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Brief mindfulness meditation training alters psychological and neuroendocrine responses to social evaluative stress



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Summary

Objective: To test whether a brief mindfulness meditation training intervention buffers self-reported psychological and neuroendocrine responses to the Trier Social Stress Test (TSST) in young adult volunteers. A second objective evaluates whether pre-existing levels of dispositional mindfulness moderate the effects of brief mindfulness meditation training on stress reactivity. **Methods:** Sixty-six ($N = 66$) participants were randomly assigned to either a brief 3-day (25-min per day) mindfulness meditation training or an analytic cognitive training control program. All participants completed a standardized laboratory social-evaluative stress challenge task (the TSST) following the third mindfulness meditation or cognitive training session. Measures of psychological (stress perceptions) and biological (salivary cortisol, blood pressure) stress reactivity were collected during the social evaluative stress-challenge session.

Results: Brief mindfulness meditation training reduced self-reported psychological stress reactivity but increased salivary cortisol reactivity to the TSST, relative to the cognitive training comparison program. Participants who were low in pre-existing levels of dispositional mindfulness and then received mindfulness meditation training had the greatest cortisol reactivity to the TSST. No significant main or interactive effects were observed for systolic or diastolic blood pressure reactivity to the TSST.

Abbreviations: SBP, systolic blood pressure; DBP, diastolic blood pressure; TSST, Trier Social Stress Test; MLM, mixed effect linear model; ANOVA, analysis of variance; AUC_I, area under the curve with respect to increase; RCT, randomized controlled trial; HIV, human immunodeficiency virus; MAAS, Mindful Attention Awareness Scale; MBSR, Mindfulness-Based Stress Reduction; HPA, hypothalamic–pituitary–adrenal; SMA, sympathetic–adrenal–medullary.

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Conclusions: The present study provides an initial indication that brief mindfulness meditation training buffers self-reported psychological stress reactivity, but also increases cortisol reactivity to social evaluative stress. This pattern may indicate that initially brief mindfulness meditation training fosters greater active coping efforts, resulting in reduced psychological stress appraisals and greater cortisol reactivity during social evaluative stressors.

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Over the last fifteen years, there has been a dramatic increase in research and public interest in mindfulness meditation training. This interest has largely focused on using mindfulness meditation training to foster well-being and improve mental and physical health outcomes (Brown et al., 2007; Ludwig and Kabat-Zinn, 2008). For example, randomized controlled trials (RCTs) show that mindfulness meditation training buffers HIV-pathogenesis in HIV-positive adults (Creswell et al., 2009; SeyedAlinaghi et al., 2012), accelerates skin clearing rates in psoriasis patients (Bernhard et al., 1988; Kabat-Zinn et al., 1998), reduces risk for depression relapse in at-risk patient populations (Ma and Teasdale, 2004; Teasdale et al., 2000), decreases pain symptomatology (Kabat-Zinn, 1982; Zeidan et al., 2011), and reduces markers of inflammatory disease risk (e.g., C Reactive Protein) (Creswell et al., 2012; Malarkey et al., 2013). This emerging research base indicates that mindfulness meditation training may have beneficial effects across a spectrum of health conditions, but the mechanisms linking mindfulness meditation training with health are unknown. The stress buffering hypothesis, initially described in the social support literature (e.g., Cohen and Wills, 1985), is described as a potential pathway linking mindfulness meditation training with health (Brown et al., 2012; Creswell, 2014). Specifically, this stress buffering hypothesis posits that mindfulness meditation training effects on health may, in part, be explained by the capacity of mindfulness meditation training to foster resilience to stress (Creswell, 2014). The present study describes the first well-controlled experimental test of mindfulness meditation training and changes in self-reported psychological and neuroendocrine stress reactivity to the Trier Social Stress Test (TSST).

It is well known that repeated, excessive, or prolonged stress reactivity can increase one's health risks (Cohen et al., 2002, 2007; McEwen, 1998). One striking feature of the mindfulness training literature to-date is that mindfulness training effects on disease outcomes have been observed in diseases where stress is known to trigger the onset or exacerbation of disease symptoms and pathogenesis (e.g., HIV, psoriasis, depression, pain, chronic inflammation) (Cohen et al., 2007). One possibility, then, is that mindfulness meditation training may facilitate reduced stress reactivity and resilience in at-risk stressed patient populations, and that this stress resilience may buffer or reverse stress-related disease outcomes. Although the stress buffering account of mindfulness meditation training has been offered in several theoretical accounts and reviews of the mindfulness literature (Creswell, 2014; Ludwig and Kabat-Zinn, 2008), very little experimental work has directly tested whether mindfulness training reduces psychological and biological stress reactivity under controlled conditions. In support of the stress buffering account, two recent correlational studies

show that greater self-reported dispositional mindfulness is associated with reduced self-reported psychological responses and biological stress reactivity to physical (Arch and Craske, 2010) and social (Brown et al., 2012) (cf. Barnes et al., 2007; Skinner et al., 2008) laboratory stressors. For example, Brown and colleagues found that dispositional mindfulness (measured by the Mindful Attention and Awareness Scale (MAAS), which measures sustained, receptive attentiveness to daily life experiences) was associated with reduced negative affect and salivary cortisol responses to the TSST, but was not associated with these stress markers under a low stress TSST control task (Brown et al., 2012). More recently, two RCTs of Mindfulness-Based Stress Reduction (MBSR) training provide initial evidence that eight weeks of mindfulness training can reduce blood pressure reactivity to the TSST in high stress community adults (Nykliček et al., 2013) and self-reported stress perceptions to the TSST in patients with generalized anxiety (Hoge et al., 2013), but notably two recent studies also showed no effects of MBSR training on buffering cortisol reactivity to the TSST (Nykliček et al., 2013; Rosenkranz et al., 2013).

Although recent studies provide an initial indication that dispositional mindfulness and mindfulness meditation training may reduce stress reactivity, there are several important unknowns that the present study will address. First, it is unclear whether mindfulness meditation training reduces stress reactivity compared to other active cognitive training programs. An active control program is important because it is currently unclear whether it is the specific capacity for developing a non-evaluative attention and awareness to present experience in mindfulness meditation training that fosters stress resilience, as opposed to general attention training and cognitive skill learning, which can buffer stress reactivity (Gaab et al., 2003). To test this, the present study compares mindfulness meditation training to an analytic cognitive training control program, and includes assessments of whether this active comparator is well-matched on attentiveness and positive treatment expectancies.

Second, it is unclear whether small doses of mindfulness meditation training are sufficient for increasing stress resilience. Previous RCT studies have described how an intensive 8-week MBSR program may reduce stress reactivity (Hoge et al., 2013; Nykliček et al., 2013), but several studies show that just three or four days of 20-min mindfulness meditation training can increase analgesia to stimulated pain (Zeidan et al., 2011, 2010). Moreover, these (and other) initial studies indicate that pre-recorded audio mindfulness interventions can be efficacious (e.g., Cavanagh et al., 2013; Morledge et al., 2013; Zautra et al., 2012). The present study tests whether three consecutive days of 25-min audio-guided mindfulness meditation (vs. control) training in meditation naïve participants reduces stress reactivity to the TSST.

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