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ORIGINAL PAPER

Comparing Mindfulness-Based Intervention Strategies: Differential Effects of Sitting Meditation, Body Scan, and Mindful Yoga

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Abstract We investigated whether three different meditation practices that are commonly used in mindfulness-based interventions lead to differential changes in psychological health outcomes when presented separately. Participants included 141 undergraduates assigned to a sitting meditation, body scan, or mindful yoga condition. Participants in all conditions attended three weekly 1-h sessions (105 min of guided meditation and 75 min of discussion) in addition to pre- and post-intervention questionnaires collected in separate sessions. Participants reported significant improvements in the tendency to describe one's experience, rumination, self-compassion, and psychological well-being regardless of condition. The following between-group differences in change over time emerged: (1) mindful yoga was associated with greater increases in psychological well-being than the other two practices, (2) sitting meditation and mindful yoga were both associated with greater decreases in difficulties with emotion regulation than the body scan, and (3) sitting meditation was associated with greater increases in the tendency to take a nonevaluative stance toward observed stimuli than the body scan.

Keywords Mindfulness · Mindfulness-based interventions · Well-being · Meditation · Yoga · Body scan

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Introduction

Intervention dismantling studies are necessary for illuminating which components of a treatment program produce change (Shapiro & Carlson, 2009). This type of investigation may be particularly important for mindfulness-based interventions (MBIs), which typically employ several distinct training techniques. Influenced by Mindfulness-based Stress Reduction (MBSR; Kabat-Zinn, 1982, 1990), MBIs often consist of three main meditation practices (Chiesa & Serretti, 2011). These include (1) body scan, in which participants sequentially and non-judgmentally focus their attention on parts of the body; (2) sitting meditation, in which participants focus their attention on their breathing, sounds in the environment, body sensations, and their stream of thoughts and emotions; and (3) mindful yoga, in which participants cultivate mindful awareness of the body while it is moving, stretching, or holding a position.

In their entirety, MBIs have been shown to lead to increased levels of self-reported mindfulness and improvements in psychological functioning (Astin, 1997; Shapiro, Schwartz, & Bonner, 1998; Carmody & Baer, 2008). However, despite the success of these treatments, very few studies to date have investigated the relative effects of the multiple components (e.g., sitting meditation, body scan, mindful yoga) that are often included in such programs. An outcome study by Carmody and Baer (2008) provides preliminary support for the value of examining the separate contributions of treatment components in MBIs. They reported that differential practice time for each meditation exercise (sitting meditation, body scan, and mindful yoga) was associated with divergent outcomes in a population with varied medical and anxiety conditions (e.g. the amount of time spent practicing Yoga, but not sitting meditation of mindful yoga, was associated with an increased nonjudgment of internal experience). Although there was some overlap on outcomes, these findings suggest that the

mindfulness practices commonly included in MBIs may target different aspects of psychological health.

The present study investigated whether three practices commonly used in MBIs, presented separately, lead to differential changes in psychological health following a 3-week intervention. Typically, MBIs are implemented for 6–8 weeks; however, MBIs with short durations have been reported with no loss of efficacy (Carmody & Baer 2008; Jain et al., 2007).

Method

Participants and Procedure

A priori power analyses revealed that a sample of 130 participants would yield 80 % power to detect small significant interaction effects of condition and time. A total of 141 (71 % female) participants were recruited from a pool of undergraduates (N=1200) enrolled in psychology at a large public university. Mean age was 18.85; the sample was 85 % Caucasian and 9 % African-American, with 6 % reporting another race. Participants volunteered via an online registration program in order to receive course credit. The three study conditions (sitting meditation, body scan, and mindful yoga) were posted as separate time slots under the same study heading: Meditation Study. Participants were assigned to conditions based on the time slot for which they enrolled. Participants were not given information about the specific experimental condition when enrolling; the same study description was provided for each condition, and study sessions were offered at similar times of day. Further, participation in one condition precluded enrollment in other conditions.

Participants in all conditions attended three weekly 1-h mindfulness training sessions, which totaled approximately 105 min of meditation practice and 75 min of discussion (i.e., reflections of participant experience, common difficulties such as mind wandering, real-life application, etc.). Experienced graduate students led guided meditations and facilitated discussion on sitting meditation, body scan, or mindful yoga, depending on the condition. Facilitators followed scripts directly transposed from meditations on CD (mindful yoga, Kabat-Zinn, 1990; sitting meditation and body scan, Segal, Williams, & Teasdale, 2002) in order to standardize the meditations. In the session preceding the mindfulness training intervention, participants completed questionnaires and were given a brief introduction to mindfulness. They were also given a CD with guided meditation tracks for sitting meditation, body scan, or mindful yoga, based on enrolled study condition, to practice at home (mindful yoga, Kabat-Zinn, 1990; sitting meditation and body scan, Segal et al. 2002); participants in the yoga condition were also given photocopies of yoga poses (Kabat-Zinn, 1990). Though participants were encouraged to practice at home every day, adherence was not assessed. Participants completed the same questionnaire battery in a separate session following the 3-week intervention. Study procedures were approved by the university Institutional Review Board.

All facilitators had experience leading MBIs, including MBSR, Acceptance and Commitment Therapy, and Dialectical Behavior Therapy in outpatient group and individual formats. Facilitators were trained and supervised by a licensed clinical psychologist/research mentor who had completed intensive training in MBSR at the University of Massachusetts Medical School. Weekly discussion of study sessions occurred, and feedback was provided as appropriate. Further, facilitators had personal meditation practices ranging from 1.5 to 5 years.

Measures

The Depression Anxiety Stress Scales (DASS; Lovibond and Lovibond 1995) was used to assess psychological symptoms. Internal consistency for the total score was high (α=0.91). The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) assesses problems in adaptive emotion regulation. Total score internal consistency was high (α=0.88). The rumination subscale of the Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999) assessed the tendency to engage in rumination. Internal consistency was high (α=0.90). The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) assesses five separate facets of mindfulness: (1) observing, (2) describing, (3) nonjudging, (4) nonreactivity, and (5) acting with awareness. Use of a total scale score is not recommended. Each subscale demonstrated adequate to high internal consistency (α ranged from 0.78 to 0.91). The Scales of Psychological Well-Being (SPWB; Ryff, 1989) assesses six dimensions of psychological well-being, which can be summed to form a total score. Internal consistency was high for the total score (α=0.89). The Self-Compassion Scale (SCS; Neff, 2003) assessed self-compassion. The SCS demonstrated high internal consistency (α=0.92).

Analytic Strategy

Following data screening and preliminary descriptive analyses, analyses were carried out using the linear mixed-effects modeling module in SPSS. This method was selected for its ability to accommodate dependence of observations (i.e., time points nested within participants) and its advanced approach to missing data. Because data were collected at only two points, random effects were not estimated. Estimates are unstandardized beta weights. Due to the large number of statistical analyses conducted, the threshold for

statistical significance was set at $p \leq 0.01$. Though not the most conservative correction for multiple tests, it has been used in similar exploratory studies to minimize chance findings while maintaining a reasonable amount of power (see Carmody & Baer, 2008).

Our first set of analyses examined the main effect of time —that is, whether each outcome variable changed across time in the full sample; time (0=time 1, 1=time 2) was entered as the only predictor. Our second set of analyses used two different condition variables to test for baseline differences and condition×time effects (see Shek & Ma, 2011). These models included time, condition (see condition coding schemes below), and the condition×time interaction. Significant main effects of condition variables represent baseline differences (from the reference group) on the outcome variable. Significant condition×time interactions represent differences from the reference group in change over time. Using two codings for condition allowed us to compare each condition's main and interactive effects to each other's condition main and interactive effects. The first coding scheme allowed for comparisons of sitting meditation (coded 1) and body scan (coded 2) to mindful yoga (coded 3; the reference group). The second coding scheme allowed for comparisons of mindful yoga (coded 1) and body scan (coded 2) to sitting meditation (coded 3; the reference group).

Results

Data Screening and Preliminary Analyses

All outcome variables met the assumption of normality. A substantial number of individuals did not return for the follow-up visit (22.6 %); Little's (1988) missing completely at random test was significant, providing support for the assumption (of mixed modeling) that missing data are missing at random rather than missing completely at random (X^2 (1,070)=1,170.293, p=0.01).

Preliminary descriptive analyses revealed no significant differences in sex, age, race, or grade level between the three treatment conditions. Descriptives for outcome variables pre- and post-intervention for each condition can be found in Table 1; pre–post effect sizes (Cohen's d) were calculated for each outcome in the full sample and within each condition and are also included. Independent samples on t tests revealed no significant baseline differences in any outcome variables.

Main Effects of Time and Condition

Models predicting outcomes from time only in the full sample indicated significant improvements over time in rumination (B_{time}=−2.73, SE=0.71, t(117)=−3.82, p<0.001), the tendency to describe (B_{time}=1.53, SE=0.39, t(107)=3.89, p<0.001), self-compassion (B_{time}=6.26, SE=1.97, t(124)=3.18, p=0.002), and psychological well-being (B_{time}=6.19, SE=2.36, t(108)=2.62, p=0.01) regardless of the condition. Significant effects of time within the separate conditions are noted in Table 1.

Models predicting outcomes from time, condition variables, and the interaction of condition variables with time (see "Analytic Strategy"). There were no main effects of condition, indicating no baseline differences between conditions on any outcome variable (all p's>0.06).

Time by Condition Interactions

Comparing the Effects of Mindful Yoga to Sitting Meditation and Body Scan over Time

Results of these models indicated that psychological well-being improved more in the mindful yoga condition than the other two conditions ($B_{sitting\times time}$=−16.76, SE=5.77, t(109)=−2.90, p=0.004; $B_{bodyscan\times time}$=−15.94, SE=5.42, t(109)=−2.94, p=0.004). Simple effects of time on psychological well-being within the three conditions indicated that psychological well-being increased significantly over time in the mindful yoga condition only (sitting meditation, B_{time}=0.34, SE=3.86, t(33)=−09, p=0.93; body scan, B_{time}=1.18, SE=3.50, t(39)=0.34, p=0.74; mindful yoga, B_{time}=17.24, SE=4.39, t(36)=−3.90, p<0.001). Additionally, emotion regulation difficulties improved more in the mindful yoga condition than in the body scan condition ($B_{bodyscan\times time}$=7.94, SE=3.34, t(108)=2.37, p=0.01). Simple effects of time on difficulties in emotion regulation within the two conditions indicated that changes over time were significant in the mindful yoga condition but not in the body scan condition (mindful yoga, B_{time}=−5.64, SE=1.73, t(34)=−3.24, p=0.003; body scan, B_{time}=2.42, SE=2.59, t(40)=0.94, p=0.35).

Comparing the Effects of Sitting Meditation to Body Scan over Time

Finally, we fit similar models with an alternate contrast coding scheme allowing the comparison of changes over time in sitting meditation and body scan (see "Analytic Strategy"). Results indicated that difficulties in emotion regulation improved more in the sitting meditation condition than in the body scan condition ($B_{bodyscan\times time}$=8.28, SE=3.41; t(106)=2.42, p=0.01). As noted before, the simple effect of time on difficulties in emotion regulation was not significant within the body scan condition; however, the simple effect of time on difficulties in emotion regulation within the sitting meditation condition was marginally

Table 1 Means and standard deviations for outcome variables pre- and post-treatment

Variable	Full sample			Sitting meditation condition			Body scan condition			Mindful yoga condition		
	Pre M (SD)	Post M (SD)	d	Pre M (SD)	Post M (SD)	d	Pre M (SD)	Post M (SD)	d	Pre M (SD)	Post M (SD)	d
Psychological symptoms (DASS)	32.53 (8.60)	32.78 (9.13)	0.03	34.04 (10.30)	32.23 (8.01)	0.20	30.36 (6.82)	33.69 (11.34)	0.35	33.23 (8.15)	32.35 (7.60)	0.11
Rumination (RRQ)	40.92 (8.56)	30.38 (9.28)	1.18*	41.08 (9.64)	39.76 (8.51)	0.15	40.25 (8.31)	36.82 (9.51)	0.38*	41.43 (7.82)	38.79 (9.69)	0.30
Emotion regulation difficulties (DERS)	70.71 (17.43)	68.17 (17.91)	0.14	72.44 (19.63)	67.34 (16.73)	0.28	67.86 (16.39)	70.02 (19.97)	0.12	71.95 (16.04)	66.92 (16.86)	0.30*
Observe (FFMQ)	25.73 (5.15)	27.04 (5.66)	0.24	26.39 (6.00)	26.96 (6.19)	0.09	24.38 (5.55)	25.62 (4.57)	0.25	26.52 (4.80)	28.69 (5.96)	0.40
Describe (FFMQ)	27.32 (5.00)	29.10 (5.40)	0.34*	26.53 (4.66)	27.54 (4.27)	0.23	27.26 (4.85)	29.20 (5.13)	0.39*	28.15 (5.45)	30.37 (6.29)	0.37*
Acting with awareness (FFMQ)	25.91 (5.04)	26.30 (4.74)	0.08	25.68 (4.81)	27.15 (4.13)	0.33	26.52 (5.52)	25.82 (5.43)	0.13	25.52 (3.32)	26.05 (4.48)	0.13
Nonjudging (FFMQ)	28.38 (5.64)	29.56 (5.76)	0.21	27.48 (5.63)	29.60 (5.70)	0.37*	29.63 (5.38)	29.15 (6.07)	0.08	27.95 (5.82)	29.97 (5.58)	0.36
Nonreactivity (FFMQ)	21.43 (4.13)	21.87 (4.66)	0.10	21.23 (4.38)	21.72 (4.71)	0.11	21.53 (4.06)	22.00 (4.26)	0.11	21.52 (4.05)	21.86 (5.14)	0.07
Self-compassion (SCS)	81.70 (18.17)	87.71 (18.08)	0.33*	81.30 (16.53)	84.67 (16.32)	0.21*	83.80 (18.54)	87.36 (19.14)	0.19	79.70 (19.54)	90.69 (18.53)	0.58*
Psychological well-being (SPWB)	248.60 (32.89)	255.13 (33.05)	0.20*	246.48 (34.71)	246.33 (32.08)	0.005	251.51 (33.35)	252.45 (33.37)	0.03	247.44 (31.10)	265.60 (31.54)	0.58*

DASS Depression, Anxiety, Stress Scales; *RRQ* Rumination-Reflection Questionnaire; *DERS* Deficits in Emotion Regulation Scale; *FFMQ* Five Facet Mindfulness Questionnaire; *SCS* Self-Compassion Scale; *SPWB* Scales of Psychological Well-being

*$p \leq 0.01$ (significant results of models predicting outcome from time)

significant (sitting meditation, $B_{time}=-5.66$, $SE=2.63$, $t(37)=2.15$, $p=0.03$). Results also indicated that nonjudging ($B_{bodyscan\times time}=-2.99$, $SE=1.23$; $t(112)=-2.44$, $p=0.01$) improved more in the Sitting condition than in the body scan condition. Simple effects of time on nonjudging within the two conditions indicated that nonjudging increased significantly in the sitting meditation condition, but not in the body scan condition (sitting meditation, $B_{TIME}=2.25$, $SE=0.89$, $t(35)=2.52$, $p=0.008$; body scan, $B_{time}=-0.76$, $SE=0.82$, $t(40)=0.93$, $p=0.35$).

Discussion

The purpose of the present study was to investigate whether three meditation practices often used in MBIs (sitting meditation, body scan, and mindful yoga) produce different changes in psychological symptoms and well-being when presented separately in a brief 3-week format. Undergraduate volunteers received training in one of three meditation practices. After the intervention, participants reported decreased rumination, increased tendency to describe experiences, increased self-compassion, and increased psychological well-being regardless of study condition. Overall, the improvements in psychological functioning reported here are consistent with improvements seen in studies evaluating MBIs in their entirety (Baer, 2003; Keng, et al., 2011), supporting the notion that the effects of MBIs may not be due to any one component of these interventions. However, that magnitude of the effects in the present study were generally small to medium (with the exception of a large effect for rumination), while effects sizes found in previous MBSR studies have typically been medium to large (see Carmody and Baer, 2008; Carmody, Baer, Lykins, & Olendzi, 2009; Greeson et al., 2011).

The primary goal of this study was to investigate whether a particular meditation practice may be more suited to address a particular symptom or deficit in well-being. For most outcomes, change over time did not differ by condition; however, some interesting differences did emerge. First, mindful yoga was associated with greater improvements in psychological well-being than the other two conditions. Second, difficulties in emotion regulation were improved more in the mindful yoga and sitting meditation conditions than in the body scan condition. Finally, although both sitting meditation and mindful yoga led to roughly equivalent improvements in the ability to adopt a nonjudgmental stance toward experience, sitting meditation led to greater gains in this area than the body scan.

There are several ways in which this pattern of results can be explained. First, the physical nature of yoga may be responsible for cultivating higher levels of well-being; the practice may act as behavioral activation, a very effective component of behavioral treatments that reintroduce

feelings of mastery and positive affect into an individual's life (Jacobson, Dobson, & Truax, 1996; Caldwell, et al., 2011). This is consistent with longstanding evidence that physical exercise promotes psychological health (see Walsh, 2011) and could account for early advantages associated with mindful yoga that might not persist in a longer intervention. Second, Sitting Mediation may be more effective than body scan at cultivating a nonjudgmental stance due to more explicit instructions against judging one's experiences. For example, although body scan instructions include acceptance of sensations as they are, sitting meditation instructions repeatedly and explicitly instruct against judging one's experience (i.e., "don't label your thoughts as good or bad, or important or silly, but just notice whatever comes along"). Finally, both sitting meditation and mindful yoga led to significantly greater improvement in emotion regulation than body scan. This may be, again, due to the fact that sitting meditation provides more explicit instructions for handing strong emotions (i.e., "observe the feelings without trying to get rid of them or clinging to them, but just allowing them to be there"), while a more active strategy, like yoga, may also be easier for novice meditators to call upon in times of strong emotions.

Limitations

There are significant limitations to the present study that limit our ability to draw conclusions. First, the short duration of the training (three 1-h sessions with only 105 min of meditation practice) may have limited the effectiveness of the intervention (null findings and small effect sizes). Relatedly, lack of homework adherence tracking made it impossible to determine exact amount of participant exposure to mindfulness and to explore practice effects. Additionally, lack of formal teacher training may have compromised the integrity of the meditation practices, limiting their effectiveness. Further, lack of random assignment limits the ability to make causal inferences about the effect of condition on outcome. A sample of student volunteers represents an additional study limitation; participants may have been insufficiently distressed, leading to limited change in psychological symptoms. Finally, the lack of a waitlist control group, without which it is not possible to rule out the possibility that changes over time are best attributed to the mere passage of time rather than active treatment effects. Overall, this study represents a preliminary attempt to isolate the unique effects that three formal meditation practices commonly used in mindfulness-based interventions have on the positive outcomes associated with such treatments. Given the limitations associated with the present study (delineated above), it is hoped that these promising preliminary findings encourage future, larger-scale MBI dismantling studies.

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