed in groups, and includes sitting meditation and mindfulness movement in addition to intensive meditation practice between group sessions. Other methods were rarely used in the studies and were least different in comparison with MBSR. The basic components are the same with some differences in number of sessions and program differences between sessions at home.

Effect of MST on pain control

Five out of eight studies approved pain improvement among MBSR method in comparison to usual cares. One study showed short-time increase in physical ability of patients underwent intervention, while pain management lasted for long-

time. In contrast, other study suggested improvements in pain and physical function through 3 months follow up.

MST cost effectiveness

In one of studies evaluating total costs estimation was $\$15,497 \pm 13,677$ (direct: $\$10,635 \pm 9,897$; indirect: $\$4,862 \pm 7,298$) for each patient. However, intervention group participants, compared to controls, had no statistically significant within-group changes or between-group differences in direct and indirect costs. Other study showed that compared to usual care, incremental pattern in cost per participant among CBT group which was $\$125$ (95% CI: $-4103, 4307$). They found approximately saving of $\$724$ in intervention group. Costs differences per participant between intervention group and usual care were $\$495$ for CBT over usual care and $-\$982$ for MBSR. QALYs in CBT/MBSR group over usual care were significantly improved and were associated with these costs: 0.041 (0.015, 0.067) for CBT and 0.034 (0.008, 0.060) for MBSR.

Discussion

Chronic low back pain in adults is a consuming and long-time bothering health issue effecting a majority of people worldwide yearly [1, 2]. Treatment of CLBP in older adults is limited due to various adverse effects of analgesics. Efficient non-pharmacologic treatment options are needed in order to improve patient' QoL as well as reducing their costs for pain reduction and different treatments [10]. This systematic review was designed to determine the effects of mindfulness on patients' pain, extent of medication use, functional capacity and overall cost-effectiveness of this intervention. In most of the studies MBSR meditation technique was the main intervention used which had a significantly positive effect on pain reduction and analgesic use.

On the other hand, some of RCTs provided conflicting results in physical functioning section. For instance, some showed long time pain reduction and improved physical activity capacity while some others showed only long-time pain reduction in additional follow-ups, so it is suggested to conduct longer mindfulness treatments in order to both test and increase the effectivity in this section. Therefore, findings of this study may suggest inconclusive evidence for the efficacy of MBSR for improving physical functioning. Studies that have estimated the cost-effectiveness of mindfulness techniques were almost few in this systematic review, and the results may not be entirely reliable and this indicates the need for further research. But according to these studies findings suggest that MBSR as the first selection, and less importantly CBT, as second choice, can provide significantly cost-effective treatment for CLBP for payers and society [11, 12].

The most important limitation of this study was heterogeneity among studies' protocols and setting for example follow up time. This study evaluated one of hot topics in pain management field with enough study numbers and strong methodology. Studies were from United states, Brazil, India and European countries which cause acceptable generalization ability of interpretation of results. Future reviews will be more scientific if studies use the same outcome measures with longer period follow up.

Conclusion

The findings of this study support strategy of using the nonpharmacological therapies for CLBP and shed light on its' effectiveness in pain management in adults. Additional research to evaluate their effects' persistence in longer period of time and the cost-effectiveness of these interventions in comparison to medications may be needed.

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Author Contribution: SN contributed to the project as the main executor. He has recently graduated from Tehran University of Medical Science as MD. He conducted all stages of the review.

Conflict of Interests: The author declares no conflicts of interest in this work.

Ethical Approval

The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences according to Helsinki Declarations.

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