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Mindfulness (Vipassana) meditation: Effects on P3b event-related potential and heart rate variability

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ABSTRACT

The concept of mindfulness is based on Vipassana, a Buddhist meditation technique. The present study examines the physiological indices of attention and autonomic regulation in experienced Vipassana meditators to test the claim that mindfulness is an effective therapeutic tool due to its effects on increasing awareness of present experience and emotional self-regulation. Ten male experienced Vipassana meditators underwent two assessment sessions, one where they practiced Vipassana meditation and another where they rested with no meditation (*random thinking*). Each meditation/no-meditation session lasted 30 min and was preceded and followed by an auditory oddball task with two tones (*standard* and *target*). Event-related potentials to the tones were recorded at the Fz, Cz, and Pz locations. Heart rate variability, derived from an EKG, was recorded continuously during the meditation/no-meditation sessions and during a 5-minute baseline before the task. The Vipassana experts showed greater P3b amplitudes to the target tone after meditation than they did both before meditation and after the no-meditation session. They also showed a larger LF/HF ratio increase during specific Vipassana meditation. These results suggest that expert Vipassana meditators showed increased attentional engagement after meditation and increased autonomic regulation during meditation supporting, at least partially, the two claims concerning the clinical effectiveness of mindfulness.

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1. Introduction

Mindfulness is a Buddhist-based meditation that current psychology has rediscovered and used as a therapeutic tool for various psychological disorders (Allen et al., 2006; Baer, 2003; Barnhofer et al., 2009; Carmody, 2009; Kuyken et al., 2010; Lazar, 2005; McCracken and Gutiérrez-Martínez, 2011; Toneatto and Nguyen, 2007; Zgierska et al., 2009). Two fundamental components of mindfulness have been distinguished in recent clinical applications: (a) self-regulation of attention (awareness) toward the present experience and (b) an attitude of curiosity, openness and acceptance of the present experience. Awareness and acceptance of internal and external aspects of the present experience are assumed to bring about emotional stability through a non-evaluative re-cognition of sensations, emotions, and thoughts without reactivity or over-involvement (Bishop et al., 2004; Hayes and Feldman, 2004; Chambers et al., 2009). These two components of mindfulness have been applied clinically as integral parts of different training programs: (a) *Mindfulness Based Stress Reduction* (Kabat Zinn, 1982), (b) *Dialectic Behavioral Therapy* (Linehan, 1993), (c) *Mindfulness-based*

Cognitive Therapy (Segal et al., 2002), (d) *Acceptance and Commitment Therapy* (Hayes et al., 1999), (e) *Mindfulness-based Relapse Prevention* (Bowen et al., 2009) and (f) *Acceptance-based Behavior Therapy for Generalized Anxiety Disorder* (Roemer and Orsillo, 2007). Despite the popularity and widespread application of mindfulness, the psychological and neuropsychological mechanisms underlying its clinical effectiveness are still poorly understood.

Vipassana is the main Buddhist meditation technique on which mindfulness is based. Vipassana, which means *to see things as they really are*, is a method of training the mind through focused attention on bodily sensations, emotions, and thoughts without mental reactivity to the experience. It has been defined as a form of self-transformation through self-observation (Thera, 1962). The main focus of the Vipassana technique is training one's awareness of any mental experience as it arises from moment to moment, including breathing sensations, sensations from all parts of the body, and thoughts related to feelings of good will, love, and compassion. The final aim of this awareness training is to achieve emotional stability and happiness.

Consistent with the focus of Vipassana on attention training and interoceptive awareness to achieve emotional stability, recent psychophysiological research on the effects of Vipassana has specifically examined changes in the central and peripheral physiological indices of attention and autonomic regulation (Delgado et al., 2010). Event-related

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