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Review Article

Mindfulness and emotional regulation: A systematic literature review*

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Objective: This systematic literature review study sought to analyze the relationship between mindfulness and emotional regulation. Method: Several national and international databases were consulted and 60 articles published in the period from 2009 to 2019 were selected for analysis. Results: In conceptual terms, mindfulness is predominantly considered as a trait, and less as a state or skill. The results of empirical studies suggest that mindfulness is associated with the use of adaptive emotional regulation strategies favoring healthy psychic functioning. The limits and contributions of this review are also pointed out. Conclusion: It is concluded that there is a need for further studies that consider the procedural aspect of mindfulness and that make it possible to capture the subjective experience of the practice, considering the prevalence of quantitative studies that used self-report scales.

Descriptors: Mindfulness; Literature Review; Emotions; Mental Health.

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Mindfulness e regulação emocional: uma revisão sistemática de literatura

Objetivo: este estudo de revisão sistemática de literatura buscou analisar as relações entre mindfulness e regulação emocional. Método: foram consultadas diversas bases de dado nacionais e internacionais e selecionou-se para análise 60 artigos publicados no período de 2009 a 2019. Resultados: Em termos conceituais, mindfulness é prevalentemente considerado como um traço, e menos como um estado ou habilidade. Os resultados dos estudos empíricos sugerem que mindfulness mostra-se associado ao uso de estratégias de regulação emocional adaptativas favorecendo o funcionamento psíquico saudável. Apontam-se também os limites e contribuições desta revisão. Conclusão: Há a necessidade de mais estudos que considerem o aspecto processual de mindfulness e que possibilitem capturar a vivência subjetiva da prática, tendo em visto a prevalência de estudos quantitativos que fizeram uso de escalas de autorrelato.

Descritores: Atenção Plena; Revisão de Literatura; Emoções; Saúde Mental.

Mindfulness y regulación emocional: una revisión sistemática de la literatura

Objetivo: este estudio de revisión sistemática de la literatura buscó analizar la relación entre la atención plena y la regulación emocional. Método: se consultaron varias bases de datos nacionales e internacionales y se seleccionaron para su análisis 60 artículos publicados en el período de 2009 a 2019. Resultados: en términos conceptuales, la atención plena se considera predominantemente como un rasgo, y menos como un estado o habilidad. Los resultados de los estudios empíricos sugieren que la atención plena se asocia con el uso de estrategias adaptativas de regulación emocional que favorecen el funcionamiento psíquico saludable. También se señalan los límites y las contribuciones de esta revisión. Conclusión: se concluye que es necesario realizar más estudios que consideren el aspecto procesal de la atención plena y que permitan capturar la experiencia subjetiva de la práctica, considerando la prevalencia de estudios cuantitativos que utilizaron escalas de autoinforme.

Descriptores: Atención Plena; Revisión de Literatura; Emociones; Salud Mental.

Introduction

Over the past three decades, there has been a notable growth in the scientific interest in the benefits promoted by the practice of *mindfulness*[1]. Diverse empirical evidence points out that this practice can allow people to deal with their emotions in a more adaptive manner[2-3]. Associated with *mindfulness,* the emotional regulation process has also been extensively investigated[4]*,* bringing out evidence that both contribute to mental health and personal well-being[4-11].

The growing interest in exploring the role of *mindfulness* in the emotional regulation process is due to its effect in reducing the negative response to stress and in improving emotional management processes[12], enhancing the effect on psychological well-being[13-14]. Higher levels of *mindfulness* have been associated with more adaptive emotional regulation processes in clinical and non-clinical populations[7,15]. However, the mechanisms of this relationship have not yet been widely understood[7,11,16].

One of the difficulties is the operationalization of the *mindfulness*[17] construct. The authors highlight three types of studies most found in the scientific literature on *mindfulness*: i) studies based on interventions (such as the use of the *Mindfulness* Based Stress reduction – MBSR program or full attention exercises), ii) comparison of *mindfulness* practitioners and non-practitioners, and iii) studies on the dispositional trait of *mindfulness*. This variability in studies is attributed to the different forms for the operationalization of *mindfulness*.

In the field of Psychology the term *mindfulness* has been used in three ways, with possible impacts on how the concept is operationalized in the empirical studies: i) characteristic or trait: stable quality that differs between the individuals, ii) momentary state: which can be induced; and iii) ability developed through the intervention: which involves learning by means of formal and informal practices. The diverse evidence on the effects of *mindfulness* differs depending on how it is operationalized[18]. There is discussion in the literature[19] that some authors conceive it as a one-dimensional construct[20], while others see it as multi-factorial[21-22]. There is also criticism on the trend to define and operate this construct as a stable trait, which departs from the definition of Buddhist texts that value its procedural and dynamic aspect[23].

Taking as a base the pointed out aspects, it was decided to carry out a systematic literature review in order to identify how *mindfulness* has been operationalized in the empirical studies and to characterize the nature of the relationships between *mindfulness* and the emotional regulation process in the national and international literature over the last ten years. Systematic reviews are important methodological resources in a context of accelerated growth of the scientific production. They allow scientists to answer questions about the quality and quantity of what is being produced in a specific scientific field, assisting researchers in the critical analysis of the accrued knowledge and in the elaboration of more promising research projects by taking into account empirical evidence and theoretical bases pointed out as more consistent[24-25].

It is expected that the results and the analysis carried out from this systematic review will contribute to offer a clearer picture of the operationalization and current state of the scientific production concerning the relationship between *mindfulness* and emotional regulation. It is also expected to contribute to the improvement of studies in this area and to offer information to subsidize intervention programs based on *mindfulness*.

Method

Systematic reviews are secondary studies conducted from published primary studies[24]. The steps to carry out a literature review are the following: definition of the research question; search for evidence (definition of terms or keywords and search strategies); selection of studies (inclusion or exclusion in view of the established criteria); evaluation of the methodological quality of the study (by reading the articles), and presentation of the results (elaboration of an abstract on the selected studies and articulation with the research question)[25].

The guiding questions for this literature review were the following: *"What are the empirical relationships between mindfulness and emotional regulation available in the national and international literature?"* and *"In what way has mindfulness been operationalized in these empirical studies?"* The established time frame was from 2009 to 2019, and this period was chosen because it made it possible to analyze both more recent publications (last five years) and previous studies, broadening the understanding of the relationship between the constructs.

Initially, between November and December 2019, a search was conducted in Google Academic and in all the databases available in the CAPES (Commission for the Improvement of Higher Education Personnel) Journal Portal for scientific articles on *mindfulness* and emotional regulation. The search was also conducted in specific databases such as Scientific Electronic Library Online (Scielo), Latin American and Caribbean Literature

in Health Sciences (*Literatura Latino-Americana e do Caribe em Ciências da Saúde*, Lilacs) and the *Research Gate* website.

The criteria established for the selection of scientific articles were as follows: empirical articles, published from 2009 to 2019, using combinations of the keywords *mindfulness*, *atenção plena*, *regulação emocional*, *emotional regulation* and *emotion regulation*. The Boolean operator "*and*" was used so that both keywords were included in the searches. The search was limited to articles published in Portuguese, English and Spanish, whose participants have been adults. The databases were configured to search the words "*título*" and "*assunto*" in the CAPES Portal and "title" and "keywords" in Google Academic and in the other databases. Through *Research Gate*, access was obtained to articles whose full text was not available in the databases consulted. The exclusion criteria were removal of theses, theoretical articles, review or meta-analysis articles, editorials, comments on articles, books and book chapters.

A total of 762 articles were found in the CAPES Journal Portal databases, 350 documents in Google Academic, one article in Scielo, one article in *Research Gate* and no article in Lilacs, totaling 1,114 documents. From the reading of the title, the first selection of articles that met the inclusion criteria was started. In cases where the title, abstract or keywords were not sufficient to decide on the inclusion of the article, the entire study was read. Duplicate documents were also excluded. At the end of this first stage, 283 texts were selected, 236 identified in the databases available in the CAPES journal platform, 45 in Google Academic, one in Scielo and one in *Research Gate*. The second and last stage of the selection of empirical articles was made by reading the abstracts of these articles. The established inclusion criteria were taken into account, excluding those articles that made reference to very specific subject matters, which would hinder drawing general conclusions from relations between *mindfulness* and emotional regulation. Therefore, very specific articles on psychopathologies, training focused on compassion or on the cognitive aspect, chronic pain, decision-making processes, target population of children, adolescents and older adults, among others, were removed from the final list of articles. There were 60 articles left for analysis, 45 in the CAPES portal, 14 in Google Academic, and one in *Research Gate*.

The databases and the respective number of articles identified for reading were as follows: *Springer* (*n*=19), *Elsevier* (*n*=18), *PubMed* (*n*=9), *Routledge* (*n*=4), *American Psychological Association* (*n*=3), *Ebsco* (*n*=2), *Semantic Scholar* (*n*=2), *Wiley Periodicals* (*n*=2) and *Australian Psychological Society* (*n*=1).

The selected articles were read in full and a synthesis of the main information, such as year, authorship, study objective and conclusions, was carried out. From reading the texts, a categorization was made regarding the operationalization of *mindfulness* using the direct information of the text or from the way in which the author treated the construct (trait, state or ability). In addition, the studies were categorized according to their objective, through analysis of the thematic content[26-27] where the studies were grouped by thematic similarity or proximity, since the data analysis of a literature review must observe patterns and carry out comparisons among the studies, grouping them into analytical categories[28]. The categories were elaborated in an inductive manner, after reading the articles selected by the first author and orientation by the second author. These categories were created trying to answer the questions of this literature review.

Results

Initially, the general characteristics of the reviewed studies will be described and, later, an analysis of their objectives and main results will be presented. It is noted that most publications occurred in the last five years (2015 to 2019), with 37 publications in this period (61.6%) and 23 between 2009 and 2014 (38.4%).

The reviewed studies were conducted in several countries: United States of America (*n*=15), China (*n*=4), Germany (*n*=2), Iran (*n*=2), Israel (*n*=2), Switzerland (*n*=2), Austria (*n*=1), Germany and Austria (*n*=1), Brazil (*n*=1), South Korea (*n*=1), India (*n*=1), Italy (*n*=1), Japan (*n*=1), United Kingdom (*n*=1), Singapore (*n*=1) and Sweden (*n*=1). The study locus was not mentioned in 23 studies.

In relation to the participants, there was a prevalence of division into two groups, with 26 studies being conducted with adult individuals from the general population and 26 with students. Five studies had a clinical sample (individuals under treatment or seeking treatment for anxiety and depression disorders) and three merged clinical and non-clinical participants.

Regarding the operationalization of *mindfulness*, in 38 studies *mindfulness* was defined as a trait (stable individual characteristic), in eight as a state (momentary state induced during data collection), and in nine as an ability (developed through an intervention program based on *mindfulness* or brief training). Three studies addressed *mindfulness* both as a state and as a trait and two treated it as a state and as an ability, as described in Figure 1.

Mindfulness	**Definition**	**Examples**	**Studies (author/year)**
Trait/ Dispositional	Stable characteristic that differs among the individuals	Self-reporting scales were applied for *mindfulness*, difficulty of emotional regulation and inventory of symptoms in 853 individuals in order to identify associations between *mindfulness*, emotional regulation and psychic dysfunctions (depression, anxiety)[14] Self-reporting scales were applied for *mindfulness*, difficulty of emotional regulation and experience in intimate relationships, in order to verify whether the abilities of emotional regulation and attachment would be related to dispositional *mindfulness*[29]	Arch and Craske, 2010; Brockman et al., 2017; Bullis et al., 2014; Cheung and Ng, 2019; Cho et al., 2017; Coffey et al., 2010; Cosme and Wiens, 2015; Curtiss et al., 2017; Desrosiers et al., 2013; Desrosiers et al., 2014; Dubert et al.,2016; Fogarty et al., 2015; Freudenthaler et al., 2017; Goodall et al., 2012; Hamill et al., 2015; Hill and Updegraff, 2012; Iani et al., 2019; Kaiser et al., 2015; Kotsou et al., 2018; LeBlanc et al., 2019; Luberto et al., 2014; MacDonald and Baxter, 2017; Mahmoudzadeh et al., 2015; Mandal et al., 2017; McLaughlin et al., 2019; Mitmansgruber et al., 2009; Modinos et al., 2010; Ostafin et al., 2014; Parmentier et al., 2019; Pepping et al., 2013; Pepping et al., 2014; Prakash et al., 2017; Quaglia et al., 2015; Reese et al., 2015; Sauer and Baer, 2009; Shafiee-Tabar, Akbari-Chermahini, 2017; Tong and Keng, 2017; Zhang et al., 2019;
State	The individuals are led by an audio to position themselves in a state of *mindfulness* (brief state – only at the time of the experiment)	It was investigated whether *mindfulness* facilitated implicit emotional regulation. For this, the participants were induced into a state of sadness and then did an exercise of *mindfulness*, distraction or rumination. The implicit and explicit mood was collected before and after the exercise by specific mood measurements[30].	Erisman and Roemer, 2010; Feldman et al., 2010; Igna and Stefan, 2015; Lalot et al., 2014; Lutz et al., 2014; Opialla et al., 2015; Remmers et al., 2016; Valim et al., 2019
Mindfulness	Definition	Examples	Studies (author/year)
Ability	The individuals undergo an intervention (brief or eight weeks) during the study that aims to promote the development of *mindfulness*, or the sample is composed of people who already practice *mindfulness*.	The increased flexibility in the choice of emotional strategies in individuals after the *mindfulness*-based intervention was tested. Emotional stimuli (images) were presented to the individuals and they were asked to identify which emotional regulation strategy was used[31]. Individuals with experience in the practice of *mindfulness* were invited to compose the sample (more than 2 years of regular practice) and in the experiment they were asked to watch a video and soon after evoke autobiographical memories opposed to the emotional content of the film (e.g., sad film – happy memory)[32]	Alkoby et al., 2018; Garland et al., 2015; Greenberg and Meiran, 2014; Hölzel et al., 2013; Kral et al., 2018; Robins et al., 2012; Snippe et al., 2017; Xiao et al., 2019; Zhang et al., 2019
State and trait	The *mindfulness* trait is measured by self-reporting and, at the time of the experiment, the individual is invited to remain in a state of *mindfulness*.	The neural activity involved in the emotional processing associated with *mindfulness* (state and trait) was investigated. For this, the participants passively visualized affective images (trait). Then, the participants were instructed to adopt a *mindfulness* perspective and saw a second equivalent set of images (state). Data was collected by electroencephalogram (EEG)[33]	Egan et al., 2017; Keng et al., 2013; Kiken and Shook, 2014
State and ability	The individuals are subjected to a *mindfulness*-based intervention or rapid training in a particular *mindfulness* technique and, at the collection time, they are invited to remain in a *mindfulness* state.	The relations between *mindfulness* and the use of cognitive reevaluation were examined. For this, 7 times a week during an intervention program based on *mindfulness* (ability), the participants did a 10-minute meditation exercise of *mindfulness* at their homes and completed an assessment of the *mindfulness* (state) degree experienced during the meditation, as well as an assessment for the use of positive reevaluation in relation to the previous week[34]. The effects of attention to breathing for dealing with aversive emotions were tested, investigating the neural aspects involved in this process. For such purpose, the participants trained for two weeks the technique of attention to breathing (ability) and, at the time of the experiment (visualization of images), they were asked to perform the learned technique (state) and passively visualize the images during the MRI[35]	Doll et al., 2016; Garland et al., 2017

Figure 1 - Operationalization of *mindfulness* in the selected articles

Among the most commonly used instruments to measure the constructs under analysis, the use of self-reporting scales was predominant. On *mindfulness*, the *Five-Facet Mindfulness Questionnaire* (FFMQ[21]; *n*=25) and *Mindful Attention Awareness Scale* (MAAS[20]; *n*=19) were prevalent and, in relation to the measurements of emotional regulation, the *Difficulties in Emotion Regulation Scale* (DERS[36]; *n*=16), *Positive and Negative Affect Schedule* (PANAS[37]; *n*=15) and *Emotional Regulation Questionnaire* (ERQ[38]; *n*=14) stood out.

As for the studies, they were organized in five categories (Figures 2 to 5) by similarity related to the research focus. Most of the studies (*n*=19) sought to identify the effects of *mindfulness* and of emotional regulation strategies on the emotional response and on the regulation of emotions (Figure 2). The most specific focus of the desired relationship was: i) *mindfulness* and specific strategies, example: cognitive reevaluation and rumination (*n*= 5); ii) *mindfulness* and the response and involvement of the individuals with emotional stimuli (*n*=3); iii) *mindfulness* and the capacity for emotional differentiation in the regulation of emotions (*n*=3); iv) the effects of a program based on *mindfulness* on the emotional experience (*n* =3); and v) how the dimensions of these constructs interrelate and impact on improvements in health and well-being (*n*=3). In summary, the results of these studies indicate positive effects of *mindfulness* on the emotional regulation process (more adaptive, more flexible, greater use of reevaluation, fewer negative thoughts, less stress), with repercussions on health and on well-being[4,7,31,34,39-45].

Contrary to the strong assumption that *mindfulness* practitioners would be less affected by emotional stimuli, in one of the studies, experienced practitioners had high emotional engagement with the tasks proposed when compared to non-practitioners, as well as faster recovery than the latter[32]. The emotional stimulus was induced from the presentation of films, after which the response time was measured in the recall of a memory with emotional content opposite to that induced (e.g., sad movie – happy memory). In another study, it was proposed to investigate reactivity and emotional recovery to affective stimuli and it was identified that individuals who presented higher *mindfulness* scores had a rapid recovery after negative stimuli induced by images with affective content, but without decreased reactivity (measured by the subjective evaluation of the images)[46].

Positive associations were identified between *mindfulness* and the ability to differentiate emotions. Higher *mindfulness* scores were shown to be associated with greater capacity for emotional differentiation and less emotional difficulty (self-reported emotional deregulation and less emotional lability)[47]. The ability to differentiate negative emotions was associated with higher *mindfulness* scores, with repercussions on the adaptive response to stress[48]. Another study goes on to investigate if, in addition to emotional differentiation, the ability to differentiate context assessment (interpretation of reality) would be a mediator of the relationship between *mindfulness* and the capacity for emotional differentiation[49]. The results suggest that individuals with lower *mindfulness* scores experience undifferentiated emotional states not only because of the inability to regulate emotions, but also because of their interpretation of the world (different and competing evaluations), therefore with emphasis also on the cognitive aspect.

In addition, some studies investigated dimensions of *mindfulness* in association with emotional regulation strategies. The "describe" and "non-reactivity" dimensions were associated with greater use of reevaluation and acceptance and with lesser use regarding suppression of emotions; observation with more rumination; and non-judgment with less rumination[50]. In another study it was identified that some factors associated with *mindfulness* (description, acting consciously) predict less reactivity to stress and anguish[12]. There was also a discussion on the overlapping of *mindfulness* and emotional regulation, considering their factors and emphasizing the mediators: clarity, managing negative emotions, detachment and rumination in the relationship between *mindfulness* and mental health[1].

The studies that included other constructs to deepen the understanding of the relationship between *mindfulness* and emotional regulation (*n*=15), presented in Figure 3, make reference to affects (*n*=4), mood (*n*=3), behavior motivation (*n*=2), work memory (*n*=2), attachment (*n*=2), self-efficacy (*n*=1) and social connection (*n*=1). The results provide evidence of positive effects of *mindfulness* on affects, mood, memory and social connection[16,51-57]. Another result indicates that affect and self-efficacy would mediate the relationship between *mindfulness* and emotional regulation, with positive effects on satisfaction with life[10,58]. Additionally, *mindfulness*, emotional regulation and attachment would be correlated[29,59]. Finally, the studies indicate that *mindfulness* relates to the behavior inhibition system, which provides for greater vigilance with behavior inhibition, and problems with psychic functioning (anxiety). That is, individuals who are more sensitive to the behavioral inhibition system have more difficulty in regulating emotions, partly because they have difficulties in using important dimensions of *mindfulness*, such as to acting consciously, not judging and not being reactive[60], and that acceptance and the facets of *mindfulness* (observation and non-reactivity) would cushion the influence of the behavioral inhibition system on psychological suffering[61].

Authorship/ Year	Objective	Results
Igna and Stefan, 2015	To compare *mindfulness*, cognitive reevaluation, images and rational statements, emotional response (negative emotions and suffering) and negative automatic thoughts	Significant difference between cognitive reevaluation and irrational and quasi-significant statement between *mindfulness* and irrational statement. These strategies are protective factors for stress perception
Prakash et al., 2017	To investigate whether emotional regulation strategies support the association between *mindfulness* and emotional deregulation (comparing different age groups)	Less avoidance of thoughts partially explains the relationship between *mindfulness* and better emotional regulation, with stronger mediation for young people
Garland et al., 2017	To examine relationships between *mindfulness* and positive reevaluation in a sample that participated in a *mindfulness*-based intervention	Intervention: > *mindfulness* and > use of positive reevaluation
Garland et al., 2015	To investigate whether the state and practice of *mindfulness* could improve cognitive reevaluation	The degree of *mindfulness* predicted increases in cognitive reevaluation over time
Lalot et al., 2014	To investigate the effects of *mindfulness*, reevaluation and suppression in the regulation of positive emotions (viewing videos with emotional content), observing the individuals' facial expression	*Mindfulness* and reevaluation: they reported less positive affect compared to suppression in the evaluation of the films and the variation in the facial expression was according to the strategy used. *Mindfulness*: decreased evaluative judgment.
Kiken and Shook, 2014	To investigate whether *mindfulness* is differentially associated with thoughts that emphasize positive or negative values	*Mindfulness* was inversely associated with rumination. The *mindfulness* condition had fewer negative thoughts. The conditions did not differ in the positive thoughts
Sauer and Baer, 2009	To explore two ways of responding to negative thoughts and emotions (approach based on change or acceptance) and assess their relationship with psychological functioning	Acceptance-based strategies (emotional awareness, clarity, acceptance, impulse control) were associated with lower levels of symptoms and greater well-being
Arch and Craske, 2010	To investigate the relationship of *mindfulness* with the response to a laboratory stressor in anxious and non-anxious samples	*Mindfulness* was associated with decreased responses to laboratory stressors in clinically anxious and non-anxious samples
Greenberg and Meiran, 2014	To investigate the relationship between the practice of *mindfulness* and the degree of involvement with the emotional experience	*Mindfulness:* associated with increased emotional involvement, increased contact with emotions, and rapid recovery from the emotional experience
Cho et al., 2017	To investigate the role of dispositional *mindfulness* in reactivity and subsequent recovery from negative emotions	*Mindfulness*: better recovery, but not reduced reactivity (more effective disengagement from previous stimuli)
Tong and Keng, 2017	To test the mediating role of emotional regulation and of the evaluation in the relationship between dispositional *mindfulness* and negative differentiation of the emotions	Maladaptive emotional regulation and assessment differentiation mediated the relationship between *mindfulness* and emotional differentiation
Hill and Updegraff, 2012	To assess the relationship between *mindfulness*, emotional differentiation, emotional lability, and emotional difficulties	*Mindfulness*: > emotional differentiation and < emotional difficulties. *Mindfulness* and lability mediated by emotional differentiation
Fogarty et al., 2015	To investigate the links between *mindfulness* and recovery from a negative experience and whether this is associated with greater emotional differentiation	Emotional differentiation associated with *mindfulness* facilitates a more adaptive response to stress and contributes to mental and physical health. *Mindfulness* as a predictor of the ER (Emotional Regulation) process
Robins et al., 2012	To investigate the effects of a program based on *mindfulness* on the daily experience of *mindfulness* and on aspects of the emotional experience and emotional regulation	*Mindfulness* (intervention) can increase awareness in everyday life and have a beneficial impact on clinically relevant emotion regulation processes
Erisman and Roemer, 2010	To examine the effects of a *mindfulness* intervention on emotional experiences and on regulation in response to stimuli with emotional content	*Mindfulness*: positive effect > in response to positive stimulus; more adaptive regulation in response to mixed stimulus and less negative effect immediately after stimulus, but not after a recovery period.
Alkoby et al., 2018	To test the hypothesis that the intervention with *mindfulness* increases the ability of the individuals to flexibly choose among ER strategies that are more adapted to the context	The regulatory choice patterns of those who received the intervention were more flexible: more cognitive reevaluation with low intensity stimuli and distraction with high intensity stimuli
Iani et al., 2019	To explore the relationship between *mindfulness* and emotional regulation at the level of dimensions, in order to understand how *mindfulness* can improve the emotional regulation processes	Describe/non-reactivity + reevaluation and acceptance; Describe and non-reactivity – suppression of emotional experience, and + suppression of emotional experience, respectively; and Observe + rumination and not judging – rumination
Bullis et al., 2014	To explore the effect of *mindfulness* on emotional regulation, as well as whether specific factors of dispositional *mindfulness* are associated with subjective and autonomous reactivity to stress	*Mindfulness* and the description factor attenuated the reactivity of the heart rate. Acting consciously predicted less anxiety. Observing predicted more panic symptoms and greater intensity of symptoms
Coffey et al., 2010	To explore *mindfulness* and its dimensions and interactions with emotional regulation, in addition to their influence on mental health	Measures of *mindfulness* and emotional regulation evaluate the constructs in an overlapping manner. Emphasis on the mediators (clarity, managing negative emotions, detachment, rumination) in relation to mental health

Figure 2 - Effects of *mindfulness* and emotional regulation strategies in the emotional regulation process (n=19)

In turn, in the studies where the relationships between *mindfulness*, emotional regulation and psychic functioning (*n*=14) were evaluated, shown in Figure 4, it is observed that, in seven of them, psychological distress or dysfunctions such as anxiety and depression were emphasized. In five, focus was given to well-being and mental health and, in one article, both dysfunctions and health and well-being were investigated.

Among the results of these studies, we highlight the findings that emotional regulation would function as a mediator in the relationship between *mindfulness* and dysfunctions or mental health[13-14,17,62-64] with the exception of a study that proposed a model where emotional regulation would facilitate *mindfulness*, with consequences for health and well-being[65]. It is also noted that *mindfulness* and emotional regulation would be predictors of healthy psychic functioning[66-68] and problematization if non-reactivity, acceptance, non-judgment and acting consciously would be relevant in the relationship between *mindfulness*, emotional regulation and psychic functioning[69-72].

Authorship/Year	Objective	Results
McLaughlin et al., 2019	To investigate the indirect effect of > *mindfulness* in < difficulty of emotional regulation due to the effect of positive affect	Direct effect of *mindfulness* in the deregulation of emotion and indirect effect of > *mindfulness* in < emotional regulation problems via > positive affect
LeBlanc et al., 2019	To investigate the relationship between reevaluation, *mindfulness* and satisfaction, with the hypothesis that positive affect mediates this relationship	Positive affects mediate this relationship. Regulating emotions in an adaptive manner (reevaluation and *mindfulness*) > positive affect, which leads to > satisfaction with life
Snippe et al., 2017	To examine how a change in perceived stress, negative affect and dissociation between perceived stress and negative affect evolved in the *mindfulness*-based intervention	The intervention in *mindfulness* reduces negative affect and stress perception. The results suggest that there is a relationship between the amount of *mindfulness* practice and reductions in daily stress and negative affect
Brockman et al., 2017	To examine the influence of three emotional regulation strategies (full attention, cognitive reevaluation and suppression) in the daily experience of negative and positive affects	Daily practice of *mindfulness*: < negative affect and > positive affect, while the reverse pattern was found for the suppression of emotions. Cognitive reevaluation is associated with positive, but not negative, affect.
Zhang et al., 2019	To examine the effects on the participants' mood in an 8-week program, comparing focused attention meditation (FAM) and open monitoring meditation (OMM)	Intervention in *mindfulness*: > *mindfulness* and > emotional states. FAM Meditation: > partially *mindfulness* and > mood. OMM Meditation: > *mindfulness* and maintenance of positive mood
Keng et al., 2013	To investigate *mindfulness* and reevaluation in < sad mood and whether *mindfulness* and the usual reevaluation moderate the effects. To compare investment in the cognitive resources	*Mindfulness* and reevaluation are equally effective in regulating sad mood, but incur in different levels of cognitive costs (reevaluation requires greater cognitive effort)
Remmers et al., 2016	To investigate whether *mindfulness* improves implicit negative mood and explicit mood	*Mindfulness* can facilitate emotional regulation at implicit and explicit levels. The *mindfulness* group exhibited greater congruence between implicit and explicit mood
Hamill et al., 2015	To examine whether the following adaptive ER strategies: *mindfulness* and acceptance, moderate the relationship: sensitivity of the Behavioral Inhibition System and psychological distress	Association + between the sensitivity of the Behavioral Inhibition System and psychological suffering with acceptance and facets of *mindfulness* (non-reactivity and observation) moderating this association
Reese et al., 2015	To examine the relationships between behavioral motivation systems and emotional deregulation, mediated by facets of *mindfulness*	Indirect relationship: sensitivity of the behavior inhibition system and > emotional deregulation via the underutilization of 3 dimensions of *mindfulness*: acting consciously, not judging and not reacting
Kaiser et al., 2015	To investigate the relationship between rumination, decentralization (*mindfulness*) and work memory after exposure to interpersonal criticism	Rumination and decentralization: opposite patterns. Ruminative: < cleaning of irrelevant information in negative emotional conditions. Decentralization: better work memory after criticism
Dubert et al., 2016	To examine the relationship between *mindfulness* and emotional regulation and the potential mediating role of the operational memory capacity in this relationship	*Mindfulness* can influence the work memory capacity and the ability to regulate emotions. The work memory capacity does not explain how *mindfulness* influenced the use of reevaluation
Goodall et al., 2012	To investigate the relationship between *mindfulness*, secure attachment and emotional regulation	The emotional regulation capacity plays a greater role in dispositional *mindfulness* than the attachment style. The results also indicated conceptual overlapping between *mindfulness* and emotion regulation (awareness and acceptance of the emotional response)
Pepping et al., 2013	To understand whether the relationship between attachment and *mindfulness* is mediated by difficulties in emotional regulation	Difficulties in emotion regulation mediated the association between anxious attachment and *mindfulness*, and between avoidance attachment and *mindfulness*
Luberto et al., 2014	To examine the self-efficacy of coping as a mediator for the relationship between *mindfulness* dimensions and ER difficulties	Coping self-efficacy partially explains the relationships between *mindfulness* and ER difficulties. > describe, acting consciously and not judging: > self-efficacy that partially mediated the relationship between these dimensions and difficulties in emotional regulation (indirect effect)
Quaglia et al., 2015	To identify the mechanisms through which the individual differences in *mindfulness* would provide for adaptive social emotional regulation and, in turn, enhance social connection	*Mindfulness* related to more efficient top-down attention to emotional facial expressions, which is related to the improved regulation of social emotions in daily life

Figure 3 - Relationship between *mindfulness*, emotional regulation and other constructs (n=15)

In the studies where neurobiological factors involved in the practice of *mindfulness* (*n*=10) were addressed, gathered in Figure 5, specific regions of the brain were investigated, such as amygdala and frontal cortex (*n*=3), as well as the brain effects of *mindfulness*-based techniques or interventions (*n*=3), the brain effects of different emotional regulation strategies (*n*=3), affective reactivity to emotional stimuli (*n*=1) and neural mechanisms of generalized anxiety (*n*=1). The results achieved with its performance indicated changes in the brain regions and neural mechanisms involved in emotional processing (amygdala and pre-frontal cortex) with optimization of the emotional regulation process[33,35,73-79]. One study tested the moderating effect of *mindfulness* in the response to emotional stimuli (images with emotional content), assuming that the reactivity to stimuli would be lower, since *mindfulness* facilitates a receptive and non-reactive posture to external and internal stimuli[18]. However, this study found no empirical evidence that dispositional *mindfulness* moderates the individual reaction (assessed with physiological and psychological measures) to emotional stimuli.

Finally, in the two studies where comparisons of meditation modalities and/or stress control techniques were made, associations were found between *mindfulness* meditation and the twin hearts meditation* (*n*=1); and between *mindfulness*, passive progressive muscle relaxation,** and loving-kindness meditation***(*n*=1). The results indicated that *mindfulness*-based meditation favors a posture of greater decentralization (a more detached way of relating to one's thoughts) than other techniques[80]. In a study, however, it was pointed out that the twin hearts meditation was more effective for the emergence of positive affects than *mindfulness*-based meditation[81]. It is important to consider the objectives of each type of meditation in order to understand the scope of these results. The twin hearts and loving-kindness meditations induce positive emotions trough directing them to the entire humanity, and the progressive muscle relaxation directs the focus of attention towards relaxing the body. The practices of *mindfulness,* in their turn, only suggest that the individual perceives the emotions and sensations found in the body, regardless of what they are. Therefore, the results of each type of meditation are consistent with the objectives they are proposed for, as seen in the results: *mindfulness* promoting greater decentralization than loving-kindness meditation and progressive muscle relaxation, while the twin hearts meditation promotes more positive emotions than *mindfulness*.

Authorship/Year	Objective	Results
Freudenthaler et al., 2017	To investigate whether emotional regulation mediated the positive effects of *mindfulness* on depression and anxiety symptoms in the general population	> *mindfulness*: better emotional regulation, associated with < depression and anxiety (ER partially mediated the associations of *mindfulness* with depression and anxiety)
Ostafin et al., 2014	To examine whether affective reactivity mediates the relationship between *mindfulness* and anxiety	Inverse relationship between *mindfulness* and chronic anxiety, partially mediated by affective reactivity
Kotsou et al., 2018	To compare the capacity of emotional competence, emotional regulation, acceptance, and *mindfulness* in predicting the severity of disorders and well-being	The four predictors correlated with psychopathology - anxiety, depression and stress - and positively with happiness. Importance of acceptance in understanding emotional disorders
Mandal et al., 2017	To investigate which models best explains: (i) *Mindfulness* – ER – well-being, or (ii) ER – *mindfulness* – well-being.	Better emotional regulation -> *mindfulness* state -> health/ well-being. Circular relationship between *mindfulness* and emotional regulation
Mitmansgruber et al., 2009	To explore the role of avoiding the experience, meta-emotions and *mindfulness* on the prediction of well-being	Meta-emotions exert a powerful influence on well-being beyond avoiding the experience and *mindfulness*
Desrosiers et al., 2013	To investigate the mechanisms of emotional regulation through which *mindfulness* is related to mental health	*Mindfulness* operates with different and common mechanisms, depending on the clinical context. Rumination and worry mediate *mindfulness* and anxiety. Rumination and reevaluation mediate *mindfulness* and depression
MacDonald and Baxter, 2017	To examine emotional regulation and suppression as mediators of the association between *mindfulness* components and well-being	> *mindfulness*: > emotional awareness and control, > ability to tolerate negative thoughts, which can > psychological health
Mahmoudzadeh et al., 2015	To investigate the relationship between psychological well-being and *mindfulness* and emotional regulation strategies, and to identify which one better predicts psychological well-being	*Mindfulness* and well-being are + correlated with the more adaptive cognitive ER strategies and - correlated with the less adaptive.

Figure 4 - *Mindfulness*, emotional regulation and psychic functioning (n=14)

* The Twin Hearts meditation was created by Grandmaster Choa Kok Sui and consists of visualizing planet Earth and directing positive emotions to the entire humanity.

** Passive progressive muscle relaxation is a technique where the individuals are guided to perceive sensations of tension in each part of the body and then allow these muscles to relax completely

*** The loving-kindness meditation is based on the Buddhist tradition and consists of creating feelings of social connection and compassion for oneself and for others, through the repetition of phrases like: "I live in safety, I live happily" and gradually extend this to significant others and unknown people: "May you live safely, may you live happily"

Authorship/Year	Objective	Results
Kral et al., 2018	To evaluate the impact of an intervention on mediators on the amygdala's response to emotional stimuli	Intervention in *mindfulness:* > affective response leads to < amygdala reactivity and > amygdala-VMPFC connectivity
Egan et al., 2017	To investigate how *mindfulness* (state and dispositional) would affect the LPP (late positive potential)	State and dispositional *mindfulness*: impact on emotional processing with different neural mechanisms. State: > LPP amplitude; and dispositional: did not correlate with LPP amplitude
Xiao et al., 2019	To assess whether changes in the functional activity in the frontal parietal cortex and DMN can be induced trough *mindfulness* meditation	> homogeneity in the right upper parietal lobe and left post-central gyrus (PoCG), changes in functional connectivity in PoCG-related networks. (optimization of emotional processing)
Lutz et al., 2014	To investigate the brain effects of a brief *mindfulness* intervention during the expectation and perception of negative and potentially negative images	*Mindfulness* associated with > activations in the pre-frontal regions during the expectation of negative and potentially negative images. Negative stimuli: < activation in regions involved in emotional processing
Doll et al., 2016	To understand the effects of attention to breathing to deal with aversive emotions at the behavioral and brain levels	Integration of the amygdala and pre-frontal cortex as a potential neural pathway for regulating emotion through the practice of *mindfulness*
Zhang et al.,2019	To investigate whether breathing focused on *mindfulness* works as a top-down ER strategy to alter the brain dynamics and its relationship to the differences in *mindfulness*	Breathing focused on *mindfulness* is an effective ER strategy and can activate the dorsal pre-frontal top-down system to early and late change the neural dynamics of affective processing
Opialla et al., 2015	To compare the neurobiological mechanisms of the following strategies: cognitive reevaluation and *mindfulness*	The results suggest that the same neural circuits are involved in the emotional regulation of *mindfulness*-based strategies and cognitive reevaluation
Modinos et al., 2010	To examine whether the brain activity induced during instructed reevaluation would be modulated by differences in the level of *mindfulness*	Differences in *mindfulness*: they modulate the activity in the neural systems involved in the effective cognitive control of the negative emotion (predicted activity in the neural regions underlying the reevaluation, with activation of the dorsomedial pre-frontal cortex increasing with more *mindfulness*)
Cosme and Wiens, 2015	To investigate the relationship between dispositional *mindfulness* and affective reactivity to emotional stimuli	Although the results showed clear effects of emotion on the dependent measures, in general, *mindfulness* did not moderate these effects
Hölzel et al., 2013	To investigate the neural mechanisms for symptom improvement in generalized anxiety after a *mindfulness*-based intervention, and to check brain activation	Generalized anxiety: the intervention in *mindfulness* leads to changes in the fronto-limbic areas crucial for emotion regulation, and these changes correspond to the reported improvements in the symptoms

Figure 5 - Neurobiological aspects involved in the practice of *mindfulness* (n=10)

Discussion

This review sought to answer two questions: (i) identify how *mindfulness* has been operationalized in empirical studies, and (ii) characterize the nature of the relationships between *mindfulness* and the emotional regulation process in the national and international literature over the last ten years. In relation to the first question, we observed the presence of three main operationalizations of *mindfulness* in the researched studies: trait, state and ability. This discussion exists in the literature[18,82], where it is emphasized that the way in which *mindfulness* is operationalized is crucial to the investigative process of this construct. These authors point out that there are different ways to investigate the *mindfulness* construct, considering it as a trait or characteristic that varies among the individuals, as a temporary state that can be induced and manipulated in the laboratory for a short period of time, and also as an ability that can be developed through *mindfulness*-based interventions[83]. In this review, there was predominance of the conception of *mindfulness* as a trait, followed by as an ability and, finally, as a temporary state.

The operationalization of the construct is linked to a conception of *mindfulness* and to the way it is measured. Some studies have found evidence of the relationship between *mindfulness* treated as a state or as an ability to decrease reactivity to emotional stimuli[18]. On the other hand, there are inconclusive results when *mindfulness* is treated as a trait. In some studies included in this review, for example, dispositional *mindfulness* was not associated with reduced affective reactivity during the visualization of emotional stimuli[18,46].

In the studies of this review, there was also no evidence on the use of qualitative methodologies to learn the subjective aspect of the *mindfulness* experience, but the frequent use of scales to measure this construct. Despite the scientific value of self-reporting measures that provide information on the individuals' self-perception, there is the problem of social desirability and inaccuracy in the response due to the individuals' lack of full knowledge on their own states and behaviors[23]. In case of the scales, there can be lack of understanding of the items, resulting in different interpretations of their meanings for the researcher and the participants[84] or even among

participants with different levels of familiarity with the concept[19,23].

Western people are relatively inexperienced with the concept and experience of *mindfulness*, which impacts on the understanding of the formulated items[72]. On the other hand, in defense of the *mindfulness* scales, several studies have identified their good psychometric properties measured by internal consistency and predictive validity[19], and predictive power of psychological problems[20], also pointing out positive correlations between high scores and practice time[21] and higher scores after the intervention[20].

Thus, it becomes relevant to consider the operationalization of the concept, since the two most cited measures in this review for assessing *mindfulness* have different factorial structures. The MAAS scale[20] has a one-dimensional structure to measure the awareness of the moment in the everyday experiences, whereas FFMQ[21] is multi-dimensional (five factors), consisting of observing, describing, not judging the inner experience, acting consciously, and not being reactive to the inner experience.

This variability in the operationalization of *mindfulness* can represent an obstacle to understanding the construct[19,23] and to conducting research studies that may come to bring out robust evidence about its effectiveness for the mental health of the individuals, as the measures may be evaluating different aspects, even with overlaps in relation to other constructs such as emotional regulation.

In a study presented in this review, the hypothesis of overlap between the *mindfulness* factors and the concept of emotional regulation was corroborated[36], even if they are different processes[1]. In examining these overlaps, the authors identified that there are some common factors, namely: "acceptance of the internal experience", "recognition of the internal experience" and "behavior in the presence of unpleasant internal experiences". On the other hand, the *mindfulness* factors of "attention in the present" and "acting consciously" were identified as specific to *mindfulness*, without overlapping with emotional regulation factors. Finally, in this study it was also revealed that the constructs under analysis can contribute or facilitate the expression of each other.

Seeking to respond to the existing interactions between *mindfulness* and emotional regulation, the analysis of the reviewed studies reasserted the conception found in the literature that *mindfulness* and emotional regulation are constructs associated with psychic functioning and mental health, and that they seek to understand the mechanisms that are at the basis of these relationships. In addition, some research studies included their interaction with other constructs of Psychology, such as affects, mood, self-efficacy, and social connection. The studies also included a neurobiological approach to identify brain changes through the practice of *mindfulness*.

The analyzed constructs may come to contribute to or facilitate the expression of each other[1], which was also pointed out by other reviewed studies[65]. The view that the relationship between emotional regulation and *mindfulness* is considered pertinent can be bidirectional[29], and that *mindfulness*-based interventions can provide better emotional regulation, while individuals with adaptive emotional regulation strategies have higher levels of *mindfulness*.

There is great variety in the literature regarding the interactions between *mindfulness* and emotional regulation, with studies where relations of mediation, moderation, prediction, associations or correlations are indicated. Furthermore, in the selected articles there was no consensus that *mindfulness* would be considered an emotional regulation strategy, as only six of the analyzed studies conceptualize *mindfulness* in such a way.

There is still the view that *mindfulness* is not just a specific emotional regulation strategy[31]. *Mindfulness* plays a broader role in the processes of emotional regulation, affecting the most central regulatory stages. This view is shared in review[2,5] and theoretical[85] articles. *Mindfulness* can promote flexibility in the cognitive evaluation by increasing interoceptive attention, which impacts on the process of emotional regulation[40].

Thus, understanding the relationship between *mindfulness* and emotional regulation in empirical studies requires returning to these concepts and to their operationalization, as well as investing in scientific efforts for a clearer and more precise delineation of the possible connections between these constructs that have been shown to be essential for the mental health and psychic functioning of the individuals.

Conclusion

This literature review provides an overview of the existing discussions in the scientific field about the relationship between *mindfulness* and emotional regulation, in addition to discussing operational aspects related to the conception of *mindfulness*. Regarding the operationalization of *mindfulness*, the following is observed: predominance in the studies that treat it as a trait, the use of self-reporting measures, and

the prevalence of quantitative analyses. Studies with a qualitative approach, which allow for a better understanding of the subjective experience, were not identified in the sample of this review. Some authors also argue about the overlapping of factors of the *mindfulness* constructs and emotional regulation, which hinders conceptualizing and understanding their relationships, in addition to the lack of consensus regarding the factors that make up *mindfulness*.

The review showed that, in fact, *mindfulness* and emotional regulation are interrelated. In the studies analyzed, it was observed that *mindfulness* has repercussions in the process for choosing emotional strategies by (i) facilitating the use of more adaptive strategies such as cognitive reevaluation; (ii) reducing the use of dysfunctional strategies such as rumination and suppression; and (iii) giving more flexibility in the choice of strategies since the individual is more present and receptive to the demands of the context. Additionally, *mindfulness* would be related to the process of effective emotional regulation, as it would promote (i) good capacity for emotional differentiation; (ii) rapid emotional recovery after negative stimuli; and (iii) high emotional engagement with emotional stimuli. In addition, it is worth noting that the results of the studies were inconclusive in relation to the investigation of the relationships between emotional reactivity, *mindfulness*, and the emotional regulation process.

Emotional regulation was also characterized as an important mediator in the relationship between *mindfulness* and mental health, although there are other models that conceive *mindfulness* as the mediator of the relationship between emotional regulation and mental health. There was also a discussion that *mindfulness* and emotional regulation are predictors of mental health and that the dimensions of *mindfulness* are related to the emotional regulation process and to mental health, favoring it, with the exception of the observation dimension that, in isolation, is associated with higher anxiety levels.

It was verified that the relationship between *mindfulness* and emotional regulation contributes with positive effects on other constructs such as affects, mood, memory, and social connection; in addition to being related to concepts such as self-efficacy and attachment. And, finally, that *mindfulness* contributes to changes in the brain regions and neural mechanisms involved in optimizing the process for regulating the emotions.

It was thus identified that there are positive repercussions of high levels of *mindfulness* and adaptive emotional regulation strategies with healthy psychic functioning, but the mechanisms underlying this process require more research. Another aspect is that the conceptual imprecision and the measures used to evaluate these constructs make it difficult to identify the relationships between them, often indicating overlap. The studies have advanced in the investigation of constructs and an important aspect they highlighted is the need to explore the processes of emotional regulation in the intervention programs, given the connection between *mindfulness* and the regulation of the emotions for psychological well-being.

In most of the studies identified in this review, a cross-sectional methodology was used, which limits conclusions about causality or temporal precedence. Thus, an observed gap was the need for more longitudinal studies. In addition, we highlight the use of other measures (physiological, for example) and strict control conditions (control group) to determine the specificity of the effects of *mindfulness*, thus indicating a need for further experimental and intervention studies.

However, there are some clear limitations in this review because, even though a consultation was carried out in various databases, some journals relevant to the area may not have been contemplated. Another methodological weakness of this study is that the selection of articles and data analysis was performed by only one researcher, without validation by an external judge or group of independent reviewers. It was also decided to delimit the review to empirical studies, excluding review and meta-analysis studies that could have added relevant information for understanding the relationship between *mindfulness* and the emotional regulation process. Although some review studies have been consulted, they have not been consulted in a systematic way, as was the case with empirical studies.

It is therefore concluded that future research studies must consider and explain the conceptual and operational aspects of *mindfulness* and emotional regulation for creating greater conceptual clarity since, in this review, it was verified that this is an aspect that needs better understanding. The results indicated in this literature review can contribute to a better understanding of the advances in the scientific field that relates *mindfulness* with emotional regulation processes, since these constructs have an impact on the healthy psychic functioning of the individuals.

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