How the practice of Mindfulness influences the treatment of patients with chronic non-cancer pain associated or not with other therapies: systematic review

Como a prática de Mindfulness influencia no tratamento de pacientes com dor crônica não oncológica associado ou não a outras terapias: revisão sistemática

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ABSTRACT

BACKGROUND AND OBJECTIVES: Chronic pain has a significant impact on patients' quality of life and the use of drug therapy is often insufficient. Therapies based on Mindfulness come in different forms and have been used as a strategy to manage this condition. Practices can guide attention to the present, help reinterpret pain and improve physical and emotional control skills via the cingulate cortex, somatosensory cortex, parietal operculum, cuneus, and anterior insula. This study seeks to evaluate the results of Mindfulness in terms of its influence on the quality of life of patients with chronic non-cancer pain and the neural changes that this practice promotes, such as greater or lesser activation or variation in size of areas as insula and cingulate cortex, and how these interfere with the perception of pain, with the aim of verifying the applicability of Mindfulness as a complementary method to treatment in this group of patients.
CONTENTS: Systematic Review submitted to PROSPERO datadase under number 359011. The search was carried out in the Pubmed, Medline, LILACS and DIALNET databases between 2019 and 2022 with the descriptors and Boolean operator [(MINDFULNESS) AND (CHRONIC PAIN)]. The selection of articles includes randomized clinical trials, cohort studies and case control studies in English, Spanish and Portuguese languages. The risk of bias was assessed using ROB2 and the quality of evidence using GRADE. After analysis, ten studies were assessed as essential for this review. Articles that addressed Mindfulness intervention for chronic pain that responded and added information to the research question were included and articles that did not focus on "Mindfulness" and "chronic pain", studies without free access and texts whose results were not published up to the date of the search were excluded. To analyze Mindfulness therapies, the majority of studies cover more than 50 patients and use scales such as the Brief Pain Inventory (BPI-DPN Q4), Patient Global Impression of Change (PGIC), Five Facet Mindfulness Questionnaire (FFMQ), Chronic Pain Acceptance Questionnaire (CPAQ) and Pain Catastrophizing Scale (PCS).
CONCLUSION: The practice of Mindfulness can reduce chronic pain and improving its perception, acceptability and quality of life by enabling the reduction of suffering, anxiety and stress associated with pain through neural changes. As there are limitations in the studies regarding the specific target population and standardization of assessment, it is recommended that future articles address the practice in children, the elderly and athletes with chronic pain, in addition to a detailed methodology to evaluate and promote the sessions. It should be noted that Mindfulness is not a cure for chronic pain, however it presents safety and effectiveness in its different application protocols, with a level of evidence similar to cognitive behavioral therapy.

Keywords: Chronic pain, Meditation, Mindfulness, Pain.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A dor crônica tem um impacto significativo na qualidade de vida dos pacientes e o uso de terapia farmacológica muitas vezes é insuficiente. As terapias baseadas em *Mindfulness (*Atenção Plena) apresentam-se de diversas formas e têm sido utilizadas como estratégia no manejo dessa condição. As práticas podem conduzir a atenção ao presente, auxiliar na reinterpretação da dor e aprimorar habilidades de controle físico e emocional via córtex cingulado,

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HIGHLIGHTS
- Mindfulness practice for chronic pain has a positive effect on reducing the perception of pain.
- Studies have shown that there are changes in neural activations during and after mindfulness practice that have an impact on nociceptive sensation.
- Mindfulness therapy for chronic pain can reduce the use of drugs such as opioids.

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somatossensorial, opérculo parietal, cúneo e ínsula anterior. O objetivo deste estudo foi avaliar a *Mindfulness* quanto a sua influência na qualidade de vida dos pacientes com dor crônica não oncológica e as alterações neurais que essa prática promove, como maior ou menor ativação ou variação de tamanho de áreas como ínsula e córtex cingulado, e como estas interferem na percepção da dor, tendo como finalidade verificar a aplicabilidade da Atenção Plena como método complementar ao tratamento nesse grupo de pacientes.

CONTEÚDO: Revisão Sistemática submetida no banco de dados PROSPERO sob o número 359011. Realizou-se a busca nas bases de dados Pubmed, Medline, LILACS e DIALNET entre 2019 e 2022 com os descritores e operador booleano [*(MINDFULNESS) AND (CHRONIC PAIN)*]. Inclui-se na seleção de artigos ensaios clínicos randomizados, estudos de coorte e estudos de caso controle nos idiomas inglês, espanhol e português. O risco de viés foi avaliado pelo ROB2 e a qualidade de evidência por meio do GRADE. Após análise, 10 estudos foram avaliados como essenciais para esta revisão. Foram incluídos os artigos que abordavam intervenção em *Mindfulness* para dor crônica que responderam e agregaram informações à pergunta da pesquisa e excluídos os artigos que não possuem o foco em "*Mindfulness*" e "dor crônica", estudos sem livre acesso e textos cujos resultados não foram publicados até a data da busca. Para analisar as terapias de *Mindfulness*, os estudos, em sua maioria, abordam mais de 50 pacientes e usam escalas como *Brief Pain Inventory (*BPI-DPN Q4*), Patient Global Impression of Change* (PGIC), *Five Facet Mindfulness Questionnaire* (FFMQ), *Chronic Pain Acceptance Questionnaire* (CPAQ) e *Pain Catastrophizing Scale* (PCS).

CONCLUSÃO: A prática de *Mindfulness* é capaz de diminuir a dor crônica e melhorar sua percepção, aceitabilidade e qualidade de vida ao possibilitar a redução do sofrimento, ansiedade e estresse associados à dor por meio de alterações neurais. Por haver limitações nos estudos com relação à população-alvo específica e à padronização de avaliação, recomenda-se que artigos futuros abordem a prática em crianças, idosos e atletas com dor crônica, além de metodologia detalhada para avaliar e promover as sessões. Ressalta-se que a *Mindfulness* não é uma cura para a dor crônica, no entanto apresenta segurança e eficácia em seus diferentes protocolos de aplicação, com nível de evidência similar à terapia cognitiva comportamental.

Descritores: Atenção plena, Dor, Dor crônica, Meditação.

INTRODUCTION

Chronic pain (CP) is considered a global public health problem that predominantly affects women and, in Brazil, has a prevalence ranging from 23.02% to 76.17% and a national average of 45.59%[1]. In addition, it is among the 10 most prevalent medical conditions in the world, causing a long period of disability, as well as triggering physical and emotional stress, increasing the risk of anxiety, depression, greater frequency of patients in health services and, consequently, more public costs[1-4]. It is known that CP can be the result of a mechanical, thermal or chemical nociceptive stimulus. From this, the body produces a signal that is transmitted by nerve fibers until it reaches the central nervous system (CNS). In addition, long-term changes in the CNS may generate pain, even in the absence of continuous neuronal stimuli. The signals affect sensory, cognitive and affective areas, and can thus interfere with one's emotional state[3-6].

Chronification of pain is defined by the International Association for the Study of Pain as a condition that persists or recurs for at least three months. It can occur in the absence of injury and can be the consequence of a morbid process[7]. As a complex symptom, CP can be theoretically divided into groups: (1) primary pain, such as headache, when it is a single complaint or (2) pain secondary to the underlying disease, such as cancer-related or post-traumatic pain[7]. This way, it is possible to understand the complexity of pharmacological treatment of patients with pain, as it is not free of adverse effects which can further affect the individual's quality of life[8-11].

That said, Mindfulness is defined as a treatment that involves controlling one's own attention, improving the ability to perceive cognition, emotion and sensation, reducing the suffering associated with pain, without fixating on thoughts of the past or future[2,6,8]. Its practice provides a decrease in the activation of pain-related areas, such as the cerebral cortex, and an improvement in pain processing regions. This process explains how different neural signals can decrease or intensify the sensation of pain and how sensory and emotional information interact[2,6,8]. This therapy can be promoted through a variety of techniques, such as Mindfulness of Breathing with Conscious Body Focus, which focuses pain patients' attention on their own breathing and other physiological body sensations, as well as movements of inhaling and exhaling, sensations that are forgotten in everyday life[2,6,8,10-13]. When the attention to breathing is established there are changes in the way patients responds to pain, making it more tolerable[2,6,8,10-13].

In this context, Mindfulness-Based Interventions (MBIs) have become the target of research aimed at managing pain and its consequences. Considering today's lifestyle, the intention of practicing Mindfulness is to make the practitioner choose to be fully aware of their body and thoughts, and to strive to achieve this goal. With this objective, there should also be no judgment as to the feelings and thought content that arise, accepting all feelings, thoughts and sensations as legitimate[10,12-14].

The present study's objective was to assess how Mindfulness therapy influences the health-disease process of patients with non-oncological CP, in relation to quality of life and the neural changes promoted by the practice of Mindfulness, which influence the perception and control of pain. In addition, the aim is to synthesize the results in order to generate reliable information in the health field and broaden the problematization in the Mindfulness scenario, not limiting it to discussions of Integrative and Complementary Health Practices (ICHP).

CONTENTS

This systematic review used the recommendations of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[15]. The guiding question of the research is: "How can

the practice of Mindfulness influence the health-disease process of patients with chronic pain?" structured and organized by the acronym PICO (Table 1). This systematic review was submitted to the PROSPERO database under number 359011.

Table 1. PICO research strategy.

Acronym	Used in this study
P (patient)	Patients with chronic non-cancer pain
I (intervention)	Mindfulness practice
C (control)	Chronic pain associated or not with other previous and ongoing pharmacological or non-pharmacological therapies
O (outcome)	Health-disease process

A survey was carried out in June 2022 in the Pubmed, Medline, LILACS and DIALNET databases for results from 2019 to 2022. The descriptors used in the search were selected from the Descriptors in Health Sciences (DeCS) dictionary and Medical Subject Heading Terms (MeSH), considering articles in Portuguese, Spanish and English, with the descriptors and Boolean operator being: [(MINDFULNESS) AND (CHRONIC PAIN)]. Priority was given to articles with the highest degree of recommendation by the Oxford Centre for Evidence-based Medicine, which are "Randomized clinical trials", "Cohort studies" and "Case-control studies".

This search was motivated by the increased relevance of the topic, as evidenced by the World Health Organization (WHO), which in 2017 included Mindfulness in the recommendations of ICHP for the promotion of mental health. Harvard University, which is recognized for its expertise in producing studies and research relevant to society, published a note on its website in 2019 about the growing spread of Mindfulness practice. Another indication of this widespread prominence is that companies such as Google®, Intel® and Apple® have recently introduced Mindfulness with a view to well-being and productivity at work[16-20].

DATA COLLECTION

Data extraction for the study eligibility process was carried out using tables in the Excel, Word and Google Docs software. After screening the studies, the selected articles were reviewed and the data was extracted in a standardized way by the three authors, identifying the author, year of publication, population, sample, intervention, comparatives and conclusion (Table 2). The outcome of interest was to systematize evidence on Mindfulness applied to patients living with CP and its influence on this health-disease process.

ASSESSMENT OF METHODOLOGICAL QUALITY AND RISK OF BIAS

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool[21] was used to check the quality of evidence and the recommendations of the articles included. It uses specific criteria to evaluate the studies, such as: study limitations, inconsistency of results, indirectness of the evidence, imprecision and bias. GRADE classifies recommendations as strong or weak based on the quality of the evidence presented. Through this tool, a remarkable reliability was observed in most of the studies, except for an inconsistency in the acceptability of an application used in the study specifically targeting women with low back pain[12], and an inconsistency and serious imprecision in the analysis of the effects of Mindfulness in the study involving active-duty soldiers[22]. These undesirable results are justified by the fact that there were limitations in the analysis and acceptability of the intervention and because the number of soldiers in the study was not specified, as well as the fact that data was collected qualitatively and subjectively in the other study[8,12,22].

The Revised Cochrane risk-of-bias tool for randomized trials (ROB 2.0), a tool recommended by Cochrane, was used to analyze the bias of the clinical trial studies. This tool assesses the risk of bias covering the following domains: selection bias, performance bias, detection bias, follow-up bias, reporting bias and other types of bias. ROB2 showed a low risk of bias in four of the five domains, however, the method used to assess the results differed between the studies, with a high overall risk.

RESULTS

After the electronic search, the 84 articles found in the initial search were organized, reviewed for duplication and initially filtered by title independently by the three authors. Of these, 50 studies that did not include "Mindfulness" and "chronic pain" in their titles were excluded. After analyzing the abstracts of the 34 filtered studies, those which did not focus on Mindfulness therapy for patients with non-oncological CP were discarded, as were reviews and texts in which the research method was not clarified, resulting in 4 exclusions. Next, the 30 selected articles were read in full. Of these, 10 studies that answered the research question were selected and assessed as essential for this systematic review. Articles that were not free of charge and those whose results had not yet been published were also excluded. Studies in English or Spanish were translated by the authors themselves. The search for the selected articles was organized in a flowchart (Figure 1), with the number of articles included and excluded at each stage, as well as the reasons for exclusion.

In the assessment of methodological quality using the GRADE[21] scale, the analyses of Severe (S) or Not Severe (NS) were carried out by the three independent reviewers (Table 2). Two articles assessed inconsistency in the data presented. One article assessed the inaccuracy of the results. The other eight articles were classified as Not Serious for risk of bias, inconsistency, indirect evidence and imprecision, and were of high quality for this review. Table 3 shows each article separately.

A study[6] looking at CP related to diabetic neuropathy included 105 patients with this condition, randomly assigned to 3 groups Mindfulness Meditation (MM), Progressive Relaxation Meditation (PM), Meditation Control (MC), who received 16 sessions of care over 8 weeks. The mean age of the participants was 62.9 years and they had been diagnosed with type 1 or type 2 diabetes for 13 ± 1.3 years. Each weekly Mindfulness session lasted 35 minutes

and was evaluated at 4, 8 and 12-week intervals using the BPI--DPN Q4 and PGIC scales, assessing CP and satisfaction with the technique and the patient's impression of pain. The MM and PM groups obtained a significant reduction ($p<0.05$) in average daily pain compared to baseline scores. At the end of the study, the improvement in the impression of pain was evidenced by the patient satisfaction scores in the MM group, which increased significantly ($p<0.05$) from 2.0±1.0 to 3.8±1.9 at week 12 of treatment. Initially in the PM group, baseline satisfaction was 2.1 and improved to 3.0, and in the MC group, satisfaction increased from 2.2 to 2.7 over the same period of time. However, the MC group did not show a reduction ($p>0.05$) in scores and did not significantly alter the global impression of change, the mean pain score of 5.0±1.9 went to 4.9±1.0 at week 12 and the pain intensity to -0.5±0.213.

A Spanish experimental project[4] applied Mindfulness-Based Cognitive Therapy (MBCT) to patients over 20 years of age with chronic pain. The study consisted of eight weekly group sessions lasting around an hour and a half, with pre- and post-test evaluations. After comparison, the study indicated a medium effect result ($p<0.05$) with the application of Mindfulness on the intensity of present pain ($p=0.004$), mental quality of life ($p=0.005$) and de-

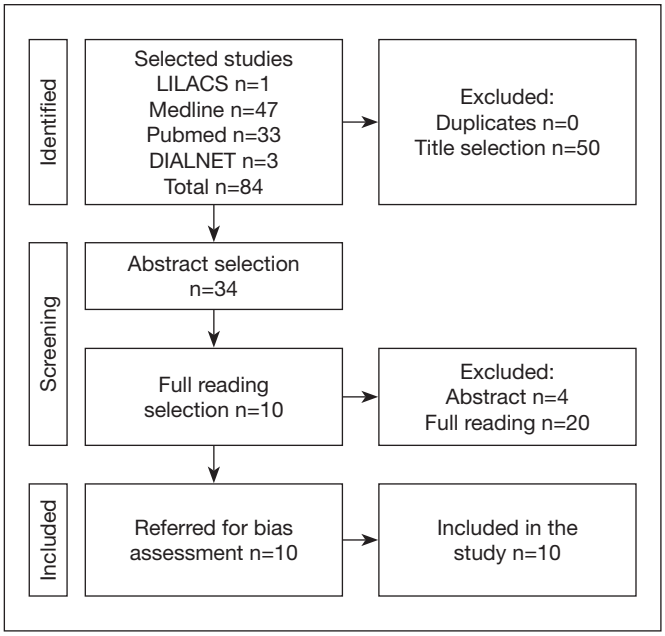

Figure 1. Flowchart of study selection.

Table 2. Quality assessment of the articles using the GRADE scale

Authors/Criteria	Hussain and Said[6]	Garland et al.[10]	Seng et al.[13]	Seminowicz et al.[24]	Pardos-Gascón et al.[4]	Hanley, Gililland and Garland[11]	Brintz et al.[8]	Ball et al.[12]	Brintz et al.[21]	Day et al.[9]
Risk of bias	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Inconsistency	NS	NS	NS	NS	NS	NS	NS	S	S	NS
Indirect evidence	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Inaccuracy	NS	NS	NS	NS	NS	NS	NS	NS	S	NS

Table 3. Features of included studies

Authors	Sample Population	Intervention	Comparative and measurements	Conclusion
Hussain and Said[6]	Women with diabetic neuropathy, Age > 55 years. n=105	MM; PM; MC.	Control interval: 4, 8 and 12 weeks with the following scales: BPI-DPN Q4 and PGIC.	The MM and PM groups obtained a significant reduction ($p<0.05$) in mean daily pain compared to baseline. The MC group did not show a reduction ($p>0.05$) in scores and did not show a significant change in PGIC.
Garland et al.[10]	Patients with chronic pain, taking opioids daily. Mean age 47 years. n=57	MM; PM; MC.	Control interval: 1st and 10th weeks with Go/NoGo test, assessed with FFFMQ and BPI-SF.	A longer time practicing MORE predicted improvements in NoGo accuracy in tests with pain-related distractors ($p=0.03$).
Seng et al.[13]	Patients with migraine. Mean age: 40 years. n=60	MBCT; WL/ TAU.	Control: 30-day pain record using the HDI and MIDAS scales.	MBCT intervention patients: the effect of severe pain decreased on the MIDAS scale from 88.3% at the start to 66.7% ($p<0.001$).
Day et al.[9]	Patients with chronic low back pain. Age > 18 years. n= 69	MM; MBCT; BT.	Control interval: 1st day, 3 and 6 months, assessing their impact with the PCS, CPAQ, PROMIS Depression Scale and FFMQ.	Patients reported improvement in pain interference and pain intensity, respectively: in the MM group by 31% and 44%; in the BT group by 42% and 32%; and in the MBCT group by 45% for both parameters.

Continue...

Table 3. Features of included studies – continuation

Authors	Sample Population	Intervention	Comparative and measurements	Conclusion
Seminowicz et al.[23]	Patients with migraine. Age: 18-65 years. n=98	MBSR +.	Control: 8 weeks, then fortnightly for a further 8 weeks, comparing MBSR+ with SMH and HIT-6.	There was a 50% reduction in headache days in the MBSR+ intervention (p=0.0008), compared to 23% in the SMH group (p=0.04). Both groups showed neurophysiological changes (p<0.05).
Brintz et al.[8]	Patients with chronic pain. Age > 18 years. n=23	MBSR +.	Control interval: 1st and 5th weeks, with the CPAQ, PCS and PSS-4.	After the intervention, there was a decrease in pain intensity (p=0.05) and interference (p=0.017), in depression (p=0.005), in sleep disturbances (p=0.001), an increase in positive affect (p=0.016) and an increase in pain acceptance (p<0.001).
Ball et al.[12]	Women with chronic pelvic pain. Average age: 35. n=90	MM via the Headspace app.	Control interval: 1st and 61st weeks, collecting the patients' individual feedback on the use of the app using the NPT tool.	Of the patients who used the app, 77% said they relaxed, de-stressed, concentrated and re-evaluated their lives. However, it was not possible to accurately assess the impact on pain due to the limited use of the app. MM must be individualized to be effective.
Brintz et al.[21]	Active-duty soldiers who are currently being treated for chronic pain. Age >18. n= *	MM via the Mindfulness Training for Pain app	Control interval: daily for 8 weeks, MM was assessed with individual feedback after each session using the Depression Scale, Health Survey 12 and Medicalo tools.	MM was recommended by the Pain Management Task Force as a first--line treatment and the app made it possible to reach a greater number of soldiers simultaneously, as it was available online.
Pardos-Gascón et al.[4]	Patients with chronic pain. Age: 32-79 years. n=57	MBCT.	Control interval: 1st and 10th weeks with T-Test, a Visual Analogue Scale, Hospital Anxiety Outcomes Study Sleep Scale, CPSS, CPAQ e Mindful Attention Awareness Scale.	With the application of Mindfulness there was an improvement in pain intensity (p=0.004), mental quality of life (p=0.005) and depression (p=0.003), as well as self-efficacy in symptom control, pain and a significant effect after therapy on sleep disturbances (p<0.05).
Hanley, Gililland and Garland[11]	Patients with chronic orthopedic pain refractory to other non-operative treatments. Average age: 65. n=118	PM, BM, CPPI.	Control interval: days 2, 3, 7, 14, 21, 28 after arthroplasty, comparing the PM, BM and CPPI groups, assessing pain intensity (0-10) and acceptability (0-10) and opioid use (question: "Have you used opioids drugs in the last 24 hours?").	The intervention may be able to prevent post-operative pain, reduce pain interference and opioid use. After surgery, patients in the PM group reported lower pain intensity (p=0.026) and lower pain interference (p<0.001).

MM = Mindfulness Meditation; PM = Progressive Relaxation Meditation; MC = Meditation Control; MBCT = Mindfulness-Based Cognitive Therapy; WL/TAU = Waitlist/treatment as usual; BT = Behavioral Therapy; MBSR + = Mindfulness Based Stress Reduction; PM = Pain Mindfulness; BM = Breathing Mindfulness; CPPI = Cognitive-Behavioral Psychoeducational Pain Intervention; BPI-DPN Q4 = Brief Pain Inventory; PGIC = Patient Global Impression of Change; FFMQ = Five Facet Mindfulness Questionnaire; BPI-SF = Brief Pain Inventory; PCS = Pain Catastrophizing Scale; CPAQ = Chronic Pain Acceptance Questionnaire; HDI = Headache Disability Inventory; MIDAS = Migraine Disability Assessment; PSS-4 = Perceived Stress Scale; SMH = Stress Management for Headache; HIT-6 = Headache Impact Test; MORE = Mindfulness-Oriented Recovery Enhancement; CPSS = Chronic Pain Self-Efficacy Scale; NPT = Normalisation Process Theory.
*Study did not show the number of paticipants[22].

pression (p=0.003), as well as on self-efficacy in symptom control (p=0.000), self-efficacy in pain control (p=0.000) and a significant effect, after the treatment, on sleep disturbances (p=0.000)[4].

A study on chronic headaches[13] randomized 60 participants aged 40 on average to both the MBCT and the Waitlist/Treatment as Usual (WL/TAU), approximately half of whom were taking preventive drugs for migraine. In the end, 29 people completed the MBCT and 21 completed the WL/TAU and provided interviews; 18 out of 21 reported benefits from the intervention and would recommend it. Approximately half of the MBCT respondents requested to continue treatment after the conclusion of the study. According to the MIDAS tool assessment, the effect of severe pain decreased from 88.3% at baseline to 66.7% at the 4th month (p< 0.001). Finally, average HDI scores decreased in the MBCT group, and increased in the control group (p=0.007). Only two adverse events were reported: one participant experienced a vivid recollection of a traumatic event; and another reported increased pain frequency and intensity. In conclusion, the treatment was shown to reduce headache-related disability and disability related to migraine attacks[13].

Another study[24], about headaches, was carried out in the United States with 98 people aged between 18 and 65 who met the International Classification of Headaches criteria for migraine. In 50 participants, the intervention carried out was MBSR+ and in 48, the application of SMH. Both interventions were performed on the patients 2 hours a week for 8 weeks, then fortnightly

for a further 8 weeks. There was a 50% reduction in headache days in the MBSR+ intervention (p=0.0008), compared to 23% in the SMH group (p=0.04). In terms of neurophysiology, Magnetic Resonance Imaging (MRI) showed that both groups had a decrease in the volume of the anterior/middle cingulate cortex (p=0.04) and a decrease in the connectivity of the right dorsal anterior insula with the cognitive task network (p=0.02). The MBSR+ group showed decreased activation in the bilateral cuneus and right parietal operculum and also reported reduced HIT-6 scores compared to the SMH group (p=0.004). Headache impact and pain intensity did not differ between the groups. It is concluded that MBSR+ can be an effective prophylactic treatment option for episodic migraine, just like the valproic acid currently used[24].

The application of MBSR+ was adapted in another study[8], in which four weekly 90-minute sessions were given to patients over the age of 18, all of whom affirmed they lived with chronic pain. They were assessed in the first and fifth weeks using the CPAQ, PSS-4 and PCS scales. After analyzing the results, there was a decrease in the intensity (p=0.05) and interference of pain (p=0.017), depression (p=0.005), sleep disturbances (p=0.001), and an increase in positive affect and well-being (p=0.016), as well as pain acceptance (p<0.001) after the intervention[8].

A study[9] carried out in Australia considered 69 participants with different orthopedic and rheumatic pathologies that involved CP as their main symptom. They were divided equally into three interventions (MM, MBCT and BT). Group sessions lasted two hours a week and individual practice 45 minutes at least six days a week. The evidence shows that MBCT is a viable, tolerable and acceptable treatment, with results similar in magnitude to a BT intervention, with improvements in physical function (p<0.001), depression scores (p=0.002) and both the BT and MBCT groups (p=0.03) reporting greater improvement than the MM group. The use of opioids in the last week decreased until the three-month follow-up (p=0.03), but at post-treatment and six-month follow-up they were not significantly lower (p=0.289 and 0.065). At the end of the study, the percentage of individuals who reported significant improvement for pain interference and pain intensity was, respectively, 31% and 44% in the MM group, 42% and 32% in the BT group and 45% in the MBCT group for both parameters.

In a complementary way, another study[11] on patients with an average of 65 years old with pain resulting from orthopedic conditions used PM, BM and CPPI as interventions. The three practices were applied once approximately three weeks before hip and knee replacement surgeries and lasted 20 minutes. A total of six post-operative questionnaires were administered over the month following surgery, on the 2nd, 3rd, 7th, 14th, 21st and 28th post-operative days. Pain intensity and pain interference were measured on a numerical scale (0-10) and opioid use was measured with a single item: "Have you used opioid drugs in the last 24 hours"? After surgery, patients in the PM group reported significantly less pain intensity (p=0.026) on postoperative days 14, 21 and 28, and less pain interference (p<0.001) on postoperative days 21 and 28. Patients who received the Mindfulness-based intervention preoperatively reported significantly less opioid use 21 days after surgery. It is suggested that a Mindfulness-based preoperative intervention may be able to prevent postoperative pain[11].

In the USA, a study[10] involved participants who had used opioids daily in the 90 days prior to the research. The Go/NoGo Trial method and the FFMQ and BPI-SF scales were used to assess the interference of pain in the tests in the first and last week pre- and post-treatment with MORE and SG, lasting two hours a day for eight weeks, as well as 15 minutes practiced individually. The results indicated that there were more errors when pain-related signals were present (p=0.02) compared to the presence of neutral signals, suggesting the interference of emotion in inhibitory responses. The group × time × condition effect showed that the MORE group experienced significantly greater improvements in NoGo accuracy on trials with pain-related distractors compared to trials with neutral distractors (p=0.047); as well as greater reductions in pain intensity from pre-treatment to three-month follow-up than the SG (p=0.01). A greater number of minutes of Mindfulness meditation practice throughout treatment predicted improvements in NoGo accuracy in tests with pain-related distractors (p=0.03)[10].

Another study[22] involved active duty soldiers with varying groups of up to 40 participants who underwent MM through The Mindfulness Training for Pain app, lasting six 60-minute weekly synchronous sessions, as well as teaching materials, guided meditations, Mindfulness resources and professional support information. Participants were assessed through individual feedback after each session. The intervention was based on the recommendation of the Pain Management Task Force and proved to be relevant and sensitive, even though the military culture is resistant to integrative and complementary therapies and, although the article did not present outcomes for the pain itself, the study suggests that it has the potential to expand the use of MM as a complementary treatment[21].

Finally, a European study[12] of 90 women with chronic pelvic pain used the Headspace app as an intervention to apply MM. The duration of the session was 10 minutes for the first 10 days, 15 until day 20, and 20 until day 60. The participants were divided into 31 at intervention group, 30 at active control group and 29 at group that maintained usual treatments such as drugs. From this, 10% of the participants in the control group reported little motivation and benefit from using the app, having difficulties with the technology and another 10% said that the app didn't reduce their pain, but that it made them more in tune with their bodies and their breathing. One patient said that the drug wasn't working, but the app was. Seventy-seven per cent of the patients talked about relaxing, de-stressing, or concentrating and re-evaluating life, as those who tried the app without Mindfulness. Still on the intervention patients, 20% said they used techniques they had learned, for example in traffic or by sitting down and taking a break. This study did not provide a clear pattern in relation to the impact of pain with the use of the app, however, it is a warning of how it is necessary to individualize treatments and not give patients generalized MM techniques[12].

DISCUSSION

CP has a significant impact on people's quality of life, as it increases the risk of developing and worsening conditions such as anxiety and depression, as well as affecting the ability to work, with financial losses due to functional incapacity[4,9,11,22]. Patients with CP have a persistent stimulus that influences brain areas, a fact that is analyzed in the gate control theory, which suggests that cognitive or motivational activity can modulate painful sensation[6]. There are several brain regions that are influenced by mechanical, thermal or chemical nociceptive stimuli, but the primary pain processing regions are the insula, the somatosensory cortex and the thalamus. The study[24] that evaluated people with migraine attacks and observed that one of the most affected brain areas is the insula, together with the left dorsolateral prefrontal cortex and the anterior cingulate cortex, triggering cognitive and emotional deficits in patients[6,24].

Another study[10] showed that patients with CP were more vulnerable to response deficits in cognitive functions and there was an attenuation of the response related to inhibitory control in the anterior cingulate and premotor cortexes. The insula is responsible for integrating sensory information, the dorsolateral prefrontal cortex for processing momentary information, the anterior cingulate cortex for regulating emotion and learning and the premotor cortex helps organize movements and actions[6,10,24]. Mindfulness-based therapies modulate this relationship between acute stressors and physiological responses. Pain is acutely reduced by cortical and thalamic mechanisms, such as relaying signals to the sensory systems, emotional and motor control, influencing cognitive efficiency and long-term pain control. The characteristics of pain modulation depend on the type of meditation and its duration, with unique differences between practitioners[6].

There are several options for mindfulness practices. BM brings attention to the present by focusing on breathing, without alterations and without judgment, reducing the intensity of pain and discomfort. PM provides a means of interoceptive exposure to pain; attention separates physical sensations from emotional sensations and evaluations of pain, and attenuates catastrophic and emotionally charged evaluations. The MORE technique helps patients reinterpret chronic pain as innocuous sensory information with fewer effects[11]. The practice of MBSR is the most widely explored intervention within Mindfulness and involves training in a variety of skills, including breathing, mindful movement and eating, body scanning and compassion practices. It improves mental and physical health in conditions such as depression, anxiety, chronic pain and substance use disorders[2,22].

MBCT involves mindfulness meditation and cognitive-behavioral skills, addressing maladaptive beliefs related to the illness. Its objective was, initially, to prevent relapse of depression, however it has been modified to address a variety of chronically painful conditions[2,13].

Mindfulness beginners show increased nociceptive processing in the anterior cingulate cortex and anterior insula and reduced activation of the primary somatosensory cortex, located in the anterior portion of the parietal lobes and responsible for awareness of nociception. The more experienced decrease the activation of the dorsolateral and ventrolateral prefrontal cortex regions, an area of particular importance for the success of cognitive reappraisal, and improve the primary pain processing regions[6,10,24]. In addition, the increased cognitive efficiency achieved by practicing Mindfulness also contributes to pain control in long-term practitioners[6,10,24].

The study[10] of Mindfulness applied as MORE observed the blocking of nociceptive information and corticothalamic brain activity. In the study[24] with MBSR, no effect was observed primarily with neuroimaging, but secondary analyses of the whole brain suggested increased cognitive efficiency and decreased activation of the parietal operculum, important for the motor component of speech, and the visual cortex (cuneus) during a cognitive challenge used by the study, both in people who had been practice meditation for a long time and in individuals trained in MBSR. In addition, with MBSR there was reduced resting neural connectivity from the anterior insula to the parietal cortex and cuneus after training, increasing cognitive efficiency and the pain attenuation effect of meditation[10,24].

Mindfulness techniques have been recommended as a first-line treatment for chronic low back pain by the Veterans Health Administration, the Army Pain Management Task Force, the Agency for Healthcare Research and Quality and the American College of Physicians[11,22], since, in addition to Mindfulness improving pain acceptance and the inhibition of response to pain, improved with time of practice, it reduces avoidance and catastrophizing of this sensation. The treatment also makes it easier to identify and treat the hyperalert state in the case of a harmful sensation[4,10,11,13,22]. In this sense, Mindfulness associated with a Multidisciplinary Plan is useful for reducing the use of drugs such as opioids[10]. Through Mindfulness training, individuals with CP cultivate impartiality in relation to bodily sensations. Increasing attention to pleasant sensations in places near or far from the pain is a key point in the process, which has also been mentioned in the surgical context[10,11,22].

Moreover, apps focused on Mindfulness are beneficial for expanding the practice and are a safe and inexpensive alternative for interested patients. Compared to the drugs currently used to control pain, the costs required for app-based therapy are minimal[12,13]. The Headspace app is an example that has proved useful even at times chosen by patients when they most needed relief of pain and stress[23]. Therefore, Mindfulness treatments are promising for their ability to reduce CP, since they do not present a risk of addiction or abuse[4,12].

Nevertheless, Mindfulness is a treatment that can have adverse effects such as increased pain when sitting, increased attention to pain, falling asleep during practice, emotional distress involving anxiety, irritation and fatigue[6,22]. In addition to this, there are some difficulties listed by the articles for the applicability of Mindfulness. The need for a minimum level of schooling on the part of the patients to follow the commands and the limited ability of the project's applicators to detect the effects are cited as examples. In addition, there is a need for specialized mentors, skill in handling Mindfulness applications, individual commitment to the treatment and dedication of time to each session. The latter being the main reason for refusing to take part in Mindfulness intervention studies[12, 22].

Despite the limitations, there are health benefits to practicing Mindfulness in various areas, whether physical, mental or spiritual[11]. There are improvements related to mental health, sleep, self-awareness in daily activities, improved accuracy in working memory tests, visuospatial processing and self-compassion, as well as generating an optimized ability to access a sense of calm and focus[10,13,22].

CONCLUSION

The practice of Mindfulness in patients with non-oncological CP has proven to be relevant as it provides quality of life for patients by enabling a reduction in the intensity of pain, suffering, anxiety and associated stress. The practice promotes neural changes such as a decrease in the volume of the cingulate cortex, decreased activation in the insula, the cuneus and the parietal operculum. In long-term practitioners, there is decreased activation in the regions of the prefrontal cortex, with improvements in the primary pain processing regions and increased cognitive efficiency that contributes to pain control.

this practice allows us to reduce drug costs by reducing the use of opioids, reducing dependence on drugs, being a good option and a form of self-care. Although its application is underused, it is supported by scientific evidence and is a safe and effective subsidiary treatment that can be prescribed individually, with low risk and cost, relying on evidence to make it recommendable.

Based on the present study, it should be noted a need for more studies in pediatric, elderly and athlete (oncological and non-oncological) patients, since pain in these groups is associated with specific psychosocial factors, interfering with how the treatment can act. In addition, there is a need for longer follow-up (>1 year), a larger sample of people studied (>100), greater detail on medical history, time with pain and its causes (accidents, amputations, chronic diseases), use of continuous drugs and daily limitations, so that the outcomes have a greater statistical impact. Future researchers should try to focus on one type and time of pain, so that the results are more targeted, reducing biases in terms of intensity, duration and frequency. It is also important to look for methods to evaluate Mindfulness sessions, with standardized questionnaires aimed at specific contexts. In this way, future clinical trials with more active and statistically accurate samples can enhance the comprehension and applicability of the method.

It is important to emphasize that Mindfulness is not a cure for CP and may not be equally effective for everyone. However, it is an innovation in clinical practice and represents an addition to the arsenal of therapeutic techniques available worldwide, as part of the ICHPs, with the potential to receive greater investment related to CP.

AUTHORS' CONTRIBUTIONS

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Statistical analysis, Data Collection, Conceptualization, Resource Management, Project Management, Research, Methodology, Writing - Preparation of the original, Writing - Review and Editing, Software, Validation, Visualization

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