

FACULTAD DE CIENCIAS DE LA SALUD
SECCIÓN DE FISIOTERAPIA

TRABAJO DE FIN DE GRADO

TITLE: Efficacy and safety of Mindfulness in the management of chronic pain

Author: Meeta Bulchandani Bulchandani

Tutor: Alejandro López Ferraz

CURSO ACADÉMICO 2021-2022

CONVOCATORIA JUNIO

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Abstract

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage." Chronic pain can have significant medical, social, and economic consequences with lost productivity and increased health care costs. A non-pharmacological option that receives the most attention is the mindfulness-based approach which exerts analgesic effects. This refers to a mode of awareness characterized by curiosity, non-judgment, acceptance, and a focus on the present moment. The objective of this study is to review the evidence on the efficacy and safety of mindful meditation interventions for the treatment of chronic pain in adults. A bibliographic review was carried out in the databases of PubMed, Cochrane, Scielo and in the Virtual Health Library (VHL). The terms used in the search were: "*Mindfulness*", "*Mindfulness Meditation*", "*Mindfulness-Based Stress Reduction*", "*Meditation-Based Interventions*", "*Chronic Pain*". A total of 1203 articles were obtained, of which 12 articles were selected documenting research protocols and studies on the efficacy and safety of the use of Mindfulness in the management of chronic pain. It was concluded that the use of mindfulness is effective for the management of chronic pain, being low cost and easy to apply and can be used as an independent treatment or as a combined therapy with other therapeutic measures. In addition, it improves emotional conditions related to chronic pain, such as anxiety and depression.

Key Words: "Mindfulness", "Meditation", "Mindfulness Meditation", "Mindfulness-Based Stress Reduction", "Chronic Pain".

Abstracto

La Asociación Internacional para el Estudio del Dolor (IASP) define el dolor como "una experiencia sensorial y emocional desagradable asociada con un daño tisular real o potencial". El dolor crónico puede tener importantes consecuencias médicas, sociales y económicas con pérdida de productividad y aumento de los costos de atención médica. Una opción no farmacológica que recibe la mayor atención es el enfoque basado en la atención plena que ejerce efectos analgésicos. Esto se refiere a un modo de conciencia caracterizado por la curiosidad, el no juzgar, la aceptación y un enfoque en el momento presente. El objetivo de este estudio es revisar la evidencia sobre la eficacia y seguridad de las intervenciones de meditación consciente para el tratamiento del dolor crónico en adultos. Se realizó una revisión bibliográfica en las bases de datos de PubMed, Cochrane, Scielo y en la Biblioteca Virtual en Salud (BVS). Los términos utilizados en la búsqueda fueron: "Mindfulness", "Mindfulness Meditation", "Mindfulness-Based Stress Reduction", "Meditation-Based Interventions", "Chronic Pain". Se obtuvieron un total de 1203 artículos, de los cuales se seleccionaron 12 artículos que documentan protocolos de investigación y estudios sobre la eficacia y seguridad del uso de Mindfulness en el manejo del dolor crónico. Se concluyó que el uso de mindfulness es efectivo para el manejo del dolor crónico, siendo de bajo costo y de fácil aplicación y puede ser utilizado como tratamiento independiente o como terapia combinada con otras medidas terapéuticas. Además, mejora condiciones emocionales relacionadas con el dolor crónico, como la ansiedad y la depresión.

Palabras Clave: "Mindfulness", "Meditación", "Meditación Mindfulness", "Reducción del Estrés Basada en Mindfulness", "Dolor Crónico".

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1. Introduction

1.1. Pain

The *International Association for the Study of Pain* (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage" (1). Other authors such as Williams & Craig (2) define pain as a distressing experience associated with actual or potential tissue damage with sensory, emotional, cognitive and social components.

Often, accurate measurement and evaluation of pain is difficult because of the subjectivity of this symptom where the sensation experienced by any individual may be different and different both physical and emotional connotations. Pain, however, is also considered a vital sensory phenomenon essential for survival(3).

In general, pain is produced from any stimulus that damages the tissue or that may damage it, alerting the body to the presence of individual pathological aggressions and thus possibly allowing it to avoid the pathogenic agent or harmful stimulus. However, when these stimuli become aberrant and chronic, the sensation of pain becomes a harmful situation that affects the individual, both physically and psychologically. On the other hand, pain is not always tied to a stimulus. In addition, it may also happen that there is no direct correlation between the severity of the tissue damage and the intensity of the pain perceived by the patient (4).

Clinically, pain can be classified as acute or chronic. Acute pain refers to pain that is continually changing and transient and accompanied by a high level of emotional and autonomic responses from the nervous system. This type of pain is usually associated with tissue injury or surgery and generates the fight-or-flight response. Acute pain is a natural and useful sensation that warns the individual of possible injury and usually results in behaviors that prevent further injury and is mediated by A δ fibers(5). On the other hand, chronic pain occurs when it lasts more than 3 months and is mainly mediated by C fibers(6). Cognitive and emotional factors play an important role in the perception of chronic pain, this due to the connectivity of the regions of the brain that control the perception of pain, attention or expectation and emotional states of the individual (4).

Pain can also be classified based on the pathophysiological mechanisms related to its development. In this sense the pain is divided into nociceptive and neuropathic pain. Nociceptive pain is one that arises from actual damage or threat to non-neural tissues and is caused by the activation of nociceptors. Among the possible causes of this type of pain include various diseases, trauma, surgeries, invasive procedures such as injections and self-injurious behavior (7).

Patients perception of pain should be documented during the initial assessment. However, the subjective and multidimensional nature of pain makes assessing this symptom a truly challenging experience. The patient's self-report is the most accurate and reliable evidence of the existence of pain and its intensity, this is valid for patients of all ages, regardless of the ability to communicate or the cognitive deficits that it has. In the absence of objective measures, the clinician should rely on key information provided by the patient on the location, quality and severity of pain (8).

Pain score scales have gained acceptance as the most accurate and reliable method for assessing a patient's pain and response to pain management. Scales designed to estimate and/or express patient pain can be divided into two groups: one-dimensional and multidimensional scales of measurements. It should be noted that one-dimensional scales measure only intensity, so they cannot be seen as a comprehensive assessment of pain. Comprehensive pain assessment is expected to encompass both one-dimensional measurement of pain intensity and multidimensional measurement of pain perception assessment. The commonly used one-dimensional pain intensity scales are as follows (8):

- Numeric Rating Scale: This scale requires the patient to rate their pain on a defined scale. For example, 0-10 where 0 is painless and 10 is the worst pain imaginable (Figure 1).

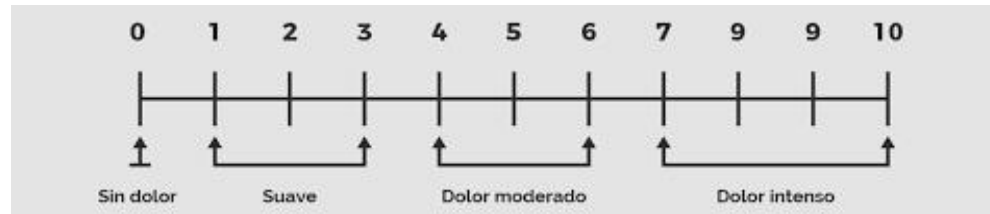


Figure 1. Numerical rating scale.

- Visual Analog Scale: Consists of a straight line with endpoints that define extreme boundaries as "no pain at all" and "the worst pain imaginable." The patient is asked to mark their pain level on the line between the two endpoints. The distance between "no pain at all" and the mark defines the subject's pain (Figure 2).

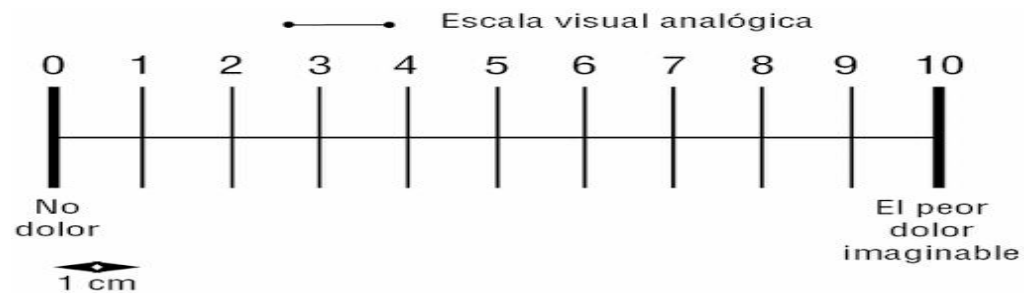


Figure 2. Visual analog scale.

- Verbal Rating/Descriptor Scale: Adjectives are used to describe different levels of pain. The respondent is asked to mark the adjective that best suits the intensity of the pain. As in VAS, two endpoints should be defined as "no pain at all" and "extremely severe pain." Between these extremes, the different adjectives describing different levels of pain intensity are placed in the order of pain severity (Figure 3).

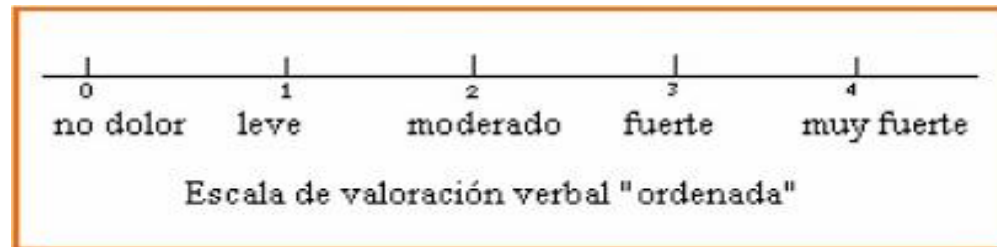


Figure 3. Verbal rating/description scale.

1.2. Pain modulation pathways

Pain is a complex, subjective conscious experience constructed and modulated by a constellation of sensory, cognitive, and affective factors, including mood, psychological disposition, meaning-related cognitions (e.g., suffering), learning, desires, and pre-pain cognitive states (e.g., expectations, anxiety) to provide a continually changing experience. Feedback connections between low-level and higher-order afferent neural processes encourage the cultivation of a distributed multidimensional network associated with the subjective experience of pain. Nociceptive sensory events are first recorded by peripheral primary afferents (A fibers δ and C fibers) at the site of tissue injury/damage, which then transmit this nociceptive information to the dorsal horn of the spinal cord. From the spinal cord, nociceptive information ascends contralaterally to the pain site to the brain, largely through the spinothalamic pathway. Nociceptive input is subsequently processed through feedback connections between lower-level sensory regions, including the parabrachial nucleus, periaqueductal gray matter (PAG), thalamus, and primary (SI) and secondary somatosensory (SII) somatosensory cortices. It is then transmitted to the posterior and anterior insular cortices, where it is precisely adjusted to encourage subsequent assessment of pain (9).

The contextual meaning of pain is facilitated by activating higher-order brain regions, including the anterior cingulate cortex (ACC), dorsal CCA (adCC), and prefrontal cortex (CPF). However, the subjective experience of pain is still greatly influenced by the context in which it occurs. That is, previous experiences, expectations, mood, conditioning, desires, sensitization/habituation, and other cognitive factors can amplify and/or drastically attenuate pain (10).

Non-pharmacological manipulations of pain attenuate the subjective experience of pain through a common final pathway, which includes the overlapping of neuronal and endogenous conduction systems. While cognitive modulation of pain is mediated by a number of endogenous modulator systems, including the cannabinoid, serotonergic, dopaminergic, cholecystokinin, adrenergic, and other neurochemical systems (i.e., vasopressin), the endogenous opioidergic system is the most understood and studied pain modulator system. Endogenous opioidergic mechanisms have been repeatedly shown to mediate placebo-produced analgesia, conditioned pain modulation, acupuncture, hypnosis, and attention control (11). Pain relief produced by these cognitive techniques is associated with significant reductions in pain-related brain activation (i.e., SI, IBS, posterior insula, parietal operculum) and activation in higher-order brain regions, such as the CCA, CPF, and insula (12).

1.3. Mindfulness meditation or Mindfulness

Mindfulness meditation is a fairly flexible term applied to many meditation practices, which have been found to improve a broad spectrum of clinically relevant cognitive and health outcomes (13). In patients, mindfulness training improves self-reports of anxiety, depression, stress, and cognition (14). Health benefits related to mindfulness are associated with improvements in mechanisms that support cognitive control, emotion regulation, positive mood, and acceptance (15).

Mindfulness has been described as a "non-elaborative, unjudged awareness" of the experience of the present moment. However, it is not necessary to practice, or even be trained in meditation to be conscious. There are varying degrees of mindfulness trait in the

general population, outside of any formal training. Mindfulness can also be developed with mental training routines, such as meditation, and there are a variety of different practices that are included in the overall mindfulness meditation rubric (16).

The main feature of mindfulness meditation is the cultivation of "mindfulness" (i.e., the development of a particular type of attention characterized by a non-judgmental awareness, openness, curiosity, and acceptance of internal and external present experiences, allowing practitioners to act more thoughtfully than impulsively) (17). Mindfulness meditation comprises three different techniques including (1) "body exploration", which involves a gradual sweep of attention throughout the body from the feet to the head, focusing non-critically on any sensation or sensation in the body regions and the periodic use of breath awareness and relaxation suggestions; (2) "meditation," which involves conscious attention to the breath or upward and downward movements of the abdomen, as well as to other perceptions and a state of unprejudiced awareness of cognitions and the stream of thoughts and distractions that flow continuously through the mind; and (3) "Hatha or Yoga practice, which includes breathing exercises, simple stretches, and postures designed to strengthen and relax the musculoskeletal system (18).

There are two fairly basic categories of mindfulness practice, namely focused attention (samatha in the Pali language) and open monitoring (Pali: vipassana), which focus on the development of a number of distinct cognitive skills (19).

During focused attention, or samatha, the practitioner is taught to develop cognitive control and stability of attention by training the practitioner to maintain focus on the quality and moment-to-moment characteristics of sensory, emotional, and cognitive events. In short, samatha involves directing attention to the dynamic nature of the chosen meditation object, most often the sensations of the breath or body. When attention is diverted from the object of focus, for example, to a distracting sensory event, the practitioner is taught to recognize the event and disconnect by returning his attention to the meditative object (e.g., the breath) (20).

Samatha is often taught as a series of distinct practices that increase in complexity (e.g., mindfulness of breathing, emotions, and thoughts). While samatha practices primarily aim to gain mind control and attention stabilization, they naturally lead, in a somewhat

ambiguous way, to the traits associated with open monitoring meditation. As a derivative of the development of focused attention practice, the mindfulness practitioner almost naturally transitions to an open-monitoring mental posture, also known as vipassana. Extensive training in samatha is thought to be required before the open monitoring aligned cognitive posture develops naturally. While samatha often involves focusing on a single dynamic meditation object, open monitoring practices are more inclusive of perceived thoughts and emotions (20). When applied to their full extent, these practices are associated with an undirected recognition of any sensory, emotional, or cognitive events that arise in the mind. While practicing open monitoring, the practitioner is said to experience the current event without evaluation. Up to this point, mindfulness meditation has been described as a state of non-valuation and/or a non-elaborative mental posture (21).

While there are some indications that the popularity of meditation is increasing, little is known about the prevalence, patterns, and predictors of meditation use in the general population. According to reports from the 2012 U.S. National Health Interview Survey (NHIS), lifetime prevalence of meditation use in the U.S. and in a period of 12 months it was 5.2% and 4.1% of the population, respectively, evaluating various types of meditation including mindfulness meditation (22).

The mindfulness-based stress reduction program, or MBSR as it is usually known by its English name (mindfulness-based stress reduction), was designed in 1979, at the Umass Memorial Medical Center and has probably been the most widely used mindfulness program. studied and used. Dr. Jon Kabat-Zinn, creator of this program, founded the Mindfulness Center in 1995, where during all these years more than 24,000 patients have benefited by completing the 8-week program, responding more effectively to stress, pain and disease. In addition, they have trained more than 14,000 health professionals to implement the MBSR program around the world. According to data from a report by the Center for Mindfulness at the University of Massachusetts, \$1.7 million dollars were billed in 2014 only for the income generated from the MBSR program. In that same year the online program was launched taking it from Worcester to around the world. As of 2015, there were already more than 740 medical centers, hospitals and clinics in the world that implement the mindfulness-based stress reduction program (23).

In the United Kingdom, in 2000, mindfulness-based cognitive therapy was designed to treat depression (MBCT), which was implemented in the public care program since 2004 and by 2009, its use presented a priority status for the treatment of depression. treatment of depression according to the National Institute for Health and Care Excellence (24).

According to the American Mindfulness Research Association (AMRA) for the year 2016 there were more than 4500 scientific studies that supported Mindfulness and other contemplative activities, 667 of them published only in that same year (24).

Over the past 2 decades, mindfulness meditation has been proposed as a treatment for many diseases, showing good efficacy for many mental and physical disorders, as well as for healthy people, although the results are not always convincing (25).

Preliminary results on the efficacy of mindfulness therapies for patients suffering from chronic pain have been established in several independent uncontrolled studies in patients with different types of pain such as lower back, upper back, shoulder and cervical pain, headache, and fibromyalgia (26). Interestingly, there is some evidence to suggest that results obtained in the short term could be maintained in the long term and that mindfulness meditation could also be useful for older people (27). However, it is worth mentioning that very often the initial emphasis derived from early uncontrolled studies has not yet been supported when conducting controlled studies (28).

Chronic pain has a negative impact on the general population since it is related to high economic costs generated in medical expenses, which are enhanced by the low labor productivity that these patients present. It has been shown that the use of stress reduction techniques based on Mindfulness can produce economic cost savings given its low costs in the application as a therapeutic technique and also accompanied by its high effectiveness for the improvement of pain, resulting in a decrease in the use of medical assistance and an increase in labor productivity, which enhances the positive effect of its economic profitability with its application as a treatment for chronic pain; This, when compared with the usual treatment of this type of patients who present pain or even when compared with the use of cognitive behavioral therapy, shows a better economic return for the use of Mindfulness(29).

As an example of this, the case of fibromyalgia is presented, which is a disabling syndrome characterized by generalized chronic musculoskeletal pain that conditions deterioration in the quality of life of these patients, thus producing a negative economic impact related to the high costs generated by the continuous medical attention and, in addition, representing one of the chronic pain conditions with the highest rates of unemployment related to its disability. This disease does not currently have a cure and is treated with both pharmacological and non-pharmacological measures that generate higher economic costs. In the case of pharmacological measures, these generate relief with limited effectiveness. Many non-pharmacological therapies have been efficient, but of all the use of stress reduction techniques based on Mindfulness was the one with the lowest economic costs, especially when applied in the long term because it reduces the need for medical attention (30).

The current use of neuroimaging studies such as magnetic resonance imaging have confirmed the theories about mindfulness and its positive effects in relieving chronic pain. Both electrophysiological methods and brain imaging have made it possible to study the neural mechanisms involved in pain modulation using mindful meditation techniques. There is an important relationship between a greater disposition to mindfulness and the rating of pain in response to noxious pain, that is, the greater the degree of mindfulness technique, the greater the deactivation of the posterior nodes of the midline of the called "default mode network" (oscillating activity within a group of different brain regions: medial prefrontal cortex, cingulate/precuneus cortex, inferior and lateral temporal cortex, and that is associated with the facilitation of this entire self-referential process, where the mind is capable of wandering, in turn projecting thoughts, images and memories automatically and without the need to be especially attentive. State in which we find ourselves with a low guard and a decrease in the ability to react.). All that has been mentioned is evidenced in detail in figure 4 (31).

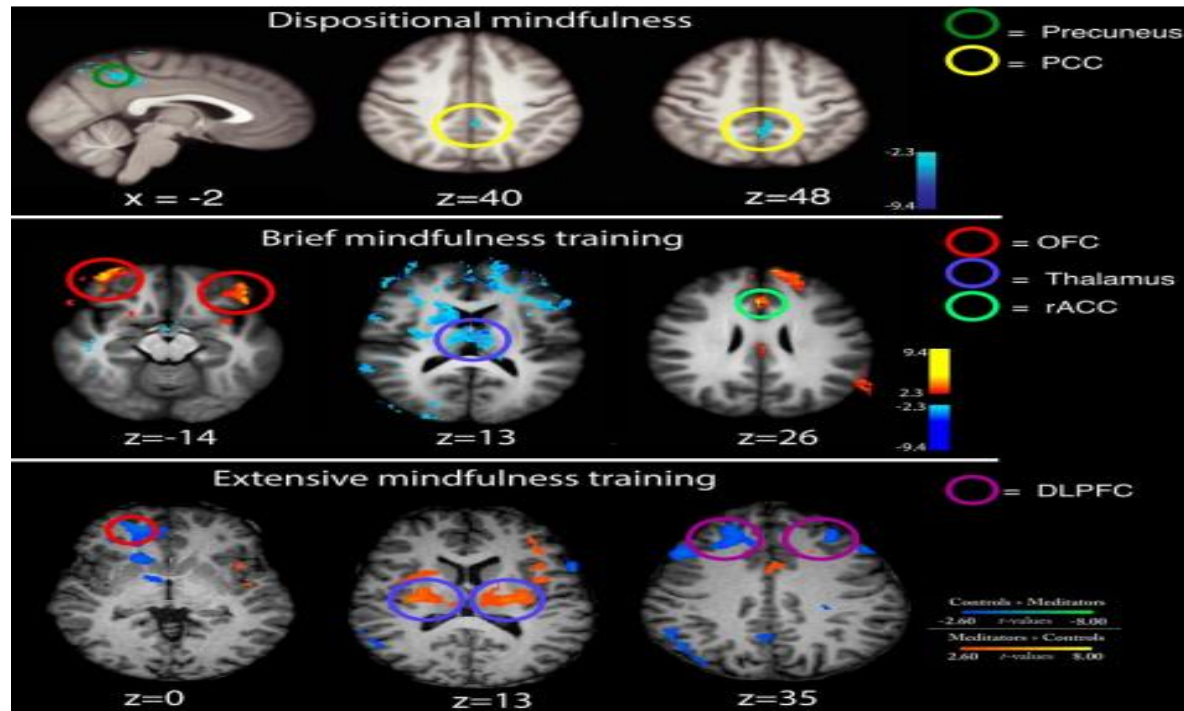


Figure 4. Types of magnetic resonance under different degrees of mindfulness.

Neural response to mindfulness-induced pain relief before and after a brief training regimen during noxious heat (49°C) in healthy subjects can be assessed in these MRI images.

In the upper row, where the lowest level of mindfulness technique given by dispositional mindfulness (natural and innate development of mindfulness) is assessed, greater deactivation of the posterior cingulate cortex (PCC)/precuneus can be assessed, associated with less pain during stimulation with noxious heat. In the central row, where the study of a patient with brief mindfulness training is observed, changes can be assessed this time given by a greater mindfulness meditation that induces the activation of the

bilateral orbitofrontal cortex (OF), the anterior cingulate cortex rostral (rACC) and greater thalamic deactivation, all of these events being associated with a greater degree of pain relief during noxious heat. Finally, in the third and last row, where a study of a patient exposed to extensive Mindfulness training is assessed, there is a significant decoupling in brain activation related to low-level pain (in the thalamus) and the brain regions that process pain. ratings and affect (medial COF and dorsolateral CPF) during noxious heat stimulation. The latter determines that the long-term practice of Mindfulness increases the pain threshold and leads to a lower sensitivity to it even without practicing this technique (31).

After training, the intensity of pain was reduced compared to rest. It was also possible to assess activation of the somatosensory and bilateral orbitofrontal cortices, the bilateral ventral striatum and the deactivation of the network by default, and also the ascending nociceptive inputs to somatosensory cortical regions are reduced. The greatest pain relief is associated with deactivation of the thalamus and of a critical node of ascending nociceptive information from the spinal cord (31).

The central executive network are brain areas that are activated to carry out activities that require some executive control, such as decision making, working memory and all cognitive control, and their operation is important for everything related to behavior. The dorsolateral prefrontal cortex is a key region for its functioning and this area is activated in MRI studies of patients who practice Mindfulness, showing that this type of meditation promotes executive control. Functional magnetic resonance imaging has shown that the practice of mindfulness increases the thickness of the brain areas belonging to the CEN circuit. In conclusion, during the practice of Mindfulness, when the DMN is reduced, the CEN is activated, which allows us to control attention and memory, allowing us to capture more information and thus make better decisions (32).

Despite their promise, mindfulness-based interventions are often time-consuming; Usually, they involve 8 weekly sessions of 1 to 2 hours plus daily practice at home. In addition, mindfulness-based interventions require highly trained therapists and are usually

provided in specialized settings (e.g., pain clinics). Consequently, standard mindfulness-based interventions are not accessible or feasible for many patients and are difficult to implement in many clinical settings, such as primary care and surgery departments (33).

2. Justification

Chronic pain, often defined as pain that lasts longer than 3 months or beyond the normal time for tissue healing, can have significant medical, social, and economic consequences, relationship problems, lost productivity, and increased healthcare costs (34). Pain has been recognized as a major public health problem that generates millions in losses a year, including health care costs and lost productivity. In addition, chronic pain is often accompanied by psychiatric disorders, such as addiction to painkillers and depression, which complicate treatment (35).

To control pain and its possible consequences, opioid medications such as oxycodone are often prescribed. In fact, more than 35% of adults with chronic pain take prescription opioids in a given year, and about 4% receive long-term opioid therapy for chronic noncancerous pain, although long-term opioid therapy has not yet been established as effective and represents a major health problem (36). Among other problems, prescription opioids have contributed to the epidemic of opioid use disorders, affecting opioid-related mortality, leading to overdose deaths (37).

Since non-pharmacological interventions may have comparable benefits and do not share the risks of opioid therapy, the Centers for Disease Control and Prevention (CDC) currently recommends non-pharmacological intervention as a first-line treatment to manage chronic noncancerous pain (38). A non-pharmacological option that receives the most attention is the mindfulness-based approach. As mentioned above, this type of approach refers to a mode of consciousness characterized by curiosity, the absence of judgments, acceptance, and a focus on the present moment. In recent decades, mindfulness techniques have been incorporated into multi-week mindfulness-based interventions, such as mindfulness-based stress reduction and mindfulness-based cognitive therapy (39).

A number of studies have applied mindfulness-based interventions and have been shown to be effective for a wide range of conditions. Existing literature indicates that mindfulness-based interventions may be effective in managing chronic noncancerous pain, including severe chronic pain treated with opioids (40). Mindfulness-based interventions are thought to exert analgesic effects through several biobehavioral mechanisms, including improvements in catastrophic pain, psychological flexibility, acceptance, the ability to move from affective to sensory discrimination of pain-evoking sensations, and top-down modulation of ascending nociceptive input (41).

Care has been helpful in being applied to substance abuse, smoking cessation, stress reduction, and chronic pain treatment (42, 43, 44). Early studies of mindfulness in patients with pain showed promising results on pain symptoms, mood disorders, anxiety, and depression, as well as the utilization of pain-related drugs (45). Numerous systematic reviews on the effects of mindfulness meditation have been published in recent years. Of those reporting positive results in pain management, several have focused on specific types of pain such as low back pain, fibromyalgia, or somatization disorder (46, 47).

There have also been several comprehensive reviews focused on controlled trials of mindfulness interventions for chronic pain, in which improvements in depressive symptoms and coping have been demonstrated, as well as positive effects for pain (48). A more recent review on various pain conditions found improvements in pain, pain acceptance, quality of life, and functional status of patients who were treated with mindfulness therapy (49). However, studies have determined the impact of individual facets of mindfulness on chronic pain outcomes, which could allow future treatment of mindfulness to be more specific (50).

3. Objectives

3.1. General objective

- To review the evidence on the efficacy and safety of mindfulness meditation interventions for the treatment of chronic pain in adults.

3.2. Specific objectives

- To know the chronic pain conditions that can be treated by mindfulness interventions.
- To analyze whether mindfulness interventions decrease pain intensity.
- To study whether pain acceptance, physical functioning, and quality of life are influenced by mindfulness interventions.

4. Materials and method

4.1. Type of study

A systematic review was conducted in the present study. The databases selected to search for the articles were: PubMed, Virtual Health Library (VHL), Scielo and Cochrane Library.

4.2. Inclusion and exclusion criteria

Inclusion criteria

- Publications made from 2011 to the present.
- Language of the publications: English and Spanish.
- Articles whose study population is older adults.
- Patients of both sexes.
- Type of articles: observational studies, randomized clinical trials and cohort studies.
- Articles whose content deals with physical exercise and healthy aging.
- Articles with access to the full text.

Exclusion criteria

- Articles published before 2011.

- Publishing.
- Publications of grey literature.
- Articles in which you had to pay to access them.

4.3. Search strategy

The search for the articles was carried out using keywords of the MeSH (Medical Subject Headings) and DeCS (Descriptors in Health Sciences) thesaurus. The Boolean operators "AND" and "OR" were used to combine these terms and thus formulate search equations to be implemented in the databases mentioned in the previous section. Table 1 shows the MeSH and DeCS terms used in the search.

Table 1. Search terms.

Term	Term in Spanish	MeSH
Mindfulness	- Atención Plena - Meditación de atención plena.	- Mindfulness meditation - Mindfulness-based stress reduction.
Meditation	- Meditación	- Meditation -Meditation-based interventions

Chronic pain	- Dolor crónico	- Chronic pain.
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Fuente: elaboración propia.

The search equations used in the databases consulted and the number of articles obtained in each of the searches are shown in the following table (Table 2).

Tabla 2. Ecuaciones de búsqueda y artículos obtenidos.

Database	Search equations	Articles obtained
PubMed	("mindfulness"[All Fields] AND ("chronic pain"[MeSH Terms] OR ("chronic"[All Fields] AND "pain"[All Fields]) OR "chronic pain"[All Fields])) AND (y_10[Filter])	650
	("meditation"[MeSH Terms] AND "chronic pain"[MeSH Terms]) AND (y_10[Filter])	53
	((Mindfulness-based stress reduction[MeSH Terms]) AND (chronic pain[MeSH Terms])) AND (y_10[Filter])	0
Cochrane	Mindfulness AND Chronic pain	0

	Meditation AND Chronic pain	254
Scielo	Mindfulness AND Chronic pain	0
	Meditation AND Chronic pain	1
BVS	mindfulness AND chronic pain AND (fulltext:"1") AND la:("en" OR "es")) AND (year_cluster:[2012 TO 2022])	0
	meditation AND chronic pain AND (fulltext:"1") AND la:("en" OR "es")) AND (year_cluster:[2012 TO 2022])	245
Total		1.203

Fuente: elaboración propia.

4.4. Assessment of methodological quality

To assess the methodological quality of the study of this exercise, the recommendations of Strengthening the reports of observational studies in epidemiology (STROBE) were used to improve the quality of the reports of the observational studies. The STROBE Declaration (Strengthening the Reporting of Observational Studies in Epidemiology) consists of a checklist of 22 items, which relate to the title, abstract, introduction, methods, results and discussion sections of the articles. Eighteen items are common to cohort studies, case-control studies, and cross-sectional studies, and four are specific to each of the three study designs. The STROBE

Statement provides guidance on how to improve observational study reporting and facilitates critical evaluation and interpretation of studies by readers.

Each item was rated as positive or negative. As a positive if said item met the indicated requirement, as negative when it did not meet it or as a question when it was not determined whether or not the article met the requirement established in STROBE. When the results of all items were equal to or greater than 80% of the maximum possible score, the study was considered to be of high quality, when the result ranged from 70% to 79% the study was considered to be of medium quality and when the result was below 70% it was considered to be of low quality. The STROBE declaration used and the results applied in the present study are shown in Annex I (51).

The articles included in this review were selected according to the PRISMA criteria (52). The PRISMA checklist is composed of 27 items and a four-phase flowchart, which have become the hallmark of academic rigor in the publication of systematic reviews and meta-analyses. The PRISMA 2020 statement is applicable for systematic reviews that focus on evaluating health, social or educational interventions in addition to etiology, prevalence or prognosis. The current statement will allow academic authors to quickly gather comprehensive systematic analyses that are of great interest within the research community. It will also provide readers with an in-depth understanding of the research topic at hand, as well as allowing the identification of new questions for future research.

Figure 1 shows the PRISMA flowchart with the different phases of the selection process of the articles included in this systematic review.

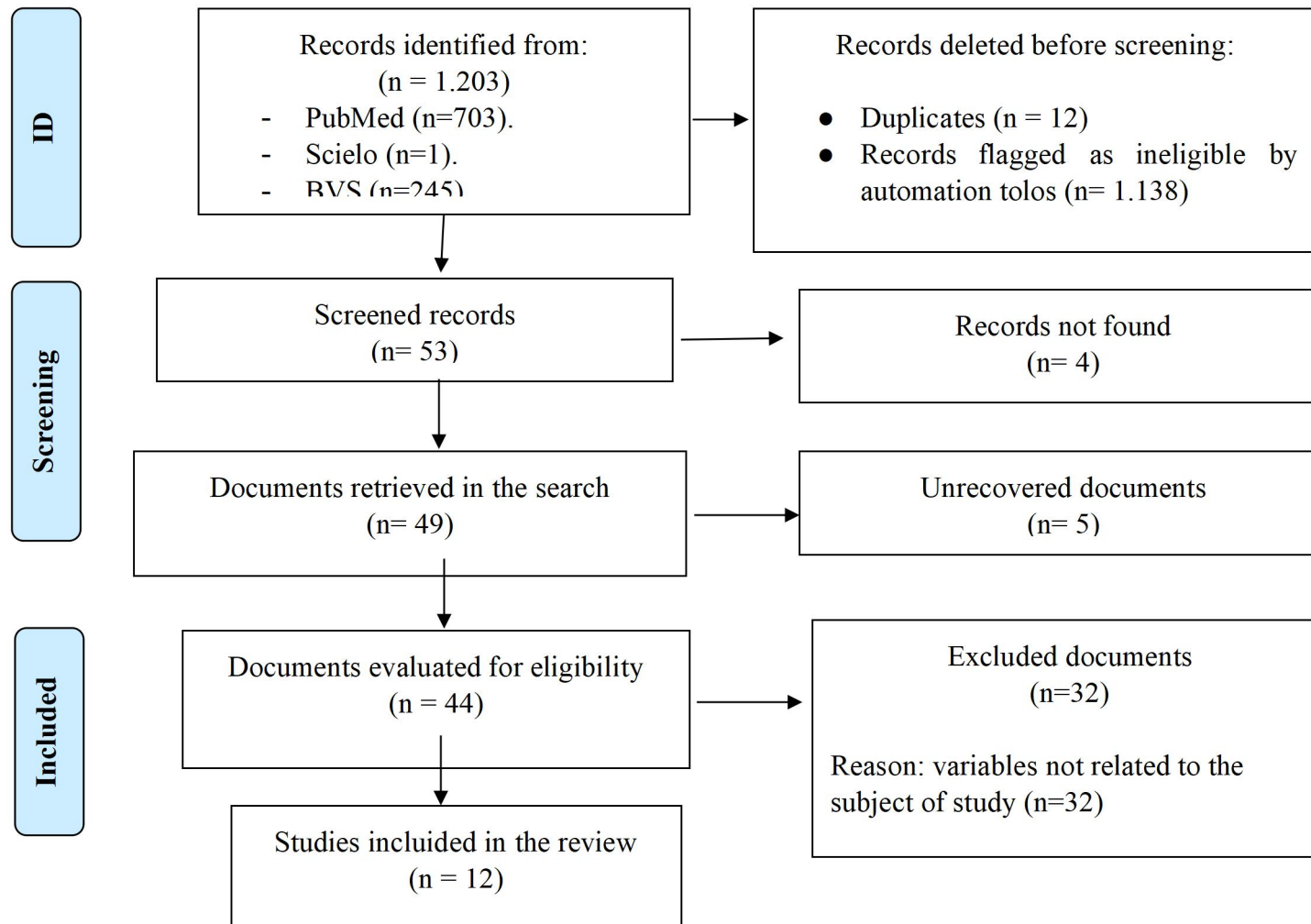


Figure 1. PRISMA flow chart illustrating the inclusion and exclusion criteria of the systematic review. Source: Sohrabi et al (52)

5. Results

A total of 1,203 articles were obtained, proceeding to discard 12 duplicates in the different databases, and 1,138 records marked as ineligible by automation tools, thus leaving 53 articles after screening, of which 4 records were not found, selecting thus 49 articles recovered in the search, of which it was not possible to recover 5 documents; therefore, only 44 full-text articles were screened for eligibility. Of these 44 articles, 32 articles whose variables were not related to the use of Mindfulness in the management of chronic pain were discarded. Finally, 12 full-text articles were selected, corresponding to the publication range of the last 10 years, both in English and Spanish, where research protocols and studies on Mindfulness in the management of chronic pain were applied. Table 3 shows the main characteristics of the articles included in the review (Table 3).

Table 3. Main characteristics of the reviewed articles.

Autor	Año	Título	Objetivo	Tipo de estudio	Muestra	Intervención	Resultados principales
Tsur et al ⁵³ .	2020	The effect of mindful attention training for pain modulation capacity: Exploring the mindfulness–pain link.	This study investigated whether a short mindful attention training based on Langerian mindfulness mitigates reductions in pain modulation.	Randomized controlled trial	Sixty healthy undergraduate students participated in the study. Participants were recruited on a voluntary basis through flyers posted at Tel Aviv University. Exclusion criteria were suffering from acute or chronic	Sensory testing of pain perception and modulation was performed before, and immediately after the intervention. The participant was randomly assigned into one of three short intervention groups: 1) Mindful attention to pain (pain-specific	Conditioned pain modulation (CPM) is dysfunctional in patients with chronic pain. In this study, a reduction in the magnitude of CPM can be evidenced only in the control group and, on the other hand, this reduction was abolished in the two mindfulness groups, also demonstrating the positive effect of mindfulness on the reduction of chronic pain.

				<p>pain, diseases causing potential neural damage (e.g., diabetes), skin lesions of any kind in the testing region, and pregnancy. All participants signed informed consent and the protocols were approved by the institutional review board.</p>	<p>mindfulness), 2) Mindful attention to visual cues (nonspecific mindfulness) y 3) No mindful attention (control group). Sensory testing commenced, which included the construction of a stimulus-response function for each participant, the CPM paradigm, and the rating of the hot water bath. Following baseline testing, the intervention was applied for a duration of 5-6 min. Immediately thereafter, another CPM paradigm was conducted, which aimed to mimic a deficiency in CPM, as well as</p>	
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						pain threshold measurement.	
Hussain et al⁵⁴.	2019	Mindfulness-Based Meditation Versus Progressive Relaxation Meditation: Impact on Chronic Pain in Older Female Patients With Diabetic Neuropathy	Compare the use of mindfulness meditation and progressive relaxation to reduce chronic pain in older females with diabetes.	Randomized controlled trial	105 Elderly females diagnosed with type 1 or type 2 diabetes >12 months and age >55 years.	The study participants were divided randomly into 3 groups: Group MM (mindfulness meditation), Group CM (control meditation), and Group PM (progressive relaxation meditation). Assessment of analgesic effectiveness required changes in average daily pain Brief Pain Inventory (BPI) modified for painful diabetic peripheral neuropathy and Patient Global Impression of Change using descriptive statistics,	Both the mindfulness meditation group and the control group had a reduction in pain in the last 24 hours after the end of the study when compared to the beginning of the study (28.7% and 39.7%), but this reduction was greater in the mindfulness meditation group. mindfulness meditation at 12 weeks. Also the satisfaction scores of the patients were higher in the mindfulness meditation group.

						Student's t test, and analysis of variance where applicable.	
Garzón et al⁵⁵.	2018	Experiencia con intervención basada en <i>mindfulness</i> (atención plena) en pacientes de un centro de salud urbano.	Analyze the effectiveness and acceptability of care workshops full (mindfulness) aimed at the population that goes to an urban health center.	Randomized controlled trial	35 patients with a diagnosis of stress, mild anxiety, mild depression, chronic pain, adaptation problems or coping with their illness.	The workshop is structured in 10 two-hour sessions, with a weekly interval. Two groups of people are welcomed, attending to a total of 35. Variables related to the different attentional qualities are measured by means of the five facet mindfulness questionnaire, at the beginning of the intervention and at two different moments of the intervention: in the 5th week and at the end of the workshop (10th week).	Statistically significant differences were obtained with the five facet mindfulness questionnaire both at 5 weeks (10.52, p=0.015) and at 10 weeks (13.64, p=0.039). Regarding acceptability, there were 47% of patients who attended 8 or more sessions, and there was no record of problems related to the organization and development of the program in the center.

Cherkin et al⁵⁶.	2016	Effects of Mindfulness-Based Stress Reduction Vs Cognitive-Behavioral Therapy and Usual Care on Back Pain and Functional Limitations among Adults with Chronic Low Back Pain: A Randomized Clinical Trial.	To evaluate the effectiveness for chronic low back pain of Mindfulness based stress reduction (MBSR) versus usual care (UC) and cognitive-behavioral therapy (CBT).	Randomized clinical trial.	342 adults aged 20–70 years with CLBP enrolled between September 2012 and April 2014 and randomly assigned to MBSR (n = 116), CBT (n = 113), or UC (n = 113) in the Healthcare system in Washington State.	CBT (training to change pain-related thoughts and behaviors) and MBSR (training in mindfulness meditation and yoga) were delivered in 8 weekly 2-hour groups. UC included whatever care participants received.	In this study, it was possible to show that in the 342 patients studied, the majority presented clinical improvement in the patients of the MBSR and CBT groups with respect to the patients of the group where they were managed with the usual care. Likewise, specific improvement in pain discomfort was found for MBSR (44%) and CBT (45%) compared to the UC group (27%). The findings described for MBSR remained unchanged for 52 weeks, all these findings demonstrating that the MBSR technique can be used positively for the management of chronic low back pain.
La Cour et al⁵⁷.	2014	Effects of Mindfulness Meditation on Chronic Pain: A Randomized Controlled Trial.	To investigate the effects of mindfulness meditation on chronic pain.	Randomized controlled trial	A total of 109 patients with nonspecific chronic pain were randomized to either a standardized mindfulness meditation program (mindfulness based	Pain, physical function, mental function, pain acceptance, and health-related quality of life were measured. The SF36 vitality scale was chosen as the primary outcome measure; the primary end point was after	A significant medium to large effect was shown in favor of less general anxiety and depression, better mental quality of life, feeling of pain control and greater pain acceptance. However, no significant effects were found for measures of pain. There were no significant differences in these measures immediately after the study compared to the 6-month follow-up, thus demonstrating that the use of mindfulness

					stress reduction [MBSR]) or to a wait list control.	completing the MBSR course. Within a 2.5-year period, 43 of the 109 randomized patients completed the mindfulness program, while 47 remained in the control group. Data were compared at three time points: at baseline, after completion of the course/waiting period, and at the 6-month follow-up.	meditation (MBSR) as a standardized program represents a positive effect for pain management and could be clinically relevant in several aspects. of the life of patients with chronic pain.
Veehof et al⁵⁸.	2016	Acceptance- and mindfulness-based interventions for the treatment of chronic pain: a meta-analytic review .	To assess acceptance- and mindfulness-based interventions for the management of chronic pain.	Review	Does not apply	Does not apply	Significantly, we see how ACT has better effects on several measures, especially depression and anxiety, than MBSR and MBCT, showing it as a good alternative to the usual cognitive therapies, especially for maintaining long-term beneficial results.
Hilton et al⁵⁹.	2017	Mindfulness Meditation for	To synthesize evidence on	Review	Does not apply	Does not apply	Much low-quality evidence showed that mindfulness

		Chronic Pain: Systematic Review and Meta-analysis.	efficacy and safety of mindfulness meditation interventions for the treatment of chronic pain in adults.				meditation was associated with decreased pain when compared to all controls in 30 studies. In addition, statistically significant effects were found for symptoms of depression and quality of life. With this study, higher quality and more rigorous studies are recommended to support the benefit of mindfulness meditation in chronic pain.
Bertolin⁶⁰.	2015	Eficacia-efectividad del programa de reducción del estrés basado en la conciencia plena (MBSR): actualización.	Review the efficacy-effectiveness of the stress reduction program based on mindfulness (MBSR)	Review	Does not apply	Does not apply	It was possible to show that MBSR is effective mainly in chronic pain, especially presenting better functional and emotional results in the acceptance of pain when it is correlated with its reduction or distraction, but it also has benefits on recurrent depression or depression that remains with residual symptoms, managing any type of stress and anxiety. It can also improve some medical conditions such as HIV, cancer, epilepsy, and psoriasis. The studies suggest beneficial effects of MBSR mainly in its short and medium term evaluation, so better and empowering studies are recommended to assess its

							advantages with long-term use, in addition to powerful studies of good methodological quality that confirm its efficacy.
Garland et al⁶¹.	2019	To review and extend the MMT to explicate how mindfulness fosters positive psychological states and produce therapeutic effects on the addictive behavior (e.g. opioid misuse) and chronic pain syndromes.	Review and expand the MMT to explain how mindfulness fosters self-transcendence by evoking upward spirals of decentering, attentional broadening, reappraisal, and savoring.	Review	Does not apply	Does not apply	The use of Mindfulness to introduce self-transcending positive emotions and non-dual states of consciousness is beneficial for therapeutically managing addiction in patients with opioid abuse and other addictions, since it allows restructuring of reward processing and also helps to manage chronic pain.
Ball et al⁶².	2017	Does mindfulness meditation improve chronic pain? A systematic review.	To evaluate the effects of mindfulness meditation in chronic pain.	Review	Does not apply	Does not apply	Significant reduction in depression was evidenced with the implementation of mindfulness meditation significantly reduced depression. In the case of affective pain, sensory pain and anxiety, there was a trend towards benefit with its use. In the case of quality of life on mental health, physical health and general score, there was a notable improvement with mindful meditation, which shows

							that mindful meditation has a more positive effect on the psychological aspects that lead to living with chronic pain, improving associated depression and quality of life.
Puig⁶³.	2017	¡Tomate un respiro! Mindfulness, el arte de mantener la calma en medio de la tempestad	Demonstrate that mental projections alter the perception of reality and that Mindfulness can help improve health, combat stress, anxiety, depression and enhance creativity with the ability to be fully present.	Book	Does not apply	Does not apply	The content of the book is divided into 3 parts: A first part that occupies almost the entire book where detailed scientific arguments are presented about what our body experiences after performing mindfulness practices. It also describes the benefits that this entails for our health and physical and mental well-being. In the last 2 parts, the steps to follow to carry out Mindfulness are described in a practical way.
Wielgosz et al⁶⁴.	2019	Mindfulness Meditation and Psychopathology	Summarize the current state of research on Mindfulness and its psychopathology in terms of theory, experimental	Review	Does not apply	Does not apply	Mindfulness is the set of various practices adapted to contemplative traditions that have in common to reduce distraction and improve awareness in mental experience, allowing the development of the basic capacities of meta-awareness and present-centered awareness.

			<p>evidence, and clinical results. Also, identify important aspects that allow understanding and priorities for the field in the coming years.</p>				<p>There are multiple mechanisms that allow mindfulness to exert a positive effect on affective systems. Mindfulness meditation-based interventions (MMBIs) function as established treatments for symptoms of depression, anxiety, pain, and substance abuse. Studies suggest benefits of mindfulness in eating disorders, post-traumatic disorders, stress, and serious mental illness, while results have been mixed for attention disorders. There are several significant methodological problems in mindfulness research, so it is advisable to carry out studies that improve the quality of the research.</p>
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6. Discussion

The purpose of this literature review was to demonstrate the effectiveness of the Mindfulness technique in the management of patients with a diagnosis of chronic pain, as well as the safety of its use to be implemented as a technique in part of the treatment.

Pain is a complex symptom, in addition to the fact that it generally presents itself with multiple causes, generating a strong incapacity and therefore impacting the quality of life of those who suffer from it. It currently represents one of the main reasons for medical consultation, thus generating high costs for the health system (65).

The majority of chronic pain is usually accompanied by addiction to opioid-type analgesics and a strong state of depression that often complicates treatment (59).

Pain is such a complex event that its intensity and presentation can vary in different people or even vary in the same person at different times, pathologies and circumstances. Pain perception can be influenced by both cognitive and emotional factors, and this is reflected in studies that show that these factors endogenously activate the interaction between afferent nociceptive brain signals and descending modular systems. In view of this, there is now a strong trend to resort to mind-body therapies, including meditation, yoga and cognitive behavioral therapies in order to manage chronic pain, which is often disabling (10).

Addiction to analgesics or simply the dependence on them in the face of refractory chronic pain has made it more and more frequent to search for other options to manage the pain of these patients and their accompanying conditions such as depression and anxiety that accompany chronic pain. and the alterations in the quality of life of these patients, such as cognitive therapies and meditation in all its variants. Mindfulness Meditation was born as an oriental technique that facilitates a posture of attention of detached observation (59).

Mindfulness is a technique that was described by Kabat-Zinn in 1994. Mindfulness or full attention is based on two pillars: attention and acceptance. This technique is defined as the psychological process that focuses the subject's attention on internal and

external experiences in the current moment and implies the acceptance of what happens, without judging and without believing that there is a correct or incorrect way of thinking or feeling (65).

The Mindfulness technique consists of focusing all the attention and subsequently consciously recognizing each of the sensory events that are perceived around us as momentary events that can be released without processing them or without making any kind of affective attachment (14).

It has been reported that these meditation-based interventions induce changes in hormonal, autonomic and structural brain activity, which have repercussions on emotional, learning and memory processes (65).

The use of mindfulness techniques in pain patients has been studied for several years, showing visibly promising results in improving pain symptoms, mood disorders that often accompany these pain patients or simply manifest themselves in pain. isolation and anxiety, inviting to delve into this topic to demonstrate the effectiveness of the technique and the safety in its use. Hilton et al (59), in their study, conducted a systematic review on the efficacy and safety of mindfulness meditation interventions for the treatment of chronic pain in adults. We know that suffering from chronic pain brings with it social, economic and medical problems, producing not only alterations in the quality of life of those who suffer from them, but also an increase in expenses for medical requirements added to the loss of work productivity. This is why, as described in this study, many people are increasingly looking for new alternatives for pain management, with mindfulness meditation being a good option based on the refractory nature of chronic pain and the negative consequences that addictions entail due to the drugs that are commonly used in these conditions (59).

Hilton et al (59), describe in their study that this technique has currently been used with positive results in patients with substance abuse, to treat smoking cessation, to reduce stress and as a treatment for chronic pain. Many reviews evaluated in this study focus on the treatment of chronic pain in specific types of pain such as low back pain, fibromyalgia and musculoskeletal pain with small positive effects not only for pain control but also for accompanying disorders, like depression and anxiety. Concluding in this way, that

mindfulness improves the symptoms of pain and depression, as well as quality of life, although it also determines the need for more well-designed, more rigorous and large-scale studies to support the issue (59).

These findings agree with what was published by Garzón et al (55), in a study carried out in an urban health center where mindfulness workshops were applied in the context of primary health care. This author is based on the fact that mental and emotional factors, our way of thinking and behaving and the way we deal with the events we go through daily, have an important effect on our physical health and on the ability to recover from illnesses and injuries. That is why through mindfulness we can become aware of how these factors influence our well-being through the ability to pay attention. He describes how mindfulness is based on a premiere that allows developing the ability to concentrate and the ability to let go of thoughts, emotions and other phenomena of the mind to experience the now, obtaining good results that demonstrate the effectiveness of this technique. of mindfulness to improve chronic pain, stress, mild anxiety, mild depression and coping with the disease. However, it also considers the need to deepen these studies to propose its use in primary health care, an area where it is extremely helpful given the large consultations of patients with depression, anxiety and chronic pain who come to primary care in any health center global health (55).

Currently, none of the most widely used pharmacological or surgical treatments to treat chronic pain are capable by themselves of achieving fullness and resolution or improvement of pain, so it has been sought to include, in combination, psychological therapies such as treatments behavioral cognitive. (CBT) which have the best support in the literature for years given their psychotherapeutic management of various conditions such as pain and acceptance and commitment therapy (ACT) that is based on the acceptance of pain in order to treat and manage it. But, also, the implementation of mindfulness therapy has been studied as formal meditation in stress reduction (MBSR) or complemented with cognitive therapy (MBCT), where in both meditation is the fundamental center of the technique. In a meta-analysis by Veehof et al (58), the effectiveness of these acceptance- and mindfulness-based treatments was evaluated. According to this author, both ACT and MBSR and MBCT can be differentiated theoretically speaking, but the 3 techniques have in common the focus on the concepts of acceptance of pain and mindfulness. With this study, I conclude that people with chronic

pain respond adequately well to treatment with therapies based on acceptance and mindfulness and that, in addition, the beneficial effects persist over time, once the treatment is finished. It also concluded that ACT was more effective in treating depression and anxiety in people with pain but that pain responds positively to the use of mindfulness techniques (58).

Cognitive behavioral therapies have been compared to mindfulness therapies for managing different types of chronic pain. In the case of a study conducted by Cherkin et al (56), the management of low back pain was evaluated as it is one of the main causes of disability in the United States, its numbers persisting despite multiple therapeutic options and large medical care resources. Some studies showed that cognitive behavioral therapy (CBT) was effective in managing low back pain, but since its access is limited, the use of Mindfulness-based stress reduction therapies (MBSR) has been proposed as a good option. However, since most studies demonstrated their efficacy in managing chronic pain in the elderly, Cherkin et al (56) evaluated younger patients with low back pain using these therapies. In their study, 342 adults between 20 and 70 years of age with low back pain were evaluated, randomly assigning those treated with MBSR, with CBT and those treated with usual care. As a result, it was evidenced that patients treated with MBSR and TCC presented greater improvement in low back pain than those treated with their usual care. No significant differences were found in the results between MBSR and TCC. Given the limited access of the latter, this author concluded that MBSR may be an effective treatment option to treat patients suffering from chronic diseases that occur with low back pain (56).

The Mindfulness-Based Stress Reduction (MBSR) program is a structured, multimodal, non-specific instructional or psychoeducational intervention designed to enhance participants' mindfulness with a focus on the present. It is based on vipassana meditation and was the first of the therapeutic interventions to be developed based on mindfulness. MBSR is a psychoeducational program, not a true psychotherapeutic treatment per se, and represents a generic or non-specific approach to intervention. The program began more than thirty years ago in the US to relieve pain and stress related to certain chronic diseases. Bertolin (60) in his study, carried out a systematic review of several investigations on this technique, where he evaluated the efficacy-effectiveness of this technique at present. In his study, he describes it as a technique with an important positive cost-benefit contribution in pain

management, which consists of 8 weekly sessions of 2 to 2 and a half hours, in addition to homework. This type of Mindfulness practice consists of: sitting or walking meditation, body scan or body scan and hatha yoga. With this study he was able to conclude that despite the large number of studies and reviews in the literature, the quality of their results is inconsistent, although many of the studies support that the MBSR program can be useful in a large number of people, especially in pain management where there is evidence that accepting pain correlates with better functional and emotional outcomes than reducing or distracting attention and vigilance from pain and has many active components in addition to vipassana meditation. It is therefore a non-specific intervention in which it is not possible to discriminate which is its most active component (60)

Bertolin (60) also describes in his study that the MBSR program increases gray matter concentration in the left hippocampus, which has been postulated to play a central role in mediating some of the benefits of meditation due to its involvement in modulating of cortical arousal and responsiveness (60).

Finally, this work by Bertolin (60) allows us to demonstrate the steps that are taken in the application of mindfulness with chronic pain, which are, first of all, to see and know what the subject feels both physically and emotionally in relation to that pain. Second, it is intended to recognize the emotional reactions to it. Finally, we try to accept the pain moment by moment, without trying to get away from it. In addition to improving pain and stress management in very diverse medical conditions, this author suggests that MBSR is efficient or effective as an adjunctive intervention in anxiety symptoms and mental health in general, and in certain mental disorders, and that it contributes to improve general health in non-clinical populations. According to this author, many studies support its benefits in the short and medium term, but he suggests further research studies to corroborate its long-term benefits (60). There is evidence of its effectiveness in chronic pain, as was also demonstrated in the studies by Veehof et al (58) and Cherkin et al (56), its effectiveness was also determined in recurrent depression or with residual symptoms, stress in general and in various anxiety disorders, as well as in certain diverse medical conditions such as cancer, resistant epilepsy, psoriasis and patients with HIV, among others. In particular, with

regard to pain, there is evidence that accepting it correlates with better functional and emotional outcomes than reducing or distracting attention and vigilance against it. However, more evidence is needed to demonstrate its long-term efficacy (60).

In contrast to what was published in the previous study, La Cour et al (57) carried out a study aimed at investigating the effects of mindful meditation on long-term chronic pain, delving into specific details regarding what was evaluated in previous studies and prolonging the evaluation time of the patients. To date, more and more studies have been carried out supporting Mindfulness techniques, however, as this author mentions, many reviews emphasize the effects of this technique on pain and health, without proper follow-up. long-term or even not mentioning the study time in their publications, which determines the need for more studies with better quality and larger populations over a longer period of time (57).

In this study, La Cour et al (57) evaluated a total of 109 patients with nonspecific chronic pain for 6 months, who were measured during the study for pain, physical function, mental function, pain acceptance and quality of life, health-related, demonstrating that mindfulness meditation, modeled on the MBSR protocol, had positive effects in long-term chronic pain patients and exerted clinically relevant effects on several patient dimensions (57).

On the other hand, since mindfulness meditation is a non-invasive technique, demonstrating its efficacy for the management of chronic pain, a condition that in most cases leads to the largely unsuccessful use of pharmacological treatment, this This technique allows it to be indicated as part of a treatment that gives better results, especially for patients with underlying diseases to whom a lot of pharmacological treatment is administered. For this reason, Hussain et al (54), in their study, directed the research to evaluate this technique in older female patients diagnosed with diabetes who present with chronic pain due to diabetic peripheral neuropathy and who are mostly accompanied by anxiety and depression, conditions that generate levels High levels of HbA1c and therefore enhance the severity of diabetic complications. The result of this study determined that conscious meditation therapies do have a positive effect on these patients in the treatment of pain, enhancing pharmacological treatment when used in combination and in some cases even

reducing their consumption, allowing the amount of medication to be reduced. received by these patients and also improved comorbid conditions such as anxiety and depression (54).

With respect to what was mentioned above, where Hussain et al (54) mention the positive effect of these mindfulness meditation therapies on anxiety and depression in patients with basic treatment for chronic diseases such as chronic pain comorbidity, mindfulness can improve the conditions that accompany chronic pain, as described in a study by Ball et al (62), where emphasis is placed on the effect of full mindfulness meditation on the psychological and emotional aspects that accompany chronic pain. He carried out a review of the studies that evaluated patients with chronic pelvic pain, a condition that not only deteriorates the quality of life of the majority of patients who suffer from it, but also has a negative effect on their economic income and their quality of work, accompanied of emotional alterations such as depression, stress and anxiety and this study showed that mindfulness has its most outstanding positive effect not in reducing pain as such, this was more of an added component to the research, but in improving everything related to the psychological . and emotional aspects of living with a type of chronic pain, that is, it improves anxiety and depression, as well as improves the patient's quality of life in general (62).

Ball et al (62), focuses his study on demonstrating not only the reduction of chronic pelvic pain with the use of Mindfulness techniques, but also the anguish related to this pain. These results applied to women and taking into account that both men and women manifest pain differently, this author recommends expanding the research aimed at both sexes. (62)

CPM (conditioned pain modulation) is based on the reduction of pain produced by a stimulus, using a second noxious conditioning stimulus in another part of the body. This modulation, widely studied in the individual, reflects the ability of the pain system to inhibit itself. In research it has been shown that this modulation has low efficacy in patients with chronic pain and given the good effects that Mindfulness has on the management of chronic pain that have been shown in several publications, Tsur et al (53), conducted a study in the that I value the effects of mindfulness to effectively block or stop CPM reductions in patients with chronic

pain. Sensory tests of pain perception and modulation were performed in this study. Then 3 types of interventions were carried out: one with specific conscious attention to pain, another with conscious attention to non-painful visual cues, and finally a control group without conscious attention. With this study, the author was able to determine that the CPM, as a reflection of the endogenous analgesic function of the organism, presented pain inhibition failures in the control group, which were not present in the two mindfulness groups, keeping the CPM in them. This made it possible to reinforce the relationship between mindfulness and the improvement of chronic pain, largely based on an improvement in cognitive functions and behavioral aspects related to coping with pain (53).

As an important finding, Tsur et al (53) was able to determine that of the two groups where the mindfulness technique was implemented, it was more beneficial to pay conscious attention to non-painful signals than to pay conscious attention to pain sensations by enhancing the effect pain-reducing blockade of pain modulation in patients with chronic pain. These results were relevant to show that mindfulness techniques are especially important for populations at risk of developing chronic pain (53).

MMT (mindfulness theory) represents a group of positive psychological processes including defocusing, attention spanning, reappraisal, and savoring, all of which have the ability to momentarily activate a state of metaconsciousness infused entirely with positive affect (wonder, compassion, gratitude, love). Sometimes this cycle of emotions can be activated as an ascending spiral that stimulates the ability of the human being to go beyond his own self, expand his personal limits and reach a spiritual path that gives meaning to life, connecting the self with others and the environment. All this self-transcendence produced by this TMM technique allows this model to be applied as a psychological treatment for addiction and chronic pain, as explained by Garlarnd et al (61), in their study, where they carry out a review that assesses studies where recovery-oriented Mindfulness can be used as a treatment for opioid abuse, a consequence that occurs in patients who receive it indicated as a treatment for chronic pain and therefore reduce intense desire and behaviors related to the misuse of opioids. As awareness expands further, pain becomes less dominant in awareness. Based on all

this, more research will be allowed to explain therapeutic action mechanisms and neurobiological mediators of self-transcendent states of consciousness (61).

Mindfulness is presented as the solution to enjoy the present without letting the mind automatically develop thoughts that drag us to the past or the future (thoughts that turn into feelings or reactions either to regret or worry), the so-called "mind dualist". The author Mario Alonso Puig (63) in his work expresses these benefits of Mindfulness for our physical and mental health and well-being, presenting detailed scientific arguments that show that a person who practices Mindfulness creates new neural connections that allow him to better solve everyday problems, improve memory and attention span and lead to multiple health benefits including pain management (63).

This author describes that when neuroimaging studies such as magnetic resonance imaging are applied to people who practice Mindfulness, changes are observed in different areas and brain circuits. Even using an electroencephalogram, changes in the brain's electrical rhythm can be seen during meditation. With these studies based on assessing the "default mode network" (DMN), which includes different brain areas that connect to each other located in the frontal, parietal and temporal lobes, the constant and restless work of the brain can be evidenced. In this way, the ventromedial cortex is valued, which processes emotions and the posterior cingulate, in charge of the sense of self and autobiographical memory. This network allows the maintenance of the dualistic mind and during mindfulness, its progressive deactivation can be assessed, coinciding with a different perception of the environment and its things. When the activity of the default mode network is reduced, the anterior cingulate and the dorsolateral prefrontal cortex are activated, which make up the central executive network (CEN) in charge of attention control, working memory, inhibition and control of habits or impulses, ability to mind to choose alternatives and solve problems. Brain MRI shows an increase in thickness of these 2 brain areas belonging to the default neural network during the practice of Mindfulness (63).

Mario Alonso Puig (63) also describes in his work that, although the brain works as a whole where the left hemisphere moves the right side of the body and the right hemisphere, the left, in reality it is not that we only have two different cerebral hemispheres, but that each one is connected to a mind that processes information in a different and particular way and as such, one of the most exciting elements of research on the effects of mindfulness has to do precisely with the observation of how this practice interacts with these two such different minds. During the practice of mindfulness we pass from the explanatory, analytical and conceptual mode of the left hemisphere to one much more based on direct sensory experience and, therefore, more connected to the right. The anterior cingulate and the insula—which are, as we have seen, association areas in which bodily sensations, feelings and reasoning converge—are especially active during this process in which we bring attention to the bodily experience during Mindfulness. The effects of this activation of the anterior cingulate and the insula are: An increase in GABA, hence the effect, on the one hand sedative and on the other muscle relaxant, that the practice of mindfulness has, an increase in serotonin that is of great importance to maintain a good mood, an increase in melatonin, which promotes sleep and a reduction in cortisol levels, the well-known stress hormone. This is one of the reasons why the practice of MBSR has achieved such prominence in the medical environment (63).

It is known that the growing success of Mindfulness has brought with it a growing cultural and scientific interest during the last three decades since its inception. Several of these scientific foundations such as those described by Mario Alonso Puig (63) previously are today available to the general public. In a study conducted by Wielgosz et al (64), he details how the versatility of Mindfulness has attracted so much to the implementation of this practice in multiple conditions and diagnoses, especially the management of mental health in recent years. He also describes the diversity of this technique as having allowed its beneficial effects to benefit patients where other treatments have not been able to respond (64).

Magnetic resonance as we see is a resource that allows us to directly visualize the activation of specific areas of the brain with the practice of Mindfulness, which allows the person with the training of this technique to learn to control this activity, thus being able to control pain modulating areas in order to improve cognitive and emotional control of pain with the practice of Mindfulness (10).

The study of Mindfulness from a neurobehavioral perspective has been a fundamental part of the investigations of this technique, says Wielgosz et al (64), who, just as Mario Alonso Puig (63) described in his work, this author also describes the effects that Mindfulness practice produces at the neural level. This author identifies 3 essential networks for cognitive aspects related to Mindfulness training: A central executive network (CEN) related to the top-down regulation of attention and includes nodes in the prefrontal cortex. A second salience network (anterior insula, dorsal anterior cingulate cortex, amygdala, and midbrain dopaminergic regions, which is responsible for ascending attentional orientation. And the default mode network (DMN), located in midline cortical regions, related to spontaneous and self-referential thinking (64).

Wielgosz et al (64), describe that the altered function of these networks is not only related to Mindfulness practices but also to all practical cognitive tasks after Mindfulness. Being able to practice Mindfulness for years to manage pain, stress, anxiety and depression, as well as manage patients with substance abuse. Although research on Mindfulness has reached great scope today, there are many physical and mental conditions that are beneficial with the use of Mindfulness, such as eating disorders and attention deficit, which require further study. In addition, according to this author, studies today should focus on strengthening methodological quality to improve their quality and weight (64).

7. Conclusions

After conducting this literature review, the following conclusions can be reached:

- 1) The use of mindfulness is effective for the management of chronic pain and can be used as an independent treatment or together as a combined therapy with pharmacological and non-pharmacological measures, also helping to reduce the use of medications and reduce the interference of chronic pain with activities of the daily life of these patients improving their quality of life.
- 2) Mindfulness makes it possible to treat chronic pain in the absence of risk of addiction, as in the case of pharmacological treatment and opioid addiction. In addition, it improves emotional conditions related to chronic pain, such as anxiety and depression.
- 3) Studies related to how mindfulness can be applied as a technique to help people suffering from chronic pain are constantly increasing, which means that more work is needed to support this topic, however, as has been seen throughout the review, the results presented so far from each of the investigations already confirm the effectiveness of this technique.
- 4) The mindfulness technique has shown high efficacy and this, added to its low cost, easy application and its few or almost zero contraindications, makes it possible to incorporate it as part of a multidisciplinary treatment in search of improving the symptoms of people with diagnosis of chronic pain.

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9. Annex

Annex I: STROBE Statement—checklist of items

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract <hr/> (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of

selection of participants. Describe methods of follow-up

Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls

Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants

(b) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed

Case-control study—For matched studies, give matching criteria and the number of controls per case

Variables		7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data measurement	sources/	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias		9	Describe any efforts to address potential sources of bias
Study size		10	Explain how the study size was arrived at
Quantitative variables		11	Explain how quantitative variables were handled in the analyses. If applicable,

describe which groupings were chosen and why

Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding
		(b) Describe any methods used to examine subgroups and interactions
		(c) Explain how missing data were addressed
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed
		<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy
		(e) Describe any sensitivity analyses

Results

Participants	13	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
	*	(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram

Descriptive data	14	*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
			(b) Indicate number of participants with missing data for each variable of interest
			(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data	15	*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time
			<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure
			<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results	16		(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
			(b) Report category boundaries when continuous variables were categorized
			(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17		Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion

Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Annex II: The STROBE Statement of Clinical Trials Reviewed

Items	Tsur et al⁵³.	Hussain et al⁵⁴.	Garzón et al⁵⁵.	Cherkin et al⁵⁶.	La Cour et al⁵⁷.
1	Si	Si	Si	Si	Si
2	Si	Si	Si	Si	Si
3	Si	Si	Si	Si	Si
4	Si	Si	Si	Si	Si
5	Si	Si	Si	Si	Si
6	Si	Si	Si	Si	Si
7	Si	Si	Si	Si	Si
8	Si	Si	Si	Si	Si
9	Si	Si	Si	Si	Si
10	Si	Si	Si	Si	Si
11	Si	Si	Si	Si	Si
12	Si	Si	Si	Si	Si

13	Si	No	Si	Si	Si
14	Si	Si	Si	Si	Si
15	Si	Si	Si	Si	Si
16	Si	Si	Si	Si	Si
17	Si	Si	Si	Si	Si
18	Si	Si	Si	Si	Si
19	Si	Si	Si	Si	Si
20	Si	Si	Si	Si	Si
21	Si	Si	Si	Si	Si
22	No	Si	Si	Si	No