

The Effects of Mindfulness Meditation on Cognitive Processes and Affect in Patients With Past Depression

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This study describes the effects of an 8-week course in Mindfulness-Based Stress Reduction (MBSR; J. Kabat-Zinn, 1982, 1990) on affective symptoms (depression and anxiety), dysfunctional attitudes, and rumination. Given the focus of mindfulness meditation (MM) in modifying cognitive processes, it was hypothesized that the primary change in MM practice involves reductions in ruminative tendencies. We studied a sample of individuals with lifetime mood disorders who were assessed prior to and upon completion of an MBSR course. We also compared a waitlist sample matched with a subset of the MBSR completers. Overall, the results suggest that MM practice primarily leads to decreases in ruminative thinking, even after controlling for reductions in affective symptoms and dysfunctional beliefs.

KEY WORDS: meditation; cognitive processes; rumination; affective disorders; treatment outcomes.

INTRODUCTION

Dysfunctional attitudes and rumination are cognitive attributes associated with a vulnerability to developing, maintaining, and relapsing into a depressive disorder (for reviews, see Beck, 1967; Beck, Rush, Shaw, & Emery, 1979; Ingram, Miranda, & Segal, 1998; Nolen-Hoeksema, 1991). Dysfunctional attitudes are characterized by negative, rigid, and extreme assumptions and beliefs about self-worth and typically involve conditional standards in areas of evaluation, perfectionism, and interpersonal approval (Weissman & Beck, 1978; Zuroff, Blatt, Sanislow, Bondi, & Pilkonis, 1999). Elevated dysfunctional attitudes are commonly reported in currently depressed individuals (for a review, see Haaga, Dyck, & Ernst, 1991), but recovered depressed individuals tend not to differ from healthy controls in the

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number and intensity of dysfunctional attitudes they endorse, unless challenged by sad mood or a stressor (for reviews, see Ingram, Miranda, & Segal, 1998; Segal & Ingram, 1994). This suggests that dysfunctional attitudes are mood state-dependent. Thus, while extreme and dysfunctional attitudes are likely to be available in the minds of vulnerable individuals, they are generally not accessible unless activated by a personally relevant environmental demand or by an increase in negative mood (for examples of research studies demonstrating this, see Miranda, 1992; Miranda, Gross, Persons, & Hahn, 1998; Miranda & Persons, 1988; Miranda, Persons, & Byers, 1990).

While dysfunctional attitudes reflect the content of the mind (i.e., what a person thinks about), rumination is associated with the processes of the mind, that is, how a person relates to the content of the mind. Rumination has been defined as passively focusing one's attention on a negative emotional state like depression, its symptoms, and thinking repetitively about the causes, meanings, and consequences of that state (Nolen-Hoeksema, 1991). Individuals who ruminate report they believe this will increase their understanding of themselves and solve their problems, but studies suggest ruminators are ineffective in active, interpersonal problem-solving and show an inflexible, perseverative cognitive style on a traditional neuropsychological test of novel problem solving (Davis & Nolen-Hoeksema, 2000; Lyubomirsky & Nolen-Hoeksema, 1995; Watkins & Baracaia, 2002). Both laboratory and field studies have demonstrated that ruminating in response to negative moods is associated with maintenance of depression and exacerbated sad affect (Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, Morrow, & Fredrickson 1993). Rumination has also been shown to increase the risk of developing depressive episodes in healthy participants who were followed prospectively (Just & Alloy, 1997; Robinson & Alloy, 2003; Spasojević & Alloy, 2001). Moreover, as reported by Spasojević and Alloy (2001), rumination mediated several other hypothesized risk factors that prospectively predicted number of depressive episodes, including dysfunctional attitudes, neediness, self-criticism, and history of past depression. Thus, a ruminative response style appears to be a factor in both the onset and maintenance of depression and a relevant target for treatments aimed at reducing current and future affective symptoms.

Self-regulatory strategies based on meditation practice, used alone or as adjuncts to other behavioral or medication regimens, may provide a set of techniques for modifying depressogenic cognitive variables such as rumination and dysfunctional beliefs. Mindfulness meditation (MM) is one such strategy that has been used in clinical practice, and existing research studies suggest that it may be a promising form of treatment for several physical and psychological conditions, including stress and mood symptoms in general, anxiety disorders, depression relapse prevention, chronic pain, fibromyalgia, binge eating, substance abuse, and skin related diseases (e.g., Astin, 1997; Goldenberg et al., 1994; Kabat-Zinn, 1990; Kabat-Zinn et al., 1992, 1998; Kabat-Zinn, Lipworth, & Burney, 1985; Kristeller & Hallett, 1999; Marlatt, 2002; Speca, Carlson, Goodey, & Angen, 2000; Teasdale et al., 2000). Results from a recent meta-analytic review corroborate the utility of mindfulness-based treatments for a variety of disorders while highlighting the need for research with sounder methodology (Baer, 2003). The latter point is echoed in a

review by Bishop (2002), who emphasized the need for construct validation and the paucity of randomized controlled studies on Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982, 1990), which limits inferences regarding the efficacy of this approach. Some studies indicate that MM is a useful adjunct to traditional forms of psychotherapy (Kutz et al., 1985; Kutz, Borysenko, & Benson, 1985) and it is an essential component of several more recently developed and empirically validated psychotherapy interventions (e.g., Acceptance and Commitment Therapy, Hayes, Strosahl, & Wilson, 1999; Dialectic Behavior Therapy for borderline personality disorder, Linehan, 1993; Mindfulness-Based Cognitive Therapy for depression, Segal, Williams, & Teasdale, 2002; Relapse prevention for substance abuse, Marlatt & Gordon, 1985).

An ancient Buddhist meditation practice often characterized as the heart of the Buddha's teachings, MM is aimed at reducing mental anguish. Mindfulness has been described as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994, p. 4). One of the goals of MM is to learn how to become aware of, observe and react less habitually to sensations, thoughts, and feelings. MM involves training in deployment of attention to maintain awareness on a designated object, such as the breath or physical sensations in the body, without ignoring other aspects of internal and external stimuli. Thus, participants are instructed to notice the thoughts and feelings that arise without becoming absorbed in their content (Kabat-Zinn, 1982). As is more extensively described by Kabat-Zinn (1990, 1994), Santorelli (1999), and Segal et al. (2002), with repeated training, this exercise is intended to highlight the habitual and automatic patterns of the mind and cultivate a more decentered and nonjudgmental perspective to cognitions, emotions, and sensations (e.g., viewing thoughts and feelings as merely passing events of the mind rather than necessarily accurate reflections of reality). One of the possible consequences of MM practice is a more flexible notion of the self and a more fluid relationship to the content of the mind.

Segal, Teasdale, and Williams have proposed that MM may be beneficial for patients with a history of depression because it is a systematic method of enhancing attentional awareness and allocation (Segal et al., 2002; Teasdale, Segal, & Williams, 1995). As noted above, previously depressed patients may have specific cognitive vulnerabilities, including dysfunctional attitudes and a tendency toward rumination, which increase the risk for further depressive episodes. Segal and colleagues suggest that MM teaches individuals to (a) identify destructive contents and habitual patterns of the mind at an early stage, and (b) relate and process this information in a nonjudgmental way that facilitates the individual choosing between various options. This approach increases flexibility over cognitive activities and allows the individual the possibility to reduce rumination, overgeneralization, and self-critical evaluation and increase constructive cognitive processes such as nonjudgmental observation of the content of the mind. Previously depressed patients utilizing these MM skills may be less susceptible to mood fluctuations and reactivation of pervasive and destructive patterns of thinking and feeling, which, if not contained, may escalate into full-blown depressive episodes (Teasdale, 1988). In support for this theory, a randomized clinical trial found a significant reduction in relapse/recurrence to major depression in recovered patients with three or more previous episodes of major

depression following an 8-week course in Mindfulness-Based Cognitive Therapy (MBCT), which trained the patients to “disengage from dysphoria-activated depressogenic thinking” (Teasdale et al., 2000, p. 615). Moreover, Williams, Teasdale, Segal, and Soulsby (2000) found that compared to a treatment-as-usual control group, recovered depressed patients reduced the number of overgeneral autobiographical memories—a characteristic of depressive cognition—and increased the specificity of their memories following MBCT.

Although there is increased research investigating the efficacy of MM, few studies have examined the mechanisms, especially from a cognitive perspective, by which this particular form of meditation operates. One study that did examine the effect of meditation on attention compared concentrative or focused meditators, who aim to restrict their attention to a single point and ignore extraneous stimuli, to mindfulness or receptive meditators, who seek to distribute their attention and incorporate extraneous stimuli as observational events in their practice (Valentine & Sweet, 1999). The authors found that both groups of meditators demonstrated improved sustained attention in comparison to controls on an auditory perception test, in which the task was to count beeps presented at slower or faster rates. Although the two groups of meditators were equally accurate at estimating the numbers of beeps when the stimulus was slower, the mindfulness meditators showed superior performance of accuracy compared to concentrative meditators when the stimulus was faster. The authors argued that beeps at a slower rate were expected and beeps at a faster rate were less expected. They explained their findings in light of Posner and Snyder’s (1975) theory of expectancy and suggested that mindfulness meditators are less likely to get absorbed or “caught up” in the presenting stimuli and can more easily shift between unexpected stimuli. The results from this study are consistent with the theory of the mechanism involved in MM as proposed by Teasdale et al. (1995), but the study did not address psychiatric populations or symptoms.

To examine the potential impact of MM on affect and negative cognitive patterns in a psychiatrically vulnerable population, we studied a sample of individuals with current or lifetime diagnosis of a mood disorder before and after participation in an MBSR course (Kabat-Zinn, 1982, 1990). We complemented this within-subject design with a smaller but well-matched comparison group who were waitlisted for the MBSR course. Given the focus of MM in modifying cognitive and affective *processes* (i.e., the relationship to cognitions, emotions, and sensations), we hypothesized that MM practice would decrease ruminative tendencies. MM practice also emphasizes acceptance and a nonjudgmental observation of the *content* of the mind, thus, we hypothesized that MM would lead to significant reductions in dysfunctional attitudes and affective symptoms. However, we expected that these would be reduced when controlling for changes in rumination, as altering the relationship or response style to emotions, cognitions, and sensations is at the heart of MM practice.

As might be predicted, the association between affective symptomatology and a ruminative response style tends to be fairly high, making it hard to dissociate components of mood versus rumination. Recent advances in the rumination literature have attempted to separate items on a commonly used rumination

scale derived from the Response Style Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991) that overlap with measurement of depressive symptomatology. Two factors, reflection/pondering and brooding, have been identified and appear to be differentially related to affective distress (Fresco, Armey, Mennin, Turk, & Heimberg, 2004; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). As reported by Treynor and colleagues, the reflection factor consists of neutrally valenced items (e.g., “go away by yourself and think about why you feel this way”) and indicates contemplation and pondering, “a purposeful turning inward to engage in cognitive problem solving to alleviate one’s depressive symptoms” (Treynor et al., 2003, p. 256). The brooding factor consists of more negatively valenced items (e.g., “think, Why can’t I handle things better”), and reflects “a passive comparison of one’s current situation with some unachieved standard” (Treynor et al., 2003, p. 256). Both Treynor et al. and Fresco et al. find the brooding factor to be more related to depressive symptoms than the pondering/reflection factor and is therefore considered more maladaptive. To delineate potential changes in rumination following training in MM, we conducted follow-up analyses on brooding and reflection, predicting a significant decline in both following the MBSR course.

METHOD

Participants

The study was initially intended to be a within-subject design assessing participants before and after the MBSR course. Thus, all subjects initially recruited participated in the course immediately upon enrollment in the study. This sample consisted of 27 participants, 13 recruited at the VA San Diego Healthcare System (VASDHS) and 14 at the University of California San Diego (UCSD) Department of Psychiatry. To increase generalizability of this study, the only exclusion criteria were symptoms that could prevent participation or interfere with learning, such as psychosis, current alcohol or substance dependence, or substantial cognitive impairment such as dementia (assessed via the Shipley, described below, and neuropsychological evaluations at the VASDHS). These criteria excluded two participants (both veterans). Two veteran participants dropped out of the course and did not come in for follow-up assessments. The final within-subject design sample consisted of 23 participants and will be referred to as the treated sample.

After this data collection was completed, we had an opportunity to modify the design to also include a between-subject comparison condition. Eleven subjects (3 veterans and 8 nonveterans), meeting the same inclusion criteria as described above, were recruited and assessed twice while on a waitlist to start the MBSR course. All of the waitlist participants were offered participation in the MBSR course after the waitlist period. For between-subject comparisons, we matched these 11 waitlist participants on age, gender, and intake Beck Depression Inventory scores with 11 subjects from the treated sample who had completed four or more sessions of the MBSR course. Thus, although random assignment of subjects to waitlist or MBSR condition would clearly have been preferable, the development

of our study design prevented us from conducting randomization, and instead we chose to carefully match the waitlist sample with MBSR completers. We reasoned that rather than comparing the 11 waitlist subjects with the entire MBSR-treated sample ($n = 23$), a carefully matched sample would limit confounds by reducing the number of potential baseline differences between the groups and make interpretation of between-subject comparisons less problematic. As can be seen in Table I, the matched sample turned out to be very similar on variables that were not explicitly used as matching criteria, such as years of education, estimated IQ, ethnicity, previous cognitive behavioral therapy experience, psychiatric diagnoses, and veteran and psychiatric medication status. For the sake of clarity, the subset of treated patients who were matched with the waitlist sample will be referred to as the matched completer sample.

Demographic and diagnostic information of the treated as well as the matched samples are presented in Table I. All of the 34 participants met a minimum of 8th-grade education requirement and were able to complete the assessment battery unassisted. All participants met lifetime diagnostic criteria for a mood disorder and 17 (50%) participants met lifetime criteria for one or more anxiety disorder. Nine (26%) participants met criteria for a current major depressive episode (MDE) as part of either major depressive or bipolar disorder. Current diagnostic criteria was met for four (12%) participants for panic disorder, three (9%) for social phobia, three (9%) for specific phobia, one (3%) for obsessive-compulsive disorder, one (3%) for posttraumatic disorder, and three (9%) for generalized anxiety disorder.

Twenty-two percent of the treated sample, 18% of the matched completer sample, and 27% of the waitlist sample reported a change in their psychotropic medication or psychotherapy treatment between the two assessments, and the differences between groups were not significant.

Procedure

Veteran participants were recruited from among patients referred by VA San Diego health care practitioners to the MBSR course for mental or physical health related concerns such as mood and anxiety symptoms or chronic pain. Eleven (48%) subjects in the treated sample, three (27%) of the waitlist sample, and two (18%) of the matched completer sample were veterans (see Table I). Upon contacting the veterans to enroll them in the course, the instructor (PEC) informed the veterans about the research study, emphasizing that participation in the research was voluntary and not necessary for participation in the course itself. Veterans who expressed an interest in being part of the research study were then contacted by one of the investigators (primarily WR) and assessed approximately 1–2 weeks prior to the first MBSR session.

Nonveteran participants were recruited at University of California San Diego and enrolled in the MBSR course either immediately or after a waitlist period. These participants had previously been recruited via advertisements in local newspapers and enrolled in either a cognitive behavioral therapy or medication treatment study for major depression. Whereas the MBSR course was part of

Table 1. Demographic and Diagnostic Information for the Treated and Matched Samples

Variable	Total treated sample (n = 23)						Completers (n = 11)						Waitlist (n = 11)					
	Mean (SD)		N	%	Mean (SD)		N	%	Mean (SD)		N	%	Mean (SD)		N	%		
	Current	Lifetime			Current	Lifetime			Current	Lifetime			Current	Lifetime				
Demographics																		
Age	50.87 (8.87)				50.27 (7.39)				50.18 (10.25)				16.27 (4.94)					
Education (estimated years)	16.13 (2.20)				15.36 (2.29)													
Males		15	65			6	55							6	55			
Caucasian		23	100			11	100							10	91			
Estimated WAIS-R IQ	109.04 (10.05)				107.18 (10.90)				108.0 (14.40)									
Veteran status		11	48			2	18							3	27			
Previous CBT		17	74			7	64							9	82			
Psychiatric medication		13	57			6	55							6	55			
Psychiatric diagnoses:																		
		%	N	%		%	N	%		%	N	%		%	N	%		
Mood disorder		35	23	100	2	18	11	100	1	9	11	100						
Major Depressive Episode		22	23	100	2	18	11	100	1	9	10	91						
Two or fewer MDEs				11	48			6	54			7	64					
Three or more MDEs				12	52			5	45			4	36					
Dysthymia				2	9			0	0			2	18					
Bipolar I & II		13	5	22	1 ^a			9	3			27	0					
Anxiety disorder		39	13	57	4	36	5	45	2	18	5	45						
Current comorbid mood & anxiety diagnosis		3	13		1	9			0									

Note. CBT: Cognitive Behavioral Therapy; MDE: Major Depressive Episode; WAIS-R: Wechsler Adult Intelligence Scale—Revised.
^aAll current Bipolar I and II patients were in a depressed episode.

standard care offered by the VASDHS to all eligible veterans, it was only available to nonveterans as part of this research study.

After the study was explained to the participant, he or she read and signed an informed consent form. A trained clinician then conducted a psychiatric screen and a structured clinical interview of past and current diagnosis of mood and anxiety disorders. Next, the participants completed a battery of questionnaires and a computer task. The participants then enrolled in the MBSR course or were placed on a waitlist before they enrolled in the course. Following the course or waitlist period the intake assessment battery was readministered. The mean interval between intake and follow-up assessments was 10.18 weeks, $SD = 1.60$.

Intervention

The manualized 8-week MBSR course was modeled on the MBSR course that was developed at the University of Massachusetts Medical Center's Stress Reduction Clinic by Kabat-Zinn (1982, 1990). The course consisted of weekly 2-hr classes, one half-day meditation, and daily homework of 45 min of guided meditation to a tape or 30 min of meditation on their own if a tape was not used. A psychiatric nurse specialist (PEC), who has participated in a professional training program under the direction of Kabat-Zinn, led the course each time together with a doctoral student in clinical psychology. Participants were asked not to practice other forms of meditation, yoga, or related stress reductions during the course of the MBSR program. Patients were not asked to change or discontinue any ongoing psychiatric treatment. An average of eight research participants attended each mindfulness course. Participants learned experiential MM techniques that use the breath, body sensations, and yoga to develop nonjudgmental, moment-to-moment awareness, attentional monitoring, and acceptance.

Instruments

Participants completed an extensive battery including questionnaires, interviews, and a computer task. Only those relevant to the current report are described below.

Diagnostic Assessment

Structured Clinical Interview for the DSM-IV (SCID; Spitzer, Williams, Gibbon, & First, 1992). The SCID is a standardized semistructured clinician administered interview for diagnosing *DSM-IV* mental disorders. It has been shown to have adequate reliability and validity for most diagnoses, and considered the "gold standard" for diagnostic assessment. SCID interviews were conducted by the first and second author (WR and PRG), clinical psychology graduate students, and research nurses who were trained to criterion by research staff at the UCSD Clinical Research Center. Diagnoses were reviewed and agreed upon in consensus meetings together with a licensed clinical psychologist (JM), who is experienced in making psychiatric diagnoses based on the SCID.

Affective Symptom Questionnaires

Beck Depression Inventory (BDI; Beck et al., 1979; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The BDI is a 21-item, standard self-report measure of depressive symptomatology that is widely used in research. The BDI has been found to correlate .68 with interview-based assessments of depression (Rabkin & Klein, 1987) and has good internal consistency ($\alpha = .84$) and moderate test-retest reliability ($r = .69$; Yin & Fan, 2000). The internal consistency at intake in the current sample was high ($\alpha = .92$).

Spielberger State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI is composed of two 20-item scales, one assessing state anxiety and the other assessing trait anxiety. The STAI generally has high internal consistency for both the trait ($\alpha = .91$ for working adults) and the state ($\alpha = .93$ for working adults) scales, and a relatively low STAI-state test-retest correlation (Spielberger et al., 1983). The internal consistency at intake in the current sample was high and in the expected range for both scales, especially the state form ($\alpha = .96$ for STAI-state and .82 for STAI-trait).

Cognitive Measures

Dysfunctional Attitudes Scale (DAS; Weissman, 1979; Weissman & Beck, 1978). The DAS is a self-report questionnaire designed to measure typical depressogenic beliefs. There are several versions, and the 40-item version (Form A) was used in the current study. Each item is rated on a 7-point Likert scale ranging from *totally agree* to *totally disagree*. Factor analytic studies have suggested two factors: Perfectionism/Performance Evaluation and Need for Approval (Cane, Olinger, Gotlib, & Kuiper, 1986; Imber et al., 1990). The two subscales have been shown to have good internal consistency ($\alpha = .91$ for Need for Approval and $\alpha = .82$ for Perfectionism) and be moderately correlated with each other ($r = .59$) as well as with self-report measures of depression (Zuroff et al., 1999). In the current sample, the two factors were moderately to highly correlated ($r = .65$ at intake, $r = .74$ at follow-up, both $p < .0001$) and showed good internal consistency at intake (approval: $\alpha = .87$; perfectionism: $\alpha = .88$).

Response Style Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991). The RSQ is a 71-item self-report measure that assesses the level at which individuals engage in various cognitive coping styles. It has four subscales (Rumination, Distraction, Problem-solving, and Dangerous activities), although only rumination responses (22 items) were analyzed in this study. The internal consistency of the Rumination scale was reported to be .89 (Cronbach's α), and subjects' responses to this scale have been shown to correlate significantly with depressed mood (Nolen-Hoeksema & Morrow, 1991).

In addition to the original subscales, scores were also calculated for reflection and brooding based on recent refinements of the RSQ (Fresco et al., 2004; Treynor et al., 2003). The scales have adequate internal consistency (for brooding $\alpha = .77-.80$; Fresco et al., 2004; Treynor et al., 2003; for reflection $\alpha = .72$; Treynor et al., 2003) and moderate test-retest reliability ($r = .60$ for reflection and $r = .62$ for brooding; Treynor et al., 2003).

In the current sample brooding and reflection were uncorrelated at both time points as were reflection and rumination (although $r = .29, p < .09$ at intake; $r = .10, p = .57$ at follow-up). However, brooding and rumination were highly correlated at both intake and follow-up ($r = .79$ and $.73$, respectively, both $p < .0001$). The internal consistency at intake for the Rumination scale was relatively high ($\alpha = .87$), but as other researchers have found, the coefficient alphas for brooding and reflection were relatively low ($.70$ and $.72$, respectively), which may be due to the small number of items.

Additional Questionnaires

General Follow-Up Questionnaire (GFQ). At the follow-up assessment the research participants were given a questionnaire designed specifically for this study. The brief questionnaire assessed any significant changes in other treatments the patient was receiving (medication or psychosocial) that occurred since the intake, and the amount and frequency of meditation practiced since the beginning of the course. While participants were given a form to track their meditation and yoga practice on a weekly basis during the MBSR course, only about half the participants did so in a reliable manner. Correlational analysis indicated a medium to high association ($r = .66, p = .04$) between amount of meditation practice reported on the GFQ and on the weekly meditation tracking form. As every participant estimated the total amount of meditation practiced at the follow-up assessment, these data were used in the statistical analyses.

Institute of Living Scale (Shipley; Zachary, 1986). The Shipley consists of a test of 40 vocabulary items and a test of 20 abstraction pattern recognition tasks (e.g., AB BC CD D_). These tests assess verbal and logical reasoning abilities and provide an estimate of general intellectual aptitude (IQ). The Shipley correlates highly with the revised Wechsler Adult Intelligence Scale (WAIS-R). The Shipley was given to participants once, either at the intake or follow-up session.

RESULTS

Treated Sample

Descriptive and Preliminary Analyses

Twenty-three individuals were studied before and after completion of the MBSR course and make up the treated sample. All reported analyses examine the treated sample unless otherwise specified. Means and standard deviation for the intake and follow-up affective symptoms (BDI and STAI) and cognitions (RSQ and DAS) are presented in Table II. Eighteen participants completed four or more of the eight weekly MBSR sessions (completers) and five participants completed three or fewer sessions (noncompleters). There were no significant differences between the completers and noncompleters on any of the demographic variables or baseline measures, so the primary analyses were conducted on the entire treated sample.

Table II. Treated Sample Intake and Follow-Up Affective Symptoms and Cognitive Measures

Variable	Intake mean (<i>SD</i>)	Follow-up mean (<i>SD</i>)
Affective symptoms		
BDI	16.41 (12.04)	11.50 (10.44)*
STAI-state	46.77 (16.15)	44.48 (13.81)
STAI-trait	52.34 (15.30)	46.58 (11.35)*
Cognitive measures		
RSQ-Rumination	56.43 (9.00)	49.57 (8.33)**
RSQ-Brooding	13.43 (3.29)	11.61 (3.22)**
RSQ-Reflection	11.26 (3.08)	9.83 (2.12)*
DAS-Approval	45.78 (13.05)	41.43 (12.64)*
DAS-Perfectionism	50.91 (16.46)	45.48 (17.20)
DAS-Total	142.65 (36.24)	127.61 (35.22)*

Note. BDI: Beck Depression Inventory; DAS: Dysfunctional Attitude Scale; RSQ: Response Style Questionnaire; STAI: Spielberger State–Trait Anxiety Inventory. A total of 23 participants are included in the treated sample. The BDI and STAI-state measures were missing from one patient's follow-up questionnaire packet, and therefore only 22 participants had these measures at follow-up.

* $p < .05$ and ** $p < .005$ for within-sample paired t test.

Within-Subject Analyses: Change in Affective Symptoms and Cognition Over Time

Paired t tests compared intake and follow-up outcome measures (BDI, STAI-state, STAI-trait, RSQ-Rumination, DAS-Approval, and DAS-Perfectionism) to assess whether they changed over time in the treated sample.

Both the BDI [$t(21) = 2.43, p < .024$] and STAI-trait [$t(22) = 2.52, p < .02$] significantly decreased following the MBSR course and yielded medium effect sizes (Cohen's $D = .52$ for both BDI and STAI-trait). Among the cognitive measures, RSQ-Rumination [$t(22) = 3.82, p < .001$] and DAS-approval [$t(22) = 2.17, p < .05$] significantly decreased from intake to follow-up assessments, with effect sizes in the large range for RSQ-Rumination (Cohen's $D = .80$) and in the medium range for DAS-approval (Cohen's $D = .45$). Neither STAI-state [$t(22) = .94, p = .36$] nor DAS-perfectionism [$t(22) = 1.68, p = .11$.] changed significantly over time.

To test whether decrease in affective and DAS symptoms accounted for the reduction in rumination and whether rumination decreases accounted for reductions in affective and DAS symptoms, the analyses were rerun using changes in BDI, STAI, RSQ-Rumination, and DAS as covariates. Changes in rumination remained significant when controlling for intake to follow-up changes in BDI, STAI-trait, and DAS-approval [$F(18) = 11.12, p < .004$]. As predicted, changes in BDI, STAI-trait, and DAS-approval were no longer significant when controlling for changes in rumination. This indicates that change in affective symptoms and need for approval do not explain the reductions in rumination following the MBSR course. However, changes in rumination explain a significant part of the decrease in affective symptoms and DAS-approval following MM practice.

To further examine the decrease in rumination while separating out items that are redundant with depressive symptomatology, the analyses were repeated using the brooding and reflection scales. The results revealed significant decreases in

both reflection [$t(22) = 3.86, p < .001$] and brooding [$t(22) = 2.51, p < .02$], even after controlling for intake to follow-up changes in BDI and STAI-trait [reflection: $F(19) = 8.44, p < .009$; brooding: $F(19) = 7.32, p < .02$].

Additional Analyses

Completers Vs. Noncompleters. Repeated measures ANOVA with one within-subject variable (intake and follow-up) and one between-subject variable (completer and noncompleter) revealed no significant interaction between completers' and noncompleters' change in either affective symptoms (BDI and STAI) or cognitions (RSQ and DAS) across the two assessments.

Current Depression Status and History. While there was no significant difference between currently and formerly depressed participants in their change in either rumination or dysfunctional attitudes before and after the MBSR course, currently depressed participants demonstrated a significantly greater decline in BDI [$F(20) = 4.48, p < .05$], STAI-state [$F(20) = 4.70, p < .05$], and STAI-trait [$F(21) = 6.42, p < .02$] than formerly depressed participants. We also followed up on Teasdale and colleagues' finding on differential effects of relapse prevention for individuals with two or fewer versus three or more MDEs (Teasdale et al., 2000). Of the affective symptoms and cognitive measures, the only variable that approached a significant interaction was the STAI-trait [$F(21) = 3.72, p = .067$], indicating that individuals with two or fewer MDEs reported a smaller reduction in trait anxiety symptoms (1.4 points) than did participants with three or more MDEs (9.75 points) from intake to follow-up.

Gender Effects. Because women are more likely than men to engage in rumination (Nolen-Hoeksema, 1987), we tested potential gender interactions. We did not find any significant differences between men and women on their changes in affective and cognitive symptoms following the MBSR course.

Within-Subject Analyses: Regression

Hierarchical linear regression analyses tested if amount of meditation practiced, as reported by participants on the GFQ, predicted affective symptoms, or cognitions at the completion of the MBSR course. The average amount of meditation practiced during the 8 weeks of the course was 11.46 hr, or about 1.4 hr a week ($SD = 15.35$ hours, range 0–72 hours). Amount of meditation practiced significantly predicted follow-up rumination values after controlling for intake rumination [$t(20) = -2.21, p < .04, \beta = -.38$], indicating that the more meditation practiced, the less ruminative cognitions were reported at follow-up, as depicted in Fig. 1. Amount of meditation practiced uniquely accounted for 15% of the variance in follow-up rumination. As can be seen in Fig. 1, most participants engaged in very little practice, and the effect appears to be strongly influenced by one participant who practiced a considerable amount of meditation (about 1.3 hr per day). However, the amount of MM practiced by this participant fell within the range of what were normal expectations for practice. Amount of meditation practiced remained significant in predicting tendencies to ruminate at the follow-up assessment when controlling for intake to follow-up changes in BDI and STAI-trait [$t(17) = -2.14, p < .05$,

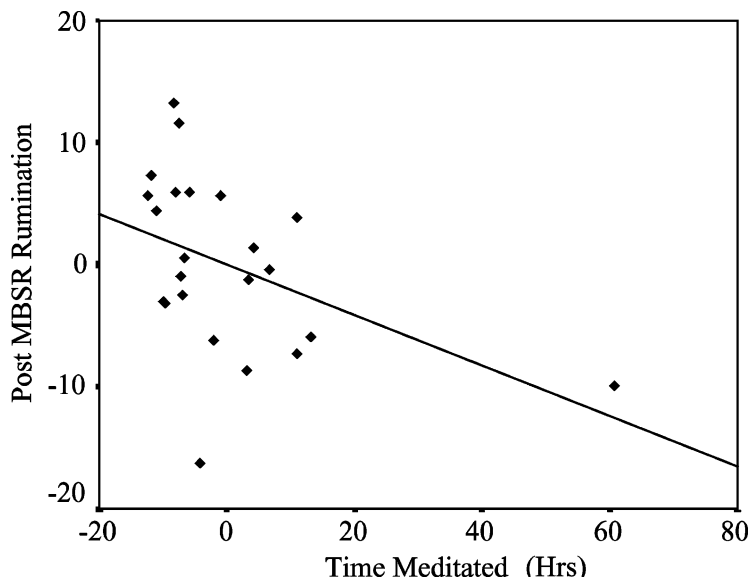


Fig. 1. Partial regression plot controlling for intake RSQ-Rumination. Amount of meditation practiced significantly predicts follow-up rumination [$t(20) = -2.21$, $p < .04$, $\beta = -.38$]. Amount of meditation practiced uniquely accounted for 15% of the variance in follow-up rumination. The data on the x -axis are shifted to the left because values are estimates after partialling out intake RSQ-Rumination scores, which is why there are values less than 0.

$\beta = -.37$]. Amount of meditation practiced did not significantly predict follow-up depressive or anxious symptoms, or DAS values after controlling for intake values in the combined sample.

Linear regressions were also conducted on the rumination subscales, brooding and reflection. The results indicated a significant decrease in reflection with increased meditation practice after controlling for intake reflection scores [$t(20) = -2.40$, $p < .03$, $\beta = -.41$], but not for brooding [$t(20) = -1.65$, $p = .115$]. Amount of meditation practiced uniquely accounted for 17% of the variance in follow-up reflection scores. Meditation practice significantly predicted decreased reflection when controlling for changes in BDI and STAI-trait [$t(17) = -2.10$, $p = .05$].

Matched Sample

Descriptive and Preliminary Analyses

In order to examine our hypotheses in a between-subject design, 11 participants were recruited and tested twice while on a waitlist to participate in the MBSR course. As noted above, the waitlist participants were matched on age, gender, and intake BDI scores with 11 completers from the treated sample (see Table I). An average of 10.48 weeks ($SD = 1.52$, range = 7.7–12.6 weeks) elapsed between the

Table III. Matched Sample Intake and Follow-Up Affective Symptoms and Cognitive Measures

Variable	Matched sample			
	Completers ($n = 11$)		Waitlist ($n = 11$)	
	Intake mean (SD)	FU mean (SD)	Intake mean (SD)	FU mean (SD)
Affective symptoms				
BDI	12.54 (10.61)	9.45 (6.73)	13.09 (7.26)	11.55 (7.83)
STAI-state	39.82 (14.24)	39.86 (10.51)	41.16 (13.69)	42.00 (10.44)
STAI-trait	46.28 (15.94)	42.39 (11.37)	50.00 (12.13)	52.00 (12.03)
Cognitive measures				
RSQ-Rumination	56.82 (6.81)	46.00 (8.07)**	48.18 (9.11)	49.36 (11.21)
RSQ-Reflection	12.45 (3.24)	10.00 (2.28)*	10.10 (2.59)	9.82 (2.44)
RSQ-Brooding	13.55 (3.53)	11.00 (3.10)*	11.64 (2.20)	11.45 (3.30)
DAS-Approval	41.64 (12.89)	39.36 (11.97)	43.91 (12.75)	45.55 (10.60)
DAS-Perfectionism	47.27 (17.96)	42.18 (20.32)	53.36 (15.83)	54.82 (19.51)
DAS-Total	131.45 (37.84)	119.45 (38.56)	146.45 (34.63)	147.18 (40.74)

Note. BDI: Beck Depression Inventory; DAS: Dysfunctional Attitude Scale; FU: follow-up; RSQ: Response Style Questionnaire; STAI: Spielberger State-Trait Anxiety Inventory.

* $p < .005$ and ** $p < .001$ for within-sample paired t test.

initial and follow-up assessments in the waitlist sample and 10.08 weeks ($SD = 1.69$, range = 8–13.6) in the completer sample, a nonsignificant difference ($p = .51$).

Descriptive statistics on the affective symptom and cognitive measures at intake and follow-up of the matched sample are displayed in Table III. Overall, the waitlist and the completer samples were similar and did not significantly differ on any of the demographic and intake diagnostic, affective or cognitive variables except for intake rumination (and its subscales), where the completers reported higher values [$t(20) = 2.52, p < .02$].

Between-Subject Comparisons: Completers Vs. Waitlist

Repeated measures ANOVAs with one within-subject factor (time) and one between-subject factor (completers vs. waitlist) were conducted to examine changes in affective symptoms (BDI, STAI-state, and STAI-trait) and cognitions (DAS-Approval, DAS-Perfectionism, and RSQ-Rumination) from intake to follow-up in the matched MBSR waitlist and completer sample. We expected to find significant interaction effects indicating decreases in affective symptoms and cognitions for the MBSR completer sample and no changes in the waitlist sample (i.e., interaction effects). The results demonstrated a significant interaction effect for the RSQ-Rumination scale [$F(20) = 10.78, p < .004$], and this effect held up also after controlling for BDI and STAI-trait intake to follow-up change values [$F(18) = 10.04, p < .005$]. The effect size for this interaction was large, Cohen's $D = 1.47$. As can be seen in Fig. 2, the completers' rumination levels decreased considerably following the MBSR course (from an intake mean of 56.82 to a follow-up mean of 46, a reduction of 10.8 points), while the waitlist participants' rumination levels increased slightly (from an intake mean of 48.18 to a follow-up mean of 49.36, an increase of 1.18 points). No significant interaction effects between the waitlist and completers were found for the DAS and affective symptoms measures (BDI and STAI).

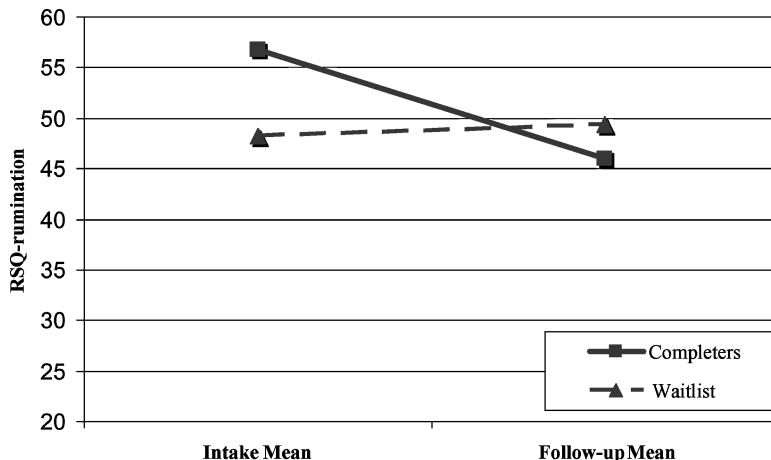


Fig. 2. RSQ-Rumination by group interaction effect for MBSR completers vs. waitlist participants at intake and follow-up [$F(20) = 10.78, p < .004$]. The results remained significant when controlling for changes in depressive and anxious symptoms.

Again, we followed up the finding on rumination by analyzing the reflection and brooding subscales of rumination. We found a significant interaction for reflection [$F(20) = 5.52, p < .03$; Cohen's $D = 1.05$], and an interaction that approached significance for brooding [$F(20) = 3.88, p = .063$; Cohen's $D = .88$]. These interaction effects remained when controlling for intake to follow-up changes in BDI and STAI-trait [reflection: $F(18) = 5.38, p < .04$; brooding: $F(18) = 4.06, p = .059$].

DISCUSSION

The goals of this study were to examine three variables that, based on prior research and theory, were predicted to be modified by training in mindfulness meditation (MM): affective disturbances, dysfunctional attitudes, and rumination. While we expected to see a decline in all these factors, drawing upon the theory derived from Segal, Teasdale, and Williams (Segal et al., 2002; Teasdale et al., 1995), we predicted that the primary area of change would be the manner in which MM practitioners learned to relate to cognitions, emotions, and sensations. As such, we expected to find the most reliable reductions across our analyses in rumination and predicted change in rumination to account for reductions in affective disturbance and dysfunctional attitudes.

Our results were generally consistent with our predictions. Reductions in ruminative tendencies were found across our three methods of analyses (within-subject repeated measures ANOVA, multiple regression, and between-subject analyses). Reductions in affective symptoms and dysfunctional attitudes were only found in our within-subject repeated measures analyses, and were not significant when rumination was used as a covariate.

The between-subject analyses based on a matched sample found significantly greater reductions in ruminative tendencies for the MM participants compared to the waitlist participants (Fig. 2). This result remained when accounting for changes in depressive and anxious affect. We found no significant interaction effects for affect or dysfunctional attitudes between the waitlist and active MM participants. Given the significantly different intake rumination values, an interpretation of regression toward the mean can be posited. However, the pattern of crossing lines and switching of mean differences from intake to follow-up make this and other alternative causal explanations, such as scaling or ceiling/floor artifacts, unlikely (Cook & Campbell, 1979, pp. 111–112). As elaborated by Cook and Campbell, if a statistical regression were to explain this finding, the completers' grand mean (51.4) would have to be lower than the grand mean of the waitlist group (48.8); this is not the case.

Also in support of our hypothesis, our regression analyses indicated that the more MM practiced, the less rumination was reported at the follow-up assessment, even after controlling for intake levels of rumination as well as changes in affective disturbance (BDI and STAI-trait). Amount of meditation uniquely accounted for 15% of the variance in follow-up rumination levels after controlling for intake rumination. However, there was a notable leverage point (outlier) in our sample. It is worth pointing out, that while this outlier participant practiced MM as homework more than anybody else, she practiced only slightly more than instructed (about an hour and 15 min rather than 45 min per day). In contrast, the treated sample reported practicing on average about one and a half hour per week. This, in addition to the general regression finding, speaks to the potential importance of a dedicated MM practice to obtain the benefit of reduced rumination. A larger sample with more careful tracking of participants' MM practice time is needed to probe this hypothesis further.

The relatively low level of MM practice overall is concerning, and likely limited the overall outcomes. We do not know why the compliance in the sample was this poor, but we speculate that part of the explanation may be the nature of our sample, that is, participants with a history of relatively significant psychopathology. However, few studies on MBSR report the average number of hours practiced per week during the MBSR course, so it is unclear whether the homework adherence of our sample is unusually low.

Overall, our results suggest that MM practice based on an 8-week stress reduction course is primarily effective at decreasing rumination, and that changes in rumination account for reductions in maladaptive cognitive content and affective symptoms, specifically depressive and anxious symptoms and dysfunctional beliefs relating to need for approval. Although we have emphasized the relationship between rumination and depression, as every participant in our sample met a lifetime diagnosis of a mood disorder, it is worth noting that half of the sample also met lifetime criteria for an anxiety disorder. Moreover, given the high level of comorbidity between depressive and anxious disorders, it is not surprising that cognitive processes similar to rumination are also central features of anxiety. As shown in a recent study, depressive rumination (dwelling on the negative) and worry are moderately correlated ($r = .46$), and both demonstrate similar positive

associations with anxious and depressive symptoms (r s range from .30 to .59; Fresco, Frankel, Mennin, Turk, & Heimberg, 2002). Segerstrom and colleagues demonstrated that the shared variance between worry and rumination can be explained by a single latent variable, repetitive thought, which is related to both anxiety and depression (Segerstrom, Tsao, Alden, & Craske, 2000). While results from these studies indicate that anxious and depressive *thought processes*, such as worry and rumination, are similar, anxious and depressive *thought content* may not be. There is evidence supporting a content-specificity hypothesis regarding anxious and depressive self-talk, with rumination containing thoughts of past losses, incompetence, rejection and failures, and worry involving future-oriented and “questioning” thoughts of threat, harm, and uncertainties (Kendall & Ingram, 1989; Safren et al., 2000). We did not include a worry questionnaire in our study, but it is possible that the reduction in rumination following the MBSR course primarily reflects a decrease in repetitive thoughts. If so, this alteration in thought process may be a general mechanism by which MBSR similarly impacts worry in anxiety disorders and rumination in depressive disorders, while disorder specific cognitive content may not be directly modified.

It is likely that the emphasis in MM training on observing and noting thoughts, feelings, and sensations as passing and impermanent events of the mind facilitates a less habitual pattern of reacting to and ruminating on arising thoughts and feelings. This alternative and more “decentered” (Segal et al., 2002; Segal, Williams, Teasdale, & Gemar, 1996, p. 379) way of relating to the contents of the mind may be incompatible with a prolonged dwelling on thoughts and feelings, and may be the mechanism by which training in MM reduces ruminative tendencies. Consistent with this theory, MM training was associated with a significant reduction in our treated sample in both brooding and reflection, two subfactors of the RSQ-Rumination scale in which items with obvious overlap with depressive thinking have been removed. Compared to a matched waitlist sample, reflection was significantly reduced in the MBSR course participants, while the reductions in brooding approached significance (the latter finding may be due to limited statistical power). However, the findings from our regression analyses suggest that reflection is indeed a critical component of rumination that is modified by MM training—the more meditation practiced, the less reflection was reported at follow-up. (A similar relationship was found for brooding, but again, it did not reach statistical significance.)

Although reflection appears to be more adaptive than brooding, in the sense that it correlates less with anxious and depressive symptoms than does brooding (Fresco et al., 2003; Treynor et al., 2003), its scale items indicate a tendency to ponder, mull over, or speculate about one’s actions, thoughts, feelings, and attempts to understand cognitions and emotions by analyzing them. While there is less emphasis on making derogatory self-judgments or comparing self to others in the reflection scale as opposed to the brooding scale, the very act of reflecting and contemplating in this manner may be a crucial initial step of what places a vulnerable individual at risk for depression relapse or recurrence. As pointed out by Segal et al., what remains when depression is over is a “tendency to react to small changes in mood with large changes in negative thinking” (Segal et al., 2002, p. 33). Although it may appear to be a rational and helpful problem-solving technique

and way of understanding the current states of mind, the process of monitoring and contemplating thoughts and emotions is likely to instigate further dwelling, brooding, questioning, and judgments about current versus desired state of self, which, for a vulnerable population, may perpetuate destructive emotions. Thus, reflecting on why or how one is feeling a certain way may be exactly what starts a delicate and potentially harmful process that may escalate to a major depressive episode.

The more robust association of reductions in rumination following MM rather than dysfunctional attitudes or affective symptoms supports the focus on altering the relationship to cognitions in MM practice, rather than changing the content of the thoughts themselves, as is emphasized in other treatments (e.g., cognitive therapy). It would be intriguing to test whether, after accounting for psychiatric symptoms, the primary mechanism of change in cognitive therapy involves a reduction in beliefs in dysfunctional attitudes (i.e., thought content), while the primary mechanism of change in MBSR entails a decrease in ruminative tendencies (i.e., relationship to thoughts), or if both forms of intervention affect similar mechanisms. Of note, about two thirds (74%) of the treated sample in the current study had previously participated in cognitive behavioral therapy for depression and 57% were on psychotropic medication. Thus, the MBSR course was offered as a secondary or tertiary treatment and the fact that we found a significant decrease in rumination and in BDI in our treated sample (significantly greater in currently depressed compared to formerly depressed participants), which appears to be primarily accounted for by decreases in rumination, suggests that MBSR is a worthwhile intervention for individuals with residual mood symptoms. In addition, that mindfulness appears to reduce rumination even for patients who have been treated with cognitive behavioral therapy suggests that either cognitive behavioral therapy did not reduce rumination, or that mindfulness can provide further benefit above and beyond that of cognitive behavioral therapy in terms of reducing rumination. This makes some sense theoretically. The cognitive behavioral therapy intervention offered at the VA San Diego and UCSD, which participants in this study received, has a strong behavioral activation emphasis, and the cognitive interventions tended to focus on content (e.g., accuracy of automatic thoughts) rather than the thought process (e.g., were patients ruminating). This form of CBT may not have been particularly suited to reducing rumination, and the MBSR intervention may therefore have complimented the treatment by addressing thinking from a new perspective.

As conceptualized by Kabat-Zinn (1990) and Segal et al. (2002), mindfulness contrasts with a ruminative, evaluative, and reflective mind set because it involves noting states of mind and bodily sensations with an accepting and nonjudgmental attitude without elaborating on the content of thoughts and feelings. In trying to prevent a potentially detrimental cognitive-affective process to unfold, mindfulness practice can help to anchor a person in the present moment by identifying, even labeling, what arises in the stream of consciousness without becoming engrossed in or judging it (e.g., upon noticing a thought such as "I am useless at this," the practitioner may simply register "judgmental thought" or "thinking"). Thus, rather than avoiding or becoming absorbed in the content of the body and mind, MM teaches attentional skills that balance these extremes while remaining alert

and observing the patterns of the mind. With time, this awareness and pattern recognition can contribute to a decentered perspective of thoughts, sensations, and feelings—a sort of metacognitive awareness—which can help reduce the potency of the literal meaning of thoughts and feelings and the tendency to become absorbed in a ruminative state of mind. The very incompatibility of these alternate states of mind, a ruminative versus a decentered, may be what contributes to improved regulatory skills in the face of mood swings and decreases the risk of relapse. As shown by an increasingly large literature on prevention of relapse, reducing residual symptoms with continued interventions following primary treatment can significantly reduce recurrence and relapse of major depression (e.g., Fava, Ruini, Rafanelli, & Grandi, 2002; Hollon, DeRubeis, Shelton, & Amsterdam, 2001; Jarrett et al., 2001; Paykel et al., 1999; Teasdale et al., 2000). The current study did not conduct long-term follow-up assessments with participants and therefore cannot assess MBSR's potential efficacy as a relapse prevention intervention. It is hypothesized, however, that the addition of MBSR following cognitive behavioral therapy may facilitate further relapse-prevention effects of regular cognitive behavioral therapy by reducing residual rumination.

Our study has several design considerations that are worth noting, as they restrict the generalizability and affect interpretation of our results. First of all, we used a small, nonrandomized sample of individuals. The small sample size cautions us in interpreting a lack of a significant relationship between our independent and dependent variables, as a null finding may simply reflect a lack of statistical power. The self-selecting nature of the sample calls into question how acceptable and effective a mindfulness-based intervention would be to the general population, and thus restricts the external validity of the study. The lack of random assignment of participants to the waitlist versus treatment groups limits the study's internal validity. Because of this, we cannot rule out nonmeasured differences between the samples that may contribute to the rumination outcome. However, we matched our groups on relevant demographic and baseline variables and did not find baseline group differences on nonmatched factors other than rumination and its subscales; thus, we can infer some degree of pretest–posttest change due to the MBSR treatment. Further, our between-sample findings replicate the within-sample results, both of which were derived from a priori predictions.

Throughout this paper we have used change scores (intake to follow-up) for the BDI and STAI-trait as control factors when testing the effect of changes in rumination and dysfunctional attitudes following the MBSR course. Although it could be argued that follow-up BDI and STAI-trait values would be better suited as covariates, we reasoned that change scores were preferable as they controlled for baseline symptoms while also addressing change over time.

Participants in our study were not restricted in obtaining new or changing their ongoing health care treatments while enrolled in the MBSR course, but changes were reported at the follow-up assessment. These changes were not taken into account in our statistical analyses, primarily because of limited power. However, a greater proportion of the waitlist sample reported changes in their treatment from intake and follow-up than the matched completer as well as the treated sample. Thus, it is unlikely that the differences we found were due to additional treatments

in the MBSR group. It is also worth pointing out that this study does not add information regarding the effectiveness of the MBSR course as a primary treatment for depression, because the majority of our sample consisted of individuals already treated with validated forms of therapy for mood disorder. Moreover, we did not examine the course leaders' adherence to the MBSR treatment protocol.

There are several future directions for this work. A randomized design with an active control condition and larger and more demographically varied samples would improve inferences of causality and control for self-selection biases. Such a design could also test whether changes in rumination mediate changes in treatment-outcome, something we were unable to do due to our limited sample size. It would also be interesting to contrast a sample of currently versus formerly depressed individuals. Additionally, a more rigorous and frequent tracking of participants' practice of MM, life events, and medical and/or psychological interventions would be desirable in order to better isolate the specific effects of MM practice.

In conclusion, the findings from this preliminary study suggest that the MBSR course is a good candidate as an intervention for reducing unhelpful thought processes such as rumination. Longitudinal studies with larger samples that include an extended follow-up period after the completion of the MBSR course are needed to provide information whether reductions in rumination is a key mechanism in lowering the number of relapses and recurrences of psychiatric disorders such as depression.

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