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Mindfulness meditation improves cognition: Evidence of brief mental training [☆]

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ABSTRACT

Although research has found that long-term mindfulness meditation practice promotes executive functioning and the ability to sustain attention, the effects of brief mindfulness meditation training have not been fully explored. We examined whether brief meditation training affects cognition and mood when compared to an active control group. After four sessions of either meditation training or listening to a recorded book, participants with no prior meditation experience were assessed with measures of mood, verbal fluency, visual coding, and working memory. Both interventions were effective at improving mood but only brief meditation training reduced fatigue, anxiety, and increased mindfulness. Moreover, brief mindfulness training significantly improved visuo-spatial processing, working memory, and executive functioning. Our findings suggest that 4 days of meditation training can enhance the ability to sustain attention; benefits that have previously been reported with long-term meditators.

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1. Introduction

People who have undergone extensive meditation training have shown improvements on cognitive performance (Cahn & Polich, 2006) and mood (Davidson et al., 2003). Long-term meditation practice has been found to enhance attentional (Jha, Krompinger, & Baime, 2007) and visuospatial processes (Kozhevnikov, Louchakova, Josipovic, & Motes, 2009). For example, 3-months of intensive meditation training (10–12 h/day) improved the ability to sustain attention during a dichotic listening task as evidenced by faster reaction times in response to a deviant tone, and reduced attentional blink responses when compared to controls (Lutz et al., 2009; Slagter, Lutz, Greischer, Nieuwenhuis, & Davidson, 2009; respectively). Moore and Malinowski (2009) found that self-reported mindfulness was positively correlated with sustained attention in experienced Buddhist meditation practitioners, when compared to controls. Additionally, long-term meditation practice has been found to reduce attentional blink in older adults when compared to age-matched and younger adults (van Leeuwen, Muller, & Meloni, 2009). In a study employing neuroimaging (Short et al., 2007), extensive meditation training heightened activation in executive attention networks that was correlated with improvements in sustained attention and error monitoring. These findings provide growing evidence of mindfulness meditation's (MM) promotion of higher-order cognitive processing; specifically facets of conflict monitoring and cognitive control processes.

Mindfulness Based Stress Reduction (MBSR) programs, which are usually 8 weeks in duration and combine mindfulness meditation and gentle yoga, have been found to improve mood and affective processes (Nyklíček & Kuijpers, 2008); and are

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associated with improvements in immune system functioning (Davidson et al., 2003), stress (Carlson, Speca, Faris, & Patel, 2007), and emotional regulation (Nielsen & Kaszniak, 2006). MBSR programs are based on teaching participants to react non-judgmentally to stressful events by focusing on automatic and dynamic stimuli (breath; body; eating; walking). As participants cultivate these skills, top-down control processes regulate affective appraisals that lead to a reduction in stress responses (Grossman, Niemann, Schmidt, & Walach, 2004). In an elegant study, a MBSR program promoted decreases in stress ratings which were correlated with reductions in amygdala gray matter density; providing objective evidence for the positive effects of MBSR on stress (Hölzel et al., 2009).

Although advantageous to well-being, MBSR programs require extensive time and financial commitment. Consequently, most individuals do not have the time or resources to participate in extensive meditation interventions and few will choose the monastic lifestyle that is often associated with Buddhist contemplatives. Studying adept meditators is invaluable to understanding the aptitude of human consciousness, however, it is important to investigate whether briefer formats of mental training can provide some of the benefits that result from longer interventions.

MM is a mental practice based on focusing on the sensations of the breath/body while maintaining a relaxed state of mind. During formal meditation practice, distractions will arise and the meditator is taught to acknowledge discursive thoughts, and non-judgmentally return his/her attention back to their breathing (Wallace, 2006). Mindfulness training cultivates moment-to-moment awareness of the self and environment (Wallace, 2006). To this extent, mindfulness training heightens meta-cognitive processing (Austin, 1998). Meta-cognition is the conscious awareness of cognitive control processes (Fernandez-Duque, Baird, & Posner, 2000). Improvements in meta-cognition are related to the ability to restrict bottom-up processing of exogenously/endogenously driven, task-irrelevant information (Posner & Rothbart, 1998). Extensive training in mindfulness has been found to improve alerting and conflict monitoring (Cahn & Polich, 2006; Jha et al., 2007), therefore mindfulness meditation training can hypothetically enhance meta-awareness. This process improves attention sustainability by teaching subjects to “release” cognitive appraisals of irrelevant information. So far, however, the cognitive benefits associated with mindfulness have been limited to studies examining adept meditators (Cahn & Polich, 2006).

Although research examining the effects of extensive meditation interventions is growing, the effects of brief mental training on mood and cognition are relatively unknown. We examined whether 4 days (20 min/day) of MM training affects behavioral markers of cognition and mood. Tang et al. (2007) reported that 5 days of Integrative Body Mind Training improved mood and cognitive processes. However, Integrative Body Mind Training incorporates various techniques (e.g. mindfulness, guided-imagery, music therapy) leaving it hard to decipher if mindfulness was the mechanism underlying improvements. A recent study (Zeidan, Gordon, & Goolkasian, 2009) found that 3 days of MM training was effective at reducing pain ratings and sensitivity, as well as anxiety scores when compared to baseline and other cognitive manipulations, such as relaxation and a math distracter task. A similar training regimen improved mood and reduced heart rate when compared to a sham MM and control group (Zeidan, Johnson, Gordon, & Goolkasian, *in press*).

The present study builds on our previous work by examining if the effects of brief meditation training can be found on cognitive tasks with varying demands on working memory, sustained attention, visual coding, and verbal fluency. We used the Symbol Digit Modalities Test and the n-back task to measure working memory, processing speed, and executive attention; the forward and backward digit span to measure immediate attention span, and the Controlled Oral Word Association Test to measure verbal fluency. Based on prior research (Cahn & Polich, 2006), we expected that these tasks would be the most sensitive to the effects of meditation. We also expected that brief MM training, when compared to a group that listened to a book recording, would promote positive mood, as measured by the Center for Epidemiologic Studies Depression scale (CES-D), State Anxiety Inventory, and the Profile of Mood States.

2. Methods

2.1. Participants

Sixty-three University of North Carolina, Charlotte students volunteered for the experiment in fulfillment of General Psychology requirements. The participants were recruited from those who were interested in learning meditation and who had no prior meditation experience. The consent form explained that subjects would be randomly assigned to a meditation or a book listening group. Group assignment depended upon the week that the participant signed up for the study. Seven participants from each of the groups did not complete the protocol and their data were not included. From the remaining participants, 24 were assigned to the meditation group and 25 to the control. Table 1 compares the groups on demographic (age; gender; ethnicity) and baseline measures and shows that there were no differences. The median age was 20 years. Sixty-one percent of the participants were White, 25% were African-American, 2% were Asian, and 4% were biracial, Native American, and Hispanic.

2.2. Interventions

2.2.1. Mindfulness meditation

Mindfulness training was modeled on basic Shamatha skills (Wallace, 2006). Meditation training was conducted by a facilitator with 10 years experience in teaching MM. In session one, small groups of three to five participants were instructed

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