



Mindfulness: Top–down or bottom–up emotion regulation strategy?



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HIGHLIGHTS

- ▶ Mindfulness training (MT) has shown efficacy for many clinical conditions.
- ▶ Little is known about the neural correlates supporting the clinical benefits of MT.
- ▶ MT could be associated with top–down emotion regulation in short-term practitioners.
- ▶ MT could be associated with bottom–up emotion regulation in long-term practitioners.
- ▶ Different instructions or mental conditions could influence the neural mechanisms of MT.

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ABSTRACT

The beneficial clinical effects of mindfulness practices are receiving increasing support from empirical studies. However, the functional neural mechanisms underlying these benefits have not been thoroughly investigated. Some authors suggest that mindfulness should be described as a ‘top–down’ emotion regulation strategy, while others suggest that mindfulness should be described as a ‘bottom–up’ emotion regulation strategy. Current discrepancies might derive from the many different descriptions and applications of mindfulness. The present review aims to discuss current descriptions of mindfulness and the relationship existing between mindfulness practice and most commonly investigated emotion regulation strategies. Recent results from functional neuro-imaging studies investigating mindfulness training within the context of emotion regulation are presented. We suggest that mindfulness training is associated with ‘top–down’ emotion regulation in short-term practitioners and with ‘bottom–up’ emotion regulation in long-term practitioners. Limitations of current evidence and suggestions for future research on this topic are discussed.

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Abbreviations: ACC, anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; DMN, default mode network; EF, experiential focus; fMRI, functional magnetic resonance imaging; IPFC, lateral prefrontal cortex; MBCT, mindfulness based cognitive therapy; MBIs, mindfulness based interventions; MBSR, mindfulness based stress reduction; mPFC, medial prefrontal cortex; NF, narrative focus; OFC, orbito-frontal cortex; PCC, posterior cingulate cortex; PFC, prefrontal cortex; rACC, rostral anterior cingulate cortex; sgACC, subgenual anterior cingulate cortex; vmPFC, ventromedial prefrontal cortex; vlPFC, ventrolateral prefrontal cortex; WL, waiting list.

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1. Introduction

In the last decade a surge of interest has been directed towards the exploration of mindfulness as a means to treat a variety of physical and psychological conditions (Chiesa & Serretti, 2010; Ludwig & Kabat-Zinn, 2008). Many different definitions of mindfulness exist and mindfulness is therefore differently interpreted and practiced across different mindfulness based interventions (MBIs; Chiesa & Malinowski, 2011; Malinowski, 2008). However, there is some consensus on defining mindfulness as the act of “paying attention in a particular way: on purpose, in the present moment, and nonjudgementally” (Kabat-Zinn, 1994, p.4).

The empirical evidence suggesting the beneficial effects of cultivating mindfulness has grown in both quantity and complexity in recent years. Results from randomized controlled trials are increasingly supporting the efficacy of MBIs for a large number of psychological and physical disorders (Chiesa & Serretti, 2010; Keng, Smoski, & Robins, 2011). As an example, Mindfulness based Stress Reduction (MBSR) has been found to reduce pain, stress and psychological problems in healthy individuals, chronic pain patients and cancer patients (Chiesa & Serretti, 2011a; Ledesma & Kumano, 2009; Shennan, Payne, & Fenlon, 2011). Furthermore, systematic reviews and randomized controlled trials have shown that Mindfulness based Cognitive Therapy (MBCT) might be an effective intervention for currently depressed patients as well as for the prevention of depression relapses in patients with three or more prior depressive episodes (Chiesa, Mandelli, & Serretti, 2012; Chiesa & Serretti, 2011b; Manicavasgar, Parker, & Perich, 2011; Piet & Hougaard, 2011). These findings are in line with traditional accounts of mindfulness suggesting that significant positive changes occur in the psycho-physiological processes of individuals cultivating mindfulness in their daily life (Grabovac, Lau, & Willet, 2011; Olendzki, 2006). Until recently, however, the mechanisms behind the effects of mindfulness practice were relatively unknown to Western psychology and neurobiology (Chiesa, Brambilla, & Serretti, 2010).

To address the current gap, several authors have recently examined the mechanisms of mindfulness within the context of emotion regulation strategies (e.g. Chambers, Gullone, & Allen, 2009; Garland et al., 2010; Hoffman & Asmundson, 2008). Emotion regulation can be defined as the ability to regulate one's own emotions and emotional responses (Gross, 1998a, 1998b). Current evidence suggests that there are several partially overlapping ways by which an individual can regulate his/her own emotions (Gross, 1998b; Gross & Munoz, 1995). However, at least two distinct emotion regulation strategies have been clearly distinguished from one another (Chiesa et al., 2010; Gross, 1998a; Gross & John, 2003, for a more detailed description see below). In particular, some emotion regulation strategies, such as cognitive reappraisal, are thought to manipulate the input to the emotion-generative system by actively reinterpreting emotional stimuli in a way that modifies their emotional impact (Gross, 1998b). This kind of emotion regulation has been found to involve a “top–down” regulation of prefrontal brain regions on emotion-generative brain regions, such as the amygdala (Lorenz, Minoshima, & Casey, 2003; Quirk & Beer, 2006).

Another way to regulate one's own emotions has been described as a direct modulation of emotion-generative brain regions without cognitively reappraise emotionally salient stimuli (e.g. Chambers et al., 2009; Westbrook et al., 2011). This kind of emotion regulation strategy has been termed “bottom–up” because it is characterized by a direct reduced reactivity of “lower” emotion-generative brain regions without an active recruitment of “higher” brain regions, such as

the prefrontal cortex (PFC; e.g. van den Hurk, Janssen, Gionmi, Barendregt, & Gielen, 2010 Westbrook et al., 2011).

There is currently no consensus as to how mindfulness practice helps regulate disruptive emotions (Chambers et al., 2009; Garland et al., 2010; Hoffman & Asmundson, 2008). According to some authors, mindfulness should be described as a top–down emotion regulation strategy facilitating positive cognitive reappraisal (Garland, Gaylord, & Park, 2009; Garland et al., 2010). According to this view, the psychological and neurobiological mechanisms of MBIs would not be significantly different from those observed in common Western psychological approaches, such as psychotherapy (Chiesa et al., 2010; Garland et al., 2009, 2010). On the other hand, other authors have argued that mindfulness could be best described as a bottom–up emotion regulation strategy (e.g. Chambers et al., 2009; Grabovac et al., 2011; Lutz, Dunne, & Davidson, 2008). Still other authors have claimed that the relationship existing between mindfulness training and different emotion regulation strategies, as well as with the activation of related brain areas, could vary as a function of overall mindfulness experience (Taylor et al., 2011).

A better understanding of whether mindfulness involves a top–down or a bottom–up emotion regulation strategy could have important clinical implications. As an example, if mindfulness training is primarily a bottom–up process, MBIs might be effective for patients not responding to traditional psychotherapies. Indeed, psychotherapy frequently relies upon top–down mechanisms, such as cognitive reappraisal, to regulate unpleasant emotions (DeRubeis, Siegle, & Hollon, 2008; Roffman, Marci, Glick, Dougherty, & Rauch, 2005). However, the possibility to reappraise one's own emotions is often impaired in psychological disorders (e.g. Keightley et al., 2003; Liotti, Mayberg, McGinnis, Brannan, & Jerabek, 2002). As a consequence, the effects of MBIs might be superior to the effects of traditional psychotherapies for patients with an impairment of their ability to reappraise unpleasant emotions.

Neuro-imaging studies focusing on the exploration of mindfulness practice and employing emotion regulation paradigms might provide particularly fruitful insights into the understanding of mindfulness as a specific emotion regulation strategy (Chambers et al., 2009; Garland et al., 2010; Lutz, Dunne, & Davidson, 2008). Indeed, they could allow for the understanding of which brain areas are activated or deactivated when mindfulness practitioners are asked to regulate their own emotions during tasks that require emotional regulation. This, in turn, would help clarify whether mindfulness could be best described as a bottom–up or as a top–down emotion regulation strategy, as well as related clinical implications. The aim of this review is, therefore, to assess whether mindfulness practice can be best described as a top–down emotion regulation strategy, as a bottom–up emotion regulation strategy, or as a combination of both strategies, on the basis of functional neuro-imaging studies employing emotion regulation paradigms.

First, we will explore critical issues concerning current discrepancies in the definitions of mindfulness. Then, we will review current studies investigating the functional neural correlates of mindfulness training that are relevant for the understanding of mindfulness within the context of emotion regulation strategies. Finally, we will present a preliminary theoretical integration of our findings and will provide suggestions for future research on this topic.

2. Critical issues related to the definition of mindfulness

Early descriptions of mindfulness can be found in traditional Buddhist scriptures such as the Abhidhamma (Kiyota, 1978) and the

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