SAIUK, Nazarii, KOŁODZIEJ, Magdalena, KOZICZ, Michał Andrzej, MĄDRY, Wojciech, MAZURKIEWICZ, Aleksandra, MĘCZYŃSKA, Joanna, SEREDYŃSKI, Tomasz, WOJCIECHOWSKA, Adriana, MARCICKA, Justyna and SALASA, Weronika. The Role of Mindfulness-Based Interventions in Treating Depression among Population Subgroups. Journal of Education, Health and Sport. 2024;66:50080. eISSN 2391-8306.
https://dx.doi.org/10.12775/JEHS.2024.66.007
https://apcz.umk.pl/JEHS/article/view/50080
https://zenodo.org/records/10997069

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).
Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).© The Authors 2024;
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The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 28.03.2024. Revised: 10.04.2024. Accepted: 15.04.2024. Published: 19.04.2024.

The Role of Mindfulness-Based Interventions in Treating Depression among Population Subgroups

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Abstract:

Introduction

Major depressive disorder (MDD) is one of the most common psychiatric disorders, with its prevalence on the rise. The use of mindfulness-based interventions (MBIs), primarily

including mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR), in MDD is scientifically justified. But will every population subgroup benefit from such an approach?

Aim of the study

The aim of our study is to analyze, based on the latest scientific findings, the effects of MBIs within specific subgroups of patients suffering from depression, including adolescents, elderly patients, cancer patients, individuals experiencing postnatal and perinatal depression, and patients with chronic pain. Additionally, we sought to summarize the current knowledge regarding the structural and functional effects of MBIs on the human brain.

Materials and methods

We conducted a comprehensive search of scientific databases including PubMed and Google Scholar to identify relevant articles focusing on MBIs and their effects on treating depression within various subgroups. Additionally, we performed a review of literature available on PubMed and Google Scholar to summarize the current knowledge regarding the impact of MBIs on the human brain.

Conclusions

Across various subgroups MBIs show promise in reducing depressive symptoms, indicating their potential as adjunctive treatments or preventive measures. While longer intervention durations are associated with larger effects, further research is needed to establish a solid evidence base, particularly in older populations and cancer patients with different cancer types.

Key words: “Mindfulness”; “Mindfulness-based congitive therapy”; “Mindfulness based stress reduction”; “depression”; “Major depressive disorder (MDD)”.

Introduction

Major depressive disorder (MDD) presents as pervasive and enduring low mood and a lack of interest in typically enjoyable activities. These symptoms coincide with a spectrum of additional manifestations, such as disrupted eating patterns, sleep disturbances, fatigue, diminished self-esteem, and recurrent morbid ideation[1]. Regrettably, MDD stands as one of the prevailing mental health afflictions today.

The correlation between depression and various negative consequences has been firmly established, resulting in heightened vulnerability to medical and psychiatric ailments, including increased societal costs such as healthcare expenditures and lost productivity[2–4]. Up to date,

common non-pharmacological interventions for depression include Cognitive Behavioral Therapy, Mindfulness-Based Cognitive Therapy (MBCT), Interpersonal Psychotherapy, Psychodynamic Therapy, Supportive Individual Psychotherapy, and Dynamic Interpersonal Therapy[5].

Mindfulness is the process leading to a mental state characterized by nonjudgmental awareness of present-moment experiences, encompassing sensations, thoughts, bodily states, consciousness, and the environment, while fostering openness, curiosity, and acceptance[6,7]. Mindfulness-Based Interventions (MBIs) aim to assist individuals in directing attention to the present moment and becoming aware of various stress manifestations[8,9]. Research indicates that MBIs effectively reduce anxiety and depressive symptoms in adults with moderate effects[10]. Moreover, MBIs have demonstrated efficacy in preventing the relapse of MDD among participants with a history of three or more depressive episodes[11,12]. The precise mechanism of MBIs appears to involve direct positive impacts on the brain, such as reducing cortisol levels in the bloodstream, mitigating adverse psychological symptoms and negative emotional responses, enhancing subjective well-being, and refining behavioral regulation[13,14]. Additionally, it may contribute to lowering blood pressure, enhancing cardiovascular and immune function, and potentially influencing gene expression while bolstering the adaptability of brain circuits, thereby fostering more positive and optimistic emotional states[15]. MBIs typically encompass two main types: Mindfulness-Based Stress Reduction (MBSR) and MBCT[16].

MBSR is an eight-week program designed to help individuals harness their inherent abilities to better manage stress, pain, and illness. Numerous studies employing this approach with adults have demonstrated its efficacy in reducing depression[17], enhancing physical well-being[18], alleviating loneliness[19], and mitigating stress and anxiety[20].

MBCT, developed by Segal et al., as an adaptation of Kabat-Zinn's MBSR, aims to prevent relapses in recurrent depression. MBCT integrates elements of cognitive therapy and mindfulness meditation into an organized eight-week group training program, which includes a full-day sessions, along with assigned homework[11].

While MBIs offer numerous potential benefits, it is essential to recognize the potential for adverse effects. Some literature has documented symptoms like anxiety, PTSD, depression, dissociation, psychosis, and religious delusions, as well as risks of seizures and somatic symptoms associated with mindfulness practices[21]. A recent systematic review assessing adverse outcomes linked with MBSR and MBCT concluded that these interventions are

generally considered safe; however, only a limited percentage of randomized controlled trials included monitoring for adverse effects[22].

Structural and functional effects of MBIs on the human brain

The impact of MBIs on the human brain has been a subject of extensive research, with studies employing various neuroimaging techniques, physiological measurements, and behavioral tests. Studies indicate that meditation training may change the resting state of the human brain and different directions of change have been reported[23].

Taylor et al. (2013) investigated the influence of mindfulness practice on functional connectivity within the Default Mode Network (DMN). Experienced meditators exhibited altered connectivity between DMN regions associated with self-referential processing and emotional appraisal. It suggests that meditation training induces changes caused by strengthened present-moment awareness[24]. In a newer study conducted by Smith et al. (2020), the impact of **MBSR** on DMN connectivity in women with chronic neuropathic pain (CNP) following breast cancer treatment was analyzed. **MBSR** significantly altered DMN connectivity, particularly between the posterior cingulate cortex and medial frontal regions. This altered connectivity was associated with reductions in pain severity, suggesting the potential of MBSR as a non-pharmacological adjunct treatment for CNP[25]. In an fMRI study conducted by Huang et al. (2019), the effects of an 8-week **MBCT** on emotion regulation and executive function in bereaved individuals were explored. MBCT led to a decrease in grief, anxiety, and depression, coupled with improved cognitive control. Neuroimaging revealed reduced DMN activity, specifically in the anterior cingulate cortex and posterior cingulate cortex, indicating less cognitive load during an executive control task. The study suggested the potential of MBCT in enhancing emotional well-being and cognitive functions in grieving patients[26].

The study conducted by Paul et al. (2013) focused on the psychological and neural mechanisms of mindfulness in reducing depression vulnerability. The study analyzed various facets of mindfulness to ascertain which ones provide protection against negative bias and rumination, recognized as key risk factors for depression. Higher non-reactivity, one of facets, was inversely correlated with depression vulnerability, accompanied by neural correlates. Non-reactivity was associated with reduced rumination and less negative bias, negatively correlated with anterior insula activation during negative stimuli engagement[27]. Furthermore a case-study by Aydın et al. (2023) with 69 MDD patients and 93 healthy controls suggested that non-

reactivity, in contrast to other facets of mindfulness, is stronger corelated with the intensity of depressive symptoms in individuals diagnosed with MDD. Emphasizing this specific facet of mindfulness has the potential to generate improved results in alleviating depressive symptoms[28].

Kang et al. (2013), in their cross-sectional study, used diffusion tensor imaging and cortical thickness mapping to explore structural changes in gray and white matter associated with meditation. Individuals practicing meditation displayed increased cortical thickness in regions associated with anterior emotional processing, encompassing the medial prefrontal cortex, superior frontal cortex, temporal pole, the middle and interior temporal cortices. Conversely, a decrease in cortical thickness was observed in posterior areas, including the postcentral cortex, inferior parietal cortex, middle occipital cortex, and posterior cingulate cortex, which are linked to self-referential processing. White matter integrity was enhanced in the anterior brain, suggesting improved information flow between regions associated with attention and emotional regulation[29]. Yang et al. (2019), in their study, looked for alterations in brain structure and amplitude of low-frequency after 8 weeks of mindfulness meditation training. The primary focus was on the parietal cortex, where there was a relative increase in cortical thickness observed in the left precuneus. Additionally, greater thickness was observed in the left superior parietal cortex[30]. In contrast, the two RCTs conducted in 2022 found that short-term mindfulness meditation training, as delivered in an 8-week MBSR course, did not result in significant group differences in structural brain changes when compared to an active control intervention or a waitlist control group. The findings emphasize the need to consider individual differences, intervention duration, and specific meditation practices in future research[31]. Santarnecchi's et al. (2014) study indicated an increase in cortical thickness in the right insular lobe and somatosensory cortex following the 8-week MBSR training program[32].

In summary, mindfulness practices have demonstrated diverse effects on the human brain, influencing resting state, functional connectivity, and structural features. Research highlights potential benefits for mental health and cognitive functions. However, conflicting findings and the need for individualized approaches underscore the importance of continued exploration in understanding the nuanced impact of mindfulness on the brain.

The effect of MBIs on subgroups with depression

1. Depression among adolescents

Depression among adolescents is a significant public health concern, affecting approximately 8 to 20% of adolescents before the age of 18 globally[33]. This condition poses a serious threat to the physical and psychological well-being of adolescents, leading to potential negative social and behavioral consequences, including academic failure[34], social disorders[35], drug use[36], and suicide[37].

In recent years, several meta-analyses have been conducted, examining the impact of MBIs on depression in adolescents[38–43].

In the latest meta-analysis by Chi et al., eighteen randomized controlled trials involving 2,042 adolescents and young adults were analyzed to assess the effectiveness of MBSR on depressive symptoms. The review identified a moderate posttest effect of MBSR in reducing depressive symptoms among adolescents when compared to control groups. Furthermore, MBSR was efficacious for both clinical and nonclinical groups, aligning with prior systematic reviews indicating the effectiveness of MBIs in reducing depressive symptoms in diverse samples of children and youth[40–43]. Additionally, the research revealed that longer intervention durations were associated with larger effects of MBSR on depressive symptoms, particularly during the follow-up period. This finding was consistent with a previous meta-regression study[40,44]. However, the literature on the moderating effect of treatment duration on the efficacy of MBSR remains inconclusive. For instance, Carmody et al. (2009) did not find a significant correlation between class contact hours and the mean effect size of MBSR interventions[45].

In conclusion, the moderate effect size of MBSR suggests its promising potential in reducing depressive symptoms and makes it applicable to the treatment of depression or depressive symptoms in adolescents with varying levels of severity. This includes those expressing depressive symptoms to those clinically diagnosed with depression. Given the growing interest in positive education, integrating MBSR into school-based educational programs targeting positive mental health could be a valuable strategy to enhance students' emotional well-being.

2. Depression among elderly patients

Depression among individuals aged 60 and above stands as one of the prevailing mental health challenges, with prevalence 1%-35%[46]. Particularly, elderly individuals who are

hospitalized or reside in care centers due to physical ailments or cognitive and physical decline tend to exhibit higher rates of depression[47]. This subgroup might demonstrate resistance towards MBI due to unfamiliarity[48], compounded by potential physical or cognitive impairments[49], which could impede their participation in MBI. Consequently, there's a distinct need for targeted research on MBCT within this older population.

Research focusing on the efficacy of MBIs for individuals aged 65 and older is limited, as studies predominantly concentrate on those below 65 years. However, recent meta-analyses conducted by Thomas et al. (2020) and Lindayani et al. (2020) have shed some light on this issue[50,51].

Thomas et al. conducted a meta-analysis comprising nine studies, encompassing various methodologies including mixed-method studies, quasi-experimental designs, a collection of five single case reports, and a randomized controlled trial. The study analyzed the use of MBCT for the treatment of anxiety and depression in older people. All nine studies acknowledged favorable findings regarding the advantages or suitability of MBCT for elderly individuals experiencing anxiety and/or depression. Additionally, six of these studies highlighted the necessity for additional research in this domain. Nevertheless, most of analyzed evidence remains insufficient to support the use of MBCT for managing anxiety and depression in older adults. While initial studies report positive outcomes, methodological weaknesses such as ethical considerations, variations in age criteria and depression diagnosis limit their applicability in clinical settings[50].

In contrast, Lindayani et al.'s meta-analysis of five Randomized Controlled Trials (RCTs) suggested a positive impact of MBSR therapy on reducing depression levels in the elderly, with no reported side effects compared to pharmacological interventions[51].

In conclusion, further robust research is imperative to establish a solid evidence base for MBIs in older individuals with depression.

3. Depression among cancer patients

In the global population, cancer remains a significant contributor to morbidity and mortality[52]. The number of individuals living with cancer is steadily increasing worldwide[53]. Apart from its detrimental somatic effects, cancer diagnosis often leads

to substantial psychological distress, including loneliness, anxiety, and depression[54,55]. Surveys indicate that many cancer patients find coping with the emotional impact of cancer more challenging than dealing with physical discomfort[56].

We identified six meta-analyses addressing the application of MBIs in depression among oncology patients, with two studies focusing on specific cancer types such as lung cancer[57] and breast cancer[58], while four analyzed the issue regardless of cancer type[59–62].

In the most recent meta-analysis by Yu et al., which included 16 studies involving 2072 cancer patients, researchers analyzed the impact of MBSR in relieving loneliness, anxiety, and depression in this population. Their findings revealed that compared to standard care, MBSR significantly alleviated loneliness, anxiety, and depression among cancer patients. Fear of cancer progression or recurrence often contributes to anxiety and depression in cancer patients. It is confirmed that mind-body interventions, particularly MBSR, effectively reduce the fear of cancer recurrence, potentially explaining the beneficial effects of MBSR on anxiety and depression in this population. Due to the fact that the meta-analysis by Yu et al. predominantly included patients with breast cancer, future high-quality and large-scale randomized controlled trials (RCTs) should investigate the impact of MBSR on patients with other cancer types as well[62].

A larger study conducted by Chayadi et al. (2022) synthesized findings from 36 existing studies examining the effects of various MBIs, including MBSR, MBCT, and Mindfulness-Based Cancer Recovery (MBCR), on depression, anxiety, and cancer-related fatigue (CRF) in oncology patients. The results indicated significant medium effects of MBIs in reducing symptoms of depression, anxiety, and CRF, with sustained effects at least three months post-intervention. However, while MBIs were superior to control groups in reducing symptoms immediately after intervention, this superiority was not maintained for depressive symptoms after three months post-intervention. The risk of bias in the included studies ranged from low to moderate.[61]

Overall, the present findings suggest that MBIs are effective in reducing depression symptoms among cancer patients, although the durability of such effects remains uncertain. Future research should continue to investigate the effectiveness and cost-effectiveness of providing MBIs to this population.

4. Perinatal and postnatal depression

It is estimated that around one in five mothers experience depression and anxiety during pregnancy and within the first year postpartum, collectively known as the perinatal period. Postpartum depressive symptoms tend to be more prevalent among new mothers compared to age-matched non-childbearing individuals, partly due to specific risk factors inherent to the perinatal period, such as pregnancy complications and hormonal, neurological, and inflammatory fluctuations[63,64]. Globally the prevalence of perinatal depression is reported to be as high as 11.9%[65].

We have identified five meta-analyses investigating the impact of mindfulness on depression related to pregnancy. Leng et al. (2023), Reangsing et al. (2024), and Corbally et al. (2021) explored the effects of MBIs on perinatal depression, while Trapani et al. (2024) and Yang et al. (2023) focused on postnatal depression[66–70].

In their study, Leng et al. analyzed 25 RCTs to summarize evidence regarding the effectiveness of MBIs on perinatal depression and anxiety. This meta-analysis included 2495 women with diverse symptom profiles during pregnancy and up to one year postpartum. The results indicate that MBIs effectively alleviate perinatal depression compared to controls, with sustained improvement observed up to one year postpartum. The quality of evidence was deemed moderate.[66] Reangsing et al. (involving 19 studies with 717 pregnant women participating in MBIs and 763 serving as controls) found significant improvement in depression among pregnant women, particularly with MBCT.[67] Corbally et al. (comprising 12 studies, including 10 randomized and 2 non-randomized controlled trials) analyzed the effect of MBI on stress, depression, and anxiety during the perinatal period in women without pre-existing stress, depressive, or anxiety disorders. They observed a small but statistically significant reduction in depression after MBIs compared with controls, suggesting that MBIs not only treat but also prevent depression during pregnancy.[68]

Yang et al. conducted a study analyzing the impact of MBIs on postpartum depression. Their meta-analysis, including eleven randomized controlled trials and one self-controlled trial, demonstrated improvement in postpartum depression symptoms in the experimental group compared with controls, indicating that MBIs can effectively mitigate negative emotions. Furthermore, the MBCT intervention group exhibited a significantly lower relapse rate and severity of depression symptoms compared to the control group, highlighting the program's effectiveness in reducing the risk of postpartum depression.[70]

Trapani et al.'s meta-analysis focused on the long-term effects on postpartum depression in patients who underwent MBI during pregnancy. They included six studies, and the overall effect size significantly reduced postpartum depression symptoms severity in the MBI group compared to the control group in the first 3 months after childbirth. The effects of MBIs were particularly significant in women with a low risk of developing postpartum depression, suggesting enduring benefits.[69]

Overall, the findings from these studies suggest that clinicians and healthcare providers should consider integrating MBIs as adjunctive treatments to treat and prevent depression during pregnancy and the postnatal period.

5. Depression among patients with chronic pain

Pain represents the most commonly cited symptom among patients seeking medical consultation and stands as a prominent contributor to global disability[71,72]. Despite appropriate management of underlying medical conditions, pain may persist and transition into chronic pain when it extends beyond the typical duration of 3 to 6 months[73,74]. Individuals suffering from chronic pain often exhibit concurrent psychological distress or psychiatric conditions such as depression, anxiety spectrum disorders, and substance abuse disorders, which can substantially disrupt the course and prognosis of chronic pain[75,76]. Our analysis focuses on the impact of MBIs on depression in patients with chronic pain; we did not assess the influence of MBIs on chronic pain itself.

PubMed and Google Scholar databases were searched, and among studies fully addressing the issue, we found 3 cross-sectional studies[77–79], 1 pre-post study[80], 3 randomized controlled trials (RCTs)[81–83], and 1 meta-analytic review[84].

Overall, the sources agree that MBIs have a beneficial effect on the course of depression in patients suffering from chronic pain. In the latest cross-sectional study by Miniati et al., the relationship between mindfulness levels and the manifestation of distress, anxiety, and depression among chronic pain patients was explored. A subset of chronic pain patients exhibiting elevated mindfulness traits reported lower levels of anxiety, depression, and perceived stress compared to those with less pronounced mindfulness traits.[77]

In the pre-post study led by Marske et al., 28 chronic pain participants engaged in an 8-week group MBSR course comprising 2.5-hour weekly sessions under the guidance of an experienced MBSR instructor. Participants practiced techniques between sessions, aiming for

30 minutes daily, 6 days weekly. Surveys administered pre- and post-course revealed an overall decrease in depression, disability, and pain scores post-intervention.[80]

Moreover, MBIs can be effectively delivered online. In an RCT carried out by Hearn and Finlay, an 8-week online MBIs was compared against online psychoeducation. Results indicated a significant reduction in depression among participants receiving MBIs compared to those with psychoeducation. Additionally, reductions in anxiety, pain unpleasantness, and catastrophizing were observed in the MBIs group relative to the psychoeducation group.[83]

These findings suggest that MBIs hold promise as a complementary treatment for depression in patients with chronic pain, offering potential benefits beyond traditional therapeutic approaches.

Conclusions

Research on MBIs indicates promising possibilities for their application in alleviating symptoms of depression across various social groups. Adolescents, elderly patients, cancer patients, women in perinatal and postnatal depression, as well as individuals with chronic pain, can benefit from mindfulness practices.

Our literature review emphasizes the diverse benefits of MBIs, including the reduction in depressive symptoms, improvement in emotional regulation, cognitive functions, and physical health. Nevertheless, it is necessary to consider potential side effects and tailor approaches to individual needs, as noted in studies on adverse effects of MBIs.

It is also important to adapt MBIs to specific social groups, taking into account age differences, health status, and cultural context. Further research on MBIs across different patient groups can provide valuable insights into their effectiveness and utility in various clinical contexts.

Disclosure

Conceptualization, Nazarii Saiuk, Michał Andrzej Kozicz and Magdalena Kołodziej; methodology, Wojciech Mądry; software, Aleksandra Mazurkiewicz and Weronika Salasa; check, Joanna Męczyńska, Tomasz Seredyński and Michał Andrzej Kozicz; formal analysis, Magdalena Kołodziej and Adriana Wojciechowska; investigation, Adriana Wojciechowska and Weronika Salasa; resources, Magdalena Kołodziej; data curation, Justyna Marcicka; writing - rough preparation, Nazarii Saiuk; writing - review and editing, Tomasz Seredyński, Aleksandra

Mazurkiewicz and Wojciech Mądry; visualization, Michał Andrzej Kozicz; supervision, Nazarii Saiuk; project administration, Joanna Męczyńska, Justyna Marcicka.

All authors have read and agreed with the published version of the manuscript.

Funding statement

The study did not receive special funding.

Informed Consent Statement

Not applicable

Acknowledgments

Not applicable

Conflict of Interest Statement

The authors report no conflict of interest

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