The Moderation of Mindfulness-Based Stress Reduction Effects by Trait Mindfulness: Results From a Randomized Controlled Trial*

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Mindfulness-based stress reduction (MBSR) has shown effectiveness for a variety of mental health conditions. However, it is not known for whom the intervention is most effective. In a randomized controlled trial ($N = 30$), we explored whether individuals with higher levels of pretreatment trait mindfulness would benefit more from MBSR intervention. Results demonstrated that relative to a control condition ($n = 15$), MBSR treatment ($n = 15$) had significant effects on several outcomes, including increased trait mindfulness, subjective well-being, and empathy measured at 2 and 12 months after treatment. However, relative to controls, MBSR participants with higher levels of pretreatment mindfulness showed a larger increase in mindfulness, subjective well-being, empathy, and hope, and larger declines in perceived stress up to 1 year after treatment. © 2010 Wiley Periodicals, Inc. J Clin Psychol 67:267–277, 2011.

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Meta-analytic reviews of outcome studies conducted over the past 25 years (Baer, 2003; Grossman, Niemann, Schmidt, & Walach, 2004) suggest that a form of mindfulness-based psychotherapeutic intervention for clinical and nonclinical populations termed mindfulness-based stress reduction (MBSR; Kabat-Zinn, 2003) is ''probably efficacious'' (Task Force on Promotion and Dissemination of Psychological Procedures, 1995). However, little attention has focused on the interaction between participant characteristics and MBSR to determine whether there are specific moderators that help to maximize its therapeutic outcomes.

Research must examine not only whether MBSR and other mindfulness interventions are effective, but also for whom these interventions are most effective (e.g., Roth & Fonagy, 2005). This is a largely unaddressed question in psychotherapy research in general, despite the fact that the field has repeatedly called for empirical studies to examine moderators of treatment outcome. A moderator is a variable that ''refers to some characteristic that influences the direction or magnitude of the relation between the intervention and outcome'' (Kazdin, 2003, p. 3). The study of moderators may help to identify those individuals likely to experience greater benefit from a particular intervention. The present study was designed to address the moderation question in the context of MBSR. In this randomized controlled trial, we explored whether individuals with higher levels of pretreatment trait mindfulness would benefit more from the MBSR intervention, measured in terms of enhanced mental health, psychological resilience, and interpersonal well-being.

Mindfulness is a form of experiential processing (Brown & Cordon, 2009; Teasdale, 1999) and refers to a ''presence of mind'' wherein attention, informed by a sensitive awareness of what is occurring in the present, simply observes what is taking place, whether external events or internal (psychological and somatic) experiences (Brown & Ryan, 2003; Kabat-Zinn, 2003;

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Shapiro & Carlson, 2009). This can be contrasted with the conceptually driven mode of processing in which experience is habitually filtered through cognitive appraisals, evaluations, memories, beliefs, and other forms of cognitive manipulation (see reviews by Brown & Cordon, 2009; Brown, Ryan, & Creswell, 2007). Mindfulness is considered an inherent human capacity that can be enhanced through training and practice (Brown & Ryan, 2003; Kabat-Zinn, 2003), and training in mindfulness is considered the essential ingredient of the MBSR intervention (Baer, 2003; Kabat-Zinn, 2003; Shapiro, Carlson, Astin, & Freedman, 2006). In the context of MBSR, mindfulness training involves forming a clear intention and cultivating an attitude of acceptance and openness to whatever arises in one's field of awareness (Shapiro & Carlson, 2009). This intentional and accepting attention fosters experiential contact with all of one's experience and a greater sense of wakefulness in one's life (Shapiro et al., 2006).

In this study, we explored whether those with higher levels of baseline or trait mindfulness would show greater psychological benefit from the MBSR intervention than those with lower levels of baseline mindfulness. For example, those with higher baseline levels of mindful attention may find the mindfulness exercises easier or more comfortable, or may persist longer at them, leading to greater perceived mental health gains over time. On the other hand, it is possible that those with low levels of pretreatment trait mindfulness may benefit more from the MBSR intervention because they have more psychological benefit to gain. From this perspective, those with higher levels of trait mindfulness may show ceiling effects on mental heath treatment outcomes that do not occur for those with lower levels of mindfulness. This perspective has some support from research, showing that those with higher levels of trait mindfulness report greater mental health and well-being without training (e.g., Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Brown & Ryan, 2003).

Given the central role of mindfulness in the MBSR intervention, in the present study, we predicted that trait mindfulness would moderate the effect of MBSR treatment on a variety of psychological outcomes, including rumination, perceived stress, and subjective well-being. However, we did not establish an a priori hypothesis regarding the specific form of the moderating role of trait mindfulness, given the divergent possibilities for treatment effect moderation outlined here.

The Present Research

This study is part of a randomized controlled trial that examined the effects of MBSR versus the Easwaran Eight-Point Program (EPP) versus a control group (Oman, Shapiro, Thoresen, & Plante, 2008). In the current study, only data from the MBSR and a wait-list control group are examined. The focus of the present study was to assess the moderating role of preintervention, trait mindfulness on the effects of MBSR (versus wait-list control) on numerous indicators of mental health (rumination, perceived stress, subjective well-being), psychological resilience (self-compassion, hope), and interpersonal well-being (e.g., empathy, forgiveness).[1] On the basis of a considerable body of research (see reviews by Baer, 2003; Brown et al., 2007; Grossman et al., 2004) we hypothesized that healthy college student participants receiving the MBSR intervention would report greater psychological benefits than those in the wait-list control condition at three time points after the intervention. Outcomes were assessed at preintervention, immediately at postintervention, and at 2-month and 12-month follow-up points. Tests of MBSR treatment effects over time, rather than at a single endpoint, allowed us to investigate whether treatment and moderation effects were durable.

There are three conditions necessary to demonstrate moderation of a treatment effect (Baron & Kenny, 1986; Kraemer, Frank, & Kupfer, 2006). First, the moderator must be a baseline or prerandomization characteristic that varies in the study population. Trait

[1]Aside from its novel focus on the moderating effect of trait mindfulness on the outcomes of MBSR (versus wait-list control), the current study includes 12-month follow up data not previously analyzed or published.

mindfulness meets this condition. Second, and relatedly, levels of the moderator must not differ across treatment condition; this condition is typically met through random assignment and will be tested here. Third, the effect size of the treatment must be shown to vary as a function of scores or levels of the moderator variable. The test of this condition will be a primary statistical focus of the present study.

Method

Participants, Recruitment, Randomization, and Schedule of Assessments

Undergraduate students at a small private university in California were recruited for the study. Recruitment efforts were directed toward first-year, second-year, and third-year students to facilitate follow-up assessment, particularly for the 12-month time point. After obtaining approval from the Institution Review Board of the University, recruitment was conducted through flyers, e-mails, classroom presentations, and special recruitment sessions in the fall 2004 academic term. Using Splus, version 3.3 computer software, 32 participants completed consent forms and the online pretest measures and were randomly allocated between the MBSR ($n = 17$) and a wait-list control group ($n = 15$). Two MBSR participants did not attend any meetings (one reporting no reason, the other deciding he had overextended himself). Thus, 30 students completed the study ($n = 15$ in each group).

Eight weeks later, after the conclusion of MBSR training, a link for the online posttest assessment was e-mailed to participants. After 2 more months, a link for the online follow-up assessment was e-mailed. All participants completed a final assessment online at 12 months posttreatment. Participants were mailed checks of $10 after doing the pretest, $20 after doing the posttest, and $30 after completing the two follow-up assessments.

Measures

Mindfulness. Baseline trait mindfulness was assessed at all four time points using the Mindful Attention Awareness Scale (MAAS, Brown & Ryan, 2003). The MAAS is a 15-item trait measure of the tendency to attend to present moment experiences in everyday activities. The MAAS uses a Likert scale, ranging from 0 (*almost always*) to 6 (*almost never*) to assess such items as, ''I find myself listening to someone with one ear, doing something else at the same time'' and ''I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.'' Higher scores indicate higher levels of trait mindfulness. Internal consistency (coefficient alpha) at baseline in the present sample was .93.

Psychological symptoms and well-being. Seven major symptoms and well-being outcomes were measured at each of the four assessment points. First, *rumination* was measured with the 12-item subscale of the Reflection Rumination Questionnaire (RRQ; Trapnell & Campbell, 1999; sample $\alpha = .90$). Example items include ''I don't waste time rethinking things that are over and done with'' (reversed) and ''Sometimes it is hard for me to shut off thoughts about myself,'' with answers coded on a 5-point scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicate stronger ruminative tendencies. *Perceived stress* was measured with a 10-item version of the Perceived Stress Scale (PSS; Cohen, Kamarck & Mermelstein, 1983; sample $\alpha = .88$). Scale items aim to tap experiences of distress related to ''how unpredictable, uncontrollable, and overloaded respondents find their lives.'' Example items include ''In the last month, how often have you felt that you were unable to control the important things in your life?'' and ''felt difficulties were piling up so high that you could not overcome them?'' Summary scores show adequate reliability ($\alpha = .78$) and range from 0 (low stress) to 40 (high stress).

To assess psychological well-being, *subjective well-being* (SWB) was first assessed, using a composite of affective state and life satisfaction, which are generally considered to be the primary components of SWB (Diener, 1984). Affective state was measured using the 20-item Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). Example adjectives include *interested* and *enthusiastic* (positive affectivity) and *distressed* and *afraid*

(negative affectivity). An affect balance score (i.e., the relative balance of positive to negative affect experienced) was computed by subtracting negative affect (sample $\alpha = .89$) from positive affect (sample $\alpha = .90$) scores (e.g., Diener, 1984). Life satisfaction was measured with the 5-item Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985; sample $\alpha = .95$). An example item is "The conditions of my life are excellent." Affect balance and life satisfaction were moderately correlated ($r = .42$, $p < .02$); thus, an overall SWB score for each person was calculated from the mean of the affect balance and life satisfaction scores for further analyses (cf., Sheldon, Ryan, Deci, & Kasser, 2004).

The 26-item *Self-Compassion Scal*e (Neff, 2003; sample $\alpha = .94$) was used to measure self-compassion based on an aggregate of responses on three subscales: self-kindness versus self-judgment, common humanity versus isolation, and mindfulness versus over-identification. Example items include, "I try to be loving toward myself when I'm feeling emotional pain" and "When times are really difficult, I tend to be tough on myself" (reversed). Higher scores on the 5-point scale indicate higher self-compassion.

Hope was measured with the psychometrically well-supported 12-item Adult Dispositional Hope Scale (ADHS; Lopez, Snyder, & Pedrotti, 2003; sample $\alpha = .87$). Example items include "There are lots of ways around any problem" and "My past experiences have prepared me well for my future," with responses coded on an 8-point scale, ranging from 1 (*definitely false*) to 8 (*definitely true*). Four distracter items do not contribute to the total scores, which range from 8 (low hope) to 64 (high hope).

The Interpersonal Reactivity Index (IRI; Davis, 1983; sample $\alpha = .89$) was used to assess the multifaceted aspects of *empathy*. Four subscales tap into interrelated personality constructs of empathy: perspective-taking, empathic concern, personal distress, and fantasy. Example items include "I often have tender, concerned feelings for people less fortunate than me" and "I sometimes find it difficult to see things from the 'other guy's' point of view" (reversed). Responses were made on a 1 to 5 point scale, with higher scores indicating higher empathy.

Finally, *forgiveness of others* was measured with a 6-item subscale of the Heartland Forgiveness Scale (HFS; Thompson & Snyder, 2003; sample $\alpha = .79$). Example items include "I continue to be hard on others who have hurt me" (reversed) and "When someone disappoints me, I can eventually move past it," with responses coded on a 7-point scale, ranging from 1 (*almost always false of me*) to 7 (*almost always true of me*). Subscale scores possess adequate reliability and range from 6 (low forgiveness) to 42 (high forgiveness).

Statistical Analyses

This study assessed treatment outcomes at four time points, including three time points after the intervention. Tests of treatment effects, and moderation of those treatment effects, therefore incorporated repeated measures of the outcomes. To assess the effect of MBSR versus control condition and the treatment-moderating effect of baseline mindfulness on the repeated measures of mental health and academic performance, a multivariate least squares general linear model (GLM) approach was used. Primary interest was in the treatment condition (MBSR vs. control) × time (pretest, posttest, 2-month follow-up, 12-month follow-up) two-way interaction and the pretreatment (baseline) MAAS mindfulness × treatment condition (MBSR vs. control) × time three-way interaction while controlling for all other two-way interactions between mindfulness, treatment condition, and time, as well as the main effects of these three variables and any relevant categorical and continuous demographic variables. To preserve statistical power, the MAAS was kept in its original continuous scale form.

To show both short-term effects and long-term treatment effects and their moderation by trait mindfulness, we analyzed data from the pretreatment-to-2-month follow-up time interval, and data from the full, pretreatment-to-12-month time period of the study. The former analyses represent the time period typically used in MBSR and other psychosocial treatment studies to examine short-term change, while the latter analyses represent a time interval over which sustained effects may be observed.

Three kinds of effect sizes were examined. First, for all primary analyses, effect size estimates based on partial eta-squared (η_p^2) were calculated to examine the amount of variance in the outcomes explained by the two effects of interest. Analogous to R^2 in regression, η_p^2 indicates the proportion of total variance in an outcome that is attributable to a predictor. Second, given the small sample size, we also calculated effect sizes of the MBSR versus control treatment effects using Cohen's *d* (Cohen, 1988), which assesses magnitude of effect, or clinical significance, independent of sample size. Finally, to more closely examine the nature and significance of the mindfulness moderation effects, correlations were computed between baseline mindfulness and each outcome, at each time point, for each treatment condition separately.

Although all 30 participants completed the study, missing data on several variables were present for one participant at posttreatment and three participants (one in MBSR, two in the control condition) at the 12-month follow-up point. These missing data were replaced by carrying forward that participant's data from the last assessment to the subsequent missing data point (cf., Flick, 1988). This approach preserves sample size, reducing possible artifactual effects of differential attrition from the two treatment conditions (Kazdin, 2003).

Before beginning analyses, all continuous variables at each time point were checked for skewness and kurtosis; all continuous variables were normally distributed. Categorical variables with seriously unbalanced category representation were corrected. Specifically, because of a small number of non-Caucasian participants, the race/ethnicity variable was dichotomized into Caucasian versus other race/ethnicity. Also, given the small number of nonsocial science academic majors represented, this variable was dichotomized (social science vs. other major). In all GLM analyses, homogeneity of variance and compound symmetry (assessed by the Mauchly Test of Sphericity) were checked and the Huynh-Feldt epsilon correction was applied where indicated.

Results

Thirty undergraduate students at a small private university in California participated in the study, with $n = 15$ randomized to either the MBSR or wait-list control group. As reported in Oman et al. (2008), the sample was predominantly female ($n = 26$; 86.7%) and most participants were Caucasian ($n = 25$; 83.3%); the remainder were Hispanic/Latino(a) ($n = 3$; 10%) or Asian ($n = 2$; 6.7%). The average age of participants was 18.73 years (standard deviation [*SD*] = 1.29, range = 18 to 24 years). Most ($n = 19$; 63.3%) were in the first year of college. Social science was the predominant academic major reported ($n = 12$; 40%), followed by natural science ($n = 8$; 26.7%), humanities ($n = 3$; 10%), and business ($n = 2$; 6.7%); five participants (16.7%) had not yet declared an academic major. All but one participant (96.7%) reported being unmarried.

Preliminary analyses showed that the MBSR and control group did not differ on any of the demographic or psychological measures at baseline, all $ps > .05$. The demographic homogeneity of the sample precluded meaningful inclusion of most of these variables in the primary analyses. Although there was some variation in academic major, preliminary *t* tests showed no relations of this variable to the psychological outcomes at any time point (all $ps > .14$), so will not be further considered. Important for tests of moderation, a *t* test showed that baseline MAAS mindfulness did not differ across treatment conditions, $t = .20$, $p > .84$.

MBSR Treatment Effects

Table 1 displays descriptive statistics on all outcome variables at each of the four time points of the study. GLM analyses showed that relative to control, the MBSR intervention was associated with statistically significant changes in several psychological outcomes over time, measured from pretest to both the 2-month and 12-month follow-up points. From pretest to the 2-month follow-up, MBSR participants reported a larger increase in MAAS mindfulness over time ($p < .05$; $\eta_p^2 = .16$) and a larger increase in SWB ($p < .01$; $\eta_p^2 = .19$). MBSR participants also reported greater increases in IRI empathy over time ($p < .02$; $\eta_p^2 = .15$) and marginally higher ATHS hope ($p < .08$; $\eta_p^2 = .09$). There were no treatment condition × time

Table 1
Mean (and SD) Values at Pretreatment, Posttreatment, and Two Follow-Up Time Points for MBSR and Control Groups

Variable	Pretreatment	Posttreatment	Follow-up, 2 months	Follow-up, 12 months	$d_{2\ mo}$	$d_{12\ mo}$	$p_{inter,\ 2\ mo}$	$p_{inter,\ 12\ mo}$
MBSR condition								
MAAS mindfulness	3.56 (0.87)	4.03 (0.84)	4.04 (1.14)	4.05 (1.06)	.04	.04	0.47	0.51
RRQ rumination	3.49 (0.87)	3.16 (0.94)	2.96 (0.89)	3.09 (0.64)	.17	.22	−0.60	−0.52
PSS perceived stress	1.81 (0.59)	1.50 (0.73)	1.46 (0.69)	1.59 (0.87)	.12	.10	−0.55	−0.30
Subjective well-being	2.99 (1.13)	3.36 (1.52)	3.86 (1.44)	3.78 (1.25)	.004	.02	0.67	0.66
SCS self-compassion	0.70 (0.13)	0.81 (0.21)	0.79 (0.19)	0.78 (0.17)	.18	.36	0.55	0.53
ADHS hope	6.03 (0.74)	6.16 (0.83)	6.37 (0.89)	6.29 (1.01)	.08	.01	0.42	0.29
IRI empathy	2.78 (0.49)	2.82 (0.60)	2.82 (0.62)	2.85 (0.60)	.02	.03	0.07	0.13
HFS forgiveness	4.73 (0.96)	5.43 (1.05)	5.37 (0.78)	5.29 (1.00)	.13	.36	0.73	0.57
Control condition								
MAAS mindfulness	3.49 (0.95)	3.61 (0.79)	3.14 (0.96)	3.39 (0.55)			−0.37	−0.13
RRQ rumination	3.74 (0.77)	3.77 (0.66)	3.48 (0.82)	3.47 (0.74)			−0.33	−0.36
PSS perceived stress	1.76 (0.65)	1.81 (0.62)	1.72 (0.48)	1.77 (0.45)			−0.07	0.02
Subjective well-being	3.03 (1.51)	3.30 (1.30)	3.51 (1.12)	3.29 (1.27)			0.36	0.19
SCS self-compassion	0.67 (0.16)	0.69 (0.16)	0.73 (0.15)	0.72 (0.16)			0.39	0.31
ADHS hope	6.13 (1.03)	6.22 (0.99)	6.36 (1.05)	6.33 (1.00)			0.22	0.20
IRI empathy	2.75 (0.60)	2.80 (0.54)	2.79 (0.60)	2.78 (0.58)			0.07	0.05
HFS forgiveness	4.29 (0.93)	4.55 (1.06)	4.33 (1.02)	4.55 (0.97)			0.04	0.27

Notes. $N = 30$ ($n = 15$ per group); SD = standard deviation; MAAS = Mindful Attention Awareness Scale; RRQ = Reflection Rumination Questionnaire; PSS = Perceived Stress Scale; SCS = Self-Compassion Scale; IRI = Interpersonal Reactivity Index; ADHS = Adult Dispositional Hope Scale; HFS = Heartland Forgiveness Scale. The p_{inter} columns show the GLM group × time interaction significance levels using pretreatment to 2-month follow-up data and pretreatment to 12-month follow-up data. The $d_{2\ mo}$ and $d_{12\ mo}$ columns show Cohen's *d* effect sizes based on unadjusted pretreatment and 2-month follow-up means, and pretreatment and 12-month follow-up means, respectively. The pooled standard deviation for each pair of time points was used in the denominator of *d*.

effects on PSS stress, RRQ rumination, SCS self-compassion, and reported capacity for forgiveness (all $ps > .12$).

GLM analyses based on the pretest to 1-year follow-up time period were similar for the mindfulness, SWB, and empathy outcomes (all $ps < .05$; η_p^2 range = .11 to .13). However, over this longer time interval, MBSR participants, relative to controls, reported marginally larger declines in PSS stress ($p < .10$; $\eta_p^2 = .08$) and significantly larger increases in ATHS hope ($p < .01$; $\eta_p^2 = .13$). There were no condition × time effects on rumination, self-compassion, and forgiveness (all $ps > .22$).

The power of these statistical tests to detect treatment effects may have been limited by sample size, and Table 1 indicates that effect sizes assessed by Cohen's *d* (Cohen, 1988), which assessed magnitude of effect independent of sample size, were generally moderately large in the MBSR condition for most of the study outcomes. In the control condition, Cohen's *d* effect sizes were generally small across the outcomes. The exception to this general pattern was the empathy outcome, in which effect sizes were small in both MBSR and control conditions despite statistically significant condition × time effects.

Baseline Mindfulness Moderation of MBSR Intervention Effects, Pretest to 2-Month Follow-Up

The same GLMs with which MBSR treatment effects were tested also showed that the beneficial effect of MBSR versus no treatment on many of the psychological outcomes was conditioned by baseline (trait) MAAS mindfulness, such that MBSR was more beneficial when baseline mindfulness was higher. Specifically, participants entering the study with higher levels of mindfulness and who were randomized to MBSR showed a larger increase in mindfulness ($p < .01$; $\eta_p^2 = .21$)[2] and SWB ($p < .002$; $\eta_p^2 = .21$) over time, steeper declines over time in PSS perceived stress ($p < .04$; $\eta_p^2 = .12$), and a marginally larger decline in RRQ rumination ($p < .07$; $\eta_p^2 = .10$). More mindful individuals enrolled in MBSR also showed marginally larger increases in SCS self-compassion ($p < .07$; $\eta_p^2 = .10$) and ATHS hope ($p < .08$; $\eta_p^2 = .09$). More mindful participants in MBSR also showed higher levels of IRI empathy over time ($p < .01$; $\eta_p^2 = .16$). Baseline trait mindfulness provided no advantage to MBSR participation in reported capacity for forgiveness ($p > .27$).

Table 2 displays the moderation effect results from GLM analyses in the form of bivariate correlations between baseline mindfulness and each outcome, at each time point, for the two study conditions separately. As can be seen, pretreatment mindfulness showed consistent, small-to-moderate correlations in the expected directions across the first three time points of the study among MBSR participants, particularly for the mindfulness outcome and for the well-being outcomes. When averaged across these three time points, these correlations were generally moderate in size, as Table 2 shows. Baseline mindfulness did not predict better treatment response in terms of the interpersonal outcomes (empathy, forgiveness, and hope) in a consistent fashion over time, suggesting that the GLM results on these outcomes reported already may have reflected only short-term moderation effects. Table 2 shows that among the control group participants, baseline mindfulness had generally little predictive power beyond the first time point of assessment.[3]

Baseline Mindfulness Moderation of MBSR Intervention Effects, Pretest to 12-Month Follow-Up

The results of the moderation analyses covering the pretest to 12-month follow-up period were generally similar to those already reported on the pretest to 2-month follow-up period, with notable differences. More mindful participants entering the study who received MBSR

[2]For GLM analyses on mindfulness, the repeated-measures dependent variable did not include pretreatment mindfulness.

[3]The small number of participants in each study condition precluded meaningful tests of the statistical significance of the differences between treatment conditions in the sizes of these correlation coefficients.

Table 2
Bivariate Correlations of Pretreatment Mindfulness With Study Outcomes at Pretreatment, Posttreatment, and Two Follow-Up Time Points for MBSR and Control Groups

Variable	Pre-treatment	Post-treatment	Follow-up, 2 months	Follow-up, 12 months	*Mean r* to 2-mo follow-up	*Mean r* to 12-mo follow-up
MBSR condition						
MAAS mindfulness	–	.57	.61	.37	.59	.52
RRQ rumination	−.52	−.43	−.58	−.39	−.56	−.55
PSS perceived stress	−.49	−.48	−.53	−.12	−.56	−.45
Subjective well-being	.34	.53	.31	.41	.45	.47
SCS self-compassion	.42	.47	.42	.27	.47	.42
ATHS hope	−.18	.23	−.17	.19	−.05	.04
IRI empathy	−.17	.17	.21	.09	.10	.10
HFS forgiveness	.36	.19	−.07	.20	.20	.21
Control condition						
MAAS mindfulness	–	.71	−.14	.16	.34	.30
RRQ rumination	−.62	.21	.00	−.07	−.20	−.16
PSS perceived stress	−.49	.23	.13	−.20	−.09	−.12
Subjective well-being	.52	−.24	−.15	−.39	.09	−.05
SCS self-compassion	.42	.15	.06	−.05	.23	.17
ADHS hope	.09	.04	.39	−.32	−.05	.18
IRI empathy	.43	.25	−.11	.08	.21	.18
HFS forgiveness	.15	.08	.15	.15	.20	.15

Notes. $N = 30$ ($n = 15$ per group). MAAS = Mindful Attention Awareness Scale; RRQ = Reflection Rumination Questionnaire; PSS = Perceived Stress Scale; SCS = Self-Compassion Scale; IRI = Interpersonal Reactivity Index; ADHS = Adult Dispositional Hope Scale; HFS = Heartland Forgiveness Scale. The *Mean r* to 2-month and 12-month follow-up columns show the average correlations from pretreatment to each follow-up time point.

continued to show a larger increase in mindfulness ($p < .01$; $\eta_p^2 = .16$) and SWB over this longer time period ($p < .005$; $\eta_p^2 = .15$),[4] a larger decline in perceived stress ($p < .04$; $\eta_p^2 = .10$), and a marginally larger decline in rumination ($p < .09$; $\eta_p^2 = .08$). However, the advantage of baseline mindfulness to increasing self-compassion among MBSR participants disappeared over this longer time period ($p > .19$). More mindful individuals receiving MBSR showed significantly larger increases in hope ($p < .008$; $\eta_p^2 = .14$) and empathy over this longer timeframe ($p < .03$; $\eta_p^2 = .11$). Again, there was no selective advantage to higher baseline mindfulness in enhancing capacity for forgiveness among MBSR versus control group participants ($p > .57$).

Inspection of the correlations in Table 2 shows that among MBSR participants, the power of baseline mindfulness to predict study outcomes measured at the 12-month follow-up point was maintained, though at a generally weaker level than that seen at the 2-month follow-up point. Baseline mindfulness again had little power to predict outcomes among control condition participants. As with the pretreatment to 2-month follow-up findings, the Table 2 results suggest that the significant GLM-based moderation results for empathy and hope reported here may reflect only short-term changes from one time period to the next rather than clear trends over the full time span of the study.[5]

[4]GLM analyses of the affective and cognitive components of SWB showed that baseline mindfulness had the expected moderating effect of MBSR on an increase in positive affect ($p < .004$) and life satisfaction ($p < .02$), and a decline in negative affect ($p < .004$) over the pretest to 2-month follow-up period. Moderation analyses covering the extended, 1-year timeframe were very similar, with the exception that the mindfulness moderation effect on life satisfaction dropped to a marginally significant level ($p < .09$).
[5]When analyses of the pretest to 12-month follow-up data were conducted with the study completing sample only ($n = 27$), the results were almost identical to those reported here. The only exception was that the marginally significant ($p < .10$) time × group effect on PSS became nonsignificant ($p > .11$) in the completer analysis.

Discussion

This study had two primary aims. First, it tested the effects of an MBSR intervention, relative to a wait-list control condition, on a variety of personal and interpersonal indicators of mental health. Second, and more centrally, the study addressed a key question in mental health intervention research: Are there predisposing participant characteristics that predict (more) positive treatment outcomes? In support of our aims, we first found that relative to a control condition, MBSR treatment had significant effects on several outcomes in this randomized trial, including increased trait mindfulness, SWB, and empathy, measured at 2 months and 12 months after the end of treatment. These findings accord with other MBSR intervention research showing beneficial psychological changes (Grossman et al., 2004), including studies conducted with the same, college-age population as that sampled here (e.g., Astin, 1997; Shapiro, Brown, & Biegel, 2007; Shapiro, Schwartz, & Bonner, 1998). Second, the study found that baseline trait mindfulness was a significant moderator of MBSR intervention effects. Specifically, relative to control participants, MBSR participants entering the study with higher levels of trait mindfulness showed a larger increase in mindfulness and SWB over time, steeper declines in perceived stress, and higher levels of empathy and hope measured up to 1 year after treatment. Thus, baseline mindfulness moderated the observed differences between treatment and control groups, such that in the treatment group, mental health outcomes were generally better over time for those with higher levels of baseline mindfulness. In the control group, baseline mindfulness was not consistently or strongly related to outcome scores over time. MBSR participants who were higher in levels of trait mindfulness upon entry into the program benefited more from it, as is reflected in the higher levels of mindfulness and well-being and lower levels of psychological symptoms after the intervention, even up to 1 year later. Although trait mindfulness also provided some benefit to those receiving no intervention, these benefits were generally short-lived and noticeably smaller than for MBSR participants. Treatment condition differences in the effect sizes of these relations indicates that the effect of baseline trait mindfulness on mental health and well-being over time was specific to those receiving MBSR treatment, rather than simply a main effect predicting well-being over time; this finding supports the role of baseline mindfulness as a moderator of MBSR treatment effects (cf., Kraemer et al., 2006).

The results of this randomized controlled trial are the first known to us to demonstrate that trait mindfulness is a moderator of MBSR intervention effects. However, it is important to note that although participants with higher levels of pretreatment mindfulness fared better than those with lower levels of pretreatment mindfulness, as a whole, participants receiving MBSR intervention reported significantly greater improvements on several outcomes than those in the control group, including mindfulness, subjective well-being, and empathy. High pretreatment mindfulness was not a necessary condition for MBSR benefit, but it did predict magnitude of benefit across a number of these and other outcomes assessed.

Although the focus of this study was on moderation of MBSR effects, it is important to ask why mindfulness offered generally poor prediction of psychological symptoms and well-being among those not receiving treatment, given other research showing that trait mindfulness does predict well-being over time in nontreatment samples (Barnes et al., 2007; Brown & Ryan, 2003). The answer to this may be study-specific. In the present sample, all assessments after baseline were collected during high-stress, end-of-academic-term periods. A dispositional measure collected months before may have less opportunity to contribute meaningful prediction under circumstances in which short-term (state) psychological conditions were more likely to have strong effects.

Limitations and Future Research

This study had several strengths, including randomization of participants to conditions and multiple assessment points extending to 1 year after treatment. However, there were specific limitations that should be addressed in future research. First, the small sample size limited statistical power to detect effects. Because the tests of moderation of MBSR effects by trait

mindfulness were exploratory, in that we did not hypothesize effects on specific outcomes, the criterion for statistical significance was retained at the traditional .05 level. But the large number of analyses performed may have produced several chance findings. The amount of variance explained by the treatment and moderation effects was sizable, however (10–20% across outcomes), which suggests that the results were clinically meaningful. Another limitation was the reliance on self-reported outcomes, and future research could benefit by including more objective (e.g., behavioral, peer-reported) measures of mental health and well-being as well as a measure of participant expectancy. Also, the demographic homogeneity of the sample precluded analyses of relations between trait mindfulness and predisposing variables that may be confounded with it, and potentially explain away the effects observed here. However, it is important to note that MAAS mindfulness has not been shown to correlate with sex, age, academic aptitude (GPA), or SES (income level; Brown, 2008), suggesting that such variables were not likely confounds of the mindfulness moderation effects observed here.

Finally, the present study examined the moderating role of only one treatment-relevant predisposing characteristic, and research may do well to examine the contribution of related, meta-cognitive qualities and attitudes that previous research has linked with mindfulness training outcomes, including intention, attitude (e.g., acceptance), and decentering/reperceiving (Baer, 2003; Brown et al., 2007; Shapiro et al., 2006).

Despite the limitations, the results of the current study support the importance of considering the interaction between participant characteristics and treatment in the prediction of outcome (Kazdin, 2007; Shoham-Solomon & Hannah, 1991). The findings suggest that pretreatment mindfulness may offer potential to predict which individuals will benefit most from MBSR before they enroll in the program. However, this line of research is new, and larger-scale studies are needed to replicate and extend the present findings to other healthy populations and to clinical populations. Also needed is research to explore why baseline mindfulness interacts with MBSR to predict better treatment outcomes. As Kazdin (2008) notes: "Moderators are only correlates of outcome, but knowing more precisely the basis of moderators may provide the option to intervene…." (p. 153).

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