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Treating chronic worry: Psychological and physiological effects of a training programme based on mindfulness

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ABSTRACT

The present study examines psychological and physiological indices of emotional regulation in non-clinical high worriers after a mindfulness-based training programme aimed at reducing worry. Thirty-six female university students with high Penn State Worry Questionnaire scores were split into two equal intervention groups: (a) mindfulness, and (b) progressive muscle relaxation plus self-instruction to postpone worrying to a specific time of the day. Assessment included clinical questionnaires, daily self-report of number/duration of worry episodes and indices of emotional meta-cognition. A set of somatic and autonomic measures was recorded (a) during resting, mindfulness/relaxation and worrying periods, and (b) during cued and non-cued affective modulation of defence reactions (cardiac defence and eye-blink startle). Both groups showed equal post-treatment improvement in the clinical and daily self-report measures. However, mindfulness participants reported better emotional meta-cognition (emotional comprehension) and showed improved indices of somatic and autonomic regulation (reduced breathing pattern and increased vagal reactivity during evocation of cardiac defense). These findings suggest that mindfulness reduces chronic worry by promoting emotional and physiological regulatory mechanisms contrary to those maintaining chronic worry.

Introduction

Worry has been defined as a chain of negatively affect-laden and relatively uncontrollable thoughts and images that promote mental attempts to avoid anticipation of potential threats (Borkovec, 2002). Worry may serve various adaptive functions. According to Tallis and Eysenck (1994), worry acts as an alarm warning of potential danger, prepares us to cope with anticipated threats and maintains awareness of unresolved problems. However, excessive worry is considered maladaptive and is the defining characteristic of Generalized Anxiety Disorder (GAD) (American Psychiatric Association, 1994). The warning of potential danger and the anticipation of threat imply activation of defence reactions, i.e., the fight-flight or freezing response (Borkovec, 2002). Continuous activation of this type of defence reaction represents a state of permanent stress and vigilance for negative emotional information, hence increasing the risk of physical and mental problems (Brosschot, Gerin, & Thayer, 2006; Knepp & Friedman, 2008). In addition, the mental avoidance of low-probability negative future events by engaging in worry is an inefficient coping strategy, since it does not reduce the likelihood of negative outcomes (Borkovec, Hazlett, & Diaz, 1999) or generate effective problem solving (Stöber, 1998).

The psychological and physiological correlates of chronic worry have been investigated by a number of studies in non-clinical high trait worriers and patients with GAD (Brosschot, Van Dijk, & Thayer, 2003; Borkovec, Robinson, Pruzinsky, & DePree, 1983; Borkovec & Roemer 1995; Conrad, Isaac, & Roth, 2008; Davis, Montgomery, & Wison, 2002; Dua & King, 1987; Hoehn-Saric, Hazlett, & McLeod, 1993; Hofmann et al., 2005; Jönsson, 2007; Karteroliotis & Gil, 1987; Lyonfields, Borkovec, & Thayer, 1995; Segerstrom, Glover, Craske, & Fahey, 1999; Thayer & Brosschot, 2008; Thayer, Friedman, & Borkovec, 1996; Thayer et al., 2000; Wilhelm et al., 2001). The two most consistent physiological findings were the absence of sympathetic hyper-activation (indexed mainly by skin conductance) and the presence of reduced parasympathetic control (indexed by respiratory sinus arrhythmia and heart rate variability measures). Skin conductance is a measure of eccrine sweat gland activity, which is innervated exclusively by sympathetic axonal terminations. The term respiratory sinus arrhythmia (RSA)

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describes the phenomenon of cyclic heart rate changes in phase with respiration: heart rate increases during inhalation and decreases during exhalation. This cardio-respiratory synchrony is mediated by the parasympathetic (vagal) nervous system, which is known to exert an inhibitory effect on heart rate: increased vagal discharges during exhalation produce cardiac deceleration, while vagal inhibition during inhalation causes cardiac acceleration. Thus, quantitative measures of RSA during resting or stationary states are considered as indirect indices of tonic parasympathetic influences on the heart. Another common quantitative measure of parasympathetic cardiac control is the power of the high frequency spectral band of heart rate variability (HRV), which coincides with the respiratory rhythm. Since a state of autonomic hyper-activation can be achieved either by an increase in sympathetic action or by a decrease in parasympathetic action, or both working reciprocally, the above findings of unaltered sympathetic activation accompanied by decreased indices of parasympathetic tonic control in high worriers, suggest that chronic worry is characterized by poor autonomic regulation due exclusively to reduced vagal control.

A recent study (Delgado et al., 2009) examined high and low chronic worriers during resting and self-induced worry periods and during cued and non-cued defence reaction paradigms. It confirmed the presence in high worriers of reduced indices of sympathetic activation (skin conductance) to emotional pictures and reduced indices of vagal control (measured by RSA) during the resting period (vagal tonic measure), accompanied by increased respiration indices. It also reported a greater defence response in the non-cued defence paradigm (cardiac defence) but no difference in the cued defence paradigm (eye-blink startle probe), supporting the notion of chronic worry as a state of anticipatory anxiety or non-cued fear reaction (Lang, Davis, & Öhman, 2000). The differences in cardiac defense also allowed identifying a deficit in vagal control in high worriers. Cardiac defense is a pattern of phasic heart rate changes to an intense white noise with a short- and a long-latency acceleration/deceleration (see Vila et al., 2007, for a review). The short-latency acceleration/deceleration is vagally mediated whereas the long-latency acceleration/deceleration is controlled by sympathetic and parasympathetic influences working reciprocally (Reyes del Paso, Vila, & García, 1994; Reyes del Paso et al., 1993). Since the differences between high and low worriers were found in the first acceleration/deceleration, it was concluded that the reduced vagal control in high worriers assessed during the resting period (vagal tonic measure) was also associated with the increased cardiac reactivity to environmental threats observed during the cardiac defense response paradigm (vagal phasic measure).

In their above-cited study, Delgado et al. also found that high worriers had significantly higher scores for trait anxiety, depressive symptoms, negative affect and subjective health complaints in comparison to low worriers and significantly lower scores for positive affect. None of their high worriers were diagnosed with GAD according to ADIS-IV clinical interview (Brown, Di Nardo, & Barlow, 1994), but their elevated scores for worry and self-reported negative symptoms suggested that they would benefit from a programme aimed at reducing chronic worry.

Mindfulness has received much attention in recent years as a therapeutic tool for psychological disorders (Allen et al., 2006; Baer, 2003; Carmody, 2009; Grossman, Niemann, Schmidt, & Walach, 2004; Lazar, 2005; Toneatto & Nguyen, 2007). It has been used as an integral part of the following psychological training programmes: (1) *Mindfulness Based Stress Reduction (MBSR)* (Kabat-Zinn, 1982), originally developed for managing chronic pain and currently used to reduce psychological suffering in chronic disease and to treat emotional and behavioural disorders; (2) *Dialectic Behavioural Therapy (DBT)* (Linehan, 1993), aimed at reducing maladaptive behaviours in personality disorders; (3) *Mindfulness Based Cognitive Therapy (MBCT)* (Segal, Wiliams, & Teasdale, 2002), a combination of cognitive therapy and meditation specifically designed to treat depression (Teasdale et al., 2000); (4) *Acceptance and Commitment Therapy (ACT)* (Hayes, Strosahl, & Wilson, 1999) a mindfulness-based procedure claimed to be effective in numerous applications; and (5) *Mindfulness-based relapse prevention (MBRP)* (Witkiewitz, Marlatt, & Walker, 2005), a programme for the treatment of substance abuse that combines mindfulness techniques and relapse prevention principles.

Mindfulness, based on Buddhist meditation, has also been used in the treatment of chronic worry in GAD patients (Craigie, Rees, Marsh, & Nathan, 2008; Evans et al., 2008; Kim et al., 2009; Roemer & Orsillo, 2002, 2007). In current psychology, two fundamental components of mindfulness are distinguished (Bishop et al., 2004): (1) self-regulation of attention (awareness) towards the present experience, and (2) 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 thoughts, sensations and emotions, without avoidance or over-involvement (Carmody, 2009; Chambers, Gullone, & Allen, 2009). These key characteristics of mindfulness are clearly opposite to those of chronic worry, i.e., anticipation of future events, cognitive avoidance of internal experience and non-acceptance of uncertainty (Arch & Craske, 2006; Borkovec, 1994; Borkovec, & Inz 1990; Freeston, Dugas, & Ladouceur, 1996; Freeston et al., 1994). Hence, mindfulness training can be postulated as a potential reciprocal inhibitory mechanism that can help to modify and cope with chronic worry.

The aim of the present study was to test this hypothesis by examining the psychological and physiological (somatic and autonomic) indices of emotional regulation in non-clinical high worriers after a mindfulness-based training programme aimed at reducing worry. Participants were the same individuals studied in the paper by Delgado et al. (2009). Previous studies on mindfulness-based clinical interventions have usually been limited to self-report measures, and they have rarely included physiological indices that might help to identify the mechanism underlying the expected clinical improvement (Lau & Yu, 2009). The only physiological measures reported in mindfulness research to date have been electrophysiological and metabolic indices of Central Nervous System functions (Cahn & Polich, 2006; Creswell, Way, Eisenberger, & Lieberman, 2007; Davidson et al., 2003; Farb et al., 2007; Goldin, Ramel, & Gross, 2009). The present study was designed to differentiate the specific effects of mindfulness by using a control group that received a parallel treatment based on progressive relaxation plus the instruction to postpone worrying to a later specific time. This type of self-instruction has been successfully used in high worriers (Brosschot & Doef, 2006; Wells, 2002). We predicted that both groups would show significant post-intervention improvements in daily measures of worry and in clinical questionnaires but that the mindfulness training group would have better indices of emotional meta-cognition (attention, comprehension, and regulation of feelings and emotions) and physiological regulation (parasympathetic cardiac control and respiration) during periods of resting, meditation/relaxation and self-induced worry and in the non-cued defence paradigm (cardiac defence). The groups were not expected to differ in the cued defence paradigm (startle probe).

Method

Participants

Participants were 36 female volunteer university students (18–24 years) with high scores in the Penn State Worry