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AN INVESTIGATION INTO THE ROLE OF BODY
POSTURE IN MINDFULNESS PRACTICE

Section A: A Review of the Mediators of the Efficacy
of Mindfulness Based Cognitive Therapy (MBCT) and
Mindfulness Based Stress Reduction (MBSR)
Interventions on Psychological Distress
(Word count: 7,930)

Section B: The Effect of Body Posture on the Outcomes
and Experiences of Mindfulness Practice
(Word count: 7,966)

Overall word count: 15,896

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CANTERBURY CHRIST CHURCH UNIVERSITY

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Summary of MRP Portfolio

SECTION A

Whilst a growing body of evidence supports the efficacy of mindfulness-based interventions (MBIs), less research has addressed the question of how MBIs exert their beneficial effects. Section A comprises a narrative review of the psychological mediators of the efficacy of mindfulness-based interventions (MBIs) on psychological distress. Eighteen studies were included. Good evidence was found for the role of improved mindfulness skills in mediating the relationship between MBIs and beneficial outcomes; whereas evidence for other cognitive mediators was less conclusive, mainly due to a paucity of studies.

SECTION B

Despite the hypothesised role of the body in theory underlying MBIs and depression, the role of physical variables in relation to the beneficial outcomes of MBIs has been under-researched. Section B was an exploratory study investigating the relationship between body posture and outcomes of mindfulness practice. The aim of the study was to provide empirical support for the importance of attending to upright posture during practice. A non-clinical, adult sample (N=39) carried out a 15-minute mindfulness exercise in upright and slouched postures with outcome measures of mindfulness, affect and distress tolerance. Participants also reported qualitative experiences. Findings are discussed and recommendations made for future research in this area.

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Appendix O: Coding framework

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Section A: Literature Review

A review of the mediators of the efficacy of Mindfulness Based Cognitive Therapy (MBCT) and Mindfulness Based Stress Reduction (MBSR) interventions on psychological distress

Word count: 7,930

Abstract

Evidence exists to suggest that mindfulness-based interventions (MBIs) are effective; recently researchers have started exploring how MBIs work and their mechanisms of action. A narrative review of the psychological mediators of the efficacy of MBIs on psychological distress was conducted. Eighteen studies met inclusion criteria, which included having a test of mediation. Study quality was impacted by issues relating to design, measurement and mediation. Good evidence was found for the role of improved mindfulness skills in mediating the relationship between MBIs and beneficial outcomes in a range of populations.

Evidence for other mediators (rumination, worry, affect, non-reactivity, re-perceiving, attention, self-compassion and daily spiritual experiences) was less conclusive, largely due to a paucity of studies. Further research into how MBIs work is warranted to be able to refine treatments thus improving clinical outcomes. Recommendations for future research are made, including investigating the mediating role of the body since only cognitive variables have been explored.

Key words: Mindfulness, MBCT, MBSR, mechanism, mediator

A review of the mediators of the efficacy of Mindfulness Based Cognitive Therapy (MBCT) and Mindfulness Based Stress Reduction (MBSR) interventions on psychological distress

Mindfulness has been defined as “awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003). Mindfulness is an innate capacity that can be further developed through training (Brown, Ryan & Creswell, 2007); this review focuses on mindfulness skills cultivated through training, rather than dispositional mindfulness.

Mindfulness-based interventions (MBIs) are used clinically to reduce psychological distress and increase well-being. In this review the term ‘MBIs’ refers to mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982) and mindfulness-based cognitive therapy (MBCT; Segal, Williams & Teasdale, 2013). Both are group programs of 8-weekly sessions, during which participants are taught a variety of practices to cultivate mindfulness skills (Del Re, Fluckiger, Goldberg & Hoyt, 2012; Metcalf & Dimidjian, 2014). MBCT combines aspects of MBSR with cognitive therapy (Schroevers & Brandsma, 2010) to treat people with relapsing depression (Segal et al., 2013).

Increasing evidence exists to support the beneficial effects of MBIs across different disorders and populations (Baer, 2009). Metcalf and Dimidjian (2014) reviewed the MBCT evidence base, concluding it is effective in preventing depressive relapse in people experiencing three or more depressive episodes. Promising results were also found for MBCT in treating anxiety, psychosis and disordered eating; along with benefits in medically ill populations, people at different developmental life stages, healthcare providers and students to reduce stress (Metcalf & Dimidjian, 2014). Similarly, reviews have found MBSR to be associated with reduced medical symptoms and psychological distress (Carmody, Baer, Lykins & Olendzki, 2009).

Until recently, research has focused on whether MBIs work; the question of how MBIs exert their effects has received less attention (Baer, 2009). One approach to addressing this question is to examine factors that statistically mediate the relationship between receiving an MBI and improvements in, or protection against, psychological distress. Therefore, this narrative review aims to evaluate potential psychological mediating variables through which MBIs improve psychological distress based on a systematic search of published literature; valuable given the limited attention towards this issue so far. Theoretical background to these mediators is incorporated into the body of the review. A better understanding of how MBIs work represents the first step in further improving these interventions (Batink, Peeters, Geschwind, van Os and Wichersm 2013). The term, “psychological distress” is used to encompass all outcomes of the studies reviewed; there being no term which perfectly captures the range of outcomes spanning well-being to depression.

One previous, published review (Chiesa, Anselmi & Serretti, 2014) focused on proposed psychological mechanisms of MBIs; however this was not systematic as literature searching methodology and key references were omitted. Therefore, a more rigorous review is justified to address the question: what are the potential psychological mediators of the efficacy of MBIs?

Method

PsychInfo, Web of Science and the Cochrane Library databases were searched, between the inception of the databases and January 2015 when this report was written. Broad search terms were used to capture all relevant studies:

- Mindfulness-based cognitive therapy OR
- MBCT OR
- Mindfulness-based stress reduction OR
- MBSR

The database output was reviewed; titles were checked before reading abstracts and full papers that appeared relevant. Reference lists of key papers were also checked.

Inclusion criteria

Primary research papers were included for which the intervention was MBCT or MBSR (minor adaptations were accepted, e.g. a focus on symptoms of health anxiety); psychological mechanisms of action were explored; outcomes related to psychological distress were measured and a test of mediation was included.

Exclusion criteria

Papers were excluded if they researched dispositional mindfulness rather than MBI; the MBI was not MBCT or MBSR or a significantly adapted version (e.g. shortened sessions); neurological or biological mechanisms were explored; the research was qualitative, unpublished or non-English language. Review papers were also excluded.

Eighteen papers were included in this review; Figure 1 details the search process. All papers were quality assessed using the Standard Quality Assessment Criteria for Evaluation Primary Research Papers (Kmet, Lee & Cook, 2004; see Appendix A). The outcomes of which are detailed in Table 1; a summary of all papers is provided in Table 2.

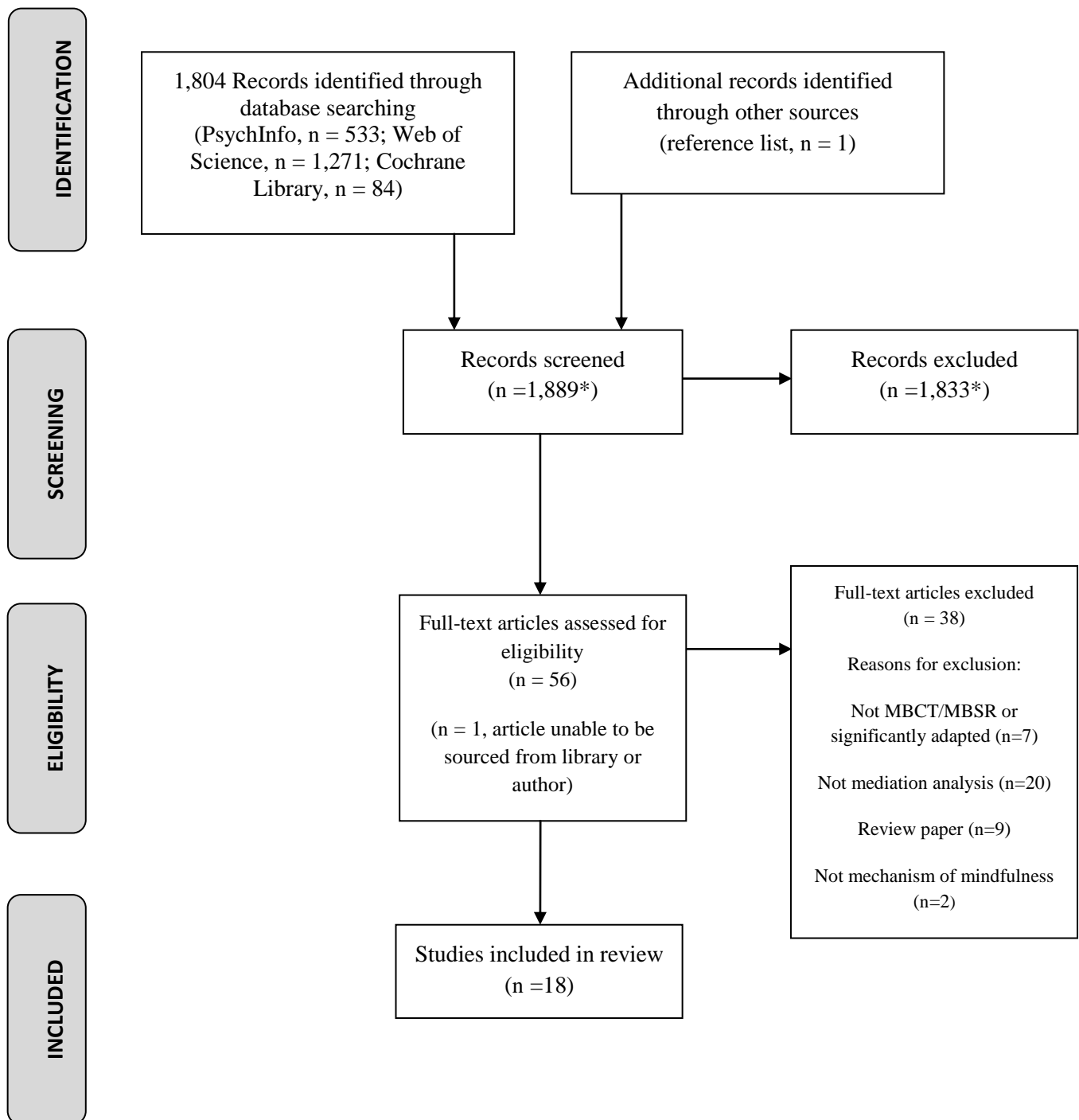


Figure 1. PRISMA flow diagram (adapted from Moher, Liberati, Tetzlaff, Altman and the PRISMA group, 2009) outlining the literature search process. *Contains some duplicate records, checking for duplicates at this stage was not possible due to the large volume of records reviewed from Web of Science and PsychInfo.

Table 1

Checklist for assessing the quality of quantitative studies (Kmet et al., 2004)

Criteria	Anderson, Lau, Segal & Bishop (2007)	Batink, Peeters, Geschwind, van Os & Wichers, 2013	Bieling et al., 2012	Britton, Shahar, Szepsenwol & Jacobs, 2012	Branstrom, Kvillemo, Brandberg & Moskowitz, 2010	Carmody & Baer, 2007	Carmody, Baer, Lykins & Olendzki, 2009	Garland et al., 2012	Greeson et al., 2011	Heeren & Philippot, 2011	Kuyken et al., 2010	McManus, Surawy, Muse, Vazquez-Montes & Williams, 2012	Nyklicek & Kuijpers, 2008	Nyklicek, van Beugen & Denollet, 2013	Raes, Dewulf, Van Heeringen & Williams, 2009	Shahar, Britton, Abarra, Figueredo & Bootzin, 2010	van Aalderen et al., 2011	Vollestad, Sivertsen & Nielsen, 2011
1. Question/objective sufficiently described?	2	2	1	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2
2. Study design evident and appropriate?	2	2	2	2	2	1	2	2	1	2	2	2	2	2	2	2	2	2
3. Method of subject/comparison group selection or source of information/input variables described and appropriate?	1	2	1	2	2	1	1	1	1	1	1	2	1	1	2	2	2	1
4. Subject (and comparison group, if applicable) characteristics sufficiently described?	2	2	2	2	2	1	1	2	1	2	2	2	2	2	2	2	2	2
5. If random allocation to treatment group was possible, was it described?	1	2	1	2	2	n/a	n/a	1	n/a	1	1	2	2	2	0	2	2	1

6. If interventional and blinding of investigators was possible, was it reported?	0	0	1	1	0	n/a	n/a	n/a	n/a	0	2	2	0	n/a	n/a	2	n/a	n/a
7. If interventional and blinding of subjects was possible, was it reported?	n/a	n/a	0	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a	n/a	n/a	n/a	n/a	2	n/a	n/a
8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement/misclassification bias? Means of assessment reported?	2	2	2	2	2	2	1	2	2	1	2	1	1	1	2	2	2	2
9. Sample size appropriate?	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2
10. Analytic methods described/justified and appropriate?	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11. Some estimate of variance is reported for the main results?	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12. Controlled for confounding?	2	2	2	2	2	0	0	2	0	1	2	2	2	2	2	2	2	2
13. Results reported in sufficient detail?	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14. Conclusions supported by the results?	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Summary score (rounded to 2 decimal places)*	.81	.92	.75	.96	.92	.77	.77	.88	.77	.64	.92	.96	.85	.92	.88	1	1	.92

Note. 2=Yes; 1=Partial; 0=No; n/a=Not applicable.

*Summary score represents the quality (internal validity) of the study. The following calculation was used:

Total sum = (number of "yes"*2) + (number of "partial"*1)

Total possible sum = 28 - (number of "n/a"*2)

Summary score: total sum / total possible sum

Table 2

Summary of articles included in the review

Author & year	Main research question	Design & (type of MBI)	Sample	Measures	Control (if used)	Mediator/s	Dependent variable/s	Key findings	Strengths	Limitations
Anderson, Lau, Segal & Bishop (2007)	Does MBSR lead to improved attentional control? Is increased mindfulness associated with improved attentional control?	RCT (MBSR)	Healthy adults with no meditation experience (N=86)	Toronto Mindfulness Scale; Positive and Negative Affect Scale, Beck Depression Inventory, Anxiety Sensitivity Index, Novaco Anger Inventory (short form), Anger Rumination Scale, Rumination Scale of the Response Styles Questionnaire, Penn State Worry Questionnaire; Vigil Continuous Performance Test, attention switching task, Stroop paradigm, object detection task.	Waitlist	Object detection (non-directed attention) - not significant	Mindfulness, mood and attentional control (sustained attention, attention switching, inhibition of elaborative processing and non-directed attention)	MBSR was associated with improved emotional well-being and mindfulness. There were no improvements in attentional control. Increased mindfulness post-MBSR was correlated with improved object detection. Changes in emotional wellbeing post-MBSR were associated with greater mindfulness; although this was not mediated by better object detection.	RCT study design. Good discussion and awareness of potential confounding variables.	Did not elaborate on non-significant finding for object detection as a mediator between improved mindfulness and improved emotional wellbeing following MBSR. Did not describe any inclusion criteria for participants or define healthy volunteers. Method of randomisation of participants to group was not described.

Batink, Peeters, Geschwind, van Os & Wichers (2013)	To examine the roles of mindfulness, rumination, worry and affect in the mechanisms of change in MBCT.	RCT (MBCT)	Adults with residual symptoms of depression (N=130) and who had experienced at least one major depressive episode	Inventory of Depressive Symptoms (self-rating), Hamilton Depression Rating Scale, Kentucky Inventory of Mindfulness Skills, Penn State Worry Questionnaire, Rumination on Sadness Scale, Experience Sampling Method, Childhood Trauma Questionnaire (short form), Interview for Recent Life Events	Treatment as usual (TAU)	Mindfulness, rumination, worry (cognitive) and changes in positive and negative affect (affective)	Depressive symptoms	Changes in mindfulness skills and worry (but not rumination) mediated the beneficial outcomes of MBCT. Affect (positive and negative) mediated the decreased depressive symptoms during MBCT. Rumination was not a mediator. In participants with 2 or less major depressive disorder (MDD) episodes, mainly cognitive and to a lesser extent, affective, processes mediated the effects of MBCT. For those with 3 or more MDD episodes, only affect changes were significant mediators.	Looked at affective as well as cognitive mediators. Compared pathways of mechanisms of change for participants with more and with less than 3 episodes of depression; interesting that underlying mechanisms may be different for different populations and individuals at different stages of their depression. Participants were people with residual depressive symptoms (not current MDD). RCT design, comparing MBCT with treatment as usual. Momentary	Doesn't outline what treatment as usual was. Additional treatments received by both groups during study was a potential confounding variable. Lack of blinding for investigators.
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										affect measured in real life rather than laboratory induced.
Bieling et al. (2012)	To examine whether decentering and mindfulness, acquired through MBCT are also present in clients receiving antidepressant medication treatment (ADM). Secondly, whether these skills mediate the effectiveness of MBCT.	RCT (MBCT plus ADM tapering)	Clinical population (treated with ADM and in remission), N=84	Toronto Mindfulness Scale, Hamilton Rating Scale for Depression, Experiences Questionnaire	Maintenance ADM/ADM tapering plus placebo	Decentering & curiosity	Symptom variables, mindfulness, rumination & decentering	Only MBCT was associated with increased ability to monitor and observe thoughts and feelings. These changes predicted lower depression scores at 6-month follow up. Rumination did not predict depression scores.	Strong RCT design. Interesting to compare different treatment modalities (MBCT and ADM). First study to examine meta-cognitive change during ADM treatment. Six month follow up showing duration of effects over time. Three different measures of negatively biased cognition used.	Small sample sizes in each study arm; high exclusion either due to drop out or not being in remission at start of study. This data was not included in the study.
Britton, Shahr, Szepeswol & Jacobs (2012)	To explore the effects of MBCT on emotion reactivity. Also whether changes in	RCT (MBCT)	Adults with partially remitted depression (N=52)	Structured Clinical Interview for Axis I and Axis II Disorders, Beck	Waitlist	Emotion reactivity	Depressive symptoms	MBCT was associated with reduced emotion reactivity to social stress. Controls showed an increased pre-stressor anxiety	RCT design with good randomisation process described. First study to	Self-report measures used. Unclear where advertisements for participants

	emotion reactivity mediate the effects of MBCT on depressive symptoms.			Depressive Inventory (BDI), Hamilton Rating Scale for Depression (HRSD), Spielberger State Anxiety Inventory (STAI-Y1), Meditation practice logs.				which the MBCT group did not. Improved emotion reactivity partially mediated the relationship between MBCT and reduced depressive symptoms.	use a potent, standardized social evaluative laboratory-based stressor to induce anxiety.	were displayed to ensure an unbiased sample was obtained.
Branstrom, Kvillemo, Brandberg & Moskowitz (2010)	To examine the effects of MBSR on stress and psychological wellbeing; also whether mindfulness mediates these outcomes.	RCT (MBSR)	Adults with previous cancer diagnosis (N=71).	Five Facet Mindfulness Questionnaire (FFMQ), Perceived Stress Scale, Hospital Anxiety and Depression Scale, Positive States of Mind, Impact of Event Scale-Revised,	Waitlist	Mindfulness	Perceived stress (primary outcome), depression, anxiety, post-traumatic stress symptoms and positive states of mind (secondary outcomes)	MBCT group showed decreased stress and post-traumatic avoidance symptoms and increased positive mind states compared with controls. Further, they showed increased mindfulness which mediated the relationship between MBCT and beneficial effects on perceived stress, posttraumatic avoidance & positive states of mind.	RCT design; proper randomization occurred. Longer follow up time than many other studies. Power calculation done. Study carried out in Northern Europe rather than USA, like many studies, improving generalisability of findings.	Not reached required number of participants as per power calculation. Only one male participant. Sample was cancer patients; might impact on generalisability of findings to other populations
Carmody & Baer (2007)	Explore whether MBSR is associated with increased	Pre-post (MBSR)	Adults with a range of problems (for	Demographic characteristics, FFMQ, home mindfulness practice log,	N/A	Mindfulness	Psychological functioning	MBSR led to increased mindfulness and psychological well-being, along with	First study to examine associations between mindfulness	Amount of mindfulness practice was not accurately recording (due

	mindfulness; and if this is related to practice time. Explore if mindfulness mediates the relationship between practice and improvements in medical symptoms and psychological functioning.	example, chronic pain, anxiety, stress), N=174	Brief Symptom Inventory (BSI), Medical Symptom Checklist (MSCL), Perceived Stress Scale (PSS), Scales of Psychological Wellbeing (PWB)					reduced medical and psychological symptoms and decreased stress. Amount of time spent in formal mindfulness practice was related to improvements in most mindfulness facets (except describing) and several measures of symptoms and well-being. Increased mindfulness fully mediated the relationship between practice time and improved psychological symptoms and stress.	cultivation, practice time and psychological functioning.	to missing homework logs), figures used were an estimate. Lack of a control group; were the effects therefore due to MBSR alone? The participants had a mix of different problems; they were not a homogenous group.
Carmody, Baer, Lykins & Olendzki (2009)	To test elements of the Shapiro et al. (2006) model of the mechanisms of mindfulness training.	Pre-post (MBSR)	Adults with a range of problems (e.g. chronic pain, anxiety, stress), N=174. Same sample as for Carmody and Baer (2007) study	FFMQ, questions on intentions, Experiences Questionnaire (EQ), Self-Regulation Scale (SRS), Purpose in Life Scale from the Scales of Psychological Wellbeing (SPWB), Environmental Mastery Scale from the SPWB, Acceptance	N/A	First: Reperceiving (decentering), Second: Self-regulation, values, flexibility & exposure	First: Self-regulation, values, flexibility & exposure; Second: Psychological symptoms/stress composite	MBSR led to increased mindfulness and reperceiving; along with increased self-regulation, values, flexibility and exposure. MBSR led to reduced levels of psychological and medical symptoms and stress. 1st Mediation analysis: Reperceiving did not mediate the relationship between increased mindfulness and self-regulation,	Study is based on a theoretical model of the mechanisms of mindfulness.	The authors used one previously unpublished measure. Same issues with sample as described in Carmody and Baer (2007).

and Action
Questionnaire
(experimental
version), Brief
Symptom
Inventory
(BSI), Medical
Symptom
Checklist
(MSCL),
Perceived
Stress Scale
(PSS)

values, flexibility &
exposure.
2nd mediation
analysis: combining
mindfulness and
reperceiving scores
led to a partial
mediation between
increased
mindfulness/
reperceiving and
psychological
symptom/stress
reduction by the four
variables (self-
regulation, values,
flexibility &
exposure).

Garland et al. (2012)	To explore the mechanisms of MBSR in participants with Irritable Bowel Syndrome (IBS)	RCT (MBSR, tailored for IBS)	Women meeting diagnostic criteria for IBS (N=75)	Irritable Bowel Symptom Severity Scale (IBS-SS), IBS Quality of Life Scale (IBS-QOL), Five Facet Mindfulness Questionnaire (FFMQ), Coping Strategy Questionnaire (CSQ), Visceral Sensitivity Index (VSI), Brief Symptom Inventory (BSI-18)	Support group	Non-reactivity and attentional shift	IBS symptom severity, IBS related quality of life, dispositional mindfulness, pain catastrophizing, visceral sensitivity, reinterpretation of pain sensations, mindfulness (5 facets) and psychological distress	Compared to control, the MBSR group experienced improvements in all dependent variables, except "acting with awareness" and "describing experiences" mindfulness facets. The relationship between MBSR and IBS severity was mediated by increased reinterpretation of pain sensations and decreased visceral sensitivity. Decreased visceral sensitivity was mediated by improvements in non-reactivity.	Exploration of the impact of MBSR on the functional disorder of IBS.	Only used female participants, limiting generalisability of findings. Slightly adapted version of MBSR may also affect generalisability. Randomization procedure not described.
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								Finally, improved non-reactivity (along with lessened visceral sensitivity and IBS severity) mediated the relationship between MBSR and improved IBS-related quality of life.		
Greeson et al.(2011)	Is improved health-related quality of life post- MBSR related to increased mindfulness; further does increased spirituality partially mediate the relationship?	Prospective, observational trial (MBSR)	Adults (N=279)	Cognitive and Affective Mindfulness Scale-Revised (CAMS-R), Daily Spiritual Experiences Scale (DSES), 12-item Short Form Health Survey (SF-12), questions on extent to which participants felt they were likely to benefit from MBSR & how frequently they did home practice during the course	N/A	Daily spiritual experiences	Mental/ physical health	Original hypothesis unsupported (relationship between increased mindfulness and improved health quality of life post MBSR would be partly mediated by changes in spirituality). Support found for an alternative model: improved mindfulness partially mediated the relationship between increased daily spiritual experiences and better mental health post-MBSR.	Looked at spirituality as a mediator which appears to be less examined than other mediators.	Participants reported a high expectancy to benefit from the MBSR - perhaps this led to the results seen. Also high number of participants had previous meditation experience and half expressed a spiritual reason for taking the course. These represent potential confounding variables. Lacked a control group. Procedure changed half way through the data collection,

researchers used an abbreviated measure and provided compensation money.

Heeren & Philippot (2011)	Are the beneficial outcomes of MBCT mediated by less maladaptive rumination and increased adaptive rumination?	Quasi experimental (MBCT adapted for stress and anxiety as well as depression)	Adults enquiring about mindfulness program (N=41)	Cambridge Exeter Rumination Thinking Scale (mini version), Symptom Checklist-90-R	Waitlist	Rumination	Psycho-pathological symptoms	MBCT reduced psychopathology (compared to controls); it also reduced maladaptive rumination and increased adaptive rumination. Changes in rumination mediated the beneficial outcomes of MBCT.	Experimental hypotheses grounded in theory. Both maladaptive and adaptive rumination constructs were examined.	Unclear whether sample were clinical or community based, or where the study took place. Participants were not randomly allocated to groups when this could have been possible. Details not provided about the SCL-90-R measure and what constitutes a clinically significant score. Unclear whether findings represented clinically significant change and whether they would endure over time.
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Kuyken et al. (2010)	Whether MBCT outcomes are mediated by improved mindfulness and self-compassion, and/or by changes in cognitive reactivity	Embedded in existing RCT comparing MBCT (discontinuation of ADM) with maintenance ADM	N=123 patients with 3 or more prior depressive episodes in full or partial remission. All on ADM.	Hamilton Rating Scale for Depression, Structured Clinical Interview for DSM-IV (depression module), Kentucky Inventory of Mindfulness Skills (KIMS), Self Compassion Scale, Dysfunctional Attitude Scale, Versions A&B	Maintenance ADM	Mindfulness, self-compassion & cognitive reactivity	Depressive symptoms severity and depressive relapse over 15-month follow up	MBCT associated with improved self-compassion and mindfulness. These increases accounted for less severe depressive symptoms at follow-up at 15-months. MBCT participants showed higher cognitive reactivity following sad mood induction than ADM participants; however this did not lead to worse depression outcomes (enhanced self-compassion may have nullified this relationship).	RCT design (MBCT vs ADM) is positive, enables MBCT to be compared to another treatment which works through a different mechanism. Longitudinal follow up (1-15 months depending on mediator).	Mindfulness and self-compassion measured using self-report questionnaires. Cognitive reactivity assessed following laboratory induced sad mood; same as in the real world? Small number of males participating. Increased reactivity may be due to many participants stopping their ADM recently.
McManus, Surawy, Muse, Vazquez-Montes & Williams (2012)	To examine the impact of MBCT on health anxiety through comparing unrestricted services (US) and MBCT	RCT (MBCT with focus on health anxiety plus usual services)	Adults with a diagnosis of hypochondriasis (N=74)	Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I), assessor ratings of distress and interference associated with health anxiety, Short	Usual services (US)	Mindfulness	Health anxiety symptoms (composite of self-measure and assessor rated)	MBCT group had lower health anxiety symptoms than US group immediately post-MBCT and at 1-year follow up. Increased mindfulness mediated the relationship between MBCT and change in health anxiety.	Provided a power calculation. Combined self-report and assessor rated health anxiety symptoms composite score, better than relying on self-	Slight adaptation to MBCT program to focus on health anxiety may limit generalisation of findings. Participants' previous experience of meditation

				Health Anxiety Inventory (SHAI), Whiteley Index (WI), Beck Anxiety Inventory (BAI) and Beck Depression Inventory (BDI), Five Facet Mindfulness Questionnaire (FFMQ)					report data alone. RCT design and first study to look at effects of MBCT on health anxiety; also did 1-year follow up. Adherence to the MBCT program and competence in delivering it was independently assessed.	was not assessed, representing a potential confounding variable.
Nyklicek & Kuijpers (2008)	To examine whether MBSR outcomes in relation to psychological wellbeing were due to improved mindfulness	RCT (MBSR)	Adults from the community (N=60) with symptoms of distress.	Demographic data, Perceived Stress Scale (PSS), Maastricht Questionnaire (MQ), Global Mood Scale (GMS), World Health Organisation Quality of Life (WHOQOL) brief version of the WHOQOL-100 (WHOQOL-Brief), Mindful Attention Awareness	Waitlist	Mindfulness	Psychological wellbeing and quality of life	MBSR participation led to greater reductions (compared with the controls) of perceived stress and vital exhaustion; and increases in positive affect, quality of life and mindfulness. Increased mindfulness mediated the relationship between MBSR and perceived stress and quality of life. Increased mindfulness partly mediated the relationship between MBSR and vital exhaustion.	RCT design with control group. Good randomization procedure for group allocation.	Participants were eligible to participate if they reported they felt distressed regularly or often; this seemed a subjective inclusion criterion. Inclusion of only 2 of the MAAS sub scales.

Scale
(MAAS),
Kentucky
Inventory of
Mindfulness
Skills (KIMS)
Observe and
Accept
without
judgement
subscales,
daily practice
information.

Nyklicek, van Beugen & Denollet (2013)	Can MBSR reduce type D personality characteristics; if so, were these mediated by increased mindfulness?	RCT (MBSR)	Distressed Dutch adults (N=146)	Demographic data, Type D Scale-14, Positive and Negative Affect Scale (PANAS), Global Mood Scale, MAAS, KIMS (Observe and Accept without Judgement subscales), daily practice data.	Waitlist	Mindfulness	Type D personality dimensions (negative affectivity and social inhibition), state negative affect, mindfulness, daily practice.	MBSR led to reductions in dimensions of Type D personality (although there was no effect on Type D caseness). Amount of practice and session attendance was not related to changes in outcome measures. Increased mindfulness skills mediated the relationships between MBSR and negative affectivity/social inhibition.	The first RCT to look at changes in personality dimensions following MBSR. RCT design and good randomization procedure. A power calculation was included.	Combined results from two studies, used different measures of state negative affect in the studies.
Raes, Dewulf, Van Heeringen & Williams (2009)	To explore the relationship between dispositional mindfulness (Study 1) and MBCT (study 2) on one hand and cognitive reactivity on	Cross-section (study 1) and Quasi-experimental (study 2) [MBCT]	Study 1: undergraduate students (N=164). Study 2: adults signing up for MBCT course	Extended version of the Kentucky Inventory of Mindfulness Skills (KIMS), Leiden Index of Depression Sensitivity-Revised, Beck	Waitlist	Mindfulness	Depressive symptoms, cognitive reactivity	Dispositional mindfulness was significantly negatively correlated with cognitive reactivity (Study 1). MBCT compared to control group significantly reduced CR and that this	Two studies with different populations, gives more confidence about generalisability of results. Also	Did not use mood challenge paradigm to induce cognitive reactivity, used self-report measure instead.

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the other.

(N=39)

Depression
Inventory II,
Major
Depression
Questionnaire

effect of MBCT on
reduction of CR was
mediated by an
increase in
mindfulness.

enabled
replication of
results.
Incorporated
social
outcome
measures as
well as these
are important
in psych-
ological
wellbeing.
Large
sample size.

Authors made
their own
adaptations to
the KIMS,
adding in an
extra factor
which may
have impacted
on reliability.
Lack of
information
regarding
procedure and
recruitment of
participants in
study 1. Study
1 was
correlational
so cannot
allow definite
conclusions
around the
direction of
relationship
found,
although study
2 improves on
this. Study 2
however had a
small sample
size. Would
have been
better for
study 2 to use
a clinical
sample.

Shahar, Britton, Sbarra, Figueredo & Bootzin (2010)	Does reduced rumination and improved mindfulness mediate the outcomes of	RCT (MBCT)	Recurrent depressed adults (N=45) who had 3 or more	Structured Clinical Interview for Axis I and Axis II Disorders,	Waitlist	Rumination (brooding & reflective pondering constructs) and	Depressive symptoms	Increases in everyday mindfulness and reductions in brooding mediated the therapeutic	RCT design. Was the first study to research how mindfulness training	Examined reduction in depressive symptoms during program, not
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	MBCT on depression		episodes of depression. Sample were partially remitted with residual symptoms.	Hamilton Rating Scale for Depression, Beck Depression Inventory, Ruminative Response Scale of the Response Styles Questionnaire, Mindful Attention Awareness Scale		mindfulness		effects of MBCT on depressive symptoms. Changes in reflective pondering were not affected by MBCT and were not associated with reductions in depressive symptoms.	leads to changes in depressive symptoms.	relapse after program. More longitudinal research is called for. Also, as with other RCT designs, requires distinct categorisation of participants' symptoms which may not be easy to do. Around half the sample were on ADM - perhaps representing a confounding variable. Mainly female sample, meaning less generalisability.
van Aalderen et al. (2011)	To explore the efficacy of MBCT in a sample with recurrent depression, including those with & without current episode of depression. Examine whether rumination,	RCT (MBCT plus TAU)	Patients with three or more depressive episodes (N=205)	Hamilton Rating Scale for Depression (HAMD), Beck Depression Inventory (BDI), Rumination on Sadness Scale (Dutch translation), Penn State Worry Questionnaire,	TAU	Rumination, worry & mindfulness	Depressive symptoms	MBCT group had less depressive symptoms, worry and rumination along with increased mindfulness compared to controls. Efficacy of MBCT was independent of baseline depression levels. Decreased worry and rumination (and increased	Use of a sample with recurrent depressive episodes which is the client group MBCT is recommended for. Long term follow up of 1-year, including booster MBCT	Doesn't compare MBCT with another treatment for recurrent depression.

worry & mindfulness mediate the relationship between MBCT and reduced depressive symptoms.

KIMS, World Health Organisation Quality of Life scale

mindfulness skill "accept without judgement") were mediators for post-measurement levels of depressive symptoms.

sessions during this time, not seemingly offered by other studies.

Vollestad, Sivertsen & Nielsen (2011)	To examine the effects of MBSR on participants with anxiety disorders. Does increased mindfulness mediate the relationship between MBSR and changes in anxiety, worry and depression symptoms.	RCT (MBSR)	Norwegian adults with heterogeneous anxiety disorders (N=76)	Beck Anxiety Inventory (BAI), Penn State Worry Questionnaire, Spielberger State Trait Anxiety Inventory, Beck Depression Inventory (BDI-II), Symptom Checklist 90 - Revised edition, Bergen Insomnia Scale, FFMQ, Practice log.	Waitlist	Mindfulness	Anxiety, worry, depression, psychological distress, insomnia symptoms, mindfulness and practice time.	The MBSR group differed significantly from controls on all measures (in the expected direction), except insomnia symptoms. Gains maintained during follow-up. Mindfulness mediated the relationship between MBSR and change in anxiety (BAI). Changes in mindfulness were partial mediators for trait anxiety and worry. No evidence was found for temporal precedence of the mindfulness mediator.	Measures taken during treatment to see if there was a temporal precedence for the mindfulness mediator. Looked at clinical significance of change following MBCT.	Did not describe random allocation to treatment/control group process. Unable to test for true mediation by using mid-point data due to lack of temporal precedence. No referral process to participate, was self-referral only which may have led to a biased sample.
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Review

The review begins by examining key issues pertinent to all the articles, relating to study design, mediation and measurement. Following this, empirical evidence (and background theory) for each mediator variable is considered.

Design

Thirteen studies used a randomised control trial (RCT) design; participants were randomly assigned to the MBI or control group, either a waitlist control or similar intervention without the mindfulness element. The latter was more robust since it helped rule out whether it was a non-specific aspect of the MBI (e.g. group support) that had an effect. MBI RCTs are considered the most reliable design for testing the intervention's efficacy; random allocation of participants reduces bias between characteristics of the treatment and control groups (Akobeng, 2005). Some studies detailed a more robust randomization procedure (e.g. Britton, Shahar, Szepeswol & Jacobs, 2012) than others.

Ideally, participants and researchers should be blind to the allocated conditions (Akobeng, 2005). However, when testing efficacy of psychological therapies such as MBIs, this is hard to conceal: researchers and participants may be aware whether they are receiving the placebo or treatment and respond accordingly. Some studies attempted to limit potential for bias e.g. independent staff performed the random allocation (McManus, Surawy, Muse, Vazquez-Montes & Williams, 2012).

The remaining studies largely used either a quasi-experimental or a pre-post design (see Table 2); less robust than a RCT since they lacked random allocation meaning there may have been differences between the groups which impacted on findings; or had no control group, making it unclear whether improvements would have occurred without the MBI. A RCT design is preferable for investigating mediation of efficacy since the random allocation

of participants reduces the potential impact of unmeasured confounding variables on outcomes.

Mediation

Mediation occurs when the relationship between an independent (X) and dependent (Y) variable is transmitted through a third mediating (M) variable (Fritz & MacKinnon, 2007). According to the Baron and Kenny (1986) approach, the following conditions must be met to show support for a mediational hypothesis (see Figure 2):

- 1) Variations in the level of X significantly account for variations in M (path a, Figure 2)
- 2) Variations in M significantly account for variations in Y (path b, Figure 2)
- 3) When paths a and b are controlled for, a previously significant relationship (path c', Figure 2) between X and Y is significantly reduced in strength.

The c' path (direct effect) should get smaller with the addition of each mediator (MacKinnon, 2015). Direct (complete) statistical mediation occurs when path c' is zero. When this path is significantly reduced but still greater than zero, indirect (partial) mediation occurs which suggests multiple mediating variables, often the case with psychological concepts (Baron and Kenny, 1986).

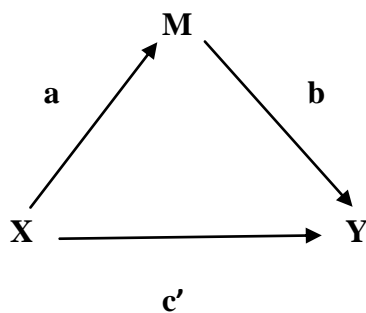


Figure 2. The causal chain in mediation (adapted from Baron and Kenny, 1986).

To conclusively establish mediation, a temporal ordering is observed, whereby changes in M occur before changes in Y. Only Vollestad, Sivertsen and Nielsen (2011) took measurements midway, along with pre- and post-MBI. Findings from other studies should therefore be interpreted with a degree of caution since they measured changes in M and Y at the same time.

There are a number of mediation tests and many articles used Baron and Kenny's (1986) approach. However, Hayes (2009) critiqued this since it does not quantify the indirect mediation effect; rather it is inferred on the basis of the outcomes of a set of hypotheses. Further, Fritz and MacKinnon (2007) only recommend the Baron and Kenny (1986) approach when the direct path is large, otherwise it may lack power. They recommend using tests which have increased power: the joint significance test (MacKinnon, Lockwood, Hoffman, West & Sheets, 2002), PRODCLIN asymmetric confidence-intervals (MacKinnon, Fritz, Williams & Lockwood, 2007) or the bias corrected bootstrap. Many studies did not use these recommended methods, thus findings should be interpreted tentatively since the test of mediation may have lacked power to find an effect (see Fritz & MacKinnon [2007] for estimates regarding required sample sizes to achieve .8 power using different tests of mediation).

Finally, evidence of statistical mediation does not conclusively mean an established mechanism of action. Rather, this represents the first step to identifying a mechanism of action since a mediator could potentially be a marker of a different mechanism of change; the same outcomes may be reached through multiple paths (Kazdin, 2007). Findings in this review are therefore suggestive of the underlying mechanisms of MBIs.

Measurement

There is a lack of consensus around the conceptualisation of mindfulness (Chiesa et al., 2014), leading to the development of a range of mindfulness measures with different

numbers of facets (Coffey, Hartman & Fredrickson, 2010). Baer, Smith, Hopkins, Krietemeyer and Toney (2006) carried out an exploratory factor analysis of different mindfulness measures. A five-factor solution was proposed: observing, describing, acting with awareness, non-judging of inner experience and non-reactivity to inner experience. The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) was developed and found to have construct validity (Baer et al., 2008), supporting a multi-faceted view of mindfulness. Although the relationship between the observe sub-scale of the FFMQ and psychological adjustment has been found to vary according to meditation experience (Baer et al., 2008).

Studies frequently used the FFMQ (Baer et al., 2006), see Table 2. This was likely to be better than the unidimensional Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) since measuring separate facets of mindfulness enables researchers to explore relationships with other variables and better understand which skills are developed during MBIs and the role that these play in the beneficial outcomes (Baer et al., 2008).

There was also a lack of consistency in the measurement of other mediators. For example, rumination was measured as two separate facets in some studies (e.g. Heeren & Philippot, 2011) but not in others (e.g. Batink et al., 2013). There was also variation between studies in the type of measures used for the same variable which may have contributed to contrasting findings. Additionally, some variable measures may have been highly correlated with others e.g. mindfulness and re-perceiving (Carmody et al., 2009) making it difficult to separate out which of these may mediate an outcome.

Studies mainly used self-report measures of mindfulness and other dependent variables, completed pre- and post-test. Self-report measures create potential for response bias (Carmody et al., 2009) and increase the likelihood of finding positive change; particularly given the time and energy participants have invested into the MBI (Chiesa et al., 2014). Thus the potential for response bias should be taken into account when interpreting

findings. Additionally, common method variance (variance attributable to the method of measurement i.e. self-report, rather than the constructs being measured) may provide another explanation for correlation between measures (Podsakoff, Mackenzie, Lee & Podsakoff, 2003).

In summary, a number of issues have been discussed in relation to the robustness of the study design, type of test of mediation used (and its power to find effect), reliability of measures and bias associated with self-report measures. These issues should be taken into account when interpreting the findings of studies in this review. The first mediator variable, mindfulness, will now be explored.

Review of Mediator Variables

Mindfulness. Segal et al. (2013) theorised two modes of mind; doing and being. “Doing” strives towards achieving goals relating to the external world or internal self. A perceived discrepancy between how things are and how they should be, results in attempts to close the gap through thought or action. When the goal is self-related and the discrepancy cannot be resolved (“driven-doing” mode), the mind theoretically becomes stuck ruminating on how to solve the discrepancy potentially leading to intensified low mood and risk of depression. In this state, it is argued the mind cannot be fully open to present experiences.

Conversely, “being” mode is not devoted to achieving goals, rather accepting and allowing present experience without attempts to change it. Thoughts and feelings are seen as passing mental events (not goal-related), thus are less likely to trigger habitual ruminative thinking patterns and difficult emotions are more easily tolerated. MBCT is intended to train individuals to disengage from ruminative processes in “doing” mode through paying mindful attention to present moment experience, switching into “being” and reducing risk of depressive relapse (Segal et al., 2013).

In line with this, mindfulness skills are hypothesised to be an integral mediator through which MBIs exert their beneficial effects. It is therefore unsurprising that mindfulness has received more attention than other mediators; seven papers investigated mindfulness (singularly) as a mediator variable. The first two had lower quality rating scores (.88 and .77, see Table 1) than others due to a non-RCT design, and they are reviewed together. (Quality scores in this review ranged from 1.0 to .64; higher quality papers scored >.90 and lower quality ones scored >.80.)

Raes, Dewulf, van Heeringen and Williams (2009); Carmody and Baer (2007). In a quasi-experimental design, Raes et al. (2009) explored the relationship between mindfulness and cognitive reactivity (the degree to which dysphoria reactivates negative thinking patterns) post-MBCT; using the bias corrected bootstrap method for mediation. Reduced cognitive reactivity post-MBCT was statistically mediated by increased mindfulness.

Carmody and Baer (2007) used a pre-post design. The Baron and Kenny (1986) approach indicated mindfulness fully statistically mediated the relationship between greater formal practice time and improvements in psychological symptoms and perceived stress. It partially statistically mediated the relationship between greater formal practice and increased psychological wellbeing.

Both studies therefore found support for mindfulness as a mediator of improved psychological outcomes, although the non-RCT designs limit confidence in findings as discussed earlier. Carmody and Baer (2007) highlighted the potential role of formal mindfulness practice; however, figures used in analyses were estimates due to missing participant practice logs potentially impacting on findings. The remaining five papers improved on these studies through a RCT design.

Nyklicek and Kuijpers (2008); Nyklicek, van Beugen and Denollet (2013). In both studies, the same distressed sample completed self-report measures of psychological

wellbeing (perceived stress, vital exhaustion and affect), quality of life, and mindfulness, and home practice logs. However, in Nyklicek et al. (2013), these data were combined with that from another sub-study which used a different affect measure (a limitation of this study).

Both used the Baron and Kenny (1986) mediation approach. Nyklicek and Kuijpers (2008) found improved mindfulness statistically mediated the relationship between MBSR and improved perceived stress and quality of life. Furthermore, mindfulness partly statistically mediated the relationship between MBSR and vital exhaustion. Nyklicek et al. (2013) also found support for mindfulness as a mediator. The authors used an additional non-parametric bootstrap procedure; improved mindfulness skills statistically mediated the relationships between MBSR and Type D personality dimensions. Both studies therefore added support to the mediating role of mindfulness in improvements in psychological wellbeing and Type D personality dimensions. Unlike Carmody and Baer (2007), no effects were found for home practice in either study.

Generalisability of findings may be limited since participants were recruited through newspaper adverts, perhaps representing a more self-motivated group. Additionally, the only inclusion criterion was reporting regular experience of distress; this seemed subjective and potentially captured a range of conditions and non-clinical distress (most studies used more formal inclusion criteria). Finally, as with Raes et al. (2009), comparison of findings between studies would be facilitated through single standardized measures, rather than selecting and combining subscales from different mindfulness measures. The Nyklicek and Kuijpers (2008) study received a lower quality rating (.85) than Nyklicek et al. (2013; .92, see Table 1); reflecting researchers not being blind to group allocation. The following three studies expanded the MBI evidence base, exploring mindfulness as a mediator in different populations.

Branstrom, Kvillemo, Brandberg and Moskowitz (2010); Vollestad et al. (2011); McManus et al. (2012). These three high quality RCT studies (scoring .92 to .96; see Table 1) are critiqued together given each involved populations not previously explored in the literature: participants with previous cancer diagnoses (Branstrom et al., 2010), anxiety disorders (Vollestad et al., 2011) and health anxiety (McManus et al., 2012).

In Branstrom et al. (2010), self-report measures were completed for mindfulness, perceived stress and psychological wellbeing (depression, anxiety, post traumatic symptoms and positive state of mind). Using the Baron and Kenny (1986) approach, mindfulness statistically mediated the relationships between MBSR and the effects on perceived stress, post-traumatic avoidance and positive states of mind at three-month follow up.

In Vollestad et al. (2011), measures of anxiety, worry, depression, insomnia symptoms, psychological distress and mindfulness were completed. Mediation analyses involved the Baron and Kenny (1986) approach combined with a nonparametric bootstrapping procedure. Increased mindfulness statistically mediated the relationship between MBSR and change in acute anxiety. Changes in mindfulness also partially statistically mediated changes in trait anxiety and worry. However, no evidence was found for temporal precedence of the mindfulness mediator. For mediation to be conclusively established changes in the mediator variable (M) should precede changes in the outcome variable (Y; Vollestad et al., 2011), so results should therefore be interpreted tentatively (although a unique strength of this study was the measurement of variables mid-intervention in addition to pre-post intervention). As with Branstrom et al. (2010), gains were maintained at 6-month follow-up.

In McManus et al. (2012), participants completed two self-report measures in health anxiety (with further verification from a clinical interview, a positive feature of the study); plus self-report measures in anxiety and depression symptoms, and mindfulness. Mediation

analyses using the Preacher and Hayes (2008) bootstrapping procedure found improved mindfulness statistically mediated the relationship between MBCT and change in health anxiety. However, MBCT was adapted to focus on health anxiety symptoms potentially limiting the generalisability of the findings. A unique study strength was the independent verification of adherence to the MBCT program and competence in delivery.

Thus the studies add weight to the role of mindfulness as a mediator in three new populations.

Summary. All articles reviewed found increased self-reported mindfulness skills fully or partially statistically mediated the relationship between MBIs and a range of outcome measures related to psychological wellbeing (for example, cognitive reactivity, perceived stress, negative affectivity and anxiety) across different population groups, including participants with cancer and anxiety. Gains were maintained at follow-up.

Therefore, there is good evidence improved mindfulness may be a potential (and enduring) mechanism of MBIs; particularly since evidence came mostly from RCT studies. However it was notable that all RCTs used a waitlist control, except McManus et al., 2012, which had usual services; arguably a better control since it could help establish MBIs are more effective than other treatments, rather than in comparison with no treatment.

Overall, findings are consistent with theory that MBIs help individuals switch from a “doing” to “being” mode of mind in which there is reduced capacity for rumination and resulting low mood (Segal et al., 2013). Further, the range of populations suggests it is not only individuals with depression that benefit from adopting a “being” mode. Given mindfulness is a multifaceted construct (Baer et al., 2006) other mediators are likely to play a role; these will now be examined.

Rumination (also worry and affect). Segal et al. (2013) describe rumination as dwelling on current negative feelings, past events and how things “should” be; as in the

“doing-driven” mode of mind described, leading to low mood. Rumination is integral to the Differential Activation Hypothesis (DAH; Teasdale, 1988) of depression, which proposes low mood is related to negatively-biased cognitive patterns, which become stronger and more entrenched with each episode of dysphoria. Over time, it is hypothesised that a slight negative mood may be enough to reactivate established patterns; creating a positive feedback loop in which depressed mood and negative thinking intensify, spiraling into depressive relapse. MBCT is proposed to help an individual recognise and disengage from ruminative negative thinking, before it spirals into depressive relapse (Segal et al., 2013). Thus decreased rumination may be a potential mediator for the salutary effects of MBIs.

However, rumination may not always be a depression risk factor. A positive feature of two studies (Heeren & Philippott, 2011; Shahar, Britton, Sbarra, Figueredo, & Bootzin 2010) was their differentiation between facets of rumination. Firstly, brooding (maladaptive) which may contribute to depressive symptoms and is related to high level processing resulting in negative over-generalising about the self and mood. Conversely, reflecting (adaptive) may be associated with reduced depressive symptoms and is related to low-level processing of perceptions about the self and mood.

Four studies exploring rumination will now be reviewed; two also included worry as a mediator variable. Worry has been defined as negative, uncontrollable thoughts about an issue; specifically about negative outcomes and involving mental problem solving (Borkovec, Robinson, Pruzinsky and Depree, 1983). Thus worry may be highly correlated with rumination. Batink et al. (2013) also included affect; given the proposed inter-linked roles of negative mood and rumination in the DAH (Teasdale, 1988) affect seems an important variable to explore.

Heeren and Philippot (2011). In a quasi-experimental design, mediation analyses using Baron and Kenny’s approach (1986) and the Sobel (1982) test found decreases in

maladaptive and increases in adaptive rumination partially statistically mediated the relationship between MBCT and psychopathology; suggesting both facets played a role in improving symptoms. However, generalizability of findings may be limited since MBCT was adapted to include psychoeducational material on anxiety and depression. The study was given a low quality score (.64; see Table 1) due to design weaknesses and lack of participant information. The remaining studies exploring rumination benefited from a RCT design (quality scores ranged from .92 to 1.0; see Table 1).

RCTs: Shahar et al. (2010); van Aalderen, Donders, Giommi, Spinhoven, Barendregt & Speckens (2011); Batink et al. (2013). In the Shahar et al. (2010) study, participants completed measures in mindfulness and rumination (brooding and reflection facets). The Preacher and Hayes (2008) bootstrapping approach found brooding and mindfulness statistically mediated the effect of MBCT on depressive symptoms however; reflection did not. This provides further support for the mediating role of reduced maladaptive rumination, although the findings for reflection are in contrast to the Heeren and Philippot (2011) findings for adaptive rumination. Half the participants in Shahar et al. (2010) were on anti-depressant medication (ADM), which may have impacted on findings.

Van Aalderen et al. (2011) further improved on the Shahar et al. (2010) study with a larger sample, a third mediator (worry) and one-year follow up. Mediation analysis using Preacher and Hayes' (2008) recommendations found decreases in worry and rumination were mediators for lower depressive symptoms post-MBCT. Only an increase in one mindfulness facet "accept without judgement" was a significant mediator; perhaps the other facets were highly correlated with rumination and worry thus diminishing indirect effects when included as potential mediators in the same analysis (although evidence of this was not reported). This study adds further evidence to the role of rumination (and worry) as potential mediator variables, although there was no differentiation between facets of rumination.

Using the same design, Batink et al. (2013) expanded on the Shahar et al. (2010) study by including affect as a fourth potential mediator variable. The Sobel-Goodman (Sobel, 1982; Goodman, 1960) mediation method was used. In keeping with previous studies, increased mindfulness skills statistically mediated the relationship between MBCT and reduced depressive symptoms. Further, the relationship between mindfulness and depressive symptoms was statistically mediated by a reduction in worry and increase in positive affect. In turn, the relationship between worry and reduced depressive symptoms was statistically mediated by both positive and negative affect; thus results showed support for both cognitive and affective variables in the mediation chain. The authors suggested reduced worrying may improve affect and lead to less negative cognition.

Unlike previous studies, rumination was not a significant mediator. The authors suggested this was due to differing levels of depression between study participants; different mediators may be active according to the level of symptom severity. Participants were in remission and had experienced at least one depressive episode; contrastingly, in both the van Aalderen et al. (2011) and Shahar et al. (2010) studies, participants had experienced three or more episodes of depression and some were currently depressed or experiencing residual symptoms.

Another finding of the Batink et al. (2013) study supports the premise different mediators are involved depending on participants' prior depression experience. In those with two or fewer episodes, cognitive (mindfulness and worry) and, to a lesser extent, affective processes statistically mediated the effects of MBCT. For those with three or more episodes, only affect was a significant mediator. This was in contrast to van Aalderen et al. (2011) who found support for cognitive mediators in participants with three or more depressive episodes (although affect was not measured). Perhaps this was due to chance sampling differences between the two groups of participants with three or more depressive episodes. Also power

issues may have impacted on the Batink et al. (2013) finding since it involved a small sub-sample (N=59) compared with the larger van Aalderen et al. (2011) sample (N=205).

Despite this, the idea that affective changes play a more prominent role in depression for those individuals with greater prior experience fits with the DAH (Teasdale, 1988) described; in which dysphoric mood is proposed to reactivate established negative thinking patterns leading to depressive relapse. Further research is required to understand which mediators are important for individuals with greater depression experience.

Summary. The above four studies reviewed provided further evidence to support mindfulness skills as a mediator of the beneficial outcomes of MBIs, however rumination received mixed support. Two studies found rumination to be a significant mediator variable, one of which found support for both adaptive and maladaptive facets of rumination. Conversely another only found support for the brooding facet and a fourth study did not find rumination to be a significant mediator. The mixed findings may be a result of power issues, chance variation in samples and differing rumination measures (see Table 2). Further research is required to clarify the role of rumination; separating out the adaptive and maladaptive facets which may have opposing roles. Future studies would benefit from a “treatment as usual” control group (as two of the RCTs did) to help establish efficacy of MBIs over other treatments.

Two studies reviewed worry as an additional mediator and found emerging support for this; although both used the same worry measure which may be highly correlated with rumination measures. One study also explored affect and found this to be more important than previously mentioned cognitive mediators for participants with greater experience of depressive episodes, in keeping with the DAH (Teasdale, 1988). A complex picture is emerging whereby several different mediators may play a role in the beneficial outcomes of

MBIs and these may differ according to individual experience. Another mediator variable, cognitive reactivity will now be reviewed.

Cognitive reactivity (also emotional reactivity and self-compassion). Cognitive reactivity is the degree by which dysphoric mood reactivates increased negative information processing (Lau, Segal & Williams, 2004). In keeping with Teasdale's (1988) DAH, cognitive reactivity represents a risk factor for depressive relapse (Lau et al., 2004). It is thought MBIs help individuals recognise when their mood is deteriorating and switch to a non-reactive ("being") mode of mind, preventing negative thoughts and feelings spiraling into depression (Raes et al., 2009).

The previously reviewed Raes et al. (2009) study found increased mindfulness skills statistically mediated the effect of MBCT on reduced cognitive reactivity. Three further studies have examined the mediating role of reduced reactivity (cognitive or emotional) and these will now be reviewed. All were RCTs and had high quality ratings ranging from .88 to .96 (see Table 1). One study also included self-compassion as another mediator variable; valuable to explore since attending to present experiences with an attitude of self-compassion is fundamental in MBCT (Segal et al., 2013).

Kuyken et al. (2010); Britton et al. (2012); Garland et al. (2012). Kuyken et al. (2010) explored cognitive reactivity, mindfulness and self-compassion as potential mediators. Mindfulness and self-compassion were measured through self-report. Cognitive reactivity was assessed one month post-intervention. A sad mood induction was used to measure the reinstatement of a depressed mood in participants; potentially a more reliable approach than a self-report measure of cognitive reactivity. Depressive relapse was assessed 15-months post-intervention.

A mediation framework recommended by Kraemer, Wilson, Fairburn and Agras (2002) was used. Increased mindfulness and self-compassion statistically mediated the

relationship between MBCT and less severe depressive symptoms at follow-up; thus finding initial support for self-compassion as a mediator. MBCT participants had higher cognitive reactivity than controls; further cognitive reactivity statistically mediated the relationship between group and depressive relapse. For controls, higher cognitive reactivity was associated with worse depressive outcomes. However; for those in the MBCT group, higher cognitive reactivity was not linked to worse depressive outcomes and it appeared that an increase in self-compassion nullified the relationship. The authors hypothesised whilst negative mood may continue to reactivate dysfunctional thought patterns in people post-MBCT, the intervention may change individual's responses to these thoughts, preventing depressive relapse .

Cognitive reactivity was measured immediately post-MBCT period whilst depressive relapse was assessed at 15-months follow up, helping establish a temporal sequence of change for the mediator and outcome variables, thus giving additional confidence to reductions in cognitive reactivity as a potential mechanism of action for MBCT (Kuyken et al., 2010). In summary, MBCT may make an individual more aware of their negative thoughts however; the vicious cycle outlined in the DAH (Teasdale, 1988) between reactivation of negative processing and depressed mood appeared to be interrupted by greater compassion towards one's thoughts and feelings.

In a RCT study, Britton et al. (2012) explored emotional reactivity (the intensity of affective response to a stressor) as a mediator; another important and under-researched mediator since MBCT trains people to accept negative emotions rather than over-evaluate these (Britton et al. 2012). The Preacher and Hayes (2008) approach with a bootstrapping procedure was used. Reduced emotional reactivity partially statistically mediated the relationship between MBCT and improved depressive symptoms, which the authors

suggested was supportive of an emotion-regulation model of mindfulness, rather than a purely cognitive one.

Finally, in an RCT, Garland et al. (2012) used a novel application of MBSR in women with IBS. The support group control was a positive feature of the study (as described earlier). Using structural equation modelling, the relationship between MBSR and IBS severity was statistically mediated by increased re-interpretation of pain sensations along with decreased visceral sensitivity. Decreased visceral sensitivity was in turn statistically mediated by improved non-reactivity. Finally, improved non-reactivity (along with lessened visceral sensitivity and IBS severity) statistically mediated the relationship between MBSR and improved IBS-related quality of life; consistent with the possibility that a non-reactive mind-set was beneficial in reducing IBS severity and quality of life impact. However, generalisability is limited by the absence of males, along with MBSR adaptations to address IBS-related concerns.

Summary. All three studies provided initial support for the mediating role of non-reactivity (cognitive and emotional) in the relationship between MBI and a range of beneficial outcomes (reduced depressive relapse, depressive symptoms, IBS severity and quality of life); in populations in remission from depression and with IBS. Findings provided further support for the DAH (Teasdale, 1988) for depressive relapse. The social support group control in one study seemed a better approach than the waitlist or maintenance ADM controls used in others, since this was similar to a MBI (in terms of group contact). Overall, findings suggest MBCT may have both cognitive and emotional regulatory effects, thus both cognitive and affective components should be further explored as mediators.

In contrast to Raes et al. (2009), Kuyken et al. (2010) found MBCT increased rather than decreased cognitive reactivity; perhaps due to differences in the measurement of cognitive reactivity (self-report versus laboratory induced), participants in the Kuyken et al.

(2010) study had also recently stopped ADM. However, an increase in self-compassion prevented higher cognitive reactivity leading to worse depressive outcomes (Kuyken et al., 2010).

Thus MBCT may have helped participants hold negative thoughts in awareness whilst adopting an attitude of self-compassion which potentially protected them from a depressed mood; in keeping with research that has found self-compassion to have an attenuating effect on negative life events (Leary, Tate, Adams, Allen & Hancock, 2007). Self-compassion therefore, in addition to non-reactivity, represents another potential mediator requiring further investigation (particularly the interaction between these).

Reperceiving. Several theoretical models of how MBIs work emphasise reperceiving (de-centering) as an integral mechanism of action (e.g. Garland, Gaylord & Park, 2009; Holas & Jankowski, 2013; Shapiro, Carlson, Astin & Freedman 2006). Shapiro et al. (2006) proposed increased mindfulness leads to increased reperceiving. Reperceiving is defined as a meta-mechanism, from which stem four further mechanisms (self-regulation and self-management; emotional cognitive and behavioural flexibility; values clarification and exposure), which lead to beneficial outcomes of mindfulness (Shapiro et al., 2006). Reperceiving involves a perspective shift, whereby an individual steps back from their thought contents and views them with greater objectivity (Shapiro et al., 2006), as in the “being” mode (Segal et al., 2013). Despite the theoretical attention given to reperceiving, only two studies have explored it.

Carmody et al., (2009); Bieling et al. (2012). Carmody et al. (2009) tested the Shapiro et al. (2006) model in a pre-post design. Mediation analyses using the Baron and Kenny (1986) approach did not find reperceiving significantly statistically mediated the relationship between mindfulness and the other dependent variables (self-regulation, values clarification, cognitive and behavioural flexibility, exposure). The authors speculated mindfulness and

reperceiving may be overlapping constructs that both improve following the MBI. A second mediation analysis used a composite variable of mindfulness and reperceiving scores. Values clarification and increases in emotional, cognitive and behavioural flexibility partially mediated the relationship between the composite variable and a reduction in psychological symptoms.

Therefore, only partial support was found for the Shapiro et al. (2006) model. Carmody et al. (2009) discussed potential difficulties in measuring variables in the model. It is unclear whether the measures were reliable; especially since the exposure variable measure was unpublished and was unassessed for validity or reliability. This combined with the pre-post design contributed to a lower quality rating (.77; see Table 1).

Bieling et al. (2012) improved on the study through a RCT design. Participants completed two self-report measures for decentering, along with measures of rumination and curiosity (not examined by the other studies). The Kraemer, Kiernan, Essex and Kupfer (2008) regression approach to mediation was used. Changes in curiosity and only one of the two decentering measures predicted depression scores for MBCT participants at six-month follow-up. In keeping with the previous mixed results; rumination did not predict depressive scores at follow-up, perhaps due to a shortcoming of the measurement scale used for rumination (Bieling et al., 2012). Power issues may have impacted on these findings due to the small sample size, one reason why the study was given a quality rating of .75 (see Table 1).

Summary. These two studies provided limited evidence for reperceiving as a mediator variable. One found reperceiving alone was not a mediating variable; the other found only one of the two decentering measures was significant in predicting later depression scores. Both studies potentially had issues with the validity of measures. Or perhaps reperceiving is part of the same construct as mindfulness, whereby as an individual becomes more mindful

and enters the “being” mode (Segal et al., 2013), they view their thoughts as passing events and can therefore step back and see them more objectively. Further research is required before conclusions can be drawn in relation to models (e.g. Shapiro et al., 2006) which centrally place re-perceiving in the workings of MBIs. The remaining two mediators: attention and daily spiritual experiences will now be considered.

Attention.

Anderson, Lau, Segal and Bishop (2007). Bishop et al. (2004) proposed a two-part model of mindfulness: firstly, self-regulation of attention onto immediate present experience, and secondly, adopting an attitude of openness, acceptance and curiosity towards experiences. Thus self-regulated attention is viewed as a key component of mindfulness, requiring skills in sustained attention on present experience and switching attention when thoughts wander. Along with inhibition of elaborative processing (allowing more resources for present focusing) and non-directed attention to enhance awareness of present experiences by losing pre-assumptions i.e. seeing objects as if for the first time (Bishop et al., 2004).

Anderson et al. (2007) tested the model using an RCT design, although the study did not adequately describe participants or randomisation, reducing the quality rating (.81, see Table 1). Additionally, as with many other RCTs reviewed, a waitlist control was used. Improvements in mindfulness post-MBSR were only correlated with improvements in one of the four attention skills: object detection (a measure of non-directed attention). Thus MBSR participation appeared to be associated with enhanced awareness of the present without pre-conceived assumptions. Increases in emotional well-being post-MBSR were associated with improved mindfulness but this relationship was not statistically mediated by improvements in object detection. Details of the mediation test used were unreported.

Thus the study did not support the attentional control component of the Bishop et al. (2004) model. The authors concluded the increase in unfiltered awareness of the present

moment post-MBSR (measured by object detection) was more closely linked to the second component of the model, than with the first component of attentional control. This was a single study and one which needs to be replicated with a more robust design before attention is ruled out as a potential mechanism.

Daily spiritual experiences.

Greeson et al. (2011). MBSR has origins in the Buddhist faith and mindfulness meditation has been described as a type of transcendence (Greeson et al. 2011). Increased daily spiritual experiences (awareness of and relationship with the transcendent; Greeson et al., 2011) were explored as a potential mediator in a prospective, observational trial. Mediation analyses using structural equation modelling found support for an exploratory model whereby improved mindfulness partially statistically mediated the relationship between increased daily spiritual experiences and better mental health post-MBSR. The authors suggested MBIs help individuals disengage from distracting self-focused narratives and notice spiritually-related experiences. The lack of control group, incomplete participant description and potential confounding variables limit confidence in the findings and reflects the quality score of .77 (see Table 1).

Most participants had religious affiliations and half reported deepening spirituality as a reason for doing MBSR. Additionally, the majority stated in advance they expected to benefit from the intervention. Thus, in combination with self-report measures, participants may have been inclined to report benefits e.g. increased spirituality. Further research is needed to replicate these findings, in samples without religious affiliation or prior expectations before conclusions can be drawn.

Discussion

Eighteen articles exploring a range of potential psychological mediators (mindfulness, rumination, worry, affect, non-reactivity, re-perceiving, self-compassion, attentional control

and daily spiritual experiences) for the efficacy of MBIs on psychological distress were critiqued. Articles encompassed healthy and clinical adult samples (including depression, anxiety disorders, hypochondriasis, IBS and cancer) and used a variety of outcomes measures related to psychological distress. The quality of evidence varied depending on study design (scores ranged from .64 to 1.0; see Table 1); however the number of RCTs was encouraging. Overall there is a lack of published studies in this area, leaving many questions unanswered about the potential mechanisms of MBIs.

Mindfulness was the most frequently researched mediator and there was reasonable evidence consistent with the possibility that MBIs exert at least some of their salutary effects on psychological distress through improved mindfulness skills. Thus supporting the premise that MBIs help individuals disengage from a “doing” mode of mind to a “being” mode (Segal et al., 2013), which may be consistent with reduced rumination and distress. Mindfulness was found to fully (Branstrom et al., 2010; Carmody & Baer, 2007; Nyklicek et al., 2013; Raes et al., 2009; McManus et al., 2012 & Vollestad et al., 2011) or partially mediate (Nyklicek & Kuijpers, 2008) the relationship between MBIs and a wide range of beneficial psychological outcomes within different samples.

However, mindfulness is a multi-faceted construct (Baer et al., 2006) and other variables are therefore likely to play a role in the mechanisms of MBIs. Four studies researched decreased rumination as a mediator with mixed results; half found support for rumination (van Aalderen et al., 2011 & Heeren & Philippot, 2011), whereas Shahar et al. (2010) only found support for the brooding facet, and Batink et al. (2013) did not find rumination to be a significant mediator. There did not seem to be a pattern in relation to the problems participants presented with (e.g. the severity of depression) and the findings; perhaps the mixed results may therefore have reflected issues with measurement and lack of power. Further research into this variable is required before conclusions can be drawn about

the role of rumination, and theories in which rumination is premised as central in depressive relapse (e.g. Segal et al., 2013; Teasdale's DAH, 1988).

Potential support was found for the related mediating role of worry (van Aalderen et al., 2011 & Batink et al., 2013) and affect (Batink et al. 2013); the latter appearing more important than cognitive mediators for people with more experience of depression. Tentative support was found for the mediating role of non-reactivity (cognitive and emotional [Kuyken et al., 2010; Britton et al., 2012 & Garland et al., 2012]) and thus for the DAH (Teasdale, 1988). Surprisingly, Kuyken et al. (2010) found cognitive reactivity increased post-MBI, although the relationship with depressive symptoms was nullified through increased self-compassion. Self-compassion was not explored in any of the other studies and should be further researched as a potential mediator, given the attitude of self-compassion encouraged by MBIs (Segal et al., 2013) and the potential interaction with cognitive reactivity.

Despite several theoretical models (e.g. Shapiro et al., 2006) placing an importance on *reperceiving*, this variable (and therefore such models) received only limited support. Carmody et al. (2009) found *reperceiving* was only a significant mediator when combined with mindfulness. Bieling et al. (2012) found only one of two *decentering* measures predicted depression scores. The authors commented findings may have reflected shortcomings in *reperceiving* measures used. Therefore, attention should be given to developing valid measures for other mediators, in addition to mindfulness. It should also be considered that some mediator variables (e.g. *reperceiving*) may be part of the same overlapping construct as mindfulness and further research should attempt to untangle which are distinct and which are part of a broader mindfulness construct.

Finally neither attention (Anderson et al., 2007) nor daily spiritual experiences (Greeson et al., 2011) were found to be significant mediator variables, although on the basis of single studies and potential power issues, it is not possible to draw conclusions about the

mediating roles of these variables or validity of related theory (e.g. the Bishop et al. [2004] model).

Additionally, in studies where significant mediators were found, results should be interpreted cautiously as temporal effects were not usually measured, meaning mediation was not conclusive. Mediation can only be conclusively established if changes in the mediator variable precede changes in the outcome variables (Vollestad et al., 2011). Further, over-representation of white, female Westerners in samples limits generalizability of findings. More research is warranted to shed light on the complex area of how MBIs work, in a wider variety of populations and ages. The findings from the small number of published studies need replicating and new variables explored. The case for a mediator does not come from a single study but is built from the findings of a sequence of studies (Kazdin, 2007), which will help refine theories not only of how MBIs work but of the cognitive processes by which distress and disorders such as depression can occur. Additional recommendations for future research will now be discussed.

Implications for research and clinical practice

Given the range of techniques learnt during MBIs, there are a wide number of potential mediators. When selecting variables to explore, researchers would benefit from continuing to draw on existing theories of how mindfulness works. It is not to say such theories are correct, however, they provide a starting point and enable hypotheses to be developed and tested which can lead to theory being refined (Shapiro et al., 2006).

Other recommendations concern study design and measures. There are benefits to a RCT design where a control group receives a similar intervention (e.g. support group in Garland et al., 2012), rather than a waitlist control which used in many of the RCTs. Consideration should be given to measures; particularly for mindfulness where a multi-dimensional measure is preferable but also in developing reliable measures for other mediator

concepts e.g. rumination. Recognising the limitations of self-report, alternative measures should be included; for example behavioural measures of mindfulness such as assessing how participants use mindfulness skills to cope with laboratory stressors (Baer et al., 2006).

Future researchers should also consider the choice of mediation analysis and sample size to ensure substantial power to detect the expected size of effect (see Fritz & MacKinnon, 2007). Researchers should report mediation effect sizes to support comparison of findings between studies. In addition, so mediation can be more definitively established, measures should be taken mid-point through the MBI, as well as pre- and post-test (as in Vollestad et al., 2011). Finally, competence in the delivery of MBIs could be independently assessed (as in McManus et al., 2012), for example using the MBI Teaching Assessment Criteria (MBI-TAC; Crane et al., 2012).

Pertinent questions that need to be addressed include whether MBSR and MBCT have different mechanisms; also whether certain mediator variables are more important for different populations (suggested by Batink et al., 2013). It was noteworthy that the mediator variables reviewed were mainly cognitive in nature; physical mediators were absent in the literature.

Michalak, Burg and Heidenreich (2012) describe how MBCT exercises focus on developing bodily awareness. Physical sensations such as the breath are used as an anchor to present experience, whenever the mind begins to wander and engage in rumination (Segal et al., 2013). Thus the body is important in MBIs (Michalak et al., 2012). Further, the Interacting Cognitive Subsystems theory (ICS; Teasdale & Barnard, 1993) highlights the role of the body in depression; proposing cognitive and sensory information (including bodily sensation) combine leading to the experience of emotion. A “depressive interlock” whereby cognitive and sensory subsystems become stuck in a self-perpetuating cycle is thought to maintain depression or lead to relapse (Teasdale & Barnard, 1993).

Given this, it is surprising research into physical mediators of MBI outcomes has been neglected; for example body posture. An intentional shift in posture to one that embodies alertness may change the approach an individual takes to their experience during mindfulness practice (Segal et al., 2013). Michalak et al. (2012) argue that considering embodied effects of MBCT may help in understanding its mechanisms of action.

Increased understanding of how MBIs exert therapeutic effects for people in distress should enable these treatments to be honed through including more effective components; improving clinical outcomes. Given MBIs are currently recommended for people with recurrent, relapsing depression (National Institute for Health and Care Excellence, 2011), this could represent a reduction in financial burden to society through reduced treatment costs (Segal et al., 2013) and increased work productivity. Importantly, the burden of emotional pain could also be reduced for individuals (Segal et al., 2013).

Conclusion

This review found reasonable evidence for the role of improved mindfulness skills as a statistical mediator of the relationship between MBIs and reduced psychological distress. Results for other psychological mediator variables were less conclusive due to a paucity of studies and issues with the validity of the measures used. Further research is required to unpick which variables make MBIs effective to improve future treatments. Researchers could helpfully widen their focus to examine the potential role of the body in bringing about the beneficial outcomes of MBIs, in addition to cognitive mediators.

References

- van Aalderen, J.R., Donders, A.R.T., Giommi, P., Spinhoven, H.P., Barendregt, H.P. & Speckens, A.E.M. (2011). The efficacy of mindfulness-based cognitive therapy in recurrent depressed patients with and without a current depressive episode: a randomized controlled trial. *Psychological Medicine*, 42, 989–1001.
<http://dx.doi.org/10.1017/S0033291711002054>
- Akobeng, A.K. (2005). Understanding randomised control trials. *Archives of Disease in Childhood*, 90, 840–844. <http://dx.doi.org/10.1136/adc.2004.058222>
- Anderson, N.D., Lau, M.A., Segal, Z.V. & Bishop, S.R. (2007). Mindfulness-based stress reduction and attentional control. *Clinical Psychology and Psychotherapy*, 14, 449–463. <http://dx.doi.org/10.1002/cpp.544>
- Baer, R.A. (2009). Self-focused attention and mechanisms of change in mindfulness-based treatment. *Cognitive Behaviour Therapy*, 38(S1), 15–20.
<http://dx.doi.org/10.1080/16506070902980703>
- Baer, R.A., Smith, G.T., Hopkins, J., Krietemeyer, J. & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13, 27–45.
<http://dx.doi.org/10.1177/1073191105283504>
- Baer, R.A., Smith, G.T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S.,...Williams, J.M.G. (2008). Construct validity of the Five Facet Mindfulness Questionnaire in meditating and non-meditating samples. *Assessment*, 15, 329–342.
<http://dx.doi.org/0.1177/1073191107313003>
- Baron, R.M. & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of*

Personality and Social Psychology, 51, 1173–1182. <http://dx.doi.org/10.1037/0022-3514.51.6.1173>

Batink, T., Peeters, F., Geschwind, N., van Os, J. & Wichers, M. (2013). How does MBCT for depression work? Studying cognitive and affective mediation pathways. *Plos One*, 8(8), 1–13. <http://dx.doi.org/10.1371/journal.pone.0072778>

Bieling, P.J., Hawley, L.L., Bloch, R.T., Corcoran, K.M., Levitan, R.D., Young, L.T.,....Segal, Z.V. (2012). Treatment-specific changes in decentering following mindfulness-based cognitive therapy versus antidepressant medication or placebo for prevention of depressive relapse. *Journal of Consulting and Clinical Psychology*, 3, 365–372. . <http://dx.doi.org/10.1037/a0027483>

Bishop, S.R., Lau, M., Shapiro, S., Carlson, L., Anderson, N.D., Carmody, J.,....Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, 11, 230–241. <http://dx.doi.org/10.1093/clipsy/bph077>

Borkovec T.D., Robinson E., Pruzinsky T. & DePree J.A. (1983). Preliminary exploration of worry: Some characteristics and processes. *Behavioral Research Therapy*, 21, 9–16. [http://dx.doi.org/10.1016/0005-7967\(83\)90121-3](http://dx.doi.org/10.1016/0005-7967(83)90121-3)

Branstrom, R., Kvillemo, P., Brandberg, Y. & Moskowitz, J.T. (2010). Self-report mindfulness as a mediator of psychological well-being in a stress reduction intervention for cancer patients: A randomized study. *Annals of Behavioral Medicine*, 39, 151–161. <http://dx.doi.org/10.1007/s12160-010-9168-6>

Britton, W.B., Shahrar, B., Szepsenwol, O. & Jacobs, W.J. (2012). Mindfulness-based cognitive therapy improves emotional reactivity to social stress: Results from a

randomized controlled trial. *Behavior Therapy*, 43, 365–380.

<http://dx.doi.org/10.1016/j.beth.2011.08.006>

Brown, K.W. & Ryan, R.M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84, 822–848. <http://dx.doi.org/10.1037/0022-3514.84.4.822>

Brown, K.W., Ryan, R.M. & Creswell, J.D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry*, 18, 211–237.

<http://dx.doi.org/10.1080/10478400701598298>

Carmody, J. & Baer, R.A. (2007). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*, 31, 23–33.

<http://dx.doi.org/10.1007/s10865-007-9130-7>

Carmody, J., Baer, R.A., Lykins, E.L.B. & Olendzki, N. (2009). An empirical study of the mechanisms of mindfulness in a mindfulness-based stress reduction program. *Journal of Clinical Psychology*, 65, 613–626. <http://dx.doi.org/10.1002/jclp.20579>

Chiesa, A., Anselmi, R. & Serretti, A. (2014). Psychological mechanisms of mindfulness-based interventions. *Holistic Nursing Practice*, 28, 124–148.

<http://dx.doi.org/10.1097/HNP.0000000000000017>

Coffey, K.A., Hartman, M. & Fredrickson, B.L. (2010). Deconstructing mindfulness and constructing mental health: Understanding mindfulness and its mechanisms of action. *Mindfulness*, 1, 235–253. <http://dx.doi.org/10.1007/s12671-010-0033-2>

Crane, R.S., Soulsby, J.G., Kuyken, W., Williams, J.M.G., Eames, C., Bartley,

- T.,...Silverton, S. (2012). The Bangor, Exeter & Oxford Mindfulness-Based Interventions Teaching Assessment Criteria (MBI-TAC) for assessing the competence and adherence of mindfulness-based class-based treatment. Retrieved from <http://www.bangor.ac.uk/mindfulness/documents/MBI-TACMay2012.pdf>
- Del Re, A.C., Fluckiger, C., Goldberg, S.B. & Hoyt, W. (2012). Monitoring mindfulness practice quality: An important consideration in mindfulness practice. *Psychotherapy Research*, 23(1), 54–66.
- <http://dx.doi.org/10.1080/10503307.2012.729275>
- Fritz, M. S. & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science*, 18, 233–239. <http://dx.doi.org/10.1111/j.1467-9280.2007.01882.x>
- Garland, E.L., Gaylord, S.A., Palsson, O., Faurot, K., Mann, D. & Whitehead, W.E. (2012). Therapeutic mechanisms of a mindfulness-based treatment for IBS: Effects on visceral sensitivity, catastrophizing, and affective processing of pain sensations. *Journal of Behavioural Medicine*, 35, 591–602. <http://dx.doi.org/10.1007/s10865-011-9391-z>
- Garland, E., Gaylord, S. & Park, J. (2009). The role of mindfulness in positive reappraisal. *Explore*, 5(1), 37–44. <http://dx.doi.org/10.1016/j.explore.2008.10.001>
- Goodman, L.A. (1960). On the exact variance of products. *Journal of the American Statistical Association*, 55, 708–713.
- <http://dx.doi.org/10.1080/01621459.1960.10483369>
- Greeson, J.M., Webber, D.M., Smoski, M.J., Brantley, J.G., Ekblad, A.G., Suareq, E.C. & Wolever, R.Q. (2011). Changes in spirituality partly explain health-related quality of

- life outcomes after Mindfulness-Based Stress Reduction. *Journal of Behavioral Medicine*, 34, 508–818. <http://dx.doi.org/10.1007/s10865-011-9332-x>
- Hayes, A.F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, 76, 408–420.
<http://dx.doi.org/10.1080/03637750903310360>
- Heeren, A. & Philippot, P. (2011). Changes in ruminative thinking mediate the clinical benefits of mindfulness: Preliminary findings. *Mindfulness*, 2, 8–13.
<http://dx.doi.org/10.1007/s12671-010-0037-y>
- Holas, P. & Jankowski, T. (2013). A cognitive perspective on mindfulness. *International Journal of Psychology*, 48, 232–243. <http://dx.doi.org/10.1080/00207594.2012.658056>
- Kabat-Zinn, J. (1982). An outpatient program in behavioural medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, 4, 33–47.
[http://dx.doi.org/10.1016/0163-8343\(82\)90026-33](http://dx.doi.org/10.1016/0163-8343(82)90026-33)
- Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present and future. *Clinical Psychology: Science and Practice*, 10, 144–156.
<http://dx.doi.org/10.1093/clipsy/bpg016>
- Kazdin, A. E. (2007). Mediators and mechanisms of change in psychotherapy research. *Annual Review of Clinical Psychology*, 3, 1–27.
<http://dx.doi.org/10.1146/annurev.clinpsy.3.022806.091432>
- Kmet, L.M., Lee, R.C. & Cook, L.S. (2004). Standard quality assessment criteria for evaluating primary research papers from a variety of fields. Edmonton: Alberta Heritage Foundation for Medical Research.

- Kraemer, H.C., Kiernan, M., Essex, M. & Kupfer, D.J. (2008). How and why criteria defining moderators and mediators differ between the Baron & Kenny and MacArthur approaches. *Health Psychology*, 27, S101–S108. [http://dx.doi.org/10.1037/0278-6133.27.2\(Suppl.\).S101](http://dx.doi.org/10.1037/0278-6133.27.2(Suppl.).S101)
- Kraemer, H.C., Wilson, G.T., Fairburn, C.G. & Agras, W.S. (2002). Mediators and moderators of treatment effects in randomized clinical trials. *Archives of General Psychiatry*, 59, 877–883. <http://dx.doi.org/10.1001/archpsyc.59.10.877>
- Lau, M.A., Segal, Z.V. & Williams, M.G. (2004). Teasdale's differential activation hypothesis: Implications for mechanisms of depressive relapse and suicidal behaviour. *Behaviour Research and Therapy*, 42, 1001–1017. <http://dx.doi.org/10.1016/j.brat.2004.03.003>
- Leary, M.R., Tate, E.B., Adams, C.E., Allen, A.B. & Hancock, J. (2007). Self-compassion and reactions to unpleasant self-relevant events: the implications of treating oneself kindly. *Journal of Personality and Social Psychology*, 92, 887–904. <http://dx.doi.org/10.1037/0022-3514.92.5.887>
- McManus, F., Suraway, C., Muse, K., Vazquez-Montes, M. & Williams, M.G. (2012). A randomized clinical trial of mindfulness-based cognitive therapy versus unrestricted services for health anxiety (hypochondriasis). *Journal of Consulting and Clinical Psychology*, 80, 817–828. <http://dx.doi.org/10.1037/a0028782>
- MacKinnon, D.P., Fritz, M.S., Williams, J. & Lockwood, C.M. (2007). Distribution of the product confidence limits for the indirect effect: Program PRODCLIN. *Behavior Research Methods*, 39, 384–389. <http://dx.doi.org/10.3758/BF03193007>

- MacKinnon, D.P., Lockwood, C.M., Hoffman, J.M., West, S.G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, 7, 83–103. <http://dx.doi.org/10.1037/1082-989X.7.1.83>
- MacKinnon, S.P. (2015). Mediation in health research: A statistics workshop using SPSS [PowerPoint slides]. Retrieved from <http://www.slideshare.net/smackinnon/introduction-to-mediation>
- Metcalf, C.A. & Dimidjian, S. (2014). Extensions and mechanisms of mindfulness-based cognitive therapy: A review of the evidence. *Australian Psychologist*, 49, 271–279. <http://dx.doi.org/10.1111/ap.12074>
- Michalak, J., Burg, J. & Heidenreich, T. (2012). Don't forget your body: Mindfulness, embodiment, and the treatment of depression. *Mindfulness*, 3, 190–199. <http://dx.doi.org/10.1007/s12671-012-0107-4>
- Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA Statement. *BMJ*, 339(b2535). <http://dx.doi.org/10.1136/bmj.b2535>
- National Institute of Health and Clinical Excellence. (2011). Depression in adults quality standard. Retrieved from <https://www.nice.org.uk/guidance/qs8/chapter/Quality-statement-13-Residual-symptoms-or-risk-of-relapse>
- Nyklicek, I. & Kuijpers, K.F. (2008). Effects of mindfulness-based stress reduction intervention on psychological well-being and quality of life: Is increased mindfulness indeed the mechanism? *Annals of Behavioural Medicine*, 35, 331–340. <http://dx.doi.org/10.1007/s12160-008-9030-2>
- Nyklicek, I., van Beugen, S. & Denollet, J. (2013). Effects of mindfulness-based stress reduction on distressed (Type D) personality traits: a randomized controlled trial.

- Journal of Behavioral Medicine, 36, 361–370. <http://dx.doi.org/10.1007%2Fs10865-012-9431-3>
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. & Podsakoff, N.P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <http://dx.doi.org/10.1037/0021-9010.88.5.879>
- Preacher, K.J. & Hayes, A.E., (2008). Asymptomatic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40, 879–891. <http://dx.doi.org/10.3758/BRM.40.3.879>
- Raes, F., Dewulf, D., van Heeringen, C. & Williams, J.M.G. (2009). Mindfulness and reduced cognitive reactivity to sad mood: Evidence from a correlational study and a non-randomized waiting list controlled study. *Behaviour Research and Therapy*, 47, 623–627. <http://dx.doi.org/10.1016/j.brat.2009.03.007>
- Schroevers, M.J. & Brandsma, R. (2010). Is learning mindfulness associated with improved affect after mindfulness-based cognitive therapy? *British Journal of Psychology*, 101, 95–107. <http://dx.doi.org/10.1348/000712609X424195>
- Segal, Z.V., Williams, J.M.G. & Teasdale, J.D. (2013). *Mindfulness-based cognitive therapy for depression* (2nd ed.). New York: Guildford Press.
- Shahar, B., Britton, W.B., Sbarra, D.A., Figueredo, A.J. & Bootzin, R.R. (2010). Mechanisms of change in mindfulness-based cognitive therapy for depression: Preliminary evidence from a randomized controlled trial. *International Journal of Cognitive Therapy*, 3, 402–418. <http://dx.doi.org/10.1521/ijct.2010.3.4.402>

Shapiro, S.L., Carlson, L.E., Astin, J.A. & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology*, 62, 373–386.

<http://dx.doi.org/10.1002/jclp.20237>

Sobel, M.E. (1982). Asymptomatic intervals for indirect effects in structural equations models. In S. Leinhardt (Ed.), *Sociological Methodology* (290–312). San Francisco:

Jossey-Bass.

Teasdale, J.D. (1988). Cognitive vulnerability to persistent depression. *Cognition and Emotion*, 2, 247–274. <http://dx.doi.org/10.1080/02699938808410927>

Teasdale, J.D. & Barnard, P.J. (1993). *Affect, cognition and change: Remodelling depressive thought*. Hove: Lawrence Erlbaum Associates.

Vollestad, J., Sivertsen, B. & Nielsen, G.H. (2011). Mindfulness-based stress reduction for patients with anxiety disorders: Evaluation in a randomized controlled trial. *Behaviour Research and Therapy*, 49, 281–288.

<http://dx.doi.org/10.1016/j.brat.2011.01.007>

Section B:

The Effect of Body Posture on the Outcomes and Experiences of Mindfulness Practice

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Abstract

Embodied emotion theory hypothesises a reciprocal relationship between physical expression of emotion and the manner in which emotional information is perceived. The Integrated Cognitive Subsystems (ICS) theory of depression and Mindfulness-Based Interventions (MBIs) propose the body as key in the development and treatment of depression. This study investigated the relationship between posture and outcomes of mindfulness practice; participants meditating in an upright posture were predicted to report greater mindfulness, positive affect and distress tolerance than in a slouched posture. A non-clinical, adult sample (N=39) carried out a 15-minute mindfulness breathing exercise in upright and slouched postures in a counter-balanced within-participant design, with outcome measures of mindfulness, affect and distress tolerance. Participants also reported qualitative experiences. Due to order effects, only data from the first posture participants adopted were analysed, converting the study into a between-participant design.

Hypotheses were not supported; between-subjects analyses found no difference in participants' reported mindfulness, affect or distress tolerance between the two posture groups; potentially due to measurement or power issues. Keeping with previous MBI research, negative affect decreased following the practice in both postures. There was tentative evidence that distress tolerance decreased in the slouched posture condition; although there was no change in the upright condition. Qualitatively, participants reported breathing was more difficult when slouched. These two findings may provide some support for the importance of attending to an upright posture in mindfulness practice. Further research is required to understand the role of the body in depression and MBIs.

Keywords: mindfulness, posture, mood, distress tolerance

The Effect of Body Posture on the Outcomes and Experiences of Mindfulness Practice

Mindfulness is awareness occurring when purposefully paying attention to our present moment experience; turning towards it non-judgmentally and with acceptance, whatever our experience is (Kabat-Zinn, 2003). Mindfulness-based interventions (MBIs) are used clinically to reduce psychological distress, protect against recurrent depression relapse and improve wellbeing; two frequently used MBIs are Mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982) and Mindfulness Based Cognitive Therapy (MBCT; Segal, Williams & Teasdale, 2013). Both have been found to be clinically effective; MBSR has been associated with reduced medical symptoms and psychological distress (Carmody, Baer, Lykins & Olendzki, 2009). A recent review found MBCT to be effective in preventing relapse in individuals with three or more previous depressive episodes (Metcalf & Dimidjian, 2014).

Whilst there is increasing evidence to suggest MBIs are effective, there has been less focus on mechanisms by which they exert their salutary effects (Baer, 2009). Further, research that has been carried out has largely focused on cognitive mediator variables, such as mindfulness skills (e.g. Branstrom et al., 2010); rumination (e.g. van Aalderen et al., 2011), self-compassion (e.g. Kuyken et al., 2010) and affect (Batink et al. 2013). Physical mediators have not yet been explored in the literature which is surprising given the focus on the body in mindfulness practice (e.g. the body scan, Michalak, Burg & Heidenreich, 2012) and in theory underpinning MBCT.

Segal et al. (2013) explain how the body scan teaches individuals to bring attention to the body, useful since powerful emotions can be expressed in the body. This enables MBI participants to shift from thinking about feelings to a new perspective of exploring the felt sense of emotion in their body. Thus the body is central in the theory underpinning MBCT, in which depressive experience represents the “distilled essence of many experiences of mind,

feelings, and body". As such, relapse is proposed to involve automatic reactivation of a "whole, integrated, package of characteristic thoughts, feelings, and physical sensations" (Segal, Williams & Teasdale, 2002, p.67); further, thoughts, emotions and physical feelings are hypothesised to reinforce each other through feedback loops (Segal et al., 2002).

This view of depressive experience in which the body affects the mind, links into the theory of embodied emotion, in which there is a proposed reciprocal relationship between physical expression of emotion and the way in which emotional information is perceived (Niedenthal, 2007). For example, when adopting positive facial expressions, individuals have reported increased positive mood (Kleinke, Peterson & Rutledge, 1998) suggesting facial expressions are related to emotional experience.

A similar embodied relationship has been found for posture; Stepper and Strack (1993) found participants reported more pride when receiving feedback about their success in an achievement task when in an upright rather than slouched posture. Similarly, Bohns and Wiltermuth (2012) found participants adopting expansive "dominant" poses (with limbs extending from their body) displayed higher pain thresholds in relation to an arm tourniquet, than those in a neutral, or constricted, "submissive" posture (with torso curving inwards). Thus posture has been found to not only impact on the experience of emotion but also an individual's ability to tolerate behavioural distress. Niedenthal, Barsalou, Winkielman, Krauth-Gruber and Ric (2005) conclude there is strong evidence for the embodiment of emotional processing.

The Integrated Cognitive Subsystems theory (ICS; Teasdale & Barnard, 1993) could explain effects of embodied emotion. In contrast to pure cognitive theories of emotion, ICS proposes both proprioceptive sensory information from the body and cognitive information (e.g. thoughts and meanings) combine together leading to the experience of emotion.

Emotion is hypothesised to arise through the activation of schematic models based on previous experiences that have elicited a given emotion in the individual (Teasdale, 1999).

A study by Oosterwijken, Rotteveel, Fischer and Hessa (2009) demonstrated such an interaction between the activation of bodily and cognitive sub-systems; they found participants' posture decreased in height when generating disappointment related words (which led to increased feelings of disappointment), in comparison to when generating pride related words. In ICS, it is proposed that a “depressive interlock”, whereby cognitive and sensory subsystems become stuck in a self-perpetuating cycle, maintains depression or causes relapse (Teasdale, 1999).

MBIs are hypothesised to help individuals recognise and exit from automatic negative spirals through increased awareness; allowing processing of depression-related information in an alternative way, reducing the likelihood of relapse (Segal et al. 2002). Mindfulness training also increases awareness of bodily sensory information (Michalak, Troje & Heidenreich, 2011). Since the body is thought to be part of the automatic feedback loop causing and maintaining depression, it can be used as an “ally” in changing this (Crane, 2009, p.52). Michalak et al. (2011) propose mindfulness training may help individuals with a depression history become aware of subtle bodily changes linked to low mood, e.g. neck tension, which could enable self-care action before depression becomes reactivated.

In keeping with theory underpinning MBCT, attention is given to posture during mindfulness meditation. In MBCT practice participants are invited to, “allow your back to adopt an erect, dignified, and comfortable posture” (Segal et al., 2013). MBCT draws on Buddhist traditions which also emphasise the importance of upright posture and acknowledge the relationship between posture and emotion. According to the Zen Buddhism master, Dogen, “...one must sit with a sense of dignity and grandeur, like a mountain or a giant pine... The innate dignity of man is physiologically manifested in his erect back, since he alone of

all creatures has this capacity to hold his spinal column vertical.” (Kapleau, 1980, p. 10, as cited in Roberts & Arefi-Afshar, 2007).

Despite this, there is an apparent absence of research exploring the role of posture in the outcomes of mindfulness training, or in the embodied effects of MBIs. The only known research looking at the embodied effect of mindfulness practice was by Michalak et al. (2011), although the study explored the effects of MBCT on gait patterns of formerly depressed participants. Michalak et al. (2011) hypothesised the manner in which individuals walk would provide bodily feedback in the maintenance of depression. Post-MBCT, participants’ gait patterns (walking speed and upper body movement) were normalised; suggestive of an embodied effect of mindfulness training (Michalak et al., 2011). However, this was not associated with significant changes in residual depressive symptoms or self-reported mindfulness; the authors proposed this may have been due to different trajectories for changes in bodily and mood/cognitive symptoms post-MBCT.

Michalak et al. (2012) argue a heightened awareness of the relationship between bodily and cognitive states through mindfulness training may enable an individual to change a depressive movement or posture (e.g. slouching) into a more beneficial one for their mood. This study aims to address a gap in the literature through providing empirical support for the importance of attending to an upright posture during mindfulness practice and to explore the significance of this in relation to practice outcomes. The study aim was therefore to investigate the effect of body posture (upright versus slouched) on known outcomes and experience of mindfulness practice.

Groups of non-clinical, adult participants carried out two 15-minute mindfulness practices (following the breath) once in an upright and once in a slouched posture, the order of which was counter-balanced. They completed self-report questionnaire measures of mood and distress tolerance before and after the mindfulness practice, as well as a mindfulness

measure post-practice. After the practices, participants were asked to provide written information about their qualitative experiences of the meditations in the two different postures.

Based on limited past research, along with the theories underpinning MBCT and of embodied emotion reviewed above, the following hypotheses were made:

- Participants will have higher levels of mindfulness following mindfulness practice in the upright posture condition than in the slouched posture condition
- Participants will experience more positive and less negative mood following mindfulness practice in the upright posture condition than in the slouched posture condition
- Participants will have higher perceived distress tolerance following mindfulness practice in the upright posture condition than in the slouched posture condition.

No predictions were made in relation to participants' qualitative experiences of the similarities and differences between the mindfulness practices in the upright versus slouched posture conditions.

Method

Participants

Thirty nine adults participated in the study. Participants were from the community and not a clinical population; Table 1 outlines sample demographics and past yoga/meditation experience. In calculating the required sample size, no past studies were found which closely matched the current study design. The two most similar gave effect sizes of .61 (Bohns & Wiltermuth, 2012) and .41 (Michalak et al., 2011). As a conservative estimate the smaller

effect size was used as a guide for the power analysis. A G*Power analysis using the effect size of .41, power of .08 and α -level of .05 indicated a sample size of 39.

Table 1

Demographic details of the sample

Demographic	Demographic category	Frequency of participants
Age (years)	20-29	16
	30-39	5
	40-49	6
	50-59	11
	60-69	1
Gender	Female	30
	Male	9
Ethnicity	White	37
	Asian	1
	Prefer not to say	1
Occupation	Undergraduate student	4
	Postgraduate student	16
	Other occupation	19
Practiced yoga or meditation ¹	No	11
	Yes	27
Frequency of practice ²	Daily to several times a week	5
	Several times a month to monthly	11
	Several times a year to less than once a year	11

Note. ¹n=38 answering this question

²Data from participants who stated that they practiced yoga or meditation (n=27)

University students were recruited through posters (see Appendix C) displayed around campus, group e-mails and class announcements by the researcher. Remaining participants were members of the public recruited by posters displayed in public areas (e.g. coffee shops), through approaching community groups (e.g. exercise classes) and advertising on an online community web forum (Gumtree.com). Participants therefore self-selected to take part.

Potential participants registered their interest by e-mail and were sent a study information leaflet (see Appendix D) to read before deciding whether to participate. Participants had opportunity to e-mail the researcher with queries about the study in advance.

Participants were eligible to take part provided they did not meet the exclusion criteria outlined on the consent form: a) current diagnosis of, or currently receiving treatment for an active mood disorder, in order to prevent causing any heightened distress to participants (however, participants who were not currently depressed but who were on maintenance antidepressant medication to prevent reoccurrence of depression were able to participate); b) postural difficulties which would make it difficult or uncomfortable to remain in a seated position for 15 minutes. As an incentive, entry into a prize draw to win £50 of Amazon vouchers was offered.

Ethics

Full approval of the study was sought from and granted by the Salomons Ethics Panel, Canterbury Christ Church University; see Appendix E for approval letter. The British Psychological Society (BPS) Code of Human Research Ethics guidelines were followed (BPS, 2014).

Design

The study initially used a within-subjects design. The independent variable was posture (2 levels: upright/slouched) and dependent variables were mindfulness, mood and distress tolerance. Participants completed pre-test quantitative measures (mood and distress tolerance) prior to adopting the first posture which was held during a 15-minute mindfulness practice. Post-test measures (mood, distress tolerance, state mindfulness, posture ratings for comfort and difficulty, a questionnaire designed to elicit qualitative experience of the practice) were taken. Mindfulness was only measured following the practice to minimise the number of measures and session duration. Following a break, the same procedure was

repeated with the second posture; the order of which was counterbalanced between groups. Finally there was an open-ended questionnaire in which participants provided qualitative information about their differing experiences between the two postures; information which may not have been apparent from the outcome measures.

Measures

Mindfulness. The self-report Toronto Mindfulness Scale (TMS; Lau et al., 2006; see Appendix F) was used to measure participants' mindfulness level post-practice. The TMS was chosen since it is a measure of state mindfulness (most scales measure trait mindfulness) and is brief (13 items). It comprises two factors of mindfulness: decentering and curiosity, providing total scores for each of these factors (a higher score represents greater state mindfulness). The TMS is reported as being a reliable and valid measure of mindfulness: the TMS had high internal consistency with an alpha co-efficient of .95 and an average item-total correlation of .53 (Lau et al., 2006). Additionally, criterion validity was demonstrated by higher scores on the two TMS factors (curiosity and decentering) for participants post-MBSR (Lau et al., 2006).

Mood. The self-report Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988; see Appendix G) was used to measure participants' mood before and after the mindfulness practice. Permission to reproduce the PANAS was granted by the authors and the American Psychological Society. The PANAS was chosen as it is two brief (10-item) scales which measure two mood dimensions comprising total scores in both positive and negative affect. Positive affect (PA) represents the extent to which an individual feels enthused, active and alert. A low total PA score is characterised by feelings of sadness and lethargy, whereas high PA is defined by energy, concentration and pleasure. Negative affect (NA) represents subjective distress and unpleasant feelings (e.g. anger and guilt).

Whilst a high total NA score is characterized by high levels of these aversive mood states, low NA signifies calmness and serenity (Watson et al., 1988).

Watson et al. (1988) reported good external validity (.65) for the NA schedule with the Hopkins Symptoms Checklist (Derogatis, Lipman, Rickels, Uhlenhuth & Covi, 1974). PA was found to be significantly negatively correlated (-.35) with the Beck Depression Inventory (Beck, Ward, Mendelson, Mock & Erbaugh, 1961). The test-retest reliability of the PANAS over an 8-week timeframe in a sample of undergraduates was acceptable with an alpha coefficient of between .45 and .54 (Watson et al., 1988).

Distress tolerance. The self-report Distress Tolerance Scale (DTS; Simons & Gaher, 2005; see Appendix H) was used to measure participants' emotional distress tolerance pre- and post-test. Distress tolerance relates to the capacity to experience and withstand negative psychological states which includes actions that an individual may take to alleviate such states (Simons & Gaher, 2005). Low distress tolerance (represented by a low DTS score) occurs when an individual finds distress unbearable and they feel unable to cope with the distress (Simons & Gaher, 2005).

The 15-item DTS comprises four first order factors (appraisal, tolerance, regulation and absorption) which are indicators of a general distress tolerance (represented by the total DTS score used in the study analyses). Four sub-scale scores are calculated from the mean of the items relating to each sub-scale, and the total DTS score is calculated from the mean of the four sub-scales. The DTS was chosen as it is the only measure of emotional distress tolerance per se (rather than a measure of persistence in a stressful and uncomfortable task e.g. breath-holding) [Simons & Gaher, 2005].

In a student sample, the DTS was found to be negatively associated with measures of affective distress (i.e. negative affectivity, $r = -.59$) and dysregulation (i.e. lability, $r = -.51$) and

positively correlated with positive affectivity ($r=.26$) [Simons & Gaher, 2005]. Test-retest reliability over a six month interval was good (intra-class $r=.61$) [Simon & Gaher, 2005].

Posture comfort/difficulty. Post-test, participants were asked to rate how comfortable they found each posture (on a 9-point Likert scale where 1 was “very uncomfortable” and 9 was “very comfortable”); along with how difficult they found it to maintain the posture (on a 9-point Likert scale where 1 was “extremely difficult” and 9 was “not at all difficult”).

Qualitative data (questionnaire format). Participants were asked to, “Describe your experience during the meditation practice in the slouched/upright posture (you may wish to comment on what happened for you and any thoughts, emotions or physical feelings you had)” following each practice. At the end, participants were asked, “Did your experience of the meditation practice differ between the two postures (upright and slouched)? If yes, please briefly describe in what way the experiences were different for you”.

Procedure

Participants were scheduled to attend a group session either on university premises (students) or a community venue (public) with up to 11 others; although due to low attendance on occasions, some participants were the only person in the group. Group allocation was not randomised since it depended on availability of participants; however the order in which the group completed the two meditation postures was randomized where possible whilst ensuring roughly equal numbers per condition. The author was present at all groups and facilitated the procedure. The session lasted up to two hours. The session format was described at the start of the group. All participants received the same instructions, scripted to ensure consistency between groups (see Appendix I). Participants were reminded of the exclusion criteria and provided written consent to participate; see Appendix J for the

consent form. There was an opportunity for questions or concerns to be addressed.

Participants were informed they could leave at any point and that their data would be coded for anonymity.

Participants were provided with the pre- and post-test measures in the correct order of administration. After completing the pre-test measures, participants were invited to adopt the first seated posture following pre-recorded guidance (see Appendix K for transcript). On-screen images (see Figure 1) of examples of upright and slouched postures were shown as a guide and to highlight the intended difference between the two postures; these were kept on-screen during the practice. To minimise discomfort, participants were advised (and reminded regularly) they could adjust the way they were sitting during the practice but to try to maintain a degree of uprightness or slouching, if possible.

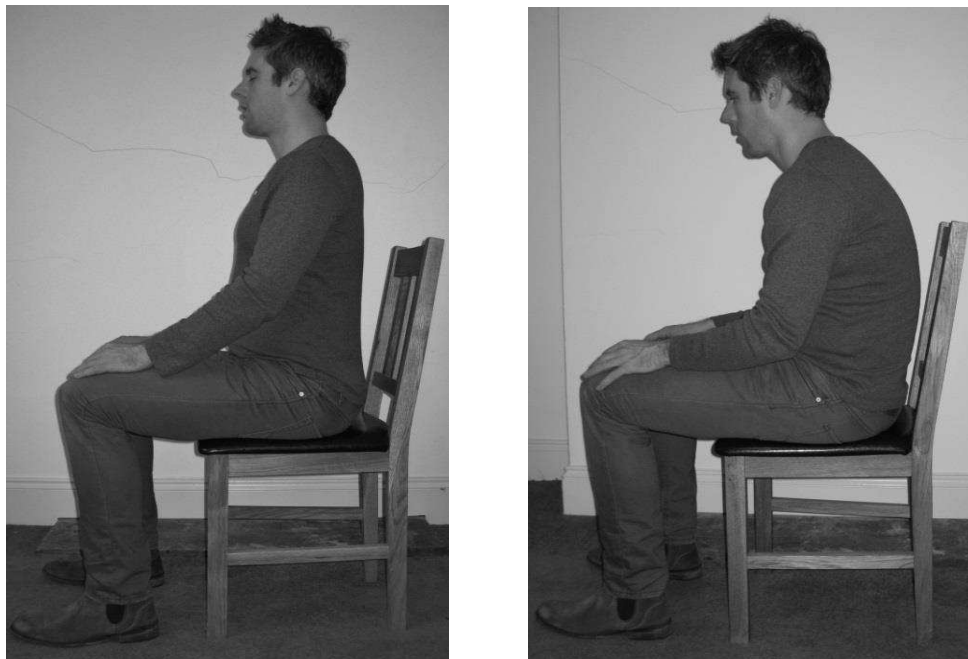


Figure 1. Examples of an upright (left) and slouched posture (right) shown to participants during the procedure

The mindfulness practice was pre-recorded to ensure consistency between groups (see Appendix L for transcript). The transcript was used with permission from Arch and Craske (2006) and was slightly adapted (e.g. by including posture reminders). It was based on a MBCT sitting mindfulness meditation (Segal et al., 2002) in which participants were invited to pay attention to present moment experiences, with a focus on following the breath. The transcript was selected since Arch and Craske (2006) found this 15-minute exercise sufficient for participants without previous mindfulness/meditation training to experience significant emotional regulatory effects.

Following the mindfulness practice, participants were asked to complete post-test measures and provide qualitative experiences of the practice. After a 5-minute break, during which participants were free to move around and have refreshments, the procedure was repeated for the second posture.

Finally, participants were asked to write about the differences they experienced between the mindfulness practices in the two postures. Participants were offered opportunity to ask questions or discuss concerns with the researcher at the end (contact numbers for help in case of distress were provided in the study information leaflet). Participants were offered the option of being e-mailed a summary of research findings (see Appendix M).

Data analysis

Originally, a within-participants data analysis was planned. However, on the basis of initial analyses the approach to analysis had to change to a between-participant analysis (the study design had both built in). For clarity, the approach taken to analyse the data is described in the results section, after findings necessitating the change are presented.

Results

Exploratory analysis

Within-subject analyses were initially carried out on the quantitative data however; the counter-balance variable (order of posture) was significant in many of the analyses thus invalidating these. Therefore, the approach to the analyses had to change to a between-subject analyses, where the data for those participants who were in the slouched condition first (N=21) were compared to those who were in the upright condition first (N=18). Thus the study design was changed to a between-participants design where the independent variable was posture (2 levels: slouched / upright) and the dependent measures were state mindfulness, distress tolerance and mood. Only data from the first mindfulness practice were included in the analysis since a repeated measures approach was no longer being used. Similarly to the quantitative data, only between-participant qualitative data were used for the content analysis due to the aforementioned carry-over effects in the within-participant analyses. The study hypotheses remained applicable to a between-participants design.

Demographics

Demographic data were compared between the two posture conditions (see Table 2). For participants who had previous meditation/yoga experience, their data were collapsed into two categories (low experience: no practice to practicing once a month, and high experience: daily practice to practicing several times a month) for the analysis. No significant differences between the two groups for meditation experience or any other demographic factors were found.

Table 2
Comparison of demographic variables between the two posture conditions

Demographic	Category	Slouched group frequency	Upright group frequency	Test statistic	p value
Gender	Male	4	5	$X^2(1) = .71^a$.71
	Female	17	13		
Ethnicity	White	20	17	$X^2(2) = 1.89^a$.72
	Asian	1	0		
	“Prefer not to say”	0	1		
Occupation	Undergraduate	4	0	$X^2(2) = 3.59^a$.17
	Post graduate	8	8		
	Other	9	10		
Age ^b	20-24 years	3	0	$W_s = 416$.91
	25-29 years	5	8		
	30-34 years	2	2		
	35-39 years	1	0		
	40-44 years	2	0		
	45-49 years	1	3		
	50-54 years	5	3		
	55-59 years	2	1		
	60-64 years	0	0		
	65-69 years	0	1		
Past meditation/yoga experience ^c	High	9	6	$X^2(1) = .90$.45
	Low	5	7		

Note. ^a Assumption of chi-square was violated due to at least one cell count falling <5, therefore Fisher’s exact test result is reported.

^b Wilcoxon rank sum test was carried out since age was ordinal data. The median value in each age range category was used for ranking purposes.

^c n=27 reported having past meditation or yoga experience.

There were also no significant differences between the two groups for any baseline outcome measures (PANAS total positive and negative affect scores, and DTS total score); see Table 3.

Table 3

Mean baseline outcome measures scores according to group. (Upright posture group n=18, slouched posture n=21)

Baseline outcome measure	M (SD) for slouched group	M (SD) for upright group	t (1)	p value
PANAS total positive affect score ^a	33.90 (6.16)	33.39 (6.97)	1.2	.45
PANAS total negative affect score ^a	18.20 (6.07)	19.17 (4.85)	2.0	.26
DTS total score	2.51 (.83)	2.42 (.81)	1.50	.37

Note. ^a n=20 as one participant did not complete the PANAS measure correctly.

For the PANAS measures, total scores can range from 10-50, with higher scores representing high levels of positive or negative affect. The participants' mean baseline scores for positive and negative affect fell roughly within an expected range: according to Watson et al. (1988), a mean weekly score for total positive affect is 33 (SD=7.2) and for negative affect, 17.4 (SD=6.2). For the DTS mean total score, this can range from 1 to 5, with a higher score representing higher distress tolerance; meaning on average the participants had a roughly mean DTS total score, in the middle of the range of possible scores.

Two-tailed test results are provided throughout the results, given the lack of past research in this research field to substantiate study predictions. The findings in relation to each hypothesis will now be considered in turn.

Mindfulness

Hypothesis: Participants will report greater mindfulness following mindfulness practice in the upright posture condition than in the slouched posture condition.

Recall that the TMS was administered after mindfulness practice in the two conditions. It measures two facets of state mindfulness: decentering and curiosity; for each facet an independent t-test was conducted. There was no significant difference in the TMS decentering scores between upright ($M = 17.5$, $SD = 4.58$) and slouched ($M = 15.10$, $SD = 5.37$) posture conditions; $t(37) = -1.49$, $p = .14$. Likewise there was no significant difference in the TMS curiosity scores between upright ($M = 14.44$, $SD = 4.56$) and slouched ($M = 12.52$, $SD = 6.16$) posture conditions; $t(37) = -1.09$, $p = .28$. Thus there was no evidence of an effect of posture type on levels of mindfulness (as measured by the TMS) and the original hypothesis was not supported.

Distress tolerance

Hypothesis: Participants will report higher perceived distress tolerance following mindfulness practice in the upright posture condition than in the slouched posture condition.

The Distress Tolerance Scale (DTS) total score was the dependent variable used in the analysis. As the DTS was administered both pre- and post-mindfulness practice in each condition, a two-way 2 (posture: slouch or upright) x 2 (time: before or after the mindfulness practice) mixed ANOVA was carried out with repeated measures on the time variable. Figure

2 is a line chart showing the interaction between posture type and time of measurement for mean DTS total scores.

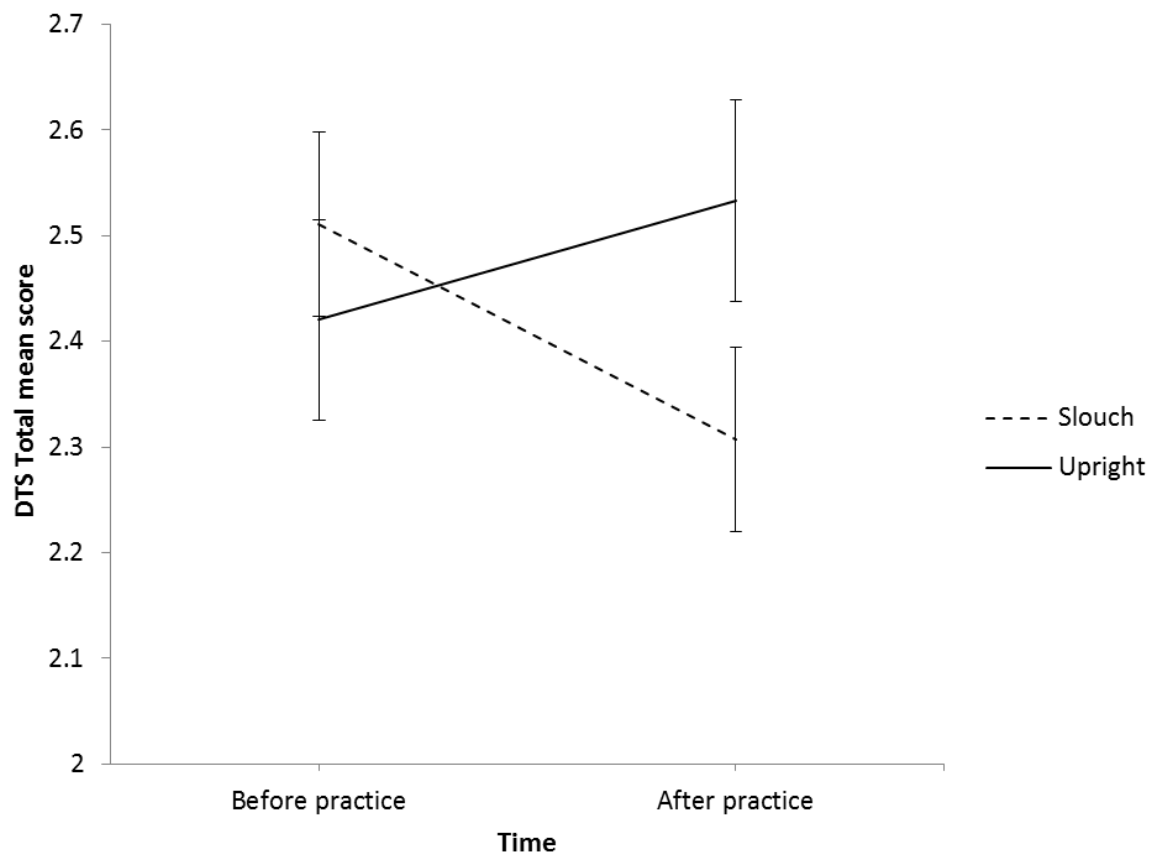


Figure 2. Line chart showing the interaction between posture type and time of measurement for mean DTS total scores (including standard errors)

There were non-significant main effects of posture $F(1,37) = .08, p=.78$, and time $F(1,37) = .51, p=.48$ on DTS total scores. However; there was a significant interaction between posture x time, $F(1,37)=5.69, p=.02, \eta^2 =.01$ (representing a small effect size; Cohen, 1988). In order to understand this interaction, post-hoc tests were carried out. Independent t-tests were used to compare DTS total scores between participants in the two posture conditions at the two time points (before and after the mindfulness practice). Dependent t-tests were used to compare the DTS total scores within each posture group before and after the mindfulness practice.

There was no significant difference between the DTS total scores for those in the two posture conditions pre-practice, $t(37)=.33$, $p=.74$; or post-practice, $t(37)=-.89$, $p=.38$; meaning the hypothesis was not supported. However, in the slouched condition, on average the DTS total score was significantly higher pre-practice than post-practice, $t(20)=2.51$, $p=.02$, although when a Bonferroni corrected α of .013 was applied (due to multiple comparisons) this result neared but did not reach significance. In the upright condition, on average there was no significant difference between pre- and post-practice DTS total scores; $t(17)=-1.04$, $p=.31$. Thus, the DTS total scores appeared to reduce in the slouched condition between pre- and post-practice (suggestive of a potential decrease in distress tolerance in this group).

Mood

Hypothesis: Participants will report higher mood ratings following mindfulness practice in the upright posture condition than in the slouched posture condition.

One participant's data were removed from this analysis due to errors in completing the PANAS scales rendering their data unusable (therefore total $n=38$; in the slouched condition $n=20$, in the upright condition $n=18$). The PANAS consists of two facets: total positive and total negative scores. For each facet, a two-way 2 (posture: slouch or upright) x 2 (time: before or after mindfulness practice) mixed ANOVA was carried out with repeated measures on the time variable. Figures 3 and 4 are line graphs showing the mean total negative and positive affect scores according to time of measurement across both posture conditions.

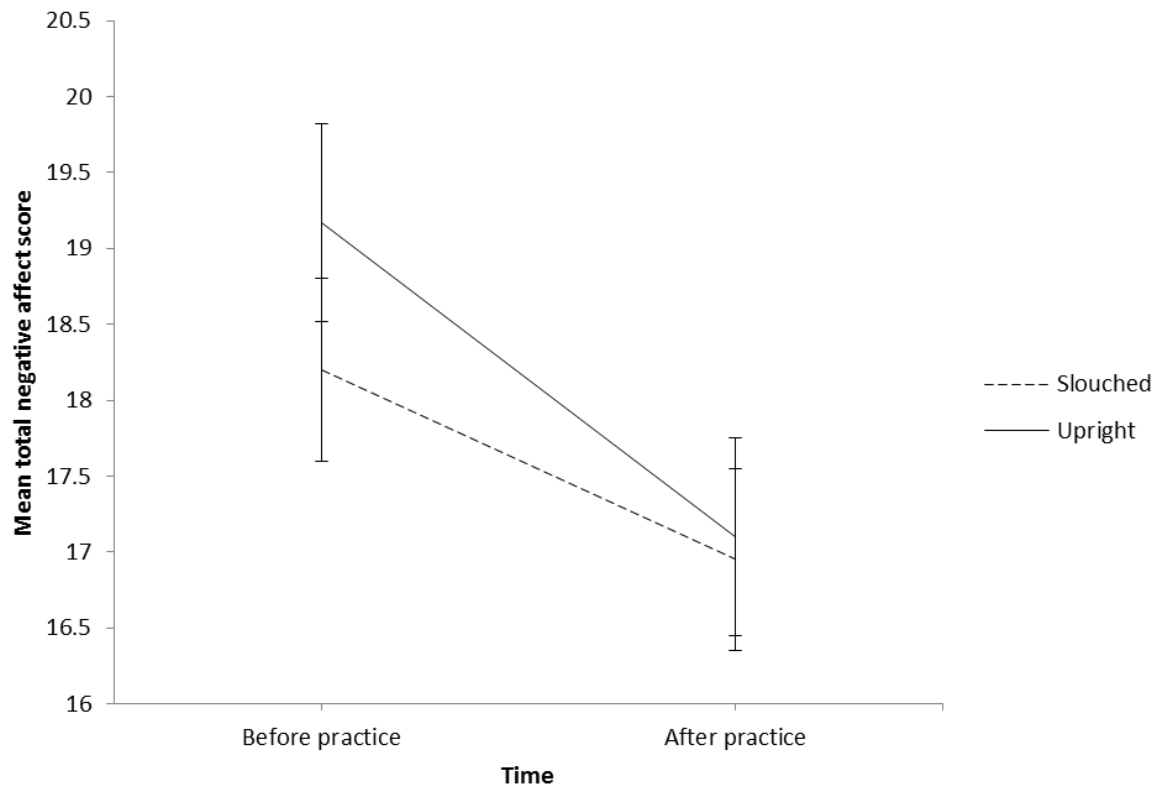


Figure 3. Line graph showing the difference between the mean total negative affect scores (with standard errors) according to time of measurement and group

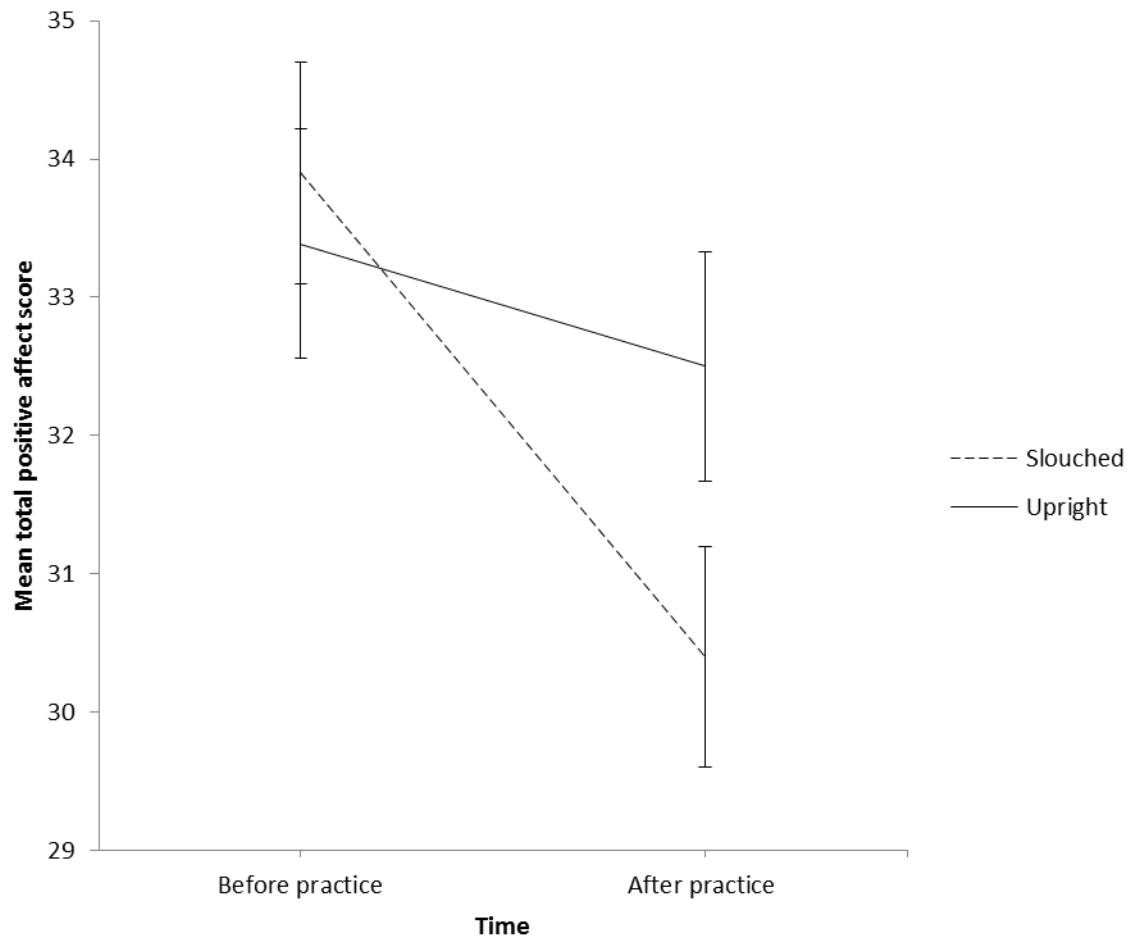


Figure 4. Line graph showing the difference between the mean total positive affect scores (with standard errors) according to time of measurement and group

There were no significant main effects of posture on positive $F(1,36) = .14, p=.71$ and negative affect scores, $F(1,36) = .10, p=.76$. However; there was a significant main effect of time for both positive $F(1,36) = 6.97, p=.01, \eta^2 = .02$ (representing a small effect size; Cohen, 1988) and negative affect $F(1,36) = 5.65, p=.02, \eta^2 = .03$ (representing a small effect size; Cohen, 1988). Post-hoc tests using the Bonferroni correction revealed a slight reduction in positive affect following the mindfulness practice (2.19) which was statistically significant ($p=.01$). Similarly, there was a small reduction in negative affect (1.71) which was also significant ($p=.02$).

There were no significant posture x time interactions for positive affect $F(1,36) = 2.47$, $p=.13$, and negative affect $F(1,36) = .41$, $p=.53$. Overall, the results suggest participants experienced reductions in both positive and negative affect during the mindfulness practice, irrespective of the posture they had adopted, meaning the original hypothesis was not supported.

Additional analyses – potential confounding variables

Participants' self-reported level of comfort in the postures, rated from 1 [very uncomfortable] to 9 [very comfortable], was explored as a potential confounding variable. Spearman's correlation analyses found no significant associations with comfort (see Table 4). Due to the small number of experienced meditators in the sample, it was not possible to carry out any meaningful analysis on experience as a potential confounding variable.

Table 4

Results of correlation analyses exploring the relationship between comfort and outcome measures

Relationship with comfort	r_s	p
TMS decentering scores	.30	.07
TMS curiosity scores	.26	.11
DTS change score ^a	-.13	.45
Positive affect change score ^a	-.29	.08
Negative affect change score ^a	.05	.77

Note. ^aChange score represents the difference between the score before and after the practice.

Content analysis

Following each mindfulness practice, participants were asked to briefly write about their experience during the practice in the slouched and in the upright posture (questions one and two); they were specifically invited to comment on any thoughts, emotions or physical feelings that arose. No hypotheses were made regarding participants' qualitative experiences.

The qualitative data generated from these questions were analysed using content analysis; all participants (N=39) provided answers to each of the questions. Content analysis was chosen as a suitable method since it has been described as “a research technique for the objective, systematic, and quantitative description of the manifest content of communication” (p.18, Berelson, 1952), hence allowing statistical comparison of counts between the groups. The content analysis was carried out following guidance from Berg (2001). A process of emergent coding was used, whereby examination and coding of the data led to the development of a coding framework; see Appendix N for an example coded transcript. Overall, eight broad categories were identified, formed from 23 sub-categories. The number of participants who mentioned codes from each subcategory in their answers to questions 1 and 2 were tallied (the frequencies are detailed in Table 5). The broad categories will now be described (see Appendix O for the coding framework which outlines each of the sub-categories and provides example coding units for these).

Table 5

Frequency of participants mentioning codes from each sub-category for the slouched and upright posture practices

Category	Sub-category	<u>Frequency count</u> Slouched	<u>Frequency count</u> Upright
Alertness	Awake	0	4
	Sleepiness	16	5
Attention	Thoughts wandered	13	8
	Distracted	8	1
	Maintained focus	6	15
	Inwards focus	2	2
Physical feelings	Awareness of neutral sensory experiences	1	8
	Physical discomfort	19	9
	Physical comfort	4	10
The breath	Breathing more difficult	15	1
	Breathing easy	0	2
Arousal	Relaxed	13	14
	Tense	1	3
Emotion	Creativity	1	2
	Positive affect	2	10
	Negative affect	3	2
	Difficult feelings eased	0	2

Attitude towards experience	Acceptance	1	2
	Self-compassion	1	2
Posture	Getting it “right”	0	2
	Posture recall	0	6
	Slouching “wrong”	4	n/a

Alertness comprised the distinct subcategories of awake and sleepiness. The category related to reported attitudes of alertness which ranged from feeling awake and attentive to present experience; to feeling sleepy and related behaviours e.g. yawning.

Attention related to participants’ reported ability to stay focused on the practice. This category comprised of four sub-categories; thoughts wandered and distracted which seemed to represent poor attention and distraction by ruminations, physical feelings or external stimuli (e.g. ticking clock). At the other end of the scale was focused attention under the sub-categories of maintained focus and inward focus; participants commented on maintaining their focus, bringing their mind back whenever it wandered and becoming focused on their internal experiences to the exclusion of the outside world.

Physical feelings related to physical discomfort and physical comfort during the practices, largely due to the postures. Physical discomfort was often noted in the neck or back area and reported as distracting from the practice, whereas physical comfort was often described as facilitative to the practice. The third sub-category: awareness of neutral sensory experiences, related to a reported awareness of physical stimuli e.g. cool air on the skin that was noticed in a neutral manner.

The breath incorporated the subcategories: breathing more difficult and breathing easy. Breathing seemed linked to posture; feeling that the abdomen was restricted in the posture (usually due to slouching) made breathing more difficult. Conversely, easy breathing (in the upright posture) related to a sense of openness in the abdomen.

Arousal related to tension during the practice and seemingly finding it difficult to relax; alternatively feeling relaxed during the practice and accompanying calmness.

Emotion encompassed emotional experiences during the practice which seemed to include positive affect (e.g. happiness, joy or positive thoughts) and negative affect (e.g. irritation, impatience). Also reported was a feeling of creativity (e.g. having new ideas) and that difficult feelings eased during the practice.

Attitude towards experience included acceptance in which participants seemed able to tolerate emotions or thoughts, even if negative. Also self-compassion, for example a reported attitude of kindness towards oneself whenever one's thoughts wandered.

Posture included three distinct sub-categories relating to the postures. Some participants reported slouching is "*wrong*" with resulting guilty feeling, or posture resistance. Some seemed distracted by concerns of getting it "*right*" i.e. feeling they weren't achieving the required posture. Posture recall was perhaps a distraction for some, bringing attention away from the mindfulness practice to remembering the posture (a different experience from being mindfully aware of the body posture).

Inter-rater reliability. An inter-rater reliability check on the coding was carried out by a second independent rater (a trainee clinical psychologist). After the coding framework had been described, the rater practiced coding a sample of data using the framework. Following this, the rater was asked to code a different sample of data, representing 25% of

the answers for each of the three questions. Cohen's kappa was calculated as a measure of inter-rater reliability; $\kappa=.76$, $p<.01$ which represented an "excellent" (Fleiss, 1981; Cicchetti, 1994) level of agreement. A subsequent discussion between the raters led to very minor amendments to two or three category labels and descriptions to add further clarification to these.

Frequencies. The number of participants who mentioned codes from each subcategory in their answers to question 1 and 2 were tallied (the frequencies are detailed in Table 5). Only between-participant data were included in this frequency comparison, given the within-participant design was compromised by carry-over effects. Also, a broadly similar pattern of results was found using the within-participants frequency data (Appendix P is a table of the within-participant data). Participants compared their experiences of the practice in the two postures; the frequency of participants mentioning codes from each category (according to the order in which the posture was performed) is provided.

Following the slouched posture mindfulness practice, the three most frequently mentioned sub-categories were physical discomfort, sleepiness and breathing more difficult. Following the upright posture mindfulness practice, the most frequently mentioned sub-categories were maintained focus, relaxed, physical comfort and positive affect.

Chi-squared tests were used to explore whether there were significant associations in the frequency of participants who mentioned codes related to each sub-category in the slouched versus upright postures. To reduce the number of potential analyses, a few sub-categories that were similar in nature were collapsed and overall 14 comparisons were made (see Table 6 for details). For each comparison there was a 2x2 contingency table containing frequency data (whether participants made reference to a category: yes/no and group: slouched/upright). The Bonferroni-Holm (Holm, 1979) step down test was used (following

guidance from Abdi, 2010) to correct for familywise error rate. There was a significant association between posture type and whether or not participants mentioned breathing more difficult, $\chi^2(1)=15.41$, $p<.05$, Cramer's $V=.45$ (representing a moderate relationship). All other associations were not significant using the Bonferroni-Holm correction (see Table 6 for a summary).

Table 6

Summary of chi-square tests and significance values

Category / collapsed category	$\chi^2(1)$	p value
Awake	4.22 ¹	.12
Sleepiness	7.89	.01
Thoughts wandered / distracted	7.80	.01
Inwards focus / maintained focus	4.77	.03
Aware of neutral experiences	6.16 ¹	.03
Physical discomfort	5.57	.03
Physical comfort	3.13 ¹	.14
Breathing difficult	15.41 ¹	>.001*
Breathing easy	2.05 ¹	.49
Positive affect / creativity / relaxed	5.16	.02
Negative affect / tension	.13 ¹	1.0
Difficult feelings eased	2.05 ¹	.49
Attitude towards experience	.72 ¹	.68
Posture	1.58 ¹	.35

Note. ¹Cell count <5 therefore Fisher's exact test result is reported

* Significant after Bonferroni-Holm correction applied ($p < .004$).

Discussion

The study aimed to provide empirical support for the importance of attending to posture during mindfulness practice and explore the significance of this in relation to known outcomes of the practice. The findings will now be discussed, considering each hypothesis in turn.

Distress tolerance

Post-practice, there was no significant difference between upright and slouched groups for distress tolerance. Therefore the hypothesis that participants would report higher perceived distress tolerance following mindfulness practice in the upright posture in comparison with the slouched posture was unsupported. This is at odds with prior research (Bohns & Wiltermuth, 2012), which found a submissive posture was related to lower levels of pain tolerance compared with a dominant posture. However, methodological differences might account for this. The dominant posture involved standing with limbs extended from the body, different from the upright posture used in this study. Also, Bohns and Wiltermuth (2012) used a physical measure of distress tolerance rather than a self-reported one relating to emotional distress. Perhaps therefore different facets of distress tolerance were measured; distress tolerance has been conceptualised in different ways in the empirical literature, including tolerance of both physical discomfort and aversive emotions (Leyro, Zvolensky & Bernstein, 2010).

Despite the lack of difference between groups, participants' mean total DTS scores appeared to decrease following the mindfulness practice in the slouched posture; suggestive of a reduction in perceived distress tolerance in this group. (This finding was significant without a Bonferroni correction and came close to significance with this applied. This means that the finding should be interpreted cautiously, although the Bonferroni correction method

has been critiqued for increasing the risk of making a type II error [Perninger, 1998]). The mean total DTS scores appeared to increase slightly following the mindfulness practice in the upright posture, although this was not significant. These findings seemed to follow a similar pattern as Bohns and Wiltermuth (2012) who found participants adopting a submissive pose (torso curving inwards; similar to the slouched posture used in this study) showed a decrease in physical pain threshold; whilst this increased in those adopting a dominant pose (although the authors did not report whether these changes were significant).

The finding that participants seemed to experience a reduction in distress tolerance following mindfulness practice in the slouched posture needs replicating. However, it may provide some initial support for the concept of embodied emotion; in which a reciprocal relationship is proposed between bodily information and how emotional information is processed (Niedenthal, 2007). Further, this links into the ICS theory of depression (Teasdale & Barnard, 1993) in which bodily sensory and cognitive information inter-lock to give rise to the experience of emotion. A slouched, forward-leaning posture, as seen in individuals with depression (Michalak, Troje, Fischer, Vollmar, Heidenreich & Schulte, 2009), could therefore potentially lower mood and reduce an individual's cognitive appraisal of being able to cope with their distress.

Mindfulness

There was no significant difference in participants' post-practice mindfulness levels between the upright and slouched groups, meaning the hypothesis that participants would report greater mindfulness following the practice in the upright posture than in the slouched posture was not supported. Potentially, posture therefore does not impact on mindfulness levels; perhaps having more of an effect on other outcomes of mindfulness practice (e.g. distress tolerance).

Alternatively, the brief 15-minute mindfulness practice (compared with an eight-week MBI) was perhaps insufficient to see a difference in post-practice mindfulness levels between groups, especially since most participants were not regular meditators. Or, a Type II error possibly occurred (particularly as means were in the predicted direction). A within-subject design was initially chosen since power calculations indicated the large sample size for a between-subject design (N=150) would have been prohibitive for the scope of this study. However, since the counter-balance variable (order of posture) was significant in many of the within-subjects analyses, between-subject analyses were carried out instead, resulting in small sample sizes in each condition. A post-hoc power analysis found the study was powered to detect a large effect (.81); as such differences signifying a smaller effect size may have been undetected, representing a study limitation.

Another explanation was potential measurement issues with the TMS (Lau et al., 2006) which only measures two facets of mindfulness (decentering and curiosity). Mindfulness is thought to be a multi-faceted construct (Baer, Smith, Hopkins, Krietemeyer & Toney, 2006) and other potentially important facets in which a difference may have been seen were not measured by the TMS, e.g. non-reactivity (Baer et al., 2006). However, at the time of selecting measures, the TMS was the only known state mindfulness measure with good reliability and validity. The recent State Mindfulness Scale (Tanay & Bernstein, 2013) which measures state mindfulness of bodily sensations and mental events therefore makes an important contribution to this field.

Given the lack of previous research exploring the relationship between posture and mindfulness, further studies are required in this area. Within the framework of embodied emotion theory (Niedenthal, 2007), it seems plausible that an upright, open posture during mindfulness practice would help embody the mindful qualities that the individual hopes to cultivate: being ready, willing and attentive to present experience (Crane, 2009).

Mood

Participants reported lower positive and lower negative affect at the end of the practice compared with the start; this pattern occurred in both posture conditions with no evidence of any difference in mood between the two groups. This result did not support the hypothesis that participants would report more positive and less negative affect following mindfulness practice in the upright posture than in the slouched posture.

The reduction in positive and negative affect in both postures is contrary to expectations. The reduction in positive affect (as measured by the PANAS) was perhaps related to participants becoming lethargic (a low PA score is represented by lethargy; Watson et al., 1988); as a result of completing repetitive questionnaires and being seated in a quiet setting for over an hour. Perhaps taking time out from a busy schedule to meditate (in either posture) reduced participants' negative affect, and elicited the feelings of calmness and serenity representative of low levels of negative affect on the PANAS (Watson et al., 1988). This could link into the Segal et al. (2013) theory that mindfulness practice helps individuals shift from a "doing" mode of mind with a focus on achieving goals, to a "being" mode, in which present experience is accepted, and the mind can "settle" (Williams, Teasdale, Segal & Kabat-Zinn, 2007).

However, the lack of control group means it is not possible to definitively attribute changes in self-reported affect to the mindfulness practice. As described, a within-subjects design was originally adopted for feasibility reasons; however future research in this area could benefit from the inclusion of a control group.

Although this study used a brief 15-minute mindfulness exercise and was not representative of a Mindfulness Based Intervention (MBI), a reduction in negative affect is consistent with prior research that found negative affect significantly reduced post-MBI

(Schroevers & Brandsma, 2010; Collard, Avny and Boniwell, 2008; Shapiro, Brown & Biegel, 2007).

Whilst Shapiro et al. (2007) and Schroevers and Brandsma (2010) found positive affect increased post-MBI, Collard et al. (2008) found no change. Conversely, in this study both groups reported reduced positive affect post- practice. Collard et al. (2008) suggested the lack of increase in positive affect may have been due to measurement issues, since PANAS has been critiqued for a bias towards excitement and activation whilst other adjectives e.g. calmness and serenity do not appear (Boniwell & Henry, 2007). Therefore reduced positive affect reduction may have been related to decreased excitation and subsequent calmness following the mindfulness practice in either posture. Future studies should consider using additional affect measures, to clarify the nature of the relationship between mindfulness and positive affect.

Content analysis

Participants provided information about their experience after meditating in the upright and slouched postures and no hypotheses were made about this qualitative data. Following the slouched practice, the three most frequently mentioned sub-categories were physical discomfort, sleepiness and breathing more difficult. Following the upright practice, these were maintained focus, relaxed, physical comfort and positive affect; fitting with the idea that adopting an upright and dignified meditation posture sends a message to the mind of attentiveness (Crane, 2009). It is also in keeping with embodied emotion theory, in that an upright posture would be associated with positive affect; in accordance with Stepper and Strack (1993) who found participants reported more pride when receiving feedback about their success in an achievement task when in an upright rather than slouched posture.

However; only one sub-category (breathing more difficult) was mentioned by significantly more participants in the slouched posture than upright posture; this seemed to be

linked to constrictive feelings in the abdomen due to slouching. Failure to find other significant differences in category counts may be a Type II error, in light of the small sample and need to apply a correction for multiple comparisons. However; this significant finding supports the guidance given at the beginning of mindfulness practice to allow the spine to adopt an upright and dignified posture (Segal et al., 2013). Given the emphasis in MBIs on following the breath (e.g. mindfulness of the breath; Segal et al., 2013) and using the breath as an “anchor” to bodily present experience; it would seem appropriate to adopt a posture that allows the breath to flow freely so that sensations of stretching and deflation can be experienced.

Summary

In summary, none of the experimental hypotheses were supported; potential explanations have been offered which include possible measurement and power issues. The tentative finding that distress tolerance seemed to decrease following mindfulness practice in the slouched posture was consistent with theories of embodied emotion and depression. This, in combination with the content analysis finding (upright posture may facilitate breathing), lends some initial support to the importance of attending to posture in mindfulness practice.

Clinical implications

The finding that distress tolerance seemed to decrease following mindfulness practice in the slouched posture may have clinical relevance since low distress tolerance has been related to greater psychopathology and poorer quality of life (Bernstein, Marshall & Zvolensky, 2011), supporting the emphasis placed on upright posture during MBIs. Clinicians could encourage clients with a slouched posture, possibly due to an embodiment of low mood, to adopt a more upright stance. This could be useful during MBIs, or potentially in other clinical interventions, such as re-living trauma.

Further, the posture clinicians themselves adopt during interventions may have an impact on clients' distress tolerance. Bohns and Wiltermuth (2012) found participants interacting with a confederate sat in a submissive posture displayed higher pain thresholds than those interacting with a confederate in a dominant pose. The authors speculated this was because it encouraged the participant to be dominant (through a complementary experience of embodied power), leading to heightened perceptions of control and self-efficacy that reduced pain sensitivity. Psychologists could be aware of this when interacting with clients in pain (for example those referred for MBSR because of chronic pain). Whilst encouraging the client to adopt an upright stance, clinicians could discreetly take a more submission pose, to attenuate potential beneficial effects for the client's distress tolerance.

Limitations

Aside from limitations already mentioned (lack of control group, brevity of the mindfulness practice in relation to a MBI, potential power issues, measurement of state mindfulness using the TMS [Lau et al., 2006] and positive affect using the PANAS [Watson et al., 1988]), there are further short-comings of this research. Firstly, the instructions used for the PANAS, "indicate to what extent you generally feel this way" could have led to a trait measure of affect. However, arguably if the PANAS had acted as a trait measure, this would have resulted in scores remaining approximately the same before and after the mindfulness practice whereas a reduction in both positive and negative affect was seen post-practice. Therefore, the measure was apparently sensitive to state change despite the instructions. Another limitation relates to reliance on self-report measures which can potentially cause response bias (Carmody et al., 2009); perhaps a behavioural measure of distress tolerance could have been used in addition to the DTS (Simons & Gaher, 2005).

A further limitation relates to the sample, which may have represented a self-selecting group who already had an interest in mindfulness; seventy percent reported having previous

experience of yoga or meditation. Additionally, as seems to be the case with many mindfulness studies, white, female participants were over-represented in the sample. Therefore caution should be taken in generalizing findings to a wider population; although this study did benefit from a mix of students and local community members in the sample. Future mindfulness studies would be strengthened from using a more diverse sample in respect of gender and ethnicity.

Further, although some attempt at random allocation was made (constrained by practicalities) it would have been better to have fully randomly allocated participants to groups. Participants signed up to groups (according to their availability) meaning it was possible that some non-random influences regarding which participants selected each group were present. Although the lack of significant differences (in baseline measures and demographics) between groups meant this was unlikely to have been an issue. Further, some randomization did occur in the study as posture order was randomly assigned to groups, within the constraints of ensuring approximately equal numbers of participants in each condition. Finally, although MBIs are usually delivered in small groups, carrying out this study in groups may have had some implications on the findings. For example, mood could have been impacted by social interactions between participants during the break, or participants could have felt more anxious about meditating surrounded by unfamiliar people.

Future research

Given this was the first known study to explore the relationship between body posture and outcomes of mindfulness practice, further research is required to understand the potential role of the body in the beneficial outcomes of MBIs; particularly to replicate a significant distress tolerance finding. Future research should address the methodological limitations of this study; for example use of a randomised control trial design where there is both a control group and fully randomised allocation of participants to conditions, a larger sample to

increase power and a more diverse sample to be able to better generalize findings. It could also be important to look at body posture in relation to outcomes following an 8-week MBI, as this study only involved a 15-minute practice.

It would also be helpful to explore whether body posture is a mediator variable for the beneficial mood-related outcomes of MBIs, using a test of mediation as part of the research analyses. Finally it would be worthwhile to investigate the duration of any posture related effects; Schnall and Laird (2003) found the emotion associated with physically expressing moods e.g. making angry facial expressions or posture, endured for 30 minutes after the physical expressions ended. It would also be interesting to compare other postures and how these impact on the outcomes of mindfulness practice, for example a lying down posture (as in the body scan) or walking (as in mindful movement).

Conclusion

This study researched the relationship between body posture and some known outcomes of mindfulness practice, following a 15-minute mindfulness induction in a non-clinical sample. None of the hypotheses were supported. Posture did not seem to impact on participants' mindfulness or mood post-practice (possibly due to measurement or power issues). However, distress tolerance seemed to decrease in the slouched posture; although this finding is reported tentatively. Qualitatively, it appeared upright posture may facilitate breathing during mindfulness practice. These two results may provide initial support for attending to posture during MBIs. There was also a reduction in positive and negative affect in both groups following the practice; the latter being consistent with findings that MBIs improve psychological well-being. This was the first known study to explore the relationship between posture and outcomes of mindfulness practice. Given the prominence of the body in theories of depression (e.g. ICS, Teasdale & Barnard, 1993) and in the MBCT treatment approach (Segal et al., 2013), it would seem important for further research to be conducted in

this field to develop psychological understanding of depression and refine treatments accordingly.

References

- van Aalderen, J.R., Donders, A.R.T., Giommi, P., Spinhoven, H.P., Barendregt, H.P. & Speckens, A.E.M. (2011). The efficacy of mindfulness-based cognitive therapy in recurrent depressed patients with and without a current depressive episode: A randomized controlled trial. *Psychological Medicine*, 42, 989–1001.
<http://dx.doi.org/10.1017/S0033291711002054>
- Abdi, H. (2010). Holm's sequential Bonferroni procedure. In N. Salkind (Ed.), *Encyclopedia of research design* (pp. 574–578). Thousand Oaks, CA: Sage.
- Arch, J.J. & Craske, M.G. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behaviour Research and Therapy*, 44, 1849–1858.
<http://dx.doi.org/10.1016/j.brat.2005.12.007>
- Baer, R.A. (2009). Self-focused attention and mechanisms of change in mindfulness-based treatment. *Cognitive Behaviour Therapy*, 38(S1), 15–20.
<http://dx.doi.org/10.1080/16506070902980703>
- Baer, R.A., Smith, G.T., Hopkins, J., Krietemeyer, J. & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13, 27–45.
<http://dx.doi.org/10.1177/1073191105283504>
- Batink, T., Peeters, F., Geschwind, N., van Os, J. & Wichers, M. (2013). How does MBCT for depression work? Studying cognitive and affective mediation pathways. *Plos One*, 8(8), 1–13. <http://dx.doi.org/10.1371/journal.pone.0072778>
- Beck, A.T., Ward, C.H., Mendelson, M., Mock, J. & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, 4, 561–571.
<http://dx.doi.org/10.1001/archpsyc.1961.01710120031004>
- Berelson, B. (1952). *Content analysis in communication research*. Glencoe, IL: Free Press.

- Berg, B.L. (2001). *Qualitative research methods for the social sciences*. Boston: Allyn & Bacon.
- Bernstein, A., Marshall, E.C. & Zvolensky, M.J. (2011). Multi-method evaluation of distress tolerance measures and construct(s): Concurrent relations to mood and anxiety psychopathology and quality of life. *Journal of Experimental Psychopathology*, 2(3), 386–399. <http://dx.doi.org/10.5127/jep.006610>
- Bohns, V.K. and Wiltermuth, S.S. (2012). It hurts when I do this (or you do that): Posture and pain tolerance. *Journal of Experimental Social Psychology*, 48, 341–345. <http://dx.doi.org/10.1016/j.jesp.2011.05.022>
- Boniwell, I. & Henry, J. (2007). Developing conceptions of wellbeing: Advancing subjectivism hedonic and eudaimonic theories. *Social Psychological Review*, 9(1), 3–18.
- Branstrom, R., Kvillemo, P., Brandberg, Y. & Moskowitz, J.T. (2010). Self-report mindfulness as a mediator of psychological well-being in a stress reduction intervention for cancer patients: A randomized study. *Annals of Behavioral Medicine*, 39, 151–161. <http://dx.doi.org/10.1007/s12160-010-9168-6>
- British Psychological Society (2010). Code of human research ethics guidelines. Retrieved from http://www.bps.org.uk/sites/default/files/documents/code_of_human_research_ethics.pdf
- Carmody, J. & Baer, R.A. (2007). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*, 31, 23–33. <http://dx.doi.org/10.1007/s10865-007-9130-7>

- Carmody, J., Baer, R.A., Lykins, E.L.B. & Olendzki, N. (2009). An empirical study of the mechanisms of mindfulness in a mindfulness-based stress reduction program. *Journal of Clinical Psychology*, 65, 613–626. <http://dx.doi.org/10.1002/jclp.20579>
- Cicchetti, D.V. (1994). Guidelines, criteria and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment*, 6, 284–290. <http://dx.doi.org/10.1037/1040-3590.6.4.284>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.
- Collard, P., Avny N. & Boniwell, I. (2008). Teaching mindfulness based cognitive therapy (MBCT) to students: The effects of MBCT on the levels of mindfulness and subjective well-being. *Counselling Psychology Quarterly*, 21(4), 323–336. <http://dx.doi.org/10.1080/09515070802602112>
- Crane, R. (2009). *Mindfulness-based cognitive therapy: Distinctive features*. Hove: Routledge.
- Derogatis, L. R., Lipman, R. S., Rickels, K., Uhlenhuth, E. H., & Covi, L. (1974). The Hopkins Symptom Checklist (HSCL): A self-report symptom inventory. *Behavioral Science*, 19, 1–15. <http://dx.doi.org/10.1002/bs.3830190102>
- Fleiss, J. L. (1981). *Statistical methods for rates and proportions* (2nd ed.). New York: John Wiley.
- Holm, S. (1979) A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics*. 6, 65–70.
- Kabat-Zinn, J. (1982). An outpatient program in behavioural medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, 4, 33–47. [http://dx.doi.org/10.1016/0163-8343\(82\)90026-33](http://dx.doi.org/10.1016/0163-8343(82)90026-33)

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present and future.

Clinical Psychology: Science and Practice, 10, 144–156.

<http://dx.doi.org/10.1093/clipsy/bpg016>

Kleinke, C.L., Peterson, T.R. & Rutledge, T.R. (1998). Effects of self-generated facial

expressions on mood. Journal of Personality and Social Psychology, 74(1), 272–279.

<http://dx.doi.org/10.1037//0022-3514.74.1.272>

Kuyken, W., Watkins, E., Holden, E., White, K., Taylor, R.S., Byford, S.,...Dalglish, T.

(2010). How does mindfulness-based cognitive therapy work? Behaviour Research and

Therapy, 48(11), 1105–12. <http://dx.doi.org/10.1016/j.brat.2010.08.003>

Lau, M.A., Bishop, S.R., Segal, Z.V., Buis, T., Anderson, N.D., Carlson, L.,...Devins, G.

(2006). The Toronto mindfulness scale: Development and validation. Journal of

Clinical Psychology, 12, 1445–1467. <http://dx.doi.org/10.1002/jclp.20326>

Leyro, T.M., Zvolensky, M.J. & Bernstein, A. (2010). Distress tolerance and

psychopathological symptoms and disorder: A review of the empirical literature among

adults. Psychological Bulletin, 136, 576–600. <http://dx.doi.org/10.1037/a0019712>

Metcalf, C.A. & Dimidjian, S. (2014). Extensions and mechanisms of mindfulness-

based cognitive therapy: A review of the evidence, Australian Psychologist, 49,

271–279. <http://dx.doi.org/10.1111/ap.12074>

Michalak, J., Burg, J. & Heidenreich, T. (2012). Don't forget your body: Mindfulness,

embodiment, and the treatment of depression. Mindfulness, 3, 190–199.

<http://dx.doi.org/10.1007/s12671-012-0107-4>

Michalak, J., Troje, N., Fischer, J., Vollmar, P., Heidenreich, T. & Schulte, D. (2009). The

embodiment of sadness and depression – gait patterns associated with dysphoric

mood. Psychosomatic Medicine, 71, 580–587.

<http://dx.doi.org/10.1097/PSY.0b013e3181a2515c>.

- Michalak, J., Troje, N.F. & Heidenreich, T. (2011). The effects of mindfulness-based cognitive therapy on depressive gait patterns. *Journal of Cognitive and Behavioral Psychotherapies*, 11(1), 13–27.
- Niedenthal, P.M. (2007). Embodying emotion. *Science*, 316, 1002–1005.
<http://dx.doi.org/10.1126/science.1136930>
- Niedenthal, P.M., Barsalou, L.W., Winkielman, P., Krauth-Gruber, S. & Ric, F. (2005). Embodiment in attitudes, social perception and emotion. *Personality and Social Psychology Review*, 9, 184–211. http://dx.doi.org/10.1207/s15327957pspr0903_1
- Oosterwijken, S., Rotteveel, M., Fischer, A.H., & Hess, U. (2009). Embodied emotion concepts: How generating words about pride and disappointment influence posture. *European Journal of Social Psychology*, 39, 457–466.
<http://dx.doi.org/10.1002/ejsp.584>
- Perneger, T.V. (1998). What's wrong with Bonferroni adjustments? *British Medical Journal*, 316, 1236–1238. <http://dx.doi.org/10.1136/bmj.316.7139.1236>
- Roberts, T.A. & Arefi-Afshar, Y. (2007). Not all who stand tall are proud: Gender differences in the proprioceptive effects of upright posture. *Cognition and Emotion*, 21(4), 714–727. <http://dx.doi.org/10.1080/02699930600826432>
- Schnall, S. & Laird, J.D. (2003). Keep smiling: Enduring effects of facial expressions and postures on emotional experience and memory. *Cognition and Emotion*, 17(5), 787–797. <http://dx.doi.org/10.1080/02699930244000183isl>
- Schroevers, M.J. & Brandsma, R. (2010). Is learning mindfulness associated with improved affect after mindfulness-based cognitive therapy? *British Journal of Psychology*, 101, 95–107. <http://dx.doi.org/10.1348/000712609X424195>

- Segal Z.V., Williams J.M.G. & Teasdale J.D. (2002). Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse. New York: Guildford Press.
- Segal, Z.V., Williams, J.M.G. & Teasdale, J.D. (2013). Mindfulness-based cognitive therapy for depression (2nd ed.). New York: Guildford Press.
- Shapiro, S.L., Brown, K.W. & Biegel, G.M. (2007). Teaching self-care to caregivers: Effects of mindfulness-based stress reduction on the mental health of therapists in training. *Training and Education in Professional Psychology*, 1(2), 105–115.
<http://dx.doi.org/10.1037/1931-3918.1.2.105>
- Simons, J.S. & Gaher, R.M. (2005). The distress tolerance scale: Development and validation of a self-report measure. *Motivation and Emotion*, 29, 83–102.
<http://dx.doi.org/10.1007/s11031-005-7955-3>
- Stepper, S. & Strack, F. (1993). Proprioceptive determinants of emotional and nonemotional feelings. *Journal of Personality and Social Psychology*, 64(2), 211–220.
<http://dx.doi.org/10.1037/0022-3514.64.2.211>
- Tanay, G. & Bernstein, A. (2013). State mindfulness scale (SMS): Development and initial validation. *Psychological Assessment*, 25(4), 1286–99.
<http://dx.doi.org/10.1037/a0034044>.
- Teasdale, J.D. (1999). Multi-level theories of cognition-emotion relations. In T. Dalgleish & M.J. Power (Eds.), *Handbook of cognition and emotion*. Chichester: Wiley.
- Teasdale, J.D. & Barnard, P.J. (1993). *Affect, cognition and change: Remodeling depressive thought*. Hove: Lawrence Erlbaum Associates.
- Watson, D., Clark, L.A. & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063–1070. <http://dx.doi.org/10.1037/0022-3514.54.6.1063>

Williams, M., Teasdale, J., Segal, Z. & Kabat-Zinn, J. (2007). *The mindful way through depression: Freeing yourself from chronic unhappiness*. New York: Guildford Press.

Section C:

Appendices of supporting material

Appendix A

Standard Quality Assessment Criteria for Evaluation Primary Research Papers (Kmet, Lee & Cook, 2004).

Checklist for assessing the quality of quantitative studies:

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Appendix B

Mindfulness journal instructions for authors

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Appendix C

Recruitment poster

Are you interested in Mindfulness?**Would you like to try a Mindfulness practice?**

I'm a trainee clinical psychologist carrying out a study into the link between body posture during Mindfulness meditation and outcomes of the practice.

If you have two hours to spare and would like to take part in the study (which will involve doing two Mindfulness practices in a small group) please contact me: Claire Jones,
xxxxxxx@canterbury.ac.uk

Groups will run at xxxxxx on:

XXXXX

XXXXX

(Other dates may be offered. You only need to attend 1 group.)

Participants will be able to enter a prize draw to win £50 of Amazon vouchers!

Appendix D

Study information leaflet

Version 2 (22 February 2013)

The effect of body posture on the outcomes and experiences of mindfulness practice

Hello. My name is Claire Jones and I am a Trainee Clinical Psychologist at Canterbury Christ Church University. I would like to invite you to take part in a research study. Before you decide it is important that you understand why the research is being done and what it would involve for you.

Talk to family members and friends about the study if you wish.

Part 1 tells you the purpose of this study and what will happen to you if you take part.
Part 2 gives you more detailed information about the conduct of the study.

What is the purpose of the study?

Mindfulness is a meditation practice that has its origins in ancient Eastern spiritual traditions. In recent years, a type of Mindfulness practice (Mindfulness-Based Cognitive Therapy) has been found to be helpful in managing stress and anxiety, along with preventing relapse in people with a history of depression. Mindfulness is about learning to bring awareness to body sensations, thoughts and emotions in the present moment; and meeting our experience (whatever it is) with an attitude of curiosity, kindness and acceptance.

This study will explore the link between body posture during Mindfulness meditation and some of the known outcomes of the practice.

Why have I been invited?

You have been invited to participate as a member of the public, or a student or staff member of Canterbury Christ Church University through which the study is being organised.

Do I have to take part?

It is up to you to decide to join the study. If you agree to take part, I will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason.

What will happen to me if I take part?

- Study participation will involve attending a group session for approximately 2 hours. There is no follow-up or further participation after this
- You will need to attend the group session at either university premises or a local community venue with up to 11 other participants. A number of sessions will be offered to enable you to choose a time and venue that is convenient. You will meet me (the researcher) at the session
- The session will involve being guided through two 15-minute mindfulness meditations whilst adopting a specific seated posture for each. Both postures are chair-based, one sitting upright and the other slouching in your seat. (If you think that

it would be difficult or uncomfortable for you to hold these postures for 15 minutes then you should not participate in this study.)

- There will be a short break in between the two meditations. You will also be asked to complete some brief questionnaires before and after each meditation.

Expenses and payments

Unfortunately travel expenses cannot be reimbursed; however the research will be taking part on university premises or a local community venue to avoid any lengthy or unnecessary travel for you. On completion of the study, you will have the option to be entered into a prize draw to win a £50 Amazon voucher to thank you for your participation.

What are the possible disadvantages and risks of taking part?

The possible disadvantages of taking part include:

- The time involved
- For some individuals, there could be a small degree of short-term physical discomfort in the seated postures. However, if you do experience any discomfort, you may withdraw from the study at any time
- Mindfulness practice involves being more aware of our physical sensations, thoughts and emotions in the present moment and meeting these experiences – whatever they are. Therefore there is a possibility that for the duration of the practice you become more aware of any negative feelings or thoughts that may be present for you.

What are the possible benefits of taking part?

There is no intended benefit to taking part in the study; however, sometimes people can find the Mindfulness meditation relaxing and benefit from some time out from a busy schedule.

We cannot promise the study will help you directly but the information we get from this study will help us better understand the role that posture may play in the outcomes of Mindfulness practice. In the future, this could encourage further research to help improve the treatment of people with depression using a Mindfulness approach.

This completes Part 1. If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2 of the information sheet

What will happen if I don't want to carry on with the study?

You have the right to withdraw from the study at any point. If you decide to withdraw, your data will be extracted and destroyed.

What if there is a problem?

If there is a problem and you would like to raise this, please follow the complaints procedure outlined below.

Complaints

If you have a concern about any aspect of this study, you should ask to speak to me and I will do my best to answer your questions. I can be contacted by leaving a voicemail message on 01892 507 673. Please say that the message is for me, Claire Jones, and leave a contact number so that I can get back to you. Or alternatively, you can e-mail me at c.e.jones14@canterbury.ac.uk.

If you remain unhappy and wish to complain formally, you can do this through the Canterbury Christchurch University complaints procedure. Details can be obtained from:

Paul Camic, Research Director
Canterbury Christ Church University
David Salomons Estate
Broomhill Road
Southborough
Tunbridge Wells
Kent
TN3 0TG
Tel: 01892 507 673

Will my taking part in this study be kept confidential?

- All information which is collected about you during the course of the research will be kept strictly confidential, apart from in the unlikely event of any information relating to risk of harm to self or others
- Data will be collected from paper questionnaires on the day of the group session
- All data will be stored securely and will be coded for anonymity. If you provide your contact details for the purpose of entering the prize draw then these will be stored separately to your study data
- The data will only be used for the purpose of this study
- Only authorised individuals directly involved in the research will have access to view any identifiable data
- You have the right to check the accuracy of data held about you and to correct any errors
- The data will be retained for 10 years following the study completion, after which it will be disposed of securely.

What will happen to the results of the research study?

The results of the study will be written up and reviewed by examiners as part of my clinical psychology doctoral training. The results may also be submitted to a scientific journal for publication. You will not be personally identified in the report or publication; any quotes from open-ended questions in the questionnaires will be anonymised.

If are interested in being e-mailed a summary of the findings of this study once completed, please provide me with your contact details in the request form.

Who is organising and funding the research?

The research is being organised and funded by Canterbury Christ Church University.

Who has reviewed the study?

All research in Canterbury Christ Church University is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by [REDACTED]

You will be given a copy of this information sheet and a signed consent form to keep for future reference.

Further information and contact details

- General information about research:

If you are interested in general information about research, the following web-link may be helpful: <http://www.newagepublishers.com/samplechapter/000896.pdf>

- Specific information about this research project, including advice as to whether you should participate:

If you would like to speak to me and find out more about the study or have questions about it answered, you can leave a voicemail message for me on 01892 507673. Please say that the message is for Claire Jones and leave a contact number so that I can get back to you.

- Who to approach if you are unhappy with the study:

Please contact me in the first instance either in person (during the study) or by telephone (see above contact details). Refer to the “*Complaints*” section for further advice if you would like to make a formal complaint.

- Contacts if you are concerned about your psychological wellbeing

If you have any concerns about your psychological wellbeing, please see your GP or contact NHS Direct for advice: 0845 46 46. Alternatively students can contact the Canterbury Christ Church University counselling service; counselling@canterbury.ac.uk or telephone 01227 863056.

Appendix E

Ethics approval letter

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Appendix F

Toronto Mindfulness Scale (TMS; Lau et al., 2006)

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Appendix G

Positive and Negative Affect Schedule (PANAS; Watson et al., 1988)

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Appendix H

Distress Tolerance Scale (DTS; Simons & Gaher, 2005)

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Appendix I

Session instructions

Introduction

Please take a seat in the circle. On the seat you will find a booklet and pen. Please don't open the booklet before I give you instructions.

Welcome, my name is Claire Jones and I am a trainee clinical psychologist at Canterbury Christ Church University. Thank you for coming to participate in the study today which is looking at the effect of body posture on the outcomes and experiences of mindfulness practice.

Today's session will last up to two hours. To begin with we will be doing some administration tasks. After this, I will ask you to complete some short questionnaires in the booklet. I will then ask you to adopt a natural upright/slouched posture and we will do a 15-minute recorded mindfulness practice together followed by some further questionnaires. After a short break, we will then repeat this process but with a slouched/natural upright posture.

I would like to inform you that you have the right to withdraw from the study at any point. If you do decide to leave, your data will be destroyed and not included in the study.

So, to begin with please can I collect one signed consent form from everyone who agrees to take part today (these were included in the pre-study booklet sent by e-mail). If you would like to be entered into the prize draw or to receive a summary of the research findings, please be sure to give me your completed request form as well. Please retain the rest of the pre-study booklet for your own information, including the second copy of your signed consent form.

(If you have not completed these forms already, please let me know as I have some spare copies here.)

As a reminder, if you meet any of the following criteria, please let me know as this will unfortunately mean you are unable to take part today (you do not need to tell me which criteria you meet):

- a) You currently have a diagnosis of, or are currently receiving treatment for a mood disorder (such as depression or anxiety)
- b) You have a postural or health condition which would make it difficult or uncomfortable for you to remain in a seated position for 15 minutes
- c) You have regularly practiced meditation or mindfulness within the past 12 months (by regular I mean more than once a week)

Before we begin the experiment, does anyone have any questions or concerns that they haven't already spoken to me about?

Pre-test questionnaires (1)

Now I'd like you to pick up the booklet that was on your chair please and I'll talk you through the instructions.

This booklet contains a number of questionnaires. Please answer all questions; try not to spend too long deciding over your answer, rather choose the one that initially feels most right or applicable to you.

Please work through the questionnaires in the order in which they appear in the booklet. Closely follow the instructions at the bottom of each page which will tell you when to stop and when to continue. If you finish writing ahead of other people, please wait quietly until everyone has finished and we can move onto the next part together.

Now please open the booklet and complete the questionnaires on pages 2 to 4. Stop writing after page 4 and wait for further instructions from me. When you have finished writing, please check over your answers to make sure you haven't missed any.

Posture 1 instructions

Now I would like to ask you to put the booklet to one side. Before we begin the first meditation, I will explain the first meditation posture to you.

This is an example of a natural upright/slouched posture I would like you to sit in for the first meditation practice [demonstrates]. We all have our own natural version of sitting upright/slouched so there will be variations of this posture amongst us. What is important is that the posture feels gentle and not forced or unnatural for your own body.

Some people find having a block under their feet helpful if their feet do not easily touch the floor, or to have a rolled up blanket against the back of the chair to support their lower spine. Please ask if you would like a block or blanket. This slide [shows PowerPoint slide] will remain on the screen throughout the meditation to remind you of an example of a natural upright/slouched posture. You will notice on the slide there is also an example of a slouched/natural upright posture to show the sort of difference in posture we are looking for between the two meditations.

Please try to remain in your natural upright/slouched posture as much as is comfortable for you to do so during the meditation. If you start to feel uncomfortable or you feel pain at any time, know that it is fine to make adjustments to the way you are sitting before returning to your original posture, if you can. If you do need to make some adjustments, please if possible try to still maintain a degree of natural uprightness/slouching, so long as this does not cause you any pain or discomfort.

So, to adopt your own natural upright/slouched posture, please listen to the guidance on the recording I will now play. It may seem a little odd that the posture and meditation instructions are recorded; however this is to ensure that all groups receive

exactly the same information. Before you hear the meditation instructions, there will be a short pause when there will be opportunity for anyone to ask questions or for help.

<Start natural upright posture/slouched guidance recording>

We will now start the recording and do a 15 minute Mindfulness practice. I will also be closing my eyes and doing the practice with you as a group.

<Start meditation 1 recording>

Post-test questionnaires (1)

Please sit however you wish and take a few minutes to readjust to having your eyes open and being out of the meditation practice.

When you're ready, please open the booklet at page 6 and complete the questionnaires on page 6 to 10, keeping in mind the meditation experience you have just had. Stop writing after page 10 and wait for further instructions. When you have finished writing, please check back over your answers to make sure you haven't missed any questions.

Break

There will now be a short break 5 minute break during which you can continue to sitting or move around the room as you wish. In 5 minutes time [state time] we will begin the process again with a second posture.

The short break has now ended please can you return to your original chair and sit down.

Pre-test questionnaires (2)

There will now be some further short questionnaires before we do the second meditation. Please open the booklet at page 12 and complete the questionnaires on page 12 and 13. Stop writing after page 13 and wait for further instructions. When you have finished please check back over your answers to make sure you haven't missed any.

Posture 2 instructions

As before, I am now going to give some instructions on how to sit for the second meditation practice and will explain this posture to you.

This is an example of a slouched/natural upright posture I would like you to sit in for the second meditation practice [demonstrates]. We all have our own natural version of sitting slouched/naturally upright so there will be variations of this posture amongst us. What is important is that the posture feels gentle and not forced or unnatural for your own body.

Some people find having a block under their feet helpful if their feet do not easily touch the floor, or to have a rolled up blanket against the back of the chair to support their lower spine. Please ask if you would like a block or blanket. As before, this slide [shows PowerPoint slide] will remain on the screen throughout the meditation to remind you of an example of a slouched/natural upright posture. You will notice on the slide there is also an example of a natural upright/slouched posture to show the sort of difference in posture we are looking for between the two meditations.

Please try to remain in your slouched/natural upright posture as much as is comfortable for you to do so during the meditation. If you start to feel uncomfortable or you feel pain at any time, know that it is fine to make adjustments to the way you are sitting before returning to your original posture, if you can. If you do need to make some adjustments, please if possible try to still maintain a degree of slouching/natural uprightness, so long as this does not cause you any pain or discomfort.

So, to adopt your own slouched/natural upright posture, please listen to the guidance on the recording I will now play. Before you hear the meditation instructions, there will be a short pause when there will be opportunity for anyone to ask questions or for help.

<Start slouched/natural upright posture guidance recording>

We will now start the recording and do a 15 minute Mindfulness practice. I will also be closing my eyes and doing the practice with you as a group.

<Start meditation 2 recording>

Post-test questionnaires (2)

Please sit however you wish and take a few minutes to readjust to having your eyes open and being out of the meditation practice.

When you're ready, please open the booklet at page 15 and complete all the remaining questionnaires, keeping in mind the meditation experience you have just had. After you have finished writing please wait in your seat and check back to ensure you haven't missed any questions.

Close

This is the end of the session. Thank you again for your participation today. Before you go, please ensure that you leave your pen and booklet. Please remember to take your pre-study booklet with you for your future reference.

I will remain behind in this room for the next 15 minutes should anyone wish to discuss any issues or questions that have arisen during the study.

Goodbye.

Appendix J

Participant consent form

Title of Project: The effect of body posture on the outcomes and experiences of mindfulness practice

Name of Researcher: Claire Jones

Please initial box

1. I confirm that I have read and understand the information sheet dated..... (version.....) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without my legal rights being affected.	
3. I agree that anonymous quotes from my questionnaire responses may be used in published reports of the study findings.	
4. I agree to take part in the above study.	
5. To the best of my knowledge I have no known medical conditions that would preclude me from participating: - Current diagnosis of, or currently receiving treatment for a mood disorder (e.g. depression, anxiety) - Postural difficulties which would make it difficult or uncomfortable to remain in a seated position for 15 minutes - Regular (once a week or more) meditation or mindfulness practice in the past 12 months.	

Name of Participant _____ Date _____

Signature _____

Name of Person taking consent _____ Date _____

Signature _____

Appendix K

Transcript of posture guidance

Posture 1: Natural upright (mindfulness seated posture instructions)

INSTRUCTIONS

Sitting away from the back of the chair so that your spine can be self-supported; or alternatively if it feels more comfortable to do so, sitting into the back of the chair or blanket for support. Releasing your sitting bones so that you sink further down, allowing your full weight to be supported by the chair. Relaxing your head, allowing the back of your neck to lengthen and the crown of your head to move towards the ceiling; taking your spine and torso upwards with it. Allowing your head and neck to feel balanced on your shoulders and inviting your shoulders to relax and soften. Placing your hands on your knees, or in your lap in a comfortable way.

Spending a few moments now bringing awareness to your body posture and making any adjustments that help you to feel more comfortable. As best you can, relaxing into this exercise; freeing your neck and spine to gently lengthen upwards, following your own natural alignment. And being aware that it is fine for your posture to move or shift during the practice so that you do not feel any strain.

So, closing your eyes now, if that feels comfortable, or alternatively having a soft gaze on the floor, a few feet in front of you....

Posture 2: Slouched condition

INSTRUCTIONS

Sitting away from the back of the chair so that your spine can be free; or alternatively if it feels more comfortable to do so, sitting into the back of the chair or blanket. Releasing your sitting bones so that you sink further down, allowing your full weight to be supported by the chair. Allowing your rib cage to fall and your body to gently slump in a downwards direction. Allowing the spine and neck to gently curve, so that the crown of your head no longer points up towards the ceiling. Inviting your shoulders to relax and roll forwards, and placing your hands on your knees or in your lap in a comfortable way.

Spending a few moments now bringing awareness to your body posture and making any adjustments that help you to feel more comfortable. As best you can, relaxing into this exercise, allowing your body to slouch in a way that feels natural to you. And being aware that it is fine for your posture to move or shift during the practice so you do not feel any strain.

So, closing your eyes now, if that feels comfortable, or alternatively having a soft gaze on the floor, a few feet in front of you...

Reminders of posture (to appear every 5 minutes during meditation)

INSTRUCTIONS

Your posture may move about or change during the practice, this is natural and to be expected. Whenever you notice your posture has changed, gently and kindly focus your attention back to the way that you are sitting. As best you can, just try to maintain a degree of upward lengthening /slouching in your posture, so long as that feels comfortable.

Appendix L

Transcript of mindfulness practice (adapted from and used with permission from Arch & Craske, 2006)

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Appendix M

Summary of research findings (sent to participants and ethics panel)

E-mail sent to participants (who requested feedback):

Dear all

You may recall some time ago that you kindly participated in my study on mindfulness. At the time, you expressed an interest in receiving a copy of the study findings. The research has now been completed and I am e-mailing you to let you know what was found which I hope you will find interesting. Please see below for a short summary:

An Investigation into the Role of Body Posture in Mindfulness Practice

This study investigated the relationship between body posture and some of the known outcomes of mindfulness practice. Participants meditating in an upright posture were predicted to report greater levels of mindfulness skills, more positive mood and a greater ability to tolerate their distress than when meditating in a slouched posture. Thirty nine adults participated in the study, carrying out a 15-minute mindfulness breathing exercise in both an upright and a slouched posture. Participants completed questionnaires about their mindfulness skills, mood and distress tolerance; they also wrote about their own experiences of doing the practice in the two postures.

Analysis of the data found that none of the study predictions were supported. There was no difference in levels of mindfulness skills between the two postures; perhaps because of the way that mindfulness was measured in this study. In both postures participants reported a decrease in negative mood at the end of the practice which is in keeping with research that shows mindfulness practice can be associated with improved psychological well-being.

During the practice, participants in the slouched posture seemed to experience a decrease in their ability to tolerate their distress; this is in keeping with theory that suggests there is a

relationship between the body and the experience of emotion. From participants' reported experiences, it appeared that breathing was easier in the upright posture. Together, these findings may provide some support for the importance of attending to an upright posture during mindfulness practice. This was an initial exploratory study and further research is required to better understand the role of posture and the body in general, in the beneficial outcomes of mindfulness-based interventions.

If you have any queries about the research or would like to discuss anything further then please don't hesitate to get in touch. I would like to take this opportunity to thank you once again for your participation in the study, without this the study would not have been possible.

Best regards

Claire Jones

Trainee Clinical Psychologist

Salomons Campus

Letter sent to ethics panel:

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Appendix N

Example of a coded transcript

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Appendix O

Table A1

Coding framework

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Appendix P

Table B2

Within participants frequency data

Did your experience of the meditation practice differ between the two postures? If yes, briefly describe in what way the experiences were different for you?

Category	Subcategory	Code relates to slouched posture			Code relates to upright posture		
		Slouch first	Upright first	Total (slouch)	Slouch first	Upright first	Total (upright)
Alertness	Awake	0	0	0	5	1	6
	Sleepiness	4	4	8	0	0	0
Attention	Thoughts wandered	1	2	3	0	0	0
	Distracted	4	5	9	0	0	0
	Maintained focus	2	0	2	6	4	10
	Inwards focus	0	0	0	0	0	0
Physical feelings	Awareness of neutral sensory experiences	0	0	0	0	0	0
	Physical discomfort	4	5	9	0	2	2
	Physical comfort	0	2	2	4	3	7
The breath	Breathing more difficult	1	4	5	0	0	0
	Breathing easy	0	1	1	1	1	2
Arousal	Relaxed	5	4	9	3	2	5
	Tense	0	0	0	1	1	2
Emotion	Creativity	0	0	0	0	0	0
	Positive affect	0	0	0	6	1	7
	Negative affect	1	3	4	0	0	0
	Difficult feelings eased	0	0	0	0	0	0

Attitude towards experience	Acceptance	0	0	0	1	0	1
	Self-compassion	0	0	0	1	1	2
Posture	Getting it “right”	0	0	0	0	0	0
	Posture recall	0	2	2	2	3	5
	Slouching “wrong”	0	2	2	0	0	0

Appendix Q

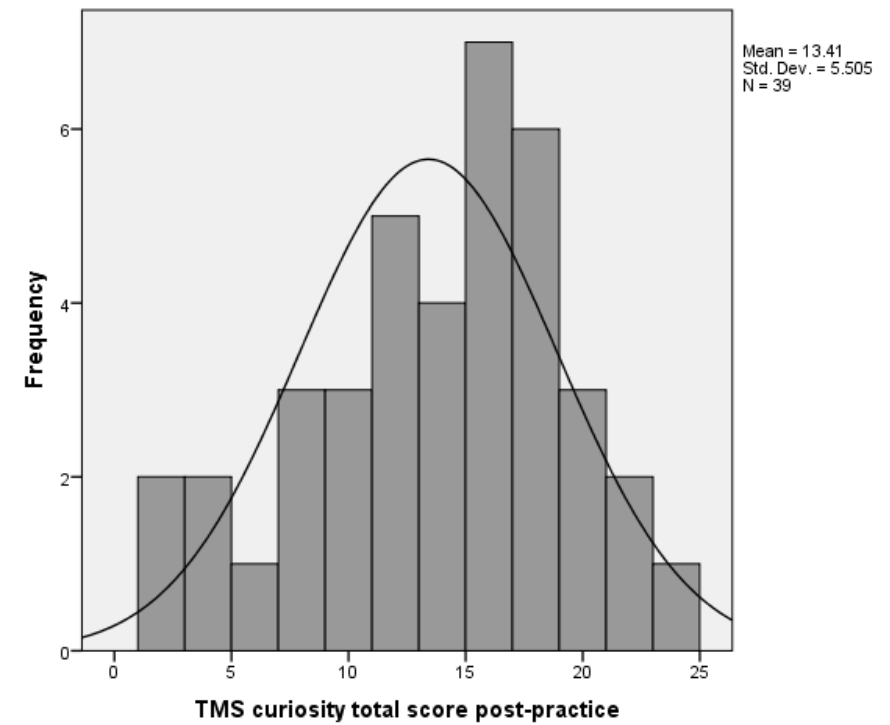
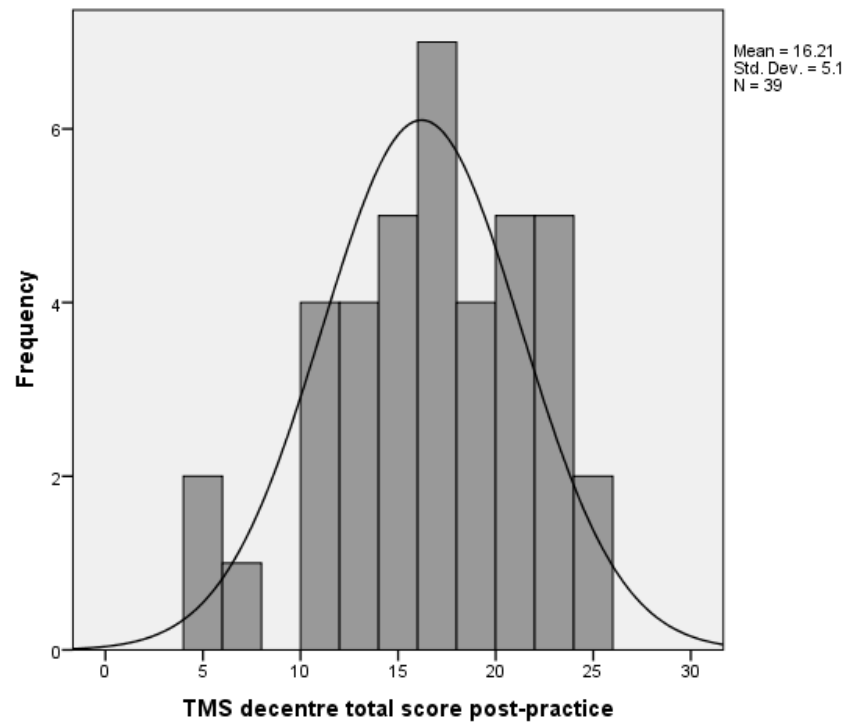
Copies of SPSS output tables for main analyses and frequency distribution graphs

Mindfulness (TMS decentre factor)**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
TMS 1 post meditation decentre total	Equal variances assumed	.075	.786	-1.491	37	.144	-2.405	1.612	-5.672	.862
	Equal variances not assumed			-1.510	37.000	.140	-2.405	1.592	-5.631	.822

Mindfulness (TMS curiosity factor)**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
TMS 1 post meditation curiosity total	Equal variances assumed	2.588	.116	-1.089	37	.283	-1.921	1.764	-5.494	1.653
	Equal variances not assumed			-1.114	36.332	.273	-1.921	1.724	-5.416	1.575



Distress tolerance (DTS)**Tests of Within-Subjects Effects**

Measure: MEASURE_1

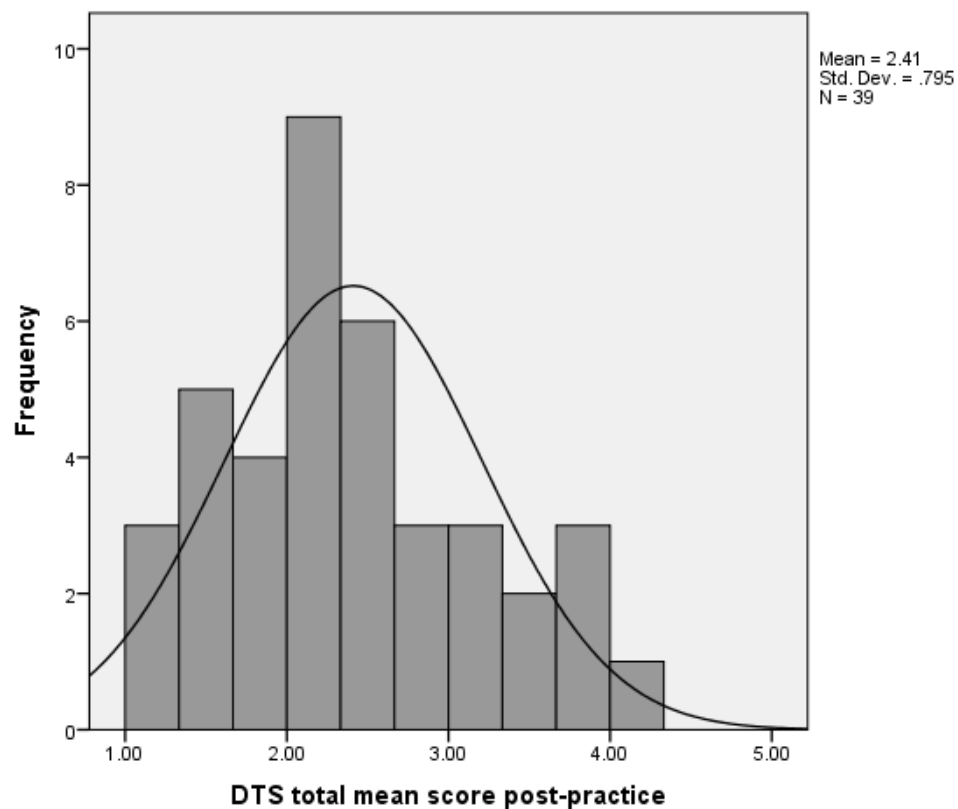
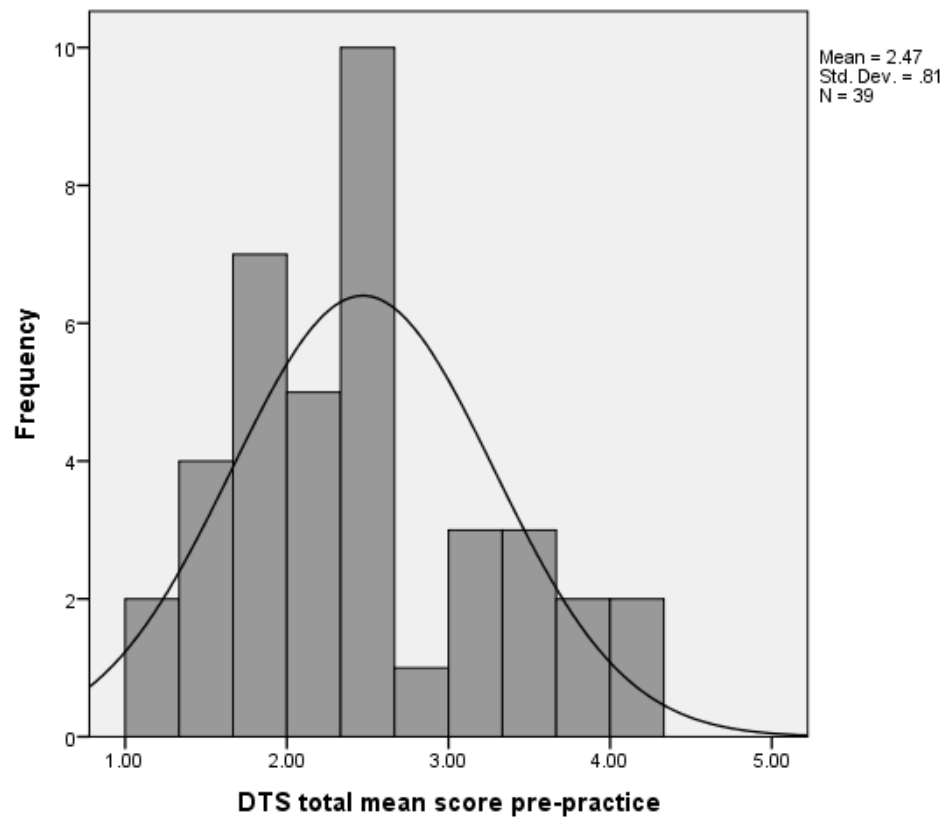
Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	.043	1	.043	.512	.479
	Greenhouse-Geisser	.043	1.000	.043	.512	.479
	Huynh-Feldt	.043	1.000	.043	.512	.479
	Lower-bound	.043	1.000	.043	.512	.479
time * posture	Sphericity Assumed	.479	1	.479	5.694	.022
	Greenhouse-Geisser	.479	1.000	.479	5.694	.022
	Huynh-Feldt	.479	1.000	.479	5.694	.022
	Lower-bound	.479	1.000	.479	5.694	.022
Error(time)	Sphericity Assumed	3.111	37	.084		
	Greenhouse-Geisser	3.111	37.000	.084		
	Huynh-Feldt	3.111	37.000	.084		
	Lower-bound	3.111	37.000	.084		

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	462.985	1	462.985	378.003	.000
Posture	.094	1	.094	.076	.784
Error	45.318	37	1.225		



Positive affect (PANAS)**Tests of Within-Subjects Effects**

Measure: MEASURE_1

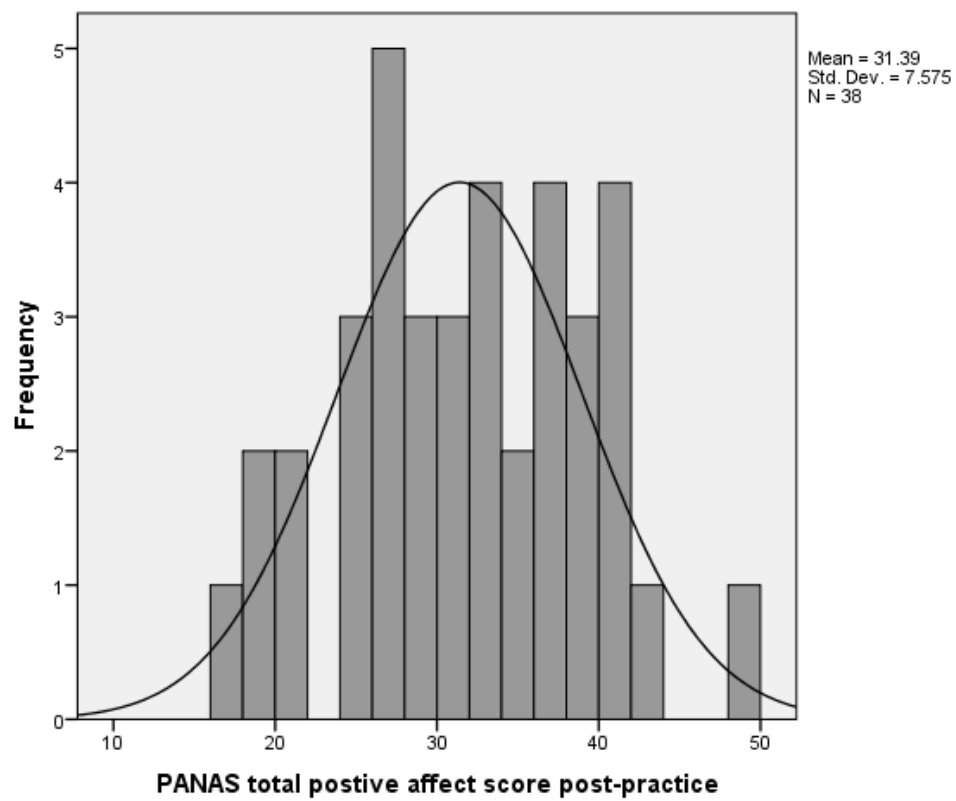
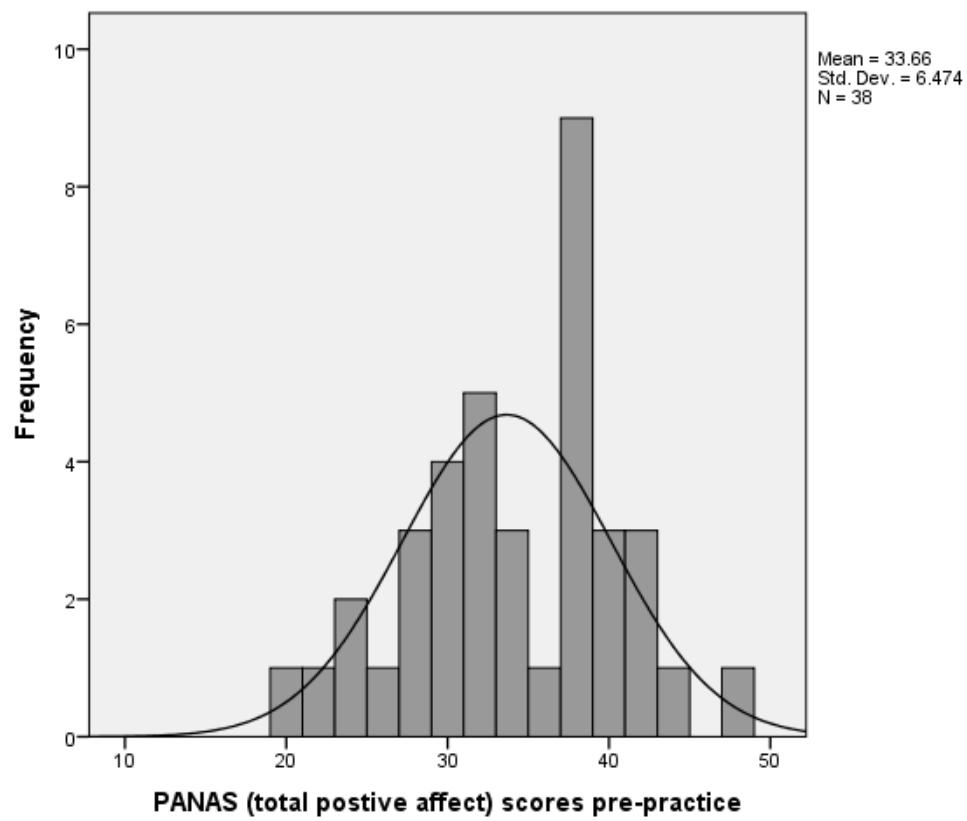
Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	91.243	1	91.243	6.968	.012
	Greenhouse-Geisser	91.243	1.000	91.243	6.968	.012
	Huynh-Feldt	91.243	1.000	91.243	6.968	.012
	Lower-bound	91.243	1.000	91.243	6.968	.012
time * posture	Sphericity Assumed	32.295	1	32.295	2.466	.125
	Greenhouse-Geisser	32.295	1.000	32.295	2.466	.125
	Huynh-Feldt	32.295	1.000	32.295	2.466	.125
	Lower-bound	32.295	1.000	32.295	2.466	.125
Error(time)	Sphericity Assumed	471.389	36	13.094		
	Greenhouse-Geisser	471.389	36.000	13.094		
	Huynh-Feldt	471.389	36.000	13.094		
	Lower-bound	471.389	36.000	13.094		

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	80285.432	1	80285.432	915.227	.000
Posture	11.958	1	11.958	.136	.714
Error	3157.989	36	87.722		



Negative affect (PANAS)**Tests of Within-Subjects Effects**

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	55.296	1	55.296	5.653	.023
	Greenhouse-Geisser	55.296	1.000	55.296	5.653	.023
	Huynh-Feldt	55.296	1.000	55.296	5.653	.023
	Lower-bound	55.296	1.000	55.296	5.653	.023
time * posture	Sphericity Assumed	3.980	1	3.980	.407	.528
	Greenhouse-Geisser	3.980	1.000	3.980	.407	.528
	Huynh-Feldt	3.980	1.000	3.980	.407	.528
	Lower-bound	3.980	1.000	3.980	.407	.528
Error(time)	Sphericity Assumed	352.125	36	9.781		
	Greenhouse-Geisser	352.125	36.000	9.781		
	Huynh-Feldt	352.125	36.000	9.781		
	Lower-bound	352.125	36.000	9.781		

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	24091.896	1	24091.896	488.205	.000
Posture	4.896	1	4.896	.099	.755
Error	1776.525	36	49.348		

