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The Effects of a Short-term Mindfulness Meditation Intervention on Coping Flexibility

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Abstract

Background and objectives: Mindfulness meditation (MM) training promotes health and well-being. One potential mechanistic link between MM and health may be coping flexibility, (e.g. the ability to monitor and modify coping strategies based on situational needs and strategy effectiveness). We hypothesized that MM training would increase coping flexibility and also explored whether gains in coping flexibility continued to increase after training, or whether they were maintained or lost with time.

Methods and Design: One hundred thirteen students (71 female, $M_{age} = 18.97$) were randomly assigned to a waitlist control or MM condition. Participants in the MM condition were trained by a certified MM instructor and given guided recordings for one-week of at-home practice. Participants provided reports of coping flexibility over a three-week span.

Results: Results from multilevel modeling indicated that MM increased coping flexibility among those in the MM condition and among those who spent relatively more time meditating. Results further suggested that the gains in coping flexibility that were evident at post-test were not only maintained but increased in the two weeks after the intervention.

Conclusions: This study provides preliminary support for the assertion that MM increases the ability to monitor and modify coping strategies during times of stress.

Keywords

coping flexibility; stress; dispositional mindfulness; health; multilevel modeling

Mindfulness meditation (MM) interventions have impressive benefits for psychological and physical health, including reductions in chronic pain, decreased depression, and reduced anxiety (Kabat-Zinn, 1982; Marchand, 2012). These benefits may be partially attributable to the effects of MM on stress reduction (Marchand, 2012; Nyklík, Mommersteeg, Van Beugen, Ramakers, & Van Boxtel, 2013) and more effective coping with stress (Sears &

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Kraus, 2009). Effectively coping with stress is important for optimal health and well-being. Those who cope more effectively report fewer illnesses, enjoy greater longevity, and report better quality of life (Cheng, Lau, & Chan, 2014; Kato, 2012; Lazarus, 1999; Lester, Smart, & Baum, 1994). MM may promote more effective coping in part by increasing the ability to cope flexibly with stressful situations.

Although definitions of coping flexibility vary, in this study it is defined as the ability to monitor whether a particular coping strategy is effective and then to transition to a different coping strategy if needed (Kato, 2012). Because most stressful situations are complex, often requiring the use of multiple coping strategies, it is advantageous to monitor the effectiveness of the current coping strategy, to recognize when a particular approach needs modification, and to utilize a variety of different strategies (Bonanno & Burton, 2013; Cheng, 2003; Sideridis, 2006). The purpose of the present study is to examine whether a short-term, one-week MM intervention can increase coping flexibility.

Coping Flexibility

Traditional theories of stress and coping incorporate the core features of coping flexibility, including the ability to monitor and modify coping strategies to promote the best outcomes (Bonanno & Burton, 2013; Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). Most previous coping research, however, has focused on either specific coping strategies such as positive reframing, or on bipolar categories of coping such as problem- and emotion-focused coping, designating these as adaptive or maladaptive, respectively. This view of coping strategies as adaptive or maladaptive has been termed by some researchers as the fallacy of uniform efficacy, as it assumes that particular types of coping are universally beneficial or detrimental, neglecting the importance of situational characteristics (Bonanno & Burton, 2013). In contrast to this view, theoretical perspectives on regulatory flexibility suggest that being sensitive to contextual demands, drawing on a wide variety of coping strategies, and monitoring and modifying strategies as needed is likely to promote more effective outcomes (Bonanno & Burton, 2013). If coping skills were a toolkit, coping flexibility would be a function of the number of tools in the kit, knowledge of which tool is most appropriate for which task, and the ability to troubleshoot when one tool is not working as expected.

Although relatively few studies have examined the effects of coping flexibility on health and well-being, empirical evidence suggests that flexible coping with stress is associated with better physiological and psychological health. Those who cope more flexibly also tend to have fewer physical illnesses (Cheng et al., 2014), better recovery from illness (Roussi, Krikeli, Hatzidimitriou, & Koutri, 2007), and experience less pain (Kato, 2016). Further, those higher in coping flexibility report greater psychological adjustment, including more optimism, lower depression, and lower anxiety (Fan, Gan, Zheng, & Wang, 2010; Cheng, Lau, & Chan, 2014; Kato, 2012; Lester et al., 1994), suggesting that the ability to promote coping flexibility may be beneficial to health and well-being.

Although coping flexibility is often viewed as a relatively stable disposition, some research indicates that coping flexibility can be modified. Two studies tested different approaches to

increase coping flexibility (Cheng, Kogan & Chio, 2012; Cheng, Yang, Jun & Hutton, 2007). Cheng and colleagues (2012) examined whether a work-based stress-management intervention could increase coping flexibility, and ultimately reduce depression. Workers assigned to the coping flexibility intervention were taught cognitive and behavioral skills to identify coping strategies that would be most appropriate for different stressful situations (i.e., goodness of fit). Participants who received the intervention showed increases in coping flexibility and decreases in depression. These effects were sustained for four months post-intervention. In another study, Cheng and colleagues (2007) used an experimental design to examine the effectiveness of a psychotherapeutic intervention to increase coping flexibility among individuals with functional dyspepsia. Participants were taught to modify coping strategies based on the controllability of the stressful situation. Those who received the intervention reported reductions in symptom severity, decreases in anxiety, and increases in coping flexibility that were maintained for a year after the intervention. The purpose of the present study was to examine whether mindfulness meditation could be another type of intervention strategy to promote coping flexibility.

Coping Flexibility and Mindfulness Meditation

Mindfulness meditation (MM) is the act of “paying attention, in the present moment, on purpose, non-judgmentally” (Kabat-Zinn, 1994, p. 4). In MM, practitioners (those who practice MM) are directed to bring conscious awareness to their thoughts in a non-judgmental way, accepting both positive and negative thoughts, events, and emotions as normal experiences (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). MM instructors guide practitioners to focus attention on a particular event or practice, such as on the breath or on a particular action such as walking, with the intent of simply noticing what is occurring in the mind, the body, or in the surrounding environment at each moment.

Although an eight-week MM intervention is the gold standard, shorter MM training programs can also effectively increase health and well-being (Baer, Carmody, & Hunsinger, 2012; Ditto, Eclache, & Goldman, 2006; Harnett et al., 2010). In spite of a large literature on MM interventions, relatively few researchers have manipulated or measured the effects of variation in the length of MM training or of the amount of practice on psychological and physical health outcomes. More time spent meditating is generally beneficial; Baer et al. (2012) found that practitioners who spent more time practicing MM reported greater decreases in stress and greater increases in well-being, potentially suggesting that short-term interventions with relatively more practice time may effectively reduce stress and promote well-being. However, it is important to note that not all studies have found that more practice promotes well-being (see Eberth & Sedlmeier, 2012 for a review). In addition, most studies examine the effects of MM by testing assignment to condition rather than evaluating the actual time spent meditating. It is therefore relatively unclear how much practice time is needed to see the benefits of meditation on health and well-being.

To our knowledge, no studies have examined the effects of a MM intervention on coping flexibility. However, prior research suggests that MM is likely related to choice of coping strategy. For example, dispositional mindfulness, which is how attentive and aware individuals tend to be in everyday experiences (Brown & Ryan, 2003), is associated with

more active and approach coping strategies (Weinstein, Brown, & Ryan, 2009), greater tolerance of distress (Donald et al., 2016), and more self-reported ability to positively reappraise stressful events (Hanley & Garland, 2014). Together, these are suggestive of a wide variety of coping skills for those higher in dispositional mindfulness. Further, evidence suggests that MM can increase dispositional mindfulness (Baer et al., 2012; Kiken, Garland, Bluth, Palsson, & Gaylord, 2015), although this varies depending on the type of MM intervention utilized (Eberth & Sedlmeier, 2012).

Additionally, although research has not yet established that MM increases coping flexibility per se, there is good reason to believe that MM training specifically should promote coping flexibility. Coping flexibility includes the ability to monitor whether a current coping strategy is effective. This skill requires the ability to notice when the current coping strategy is ineffective. Because cultivating present moment awareness is a central feature of MM training, the capacity for observation of coping effectiveness should be promoted through MM training. Consistent with this expectation, empirical research suggests that MM increases attention and awareness (Josefsson, Lindwall, & Broberg, 2014; Tang & Posner, 2015), which are important for self-regulation, for identifying when a desired goal is not being met, and for reorienting to a desired activity (Hasenkamp, Wilson-Mendenhall, Duncan, & Barsalou, 2012; Tang & Posner, 2015). These processes are central to the task of noting when a coping strategy is not working, as required for coping flexibility.

Coping flexibility also requires the ability to adjust from an ineffective coping strategy to a more effective approach. Cognitive flexibility, the ability to adapt mental processing strategies to meet different environmental conditions, is positively related to both MM practice and to coping flexibility (Cheng, 2003; Moore & Malinowski, 2009). Greater dispositional mindfulness has been associated with more flexible cognitive control (i.e., the ability to refocus attention to pertinent information despite competing stimuli; Anicha, Ode, Moeller, & Robinson, 2012) and to decrease inflexible ruminative thought (Ramel, Goldin, Carmona, & McQuaid, 2004). MM training should thereby allocate more cognitive resources to think creatively about the value of various possible strategies for coping with a particular situation. MM may therefore promote the ability to flexibly adapt to a variety of different situations, potentially increasing the ability to modify a coping strategy when the current strategy is not having the desired effect. Taken together, these results suggest that MM may promote attentional focus, increasing the ability monitor coping strategies, and that MM may promote cognitive flexibility and control, allowing those who practice MM to change to a different coping strategy as needed. These two processes may thereby increase the capacity for coping flexibility.

The Present Study

Based on limited previous literature, we hypothesized *a priori* that MM would promote coping flexibility, and that more time spent practicing MM would be associated with greater increases in coping flexibility. These hypotheses were proposed as part of a Master's thesis, and are described in Jones (2015). Additionally, because previous studies suggest that increases in coping flexibility may be sustained over time (Cheng et al., 2012; Cheng et al.,

2007), we also explored whether changes in coping flexibility were increased, maintained, or lost in the weeks following the intervention.

Method

The present study received all necessary approval from the institutional review board. All participants provided informed consent. One hundred fifteen students enrolled in undergraduate psychology classes were awarded research participation credit for taking part in this study. As an incentive to complete the entire study, participants with at least 90% compliance were entered into a raffle to win \$25. Participation required a three-week commitment. Those who self-reported more than two hours of MM practice with a trained meditation instructor, or who self-reported diagnoses of clinical depression or anxiety were excluded from participating in the present study.

Procedure

Data were collected over two academic quarters, and three separate groups of participants were enrolled across this time frame. The same study protocol was followed with each group of participants. Participants were pre-screened to determine familiarity with MM or yoga, a traditional component of MM. Seven participants reported having meditated in the past, although none reported receiving formal training in MM. Sixteen participants reported previous participation in yoga. To ensure that those familiar with MM or yoga were not differentially assigned to condition, we used stratified random assignment based on familiarity with either yoga or MM to the MM intervention condition ($N = 64$) or to the waitlist control condition ($N = 51$).

On the first day of the study, participants came into the lab in groups of up to 50 for a one hour session in which they provided informed consent. Participants then provided demographics and completed preliminary measures of dispositional mindfulness, perceived stress, and coping flexibility. On the second day of the study, participants in the MM condition received their formal MM training (described below), after which they were asked to meditate for 30 minutes daily for six days (days 3–8), and were provided with two MM recordings to use for practice. During the six days of at-home practice, participants completed online daily logs of time spent meditating, stress, and affect. The control condition was a waitlist control and therefore participants were not given specific instruction for activities between measurements. However, control participants also provided daily measures describing any time spent meditating, stress, and affect. On the 8th day of the study, and again on the 22nd day of the study, participants from both conditions returned to the lab for approximately half an hour each visit and completed post-test and follow up assessments (respectively) of coping flexibility, dispositional mindfulness, and stress. At the conclusion of the study, participants in the control condition were offered the same intervention and materials as those in the MM condition. Although a number of participants accepted the recordings of MM, none attended the formal MM training with the instructor.

MM Intervention.—The MM training session emphasized two meditation practices, a sitting meditation and a body scan. These practices were chosen because it was feasible to incorporate them both into one MM training session, allowed for at-home practice, and

because these are often the first two practices taught in Mindfulness Based Stress Reduction interventions. The director of a local MM center provided two and a half hours of MM instruction (one hour of actual practice time) to participants in the MM condition. This experienced instructor was certified in Mindfulness Based Stress Reduction interventions and had previously led MM courses for other researchers, lay people, and health care professionals. Participants were instructed on techniques for sitting meditation and practiced with instructor feedback. Following this, participants practiced a guided sitting meditation for 30 minutes. This meditation instructed participants to focus their attention on their breath. Participants were asked to notice whether their attention had wandered and, if it had, to gently bring back their attention to their breath. After the meditation, participants engaged in a reflection of their experience during this practice and were encouraged to share their experience with the group. These discussions were focused on the experience of MM as well as anything participants found particularly beneficial or difficult. For example, participants reported frequent mind wandering and described the process of bringing their attention back to the breath. Following the sitting meditation practice, participants were provided water and given a short break. After the break, participants received instructions and practiced the body-scan meditation.

The body-scan meditation also lasted 30 minutes. During this meditation, participants were asked to lie on a mat and attend to their breath. Over the course of 30 minutes, participants attended to various areas of their bodies, moving from their feet to the top of their head, noting any sensations. Special focus was given toward non-judgment. For example, if participants felt discomfort in a particular area, they were encouraged to notice the feeling but refrain from assigning a negative judgment toward that feeling. Following the meditation, participants engaged in another debriefing session of their second MM experience. Once both meditation practices were complete, participants were given a compact disc with two 30-minute guided meditations, the body-scan and sitting meditation led by the same instructor. They were provided with instructions regarding at-home practice, such as alternating between the sitting and body-scan meditation and practicing for a minimum of 30 minutes per day.

Measures

Dispositional Mindfulness.—The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) assessed dispositional mindfulness, which was used to determine the effectiveness of the MM intervention. The validity of this scale was established by Baer et al. (2006). The FFMQ is a 39-item, Likert-type scale with responses ranging from “never or very rarely true” (1) to “very often or always true” (5). Because we sought to ascertain changes in psychosocial variables across one week, instructions directing participants to think about how true the statements were for them in the past month were altered to direct participants to think about how true the statements are for them in the last week. There are five subscales to the FFMQ. These assess: 1) non-reactivity to inner experience, 2) tendencies to observe, notice, or attend to sensations, thoughts, and feelings, 3) tendencies to act with awareness, concentration, and non-distraction, 4) tendencies to describing and labeling with words and 5) non-judgment of experience, thoughts, and feelings. To decrease the number of analyses and because analyses with the FFMQ served to examine intervention

effectiveness, all five facets were combined to create a single measure of dispositional mindfulness. The FFMQ exhibited good internal consistency at baseline ($\alpha = .89$) post-test ($\alpha = .91$) and follow up ($\alpha = .92$).

Stress.—The Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) was used to measure stress, and was also included to determine intervention effectiveness. Validity of the PSS was demonstrated in Cohen et al. (1983). Cohen et al.'s PSS is a 10-item scale, ranging from “never” (0) to “very often” (4). For the purposes of this study, instructions directed participants to rate how much stress they had experienced in the previous week. The PSS exhibited good internal consistency at baseline ($\alpha = .89$), post-test ($\alpha = .90$), and follow up ($\alpha = .91$).

Coping Flexibility.—The Coping Flexibility Scale (Kato, 2012) was used to measure coping flexibility. Validity of the Coping Flexibility Scale was demonstrated in Kato (2012). Kato's coping flexibility scale is a 10-item, Likert-type scale ranging from “not applicable” (1) to “very applicable” (4) that assesses self-perceptions of the ability to monitor and modify coping strategies. Sample items include “When a stressful situation has not improved, I think of other ways to cope with it” and “After coping with stress, I think about how well my ways of coping worked or did not work.” The Coping Flexibility Scale exhibited good internal consistency at baseline ($\alpha = .83$), post-test ($\alpha = .83$), and follow up ($\alpha = .87$).

Time Meditating.—A measure of time meditating was created by summing the daily minutes meditating measure across all days of participation and dividing by 60 to index how many hours participants spent meditating over the course of the study. Limited previous work suggests spending more time meditating may be important to experience the benefits of MM (Baer et al., 2012). Expected MM practice in this intervention totaled 4 hours of MM (1 hour of training, 3 hours of at-home practice). As anticipated, actual practice time varied greatly from participant to participant in the MM condition ($M = 2.84$, $SD = 1.39$, range: 1.00–7.50). Although all participants in the MM condition had an hour of practice time with the instructor, seven participants in the MM condition reported no at-home practice. Because of the variability in time spent meditating, all analyses were conducted twice, one analysis in which each outcome was predicted by randomly assigned condition (MM = 1, control = 0) and once with each outcome predicted using time meditating.

Data Analysis Plan

Intervention Effectiveness.—A series of tests were used to examine whether dispositional mindfulness and perceived stress at post-test (responses from day 8 of the intervention) changed in response to the MM intervention. We separately examined these associations using condition (via F-tests) and time meditating (via regression), controlling for baseline perceived stress (responses from day 1) in all models.

Main Analyses.—Multilevel modeling was used to test whether MM would increase coping flexibility and whether these gains in coping flexibility would increase, be maintained, or be lost over time. Multilevel modeling was used for analyses because it

allows for estimates of random effects, utilizes all available data, and includes cases with missing data. To examine our hypotheses, we created a series of contrast codes (a series of weights that sum to zero). Contrast codes can be used to flexibly test competing models of within-person change, such as linear increases over time versus a pattern suggesting that increases may plateau at a particular point (Kirsch & Lehman, 2015; Lehman, Kirsch, & Jones, 2015; Nezlek, 2003). Three separate models were used to test these patterns. This approach was necessary because one of our models was not orthogonal to the others and only orthogonal contrast codes can be examined simultaneously (Warner, 2013). First, to test whether MM increased coping flexibility linearly over time (with coping flexibility increasing after baseline, and continuing to increase after the intervention was over) we created contrast codes with a linear slope. This variable was coded as -1 for baseline data, 0 for post-test data, and 1 for follow up data. To test whether coping flexibility increased during the intervention and then remained stable, we also tested a plateau slope, coded as -2 for baseline data, 1 for post-test data, and 1 for follow up data. Finally, to test whether coping flexibility increased during the intervention but those gains were lost after the intervention ended, we created an inverted U slope, coded as -1 for baseline data, 2 for post-test data, and -1 for follow up data¹. The following example illustrates the equations used to examine these slopes over time, after covarying baseline stress:

$$\text{Level 1: Coping flexibility}_{ij} = \pi_{0j} + \pi_{1j} (\text{Slope Pattern}) + e_{ji}$$

$$\text{Level 2: } \pi_{0j} = \beta_{00} + \beta_{01} (\text{Meditation Experience}) + \beta_{02} (\text{Baseline Stress}) + r_{0j}$$

$$\pi_{1j} = \beta_{10} + \beta_{11} (\text{Meditation Experience})$$

In the above equations, outcome_{ij} represents coping flexibility for person j on time i ; π_{0j} is the person-level intercept for coping flexibility, π_{0j} is the within-person effect of the contrast coded slope pattern (e.g., linear slope) on coping flexibility; e_{ji} is error for person j at time i ; π_{0j} is the effect of meditation experience, either time spent meditating or condition, on coping flexibility; β_{00-02} are the average effect of the intercept, meditation experience, and baseline stress, after considering all other predictors; β_{10} is average effect of the slope pattern, β_{11} is the interaction of meditation experience with the slope, and r_{0j} indicates random effects in the intercept. Level 1 variables consisted of coping flexibility and contrast coded variables that indicate the slope patterns. Level 2 variables consisted of baseline stress, time meditating, and condition (MM or control).

Results

Consistent with the general student body, participants were predominantly female (64%), of European descent (European 72%, Latino/Latina 13%, Asian 7%, other 3%, missing 2%, 1% or less each: African American, Middle Eastern, Native American, Pacific Islander), with a mean age of 18.97 ($SD=2.14$) years. There were no significant differences between conditions on gender ($\chi^2(110) = .02, p = .981$; %Female/Control = 63.30, %Female/MM = 62.50),

¹Please note that the linear slope and inverted U patterns of contrast codes are orthogonal to each other and might ideally be analyzed together (Cohen, Cohen, West, & Aiken, 2002). Because it is impossible to test the plateau slope model together with the linear and quadratic models, we separately present each model. However, the results of multilevel analyses simultaneously testing the linear slope and inverted U patterns parallel those presented in this manuscript; only the condition (or time meditating) by *linear* slope statistically significantly predicts coping flexibility. The quadratic model does not explain the pattern of change in coping flexibility.

ethnicity (dummy coded 1=European American; $t(106) = -.24, p = .808$; %European/Control = 71.40, %European/MM = 70.30), or age ($t(111) = .03, p = .979$; $M_{\text{Control}} = 18.98, M_{\text{MM}} = 18.97$).

A check on equality of conditions (MM vs. control) revealed that, although at baseline dispositional mindfulness and coping flexibility did not differ by condition, perceived stress was higher for the control condition than for the MM condition ($M_{\text{Control}} = 2.89, M_{\text{MM}} = 2.59, t(110) = 2.31, p = .023$). Baseline perceived stress was therefore used as a covariate in all models.

Multivariate Outliers

Prior to any data analysis, we examined the data for multivariate outliers with Mahalanobis distance using post-test assessments of dispositional mindfulness, stress, and coping flexibility. Following the recommendations of Tabachnick and Fidell (2007), the MM and control conditions were tested separately. Two multivariate outliers emerged, both from the control group. Further examination revealed that although these two individuals initially reported no previous experience with MM, during the study they reported practicing MM for 95 and 110 minutes. Because these individuals began practicing MM despite being assigned to the control condition and also emerged as multivariate outliers, they were excluded from all analyses. No participants in the MM condition emerged as multivariate outliers.

Attrition and Random Assignment Checks

Of the 113 individuals remaining in the study, 103 provided complete assessments (i.e., returned for post-test and follow up; see Figure 1 for consort diagram of attrition). Attempts were made to contact those who dropped from the study. Those who responded indicated they dropped because they no longer had time to participate in the study (e.g., athletes whose season began mid-study), became ill, or were unaware the study required three weeks of participation. Results from a chi-square analyses examining differential attrition by condition were not statistically significant, $\chi^2(N = 113, df = 1) = 2.56, p = .172$, indicating that attrition did not differ by condition. Likewise, independent samples t-tests examining differences in attrition by sex, age, and baseline variables (dispositional mindfulness, stress, and coping flexibility) were not statistically significant, suggesting that these individual differences did not account for attrition. Additionally, the three different groups of participants who took part over the course of the academic quarters did not differ in baseline or post-test variables.

Tests of MM Intervention

See Table 1 for descriptive statistics on dispositional mindfulness, stress, and coping flexibility at pre-test, post-test, and follow up. See Tables 2–4 for model results and effect sizes.

Intervention Effectiveness.—To ensure that our MM intervention was effective, we tested for differences between the MM and control condition on dispositional mindfulness and perceived stress at post-test, controlling for baseline stress. Analysis of covariance indicated that those assigned to the MM condition reported significantly greater

dispositional mindfulness at post-test ($F(1,99) = 6.84, p = .010$; $M_{\text{Control}} = 3.19, M_{\text{MM}} = 3.50$), and significantly less stress at post-test ($F(1,99) = 11.24, p = .001$; $M_{\text{Control}} = 2.89, M_{\text{MM}} = 2.36$), compared to those in the control group. Moreover, regression analyses on time spent meditating indicated that spending an additional hour meditating was associated with greater dispositional mindfulness at post-test ($b = .08, SE = .02, p = .002$), and less stress at post-test ($b = -.10, SE = .03, p < .001$). These results suggest that the MM intervention effectively promoted dispositional mindfulness and decreased stress.

Coping Flexibility.—As a preliminary step to determine the extent to which each individual's reports of coping flexibility were correlated, the variability in coping flexibility was partitioned between and within people. The within-person variance was statistically significant ($b = .10, SE = .01, p < .001$), highlighting the need for multilevel modeling with these data. Intraclass correlation for coping flexibility was .621, suggesting that 38% of the total variability in coping flexibility was within-person.

To examine whether MM increased coping flexibility, we separately tested whether MM condition and time meditating interacted with linear change over time. There was a significant interaction between condition and the linear slope (Table 3 and Figure 2). Simple slopes suggested that although the linear slope was not a significant predictor of coping flexibility in the control condition ($b < -.01, SE = .03, p = .998$), it was a significant predictor of coping flexibility in the MM condition ($b = .09, SE = .03, p = .006$). Similarly, there was a significant interaction between time meditating and the linear slope (Table 4). Region of significance tests suggested that the linear slope was significant among participants who reported .10 or more hours of meditation. Importantly, however, all participants in the MM condition had at least 1 hour practice time in the session with the MM instructor.

To examine whether increases in coping flexibility were merely maintained, as opposed to continuing to increase following the MM intervention, we separately tested whether MM condition and time meditating interacted with a plateau slope. As shown in Table 3, there was not a significant interaction between condition and the plateau slope ($b = .04, SE = .02, p = .114$), however, there was a significant interaction between time meditating and the plateau slope ($b = .02, SE = .01, p = .008$). Region of significance tests suggested that the plateau slope was significant for those who spent at least 1.28 or more hours meditating.

To examine whether increases in coping flexibility declined after the MM intervention, we tested whether MM condition and time meditating interacted with an inverted U slope. There was not a significant interaction between condition or time meditating with the inverted U slope (condition: $b = -.01, SE = .03, p = .795$; time meditating: $b < .01, SE = .01, p = .731$), suggesting that the data were not consistent with a model in which gains in coping flexibility were lost in the two weeks following the intervention.

Discussion

The present study examined the effects of a short-term MM intervention on coping flexibility. Overall, these results suggest that a one-week MM intervention effectively

increased coping flexibility among novice meditators. Moreover, analyses testing a linear pattern of change among those in the MM condition indicated that gains in coping flexibility continued to increase in the two weeks after the intervention was complete. This work suggests that MM interventions may be a useful way to promote coping flexibility among novice meditators and may also potentially suggest that coping flexibility helps explain the mechanisms by which MM training promotes health and well-being.

Previous research suggests that MM training can affect coping strategies (Josefsson et al., 2014; Sears & Kraus, 2009), and that dispositional mindfulness is correlated with coping flexibility (Finkelstein-Fox, Park, & Riley, 2018), but to our knowledge this is the first study to examine increases in coping flexibility in response to a MM intervention. Because prior research suggests that MM promotes the attentional and cognitive underpinnings of coping flexibility, we hypothesized that MM would increase coping flexibility. Consistent with this hypothesis, we found that those in the MM condition reported more linear increases in coping flexibility compared to those in the control condition. Moreover, we found that more time spent meditating was associated with greater increases in coping flexibility, relative to one's baseline. All participants in the MM condition had at least one hour of meditation time, and each additional hour of time spent meditating predicted a .04 increase in coping flexibility (Table 2). Together these results suggest that MM is another potential intervention whereby flexible coping skills can be improved and that those who spend more time practicing MM may experience greater increases in coping flexibility.

We found the most robust support for the linear slope model, suggesting that gains in coping flexibility continued even after the intervention was complete. It is possible that participants continued to meditate after the intervention and that these increases in coping flexibility after the intervention are due to continued practice. However, it is also possible that this MM intervention provided practitioners with valuable coping skills and attentional resources that they continued to build upon. This line of thinking is supported by the broaden-and-build theory of positive emotions (Fredrickson, 2001), that suggests positive emotions such as those promoted by MM (Jones, Graham-Engeland, Smyth, & Lehman, 2018), broaden attention and problem solving abilities, building resources that may self-perpetuate over time.

A second finding was that among those who spent more time meditating increases in coping flexibility began to level off somewhat between post-test and follow up (i.e., the slope between time meditating and coping flexibility became less steep for those who meditated more). Effect sizes were small for the plateau pattern when examining effects by time meditating and were not significant when examining effects by condition. Because of the non-intuitive direction of this association, and inconsistencies in significant effects here, caution is warranted when interpreting these results. Nevertheless, it is possible that those who spent the most time meditating reached a ceiling effect where these participants they felt they were coping as flexibly as possible. Future research is needed to explore this possibility. Finally, our models examining whether coping flexibility declined in the two weeks following the intervention (models of the inverted U slope), did not yield any evidence that gains in coping flexibility declined after the MM intervention was complete. Together, these results provide evidence that for those in the MM condition and who spent

more time meditating, initial increases in coping flexibility were maintained or continued to increase in the two weeks following completion of the intervention.

Future Directions for Coping Flexibility and MM Studies

The measure of coping flexibility utilized in the present study examines self-perceptions of the ability to monitor the effectiveness of coping strategies and to modify these strategies as necessary (Kato, 2012). Although we believe this definition and measure of coping flexibility to be most in line with traditional theories of stress and coping (Folkman et al., 1986) and theories of regulatory flexibility (Bonanno & Burton, 2013), definitions and measurement of coping flexibility vary substantially in which aspects of coping flexibility they emphasize and assess. Indeed, some coping flexibility definitions and measures focus on ‘goodness of fit’ strategies, others on the number of coping strategies available for use, and still others on the ability to use a variety of different approaches over time (see Cheng, Lau, & Chan, 2014 or Kato, 2012 for a synthesis). Future research is needed to examine which aspects of flexible coping MM promotes. For example, although the present study provides evidence that MM promotes the self-reported ability to monitor and modify coping strategies, it is important to examine whether it also increases the repertoire of strategies available for use, and whether MM promotes the effectiveness of strategies used.

Results from the present study provide promising evidence that MM can promote coping flexibility and may thereby affect health and well-being. Other studies document coping flexibility’s associations with health-relevant indicators, including lower depression, lower anxiety, and higher quality of life (Cheng, Lau, & Chan, 2014; Kato, 2015). Longitudinal studies and experience sampling studies are needed to test whether MM-induced increases in coping flexibility help to produce positive physical and psychological health.

Limitations

There are several limitations of the present study. First, the present study was of short duration. We utilized a one-week intervention with a short (2.5 hour) training period, and only one hour of supervised practice time. Despite the limited time for the intervention, we found significant effects of MM on coping flexibility, although the effect sizes were small this result is promising as studies of longer duration may be even more effective for promoting the skills necessary for flexible coping with stressful events. Relatedly, it is unclear how long the increases in coping flexibility will be maintained and importantly, to what extent participants need to continue in their meditation practice to maintain these gains. Future studies are needed to examine these important questions.

Second, due to budgetary restraints, the present study lacked an active control group. An active control group, ideally utilizing relaxation or stress management techniques, would strengthen causal assertions by providing evidence that MM – rather than expectancy effects – is effective in increasing coping flexibility. Future work is therefore necessary to substantiate the results seen here. Third, generalizability of the study is limited by the chosen sample. The study examined whether MM would promote coping flexibly among novice undergraduate student meditators, and it therefore is unknown whether similar changes would be seen ifor those who regularly meditate, or whether there are ceiling effects

for regular MM practitioners. Finally, baseline stress differed by condition, despite random assignment. Although baseline stress was included as a covariate in all models to reduce this bias, it is imperative that future research replicate the findings that MM increased coping flexibility. Despite these limitations, we believe that these results have important implications for research examining MM interventions and coping, and are encouraged by the consistency across models suggesting that MM did promote coping flexibility.

Conclusion

This study was designed to examine whether MM could effectively promote coping flexibility and whether these gains were increased, maintained, or lost in the weeks following the intervention. Our results suggested that those randomly assigned to the one-week MM intervention experienced increased self-reported coping flexibility compared to those in the control condition. Similarly, those who spent more time meditating had greater increases in coping flexibility. Additionally, our results suggested that gains in coping flexibility continued to increase or were maintained (depending on how much time participants spent meditating) in the two weeks after the intervention was complete. This study provides novel evidence that MM may promote the ability to monitor and modify coping strategies to promote more effective coping with stress.

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Figure 1.
A consort diagram of study recruitment and retention.

Figure 2.

A comparison of the mindfulness meditation condition (MM) with the control condition on coping flexibility over time.

Note. N (pre-test)=112, N (post-test)=103, N (follow up)=101. Significant linear slopes emerged for the MM $p=.006$, but not the control condition $p=.998$.

Table 1

Means, Standard Deviations (SD), and N's by Condition for Baseline, Post-test, and Follow up

	Mindfulness Meditation Condition			Control Condition		
	<i>Baseline</i> (<i>N</i> = 63)	<i>Post-test</i> (<i>N</i> = 56)	<i>Follow up</i> (<i>N</i> = 56)	<i>Baseline</i> (<i>N</i> = 49)	<i>Post-test</i> (<i>N</i> = 47)	<i>Follow up</i> (<i>N</i> = 45)
Dispositional Mindfulness	3.30 (.41)	3.50 (.50)	3.59 (.48)	3.15 (.39)	3.19 (.47)	3.24 (.47)
Stress	2.59 (.69)	2.39 (.60)	2.36 (.73)	2.89 (.68)	2.87 (.72)	2.80 (.79)
Coping Flexibility	2.66 (.56)	2.74 (.54)	2.82 (.55)	2.55 (.43)	2.60 (.39)	2.55 (.44)

Table 2

Associations between mindfulness meditation condition, time meditating, the linear slope, and their interactions predicting coping flexibility.

Condition (Control = 0, Mindfulness =1)						
	Main effects models			Interaction models		
	b	SE	p	b	SE	p
Intercept	2.60 *	(.06)	<0.001	2.60 *	(.06)	<0.001
Baseline stress	-0.20	(.06)	0.001	-0.20	(.06)	0.001
Linear slope	0.05	(.02)	0.026	0.00	(.03)	0.996
Condition	0.12	(.08)	0.131	0.13	(.08)	0.116
Linear slope * condition	---	---	---	0.09	(.04)	0.045
<i>Pseudo R²</i>	1.37%					

Time meditating (in hours)						
	Main effects models			Interaction models		
	b	SE	p	b	SE	p
Intercept	2.58 *	(.05)	<.001	2.58 *	(.05)	<.001
Baseline stress	-0.20	(.05)	<.001	-0.20	(.05)	<.001
Linear slope	0.05	(.02)	0.027	-0.01	(.03)	0.726
Time meditating	0.06	(.02)	0.016	0.06	(.02)	0.015
Linear slope * time meditating	---	---	---	0.04	(.01)	0.003
<i>Pseudo R²</i>	01%					

Note. Each set of lines (meditation experience, linear slope, med. experience x linear slope) represent separate analyses.

* Variable exhibited, and was modeled with, a significant random effect. *Pseudo R²* were calculated with baseline stress as null models, so that in each model, *Pseudo R²* represents the additional percent of residual variance accounted for once condition or time meditating and slopes are entered into models.

Table 3

Associations between mindfulness meditation condition, time meditating, the plateau slope, and their interactions predicting coping flexibility.

Condition (Control = 0, Mindfulness meditation =1)						
Main effects models			Interaction models			
	b	SE	p	b	SE	p
Intercept	2.60 *	(.06)	<.001	2.60 *	(.06)	<.001
Baseline stress	-0.20	(.06)	0.001	-0.20	(.06)	0.001
Plateau slope	0.03	(.01)	0.015	0.01	(.02)	0.653
Condition	0.12	(.08)	0.128	0.13	(.08)	0.116
Plateau slope * condition	---	---	---	0.04	(.02)	0.114
<i>Pseudo R²</i>	1.34%					

Time meditating (in hours)						
Main effects models			Interaction models			
	b	SE	p	b	SE	p
Intercept	2.58 *	(.05)	<.001	2.58 *	(.05)	<.001
Baseline stress	-0.20	(.05)	<.001	-0.20	(.05)	<.001
Plateau slope	0.03	(.01)	0.016	0.00	(.02)	0.964
Time meditating	0.06	(.02)	0.016	0.06	(.02)	0.015
Plateau slope * time meditating	---	---	---	0.02	(.01)	0.007
<i>Pseudo R²</i>	.14%					

Note. Each set of lines (meditation experience, linear slope, med. experience x linear slope) represent separate analyses.

* Variable exhibited, and was modeled with, a significant random effect. *Pseudo R²* were calculated with baseline stress as null models, so that in each model, *Pseudo R²* represents the additional percent of residual variance accounted for once condition and slopes are entered into models.

Table 4

Associations between mindfulness meditation condition, time meditating, the inverted U slope, and their interactions predicting coping flexibility.

Condition (Control = 0, Mindfulness =1)						
	Main effects models			Interaction models		
	b	SE	p	b	SE	p
Intercept	2.60 *	(.06)	<.001	2.60 *	(.06)	<.001
Baseline stress	-0.20	(.06)	0.001	-0.20	(.06)	0.001
Inverted U slope	0.01	(.01)	0.303	0.02	(.02)	0.375
Condition	0.12	(.08)	0.134	0.12	(.08)	0.134
Inverted U slope * condition	---	---	---	-0.01	(.03)	0.795
<i>Pseudo R²</i>	0%					

Time meditating (in hours)						
	Main effects models			Interaction models		
	b	SE	p	b	SE	p
Intercept	2.58 *	(.05)	<.001	2.58 *	(.05)	<.001
Baseline stress	-0.20	(.05)	<.001	-0.20	(.05)	<.001
Inverted U slope	0.01	(.01)	0.305	0.01	(.02)	0.599
Time meditating	0.06	(.02)	0.015	0.06	(.02)	0.015
Inverted U slope * time meditating	---	---	---	<.01	(.01)	0.731
<i>Pseudo R²</i>	0%					

Note. Each set of lines (meditation experience, linear slope, med. experience x linear slope) represent separate analyses.

* Variable exhibited, and was modeled with, a significant random effect. *Pseudo R²* were calculated with baseline stress as null models, so that in each model, *Pseudo R²* represents the additional percent of residual variance accounted for once condition and slopes are entered into models.