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Review article

Mindfulness meditation practice and executive functioning: Breaking down the benefit

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ABSTRACT

This paper focuses on evidence for mindfulness meditation-related benefits to executive functioning, processes important for much of human volitional behaviour. Miyake et al. (2000) have shown that executive functions can be fractionated into three distinct domains including inhibition, working memory updating, and mental set shifting. Considering these separable domains, it is important to determine whether the effects of mindfulness can generalize to all three sub-functions or are specific to certain domains. To address this, the current review applied Miyake et al.'s (2000) fractionated model of executive functioning to the mindfulness literature. Empirical studies assessing the benefits of mindfulness to measures tapping the inhibition, updating, and shifting components of executive functioning were examined. Results suggest a relatively specific as opposed to general benefit resulting from mindfulness, with consistent inhibitory improvement, but more variable advantages to the updating and shifting domains. Recommendations surrounding application of mindfulness practice and future research are discussed.

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1. Introduction

Common amongst human nature is our consciousness, comprised of an awareness and attention to internal and external environments (Brown & Ryan, 2003). Whether we are *mindful* of our consciousness, however, is another story. Compared to those who are mindless, the mindful individual is oriented in the present, open to novelty, sensitive to changes in context, and aware of multiple perspectives (Langer & Moldoveanu, 2000; Sternberg, 2000). The cultivation of mindfulness is rooted in Eastern Buddhist tradition, where it is perceived as a state of mind that can be achieved through various forms of meditation. These practices are generally based on two foundational principles including awareness and attention to the present moment and mindful, nonjudgmental acceptance of emotional states (Baer & Krietemeyer, 2006; Brown & Ryan, 2003; Hick, 2008; Kabat-Zinn, 1990, 2003; Teper, Segal, & Inzlicht, 2013). Mindfulness is therefore trained by practicing moment-to-moment monitoring of attention with an emphasis placed on always bringing focus back to the present. When the mind wanders or distractions arise, trainees are taught to acknowledge these mental shifts and bring attention back to the present without judgment. As a result, mindfulness meditation fosters alertness to changes in environment and emotion and as well as the ability to react without rumination (Langer & Moldoveanu, 2000; Sternberg, 2000; Teper et al., 2013).

Mindfulness can be practiced through formal intervention-style meditation practices or informally on an individual basis. Formal practices such as Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982), Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2013), or Integrative Mind–Body Training (IMBT; Tang, Yang, Leve, & Harold, 2012; also see Baer & Krietemeyer, 2006; Hick, 2008) are generally led by a trained instructor that guides participants in sustaining attention to the present moment according to the aforementioned principles. Recently, scientific interest in the beneficial effects of such practices has increased in contexts such as medicine, mental health, and education. Evidence from these studies have identified positive effects including stress management (Chiesa & Serretti, 2009; Nyklíček & Kuijpers, 2008), symptom reduction in depression (Coffman, Dimidjian, & Baer, 2006; Hoffman, Sawyer, Witt, & Oh, 2010; Ma & Teasdale, 2004; Piet & Hougaard, 2011) and anxiety (Hoffman et al., 2010; Roemer, Salters-Pedneault, & Orsillo, 2006), decreased substance abuse (Bowen et al., 2006), and reduced binge eating (Tapper et al., 2009). In addition to these more clinically-based findings, mindfulness practices have been found elicit a positive impact on objective measures of mood and cognition, including executive functioning (e.g., Chambers, Lo, & Allen, 2008; Chiesa, Calatti, & Serretti, 2011; Fiocco & Mallya, 2015; Heeren, Van Broeck, & Philippot, 2009; Jha, Krompinger, & Baime, 2007; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010; MacLean et al., 2010; Moore & Malinowski, 2009; Zeidan, Johnson, Diamond, Zhanna, & Goolkasian, 2010).

Executive functions make up the system that controls and directs higher-order cognitive processes such as planning, decision making, disinhibition, self-regulation, and many other goal-directed behaviours (Alvarez & Emory, 2006; Ardila, 2008; Black, Semple, Pokhrel, & Grenard, 2011; Chan, Shum, Toulopoulou, & Chen, 2008). The work of Miyake et al. (2000) fractionates executive functioning into three distinct domains including *inhibition* of irrelevant information, *updating* of working memory contents, and mental set *shifting* (also see Miyake & Friedman, 2012). The fact that the system can be fractionated in this manner points to the importance of considering each separable process in executive functioning research. As an example, Bueno et al. (2014) recently examined cognitive performance of an attention deficit hyperactivity disorder (ADHD) population according to Miyake et al.'s (2000) fractionated model of executive functioning. Whilst the existing literature was unclear on whether executive dysfunction in ADHD was selective or general, their results demonstrated *selective* impairment to the shifting domain. This reinforces the argument in favour of considering each constituent process when executive functioning performance is the primary outcome measure. Applying this to the scope of the current paper, before it can be stated that mindfulness meditation practice benefits executive functioning in general, it must be determined how such practices impact each sub-function. Accordingly, the goal of this review is to evaluate the effects of mindfulness meditation practice on each domain of executive functioning so as to determine if effects are specific (i.e., extend to only specific sub-functions) or general (i.e., extends to all sub-functions).

This is a critical question to address as efficient executive functioning has been linked to several positive developmental outcomes including greater attentional control, successful relationships, enhanced emotion regulation, and many other activities of daily living (Alvarez & Emory, 2006). The current review therefore used Miyake et al.'s (2000) model as a framework for addressing the primary research question, in which studies were reviewed based on whether they objectively measured the effects of mindfulness meditation practice on the inhibition, updating, or shifting sub-functions. Prior to this systematic review of the literature, however, an operational definition of mindfulness meditation practice and an understanding of the complex nature of executive functions are required.