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Original Article:

MEDITATION AND ITS EFFECTS ON EMOTION REGULATION: THE ROLE OF TRAIT MINDFULNESS IN SHORT VS LONG-TERM INTERVENTIONS

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Abstract

Previous research demonstrates that mindfulness meditation enhances emotion regulation, or the ability to calmly and objectively evaluate negative emotions. Studies using long-term meditation consistently show this benefit, but it is unclear whether short-term interventions are lengthy enough to do the same. Trait mindfulness, or one's individual tendency towards mindfulness, is closely related to mindfulness meditation as the dispositional version of meditation. This raises the question of how trait mindfulness impacts one's capacity for meditation-induced enhancements in emotion regulation, and whether this varies across meditation length. Experiment 1 (n = 75) was designed to investigate the effect of a short-term (10-minute) meditation on emotion regulation following a stress-inducing task, with trait mindfulness as a moderator. Experiment 2 (n = 69) followed the same design across a long-term (10-day) meditation. There were no significant main effects for meditation or trait mindfulness on emotion regulation in either experiment, but a significant interaction was found in Experiment 2—individuals with higher trait mindfulness showed the greatest enhancements in emotion regulation, particularly related to acceptance-based strategies. This provides evidence that trait mindfulness moderates meditation-induced enhancements in emotion regulation, but further research is required to assess how this differs across short-term and long-term meditations.

Keywords: meditation, emotion regulation, trait mindfulness, short-term meditation, long-term meditation

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INTRODUCTION

Mindfulness is the ability to pay attention to the present moment and to be calmly aware of one's thoughts and feelings in an intentional, non-judgmental manner (Kabat-Zinn, 2003). The practice of meditation is the most common way to improve mindfulness and involves focusing one's attention on a specific bodily sensation—usually the breath—in order to cultivate an increased sense of self-awareness (Banks et al., 2015). Today, meditation is a common practice that comes in various forms, for example short-term interventions (i.e., a single meditation session less than 30 minutes) or long-term interventions (i.e., multiple sessions over the span of 1-8 weeks). The prominence of meditation in popular culture has also led to a surge in scientific research on its cognitive benefits, including but not limited to increased attention, enhanced emotion regulation, enhanced state mindfulness, and decreased levels of state anxiety and/or depressive thoughts (Mrazek et al., 2016). At some point in their lives, most individuals will struggle with negative emotions, feelings of anxiety, or the inability to focus on the task at hand. By training the mind to slow down and focus on the breath, meditation teaches a person to ground themselves before blindly reacting to the negative emotions that are an inevitable aspect of the human experience (Mrazek et al., 2016). Previous research primarily focuses on these benefits as a result of long-term meditation, and thus far, there is strong evidence of causality between the two (Basso et al., 2019; Zhang et al., 2019). Short-term interventions have been studied as well, but not to the same extent as long-term ones. Despite this lack of research, recent smaller studies demonstrate that even short-term meditation interventions may lead to increased cognitive benefits, for example, better focused attention and the ability to re-evaluate negative emotions from a different perspective (Greif and Kaufman, 2021; Valim et al., 2019). Further research is needed to examine whether short-term meditation interventions—which could potentially be implemented in healthcare, schools, and other social structures—yield the same cognitive benefits as long-term interventions.

Emotion regulation is arguably one of the most important cognitive benefits of meditation. According to Gross (2002), this is defined as the ability to process one's emotions and objectively evaluate them from a calm, unbiased perspective. Since emotions are present in every aspect of our lives, how we respond to them greatly affects our ability to function in society—whether it be within our personal relationships, everyday experiences, or bigger, life-altering events. Coping with negative emotions in particular is essential for our mental health, making meditation's capacity for increasing emotion regulation both relevant and beneficial. Although the mechanisms behind meditation's impact on emotion regulation are not fully known, many theories suggest that meditation enhances emotion regulation via attention. There are two main theories that follow this approach: the information processing approach and appraisal theory. The information processing approach states that by anchoring one's attention to the breath, meditation trains a person to switch their focus away from emotionally evocative stimuli (Menezes et al.,

2012). This is a good emotion regulation strategy because it prevents a person from paying too much attention to upsetting emotional stimuli—therefore giving them more time to process and think through their response. Appraisal theory posits that once an individual can selectively attend to their emotions, they have more control over how they interpret them (also known as reappraisal; Menezes et al., 2012). Both attention allocation and reappraisal are important cognitive mechanisms behind how meditation enhances emotion regulation. By training the mind to focus on the breath, meditation helps a person control what they attend to. Once the information is in front of them, they can process it at their own pace and therefore in a less-stressed state-of-mind (Menezes et al., 2012).

The majority of empirical research on meditation and emotion regulation has been done using long-term interventions, and thus far, there is significant evidence that they enhance emotion regulation. Although what qualifies as "long-term" is wide ranging—anywhere from 1-8 weeks— the capacity for long-term meditation to enhance emotion regulation has been demonstrated across a variety of intervention lengths. Patel et al. (2018) demonstrated that a 2-week meditation intervention enhanced emotion regulation and reduced overall negative affect. Additional studies have used slightly longer interventions, demonstrating that 3-week meditation programs are capable of reducing difficulties in emotion regulation (Sauer-Zavala et al., 2012), as well as improving self-reported emotion regulation (Mrazek et al., 2022). Other studies found similar results with 6- and 8-week interventions (Long et al., 2021; Menezes and Bizzaro, 2015; Zhang et al., 2019). Although the aforementioned literature measured emotion regulation within participants' day-to-day lives, researchers have also examined it in the context of abnormal or experimental stress. For example, a study by Basso et al. (2019) had participants complete an 8-week meditation intervention before undergoing a stressful public speaking task. They were then assessed for emotion regulation, which was measured through a variety of self-report scales including those for state anxiety, mood disturbance, perceived stress, depression, and rumination. Results indicated that meditation significantly enhanced emotion regulation (i.e., via decreased mood disturbance and anxiety) even after the stressful experience (Basso et al., 2019). In a similar study, an 8-week meditation intervention was administered to two military cohorts during the high stress period before their deployment, and once again, results showed support for the role of meditation in enhancing emotion regulation (Jha et al., 2010). Overall, whether it be in stressful or non-stressful conditions, the existing body of research provides a solid empirical foundation for the role of long-term meditation interventions in enhancing emotion regulation.

In comparison to research on long-term interventions, the literature on short-term meditation is considerably lacking. There are also discrepancies amongst the research that does exist, and so further examination is needed to determine the impact of short-term meditation on enhancing emotion regulation. More recent studies have found some support for short-term interventions enhancing emotion regulation (Edwards and Loprinzi, 2018; Greif and Kaufman, 2021). Both experimental studies assigned participants to either a 10-

minute meditation or an active control—for example, a 10-minute podcast—and found greater enhancements in emotion regulation (i.e., via decreased state anxiety) amongst the meditation groups (Edwards and Loprinzi, 2018; Greif and Kaufman, 2021). However, it is important to note that the experiment by Greif and Kaufman (2021) was only a pilot study with a very small sample size, and so additional studies would be useful in confirming their results. Additionally, despite these findings that show support for short interventions in enhancing emotion regulation, other studies show no significant effects. The study by Valim et al. (2019), for instance, tested the effects of multiple kinds of short-term meditation interventions on emotion regulation, and in contrast to other research, the focused-attention meditation condition did not yield any significant enhancements. Discrepancies like this warrant further research on the impact of short-term meditation interventions on emotion regulation. Furthermore, unlike the literature on long-term interventions, there are no studies examining the effects of short-term interventions on emotion regulation following a stressful situation. It is therefore necessary to add to this body of research so that short and long-term interventions can be more closely compared.

A related area of research involves one's predisposed capacity for mindfulness and whether this can reap the same cognitive benefits as practiced meditation. This is known as trait mindfulness, and is defined as one's inherent ability to be mindful in the present moment (Brown and Ryan, 2003). The close relationship between meditation (an acquired ability) and trait mindfulness (a dispositional, personality-like quality) raises the question of how trait mindfulness influences one's receptivity to meditation interventions and the cognitive benefits they produce—for example, enhanced emotion regulation. Thus far, research on trait mindfulness shows it to be significantly associated with enhanced emotion regulation (Brown and Ryan, 2003). However, the extent and strength of this relationship varies. In long-term meditation studies, results demonstrate that individuals with high trait mindfulness show greater enhancements in emotion regulation than individuals with low trait mindfulness after meditation (Kiken et al., 2015; Verhaeghen, 2012). This suggests that high trait mindfulness acts as a catalyst for promoting greater enhancements in emotion regulation during long-term meditation interventions, although more studies should be done to support this finding (Kiken et al., 2015; Verhaeghen, 2012). Furthermore, past studies used interventions on the "longer" end of the long-term meditation definition spectrum (i.e., 4-8 weeks), and so it is worth examining whether those on the shorter end (i.e., less than 4 weeks) would reap this same effect. Turning to literature on short-term interventions, research is even more limited and less conclusive. A study by Greif and Kaufman (2021) used a 10-minute meditation, and in contrast to the findings of long-term meditation studies, it was actually the low trait mindfulness individuals—not high trait mindfulness individuals—who showed greater enhancements in emotion regulation. To explain this, the authors argue that short-term interventions may not be long enough to produce significant enhancements in already high trait mindfulness individuals. In other words, in order for high trait mindfulness to become a catalyst for enhancing emotion

regulation, the meditation intervention must be lengthy enough for the effect to become visible (Greif and Kaufman, 2021). Short-term interventions may be too brief to trigger this in high trait mindfulness individuals since they already possess an innate amount of dispositional mindfulness, but since low trait mindfulness individuals have lower emotion regulation to begin with, even a short-term meditation can enhance their emotion regulation abilities (Greif and Kaufman, 2021). Further research is needed to support this argument and to shed light on the complex relationship between trait mindfulness and meditation-induced enhancements in emotion regulation.

The purpose of the present study is to provide further insight on the effects of short-term meditation interventions on emotion regulation, and to examine how trait mindfulness moderates that effect across short- and long-term interventions. Specifically, Experiment 1 was designed to test the effects of a short-term, 10-minute, focused breathing meditation in comparison to a control group. This study adds to the limited research on the effects of short-term interventions and emotion regulation, and to examine the effects of short-term interventions on emotion regulation after a stressful situation—which has not yet been studied. A secondary goal was to bridge some of the gaps in current literature making research on short- versus long-term interventions more comparable. In Experiment 2, the effects of a long-term 10-day focused breathing meditation intervention in comparison to a control group was studied. In both experiments, the studies examine the moderating role of trait mindfulness on short- and long-term meditation interventions on emotion regulation.

EXPERIMENT 1

There is a lack of consistent research on short-term meditation, its effects on emotion regulation, and the moderating role of trait mindfulness. As such, in Experiment 1, the investigators tested the effects of emotion regulation following either a 10-minute guided breathing meditation similar to those used in prior studies (Basso et al., 2019; Edwards and Loprinzi, 2018; Greif and Kaufman, 2021) or an active control condition. After the 10-minute intervention or control, participants completed a task that induced emotional stress (Katz et al., 2017) before being assessed for their emotion regulation abilities. Participants also completed a questionnaire designed to assess trait mindfulness (Brown and Ryan, 2003). Although some previous studies completed a baseline measure for emotion regulation to assess pre/post levels, this was not included in the current study due to the short duration of the meditation intervention. On the basis of previous research, we hypothesized that participants in the meditation condition would demonstrate enhanced emotion regulation following a stressful task compared to those in the active control condition (Edwards and Loprinzi, 2018). With regards to trait mindfulness, we predicted that participants with low trait mindfulness would show enhanced emotion regulation after a stressful task compared to high trait mindfulness individuals as prior studies have found

this pattern (Greif and Kaufman, 2021). For the interaction, we predicted that participants in the meditation condition who also had low trait mindfulness would show the greatest enhancements in emotion regulation.

METHOD

Participants

Seventy-five undergraduates from a university in California participated in the experiment and were given $10 payment for their participation. There were 63 participants that identified as female (84%), 10 that identified as male (13.33%), and two preferred not to say (2.67%). Participants were recruited via email listservs for all academic departments at the university. The email contained a brief description of the study, a mention of compensation for participation, and an interest form for students to input their email. Anyone who filled out this interest form was sent a follow up email with instructions on how to sign up for the study via SONA. Unfortunately, SONA experienced technical difficulties during the time of recruitment, and so a few students emailed us about problems with signing up. In these cases, a list of available days/times was sent to the students and they confirmed their slot via email. This was only done for 3 participants, and the rest signed up through SONA. All participants were accepted into the study and there were no exclusionary criteria. This study was approved by the university's Institutional Review Board.

Design

The current study was a two-arm randomized between-subjects design with condition (meditation intervention vs active control) as the independent variable, emotion regulation (measured via reappraisal and acceptance) as the dependent variable, and trait mindfulness as a measured continuous moderator. Condition was operationalized by having participants randomly assigned to either a meditation intervention (i.e., 10-minute focused breathing meditation) or an active control (i.e., 10-minute podcast). Trait mindfulness was measured using the Mindful Attention Awareness Scale (MAAS) developed by Brown and Ryan (2003). Emotion regulation abilities were measured using the Reappraisal and Acceptance subscales of the State Emotion Regulation Inventory (SERI) developed by Katz et al. (2017).

Measures and Apparatus

Meditation Intervention. Participants in the meditation condition listened to a 10-minute seated Vipassana guided meditation from the Vipassana Series of the "Can You Zen" YouTube channel. This was a focused-attention meditation that had participants first

draw their attention to their breath, and then shift that focus across their body whilst noticing the sensations in each part. This meditation was chosen because of its anchoring in the breath, and its similarities to the focused-attention meditation interventions used in prior studies (Basso et al., 2019; Kabat-Zinn, 2003; Grief and Kaufman, 2021).

Control Condition. Participants in the control condition were assigned to the first 10-minutes of the podcast, "The Theater of David Byrne's Mind," by Radiolab. This podcast was chosen because it was on a neutral topic—the recent accomplishments of rockstar David Byrne—and did not contain any mention of meditation or mindfulness. Podcasts from Radiolab have been used as active control conditions in prior short-term meditation studies (Basso et al., 2019).

Stress-Inducing Task. To induce mild stress in order to measure context specific emotion regulation skills, all participants completed the Emotional Stressor Task developed by Katz and colleagues (2017). This task was used in prior meditation intervention studies that studied emotion regulation (Katz et al., 2017). Participants were asked to recall "an unpleasant experience" they have had, "one that at times still disturbs and saddens" them (Katz et al. 2017). This event must specifically provoke negative feelings about themselves, and although the instructions say to choose an upsetting event, it should not be so upsetting to the point of being traumatic. The task starts by having the participant recall this memory and write down a few sentences describing the event, as well as the "sensations, feelings, and thoughts" they still have about that event and how that makes them feel about themselves. The participant is then guided through a focused rumination task in which they reflect on the situation. A series of sentences are displayed (25 seconds each) one after the other, and include examples like: 1) "Reflect on your personal characteristics. Were they a factor in what transpired? How so?" 2) Consider: Would others have coped more successfully than you? 3) Reflect on why you were unable to deal with the situation in a better way. This task has been validated as effective in inducing negative cognition and stress and decreasing positive emotion (Katz et al., 2017).

State Emotion Regulation Inventory (SERI). To measure emotion regulation, all participants completed the State Emotion Regulation Inventory (SERI) developed by Katz et al. (2017), which has been used in previous studies on meditation interventions and emotion regulation to capture state rather than trait emotion regulation. The SERI was created in tandem with the Emotional Stressor Task developed by Katz and colleagues in 2017 and is therefore always completed following the stressor task (Katz et al., 2017). It is a validated measure for situational use of emotion regulation strategies, consisting of 16 questions and four subscales: Distraction (α=0.91), Reappraisal (α=0.91), Brooding (α=0.82), and Acceptance (α=0.82). This questionnaire requires participants to evaluate the extent to which they agree with a series of statements regarding negative thoughts they have had about themselves. When rating themselves on these statements, they must evaluate how they dealt with those negative thoughts from the moment the thoughts occurred until now. Statements are rated on a 7-point Likert scale from "*strongly disagree*"

(1 point) to "*strongly agree"* (7 points) and sample items include: "I tried to think about other things" and "I looked for the positive aspects of the situation." No items are reverse-coded and the final score is calculated by averaging the items in each subscale. High average means higher use of the strategy. The following lists which questions are associated with each subscale: Distraction (1,5,9,11), Reappraisal (2,6,10,14), Brooding (3,7,11,15), and Acceptance (4,8,12,16). Each subscale is to be left discrete, with higher scores on Reappraisal and Acceptance indicating greater emotion regulation abilities. Distraction and Brooding are indicative of lower emotion regulation abilities, and since they are not reverse-coded in the SERI, they were disregarded for the purposes of this study. The Reappraisal and Acceptance subscales are indicative of higher emotion regulation and were therefore analyzed and included in the results (Kolbeinsson et al., 2022).

Mindful Attention Awareness Scale (MAAS). The moderator of trait mindfulness was measured using the Mindful Attention Awareness Scale (MAAS)—one of the oldest and most relied upon measures for trait mindfulness (α=0.89; Brown and Ryan, 2003). It has been validated across multiple populations (i.e., general adults, cancer patients, children, and normative and psychiatric adolescents) and has versions in Spanish as well as Turkish (Brown and Ryan, 2003; Brown et al., 2011; Carlson and Brown, 2011; Catak, 2011; Lawlor et al., 2013). This self-report scale consists of 15 statements asking about one's everyday experience and how frequently/infrequently one has these experiences. Participants are instructed to answer according to what their experience actually is versus what they think it should be. Each statement is rated on a 6-point reversed Likert scale from "*almost always*" (1 point) to "*almost never*" (6 points) and sample items include: "I could be experiencing some emotion and not be conscious of it until some time later" and "I find it difficult to stay focused on what's happening in the present". There are no subscales and the final score is calculated by computing the mean of the 15 items. Higher scores indicate higher trait mindfulness while lower scores indicate lower trait mindfulness.

Procedure

Upon arrival, participants were given a brief intro to the study. They were told the experiment was about the effects of self-improvement interventions, and that they would be assigned to either a meditation exercise or a podcast. They were not informed that the study would measure trait mindfulness so as to keep their responses unbiased. They were then assigned a unique participant ID number and guided to a computer to begin the experimental survey conducted via Qualtrics. Once they inputted their ID and marked whether it was an even or odd number, participants were guided through the consent process and their right to waive consent at any point during the experiment. To obtain consent, participants were first informed of the potential risks to the study, which included mild to moderate emotional distress. They were also directed to the university's free Counseling and Psychological (CAP) services in the event that they needed assistance

working through any painful emotions during or after the experiment. They were also informed of the benefits of participating, for example, contributing to the furthering of scientific knowledge. It is important to note that in order to avoid biased responses, participants were not informed that the study would be looking at the effects of mindfulness meditation. This piece of information was withheld until the debrief form at the end of the experiment. Once they had consented, participants completed the Mindful Attention Awareness Scale (MAAS) (Brown and Ryan, 2003). They were then randomly assigned to the meditation condition (even participant IDs) or the control (odd participant IDs). Participants then took the next 10 minutes to complete the task (i.e. meditation or control-podcast) associated with their assigned condition. Next, since this study was conducted in collaboration with another honors thesis student, all participants completed a task unrelated to the present research called the Dyads of Triads Task. This task measured intuition via perception of coherence by having participants evaluate the semantic coherence of word triads, and then guess the common associate across the three words (Bowers et al., 1990). They then completed the Emotional Stressor Task (Katz et al., 2017) and the State Emotion Regulation Inventory (Katz et al., 2017). Next, they completed another task unrelated to the present study that measured over-inclusive thinking, first developed in 1984 by Isen and Daubman. In this task, participants were asked to rate the extent to which a list of words fell into a certain category. Participants who more often put "atypical" words into the category were rated as having higher over-inclusive thinking (Isen and& Daubman, 1984). Finally, participants were guided to the debrief form in which they were told the full nature of the study, our hypotheses, and why the trait mindfulness aspect of the experiment was withheld from them. Participants were told that they could withdraw their consent if they wanted, but if not, all their data would be kept confidential and used for experimental purposes only. They were thanked for their participation, compensated $10 in cash, and given the researchers' contact information should they have any questions or concerns regarding the study. All data was collected through Qualtrics and inputted into an Excel spreadsheet and analyzed using R statistical software.

RESULTS

Condition x Trait Mindfulness on Reappraisal

Neither condition (b = -0.01, p = .98) nor trait mindfulness (b = 0.22, p = .29) demonstrated a significant main effect on the reappraisal subscale. A hierarchical moderated regression analysis was conducted to test the hypothesis that the relationship between condition and reappraisal would be moderated by trait mindfulness. Step 1 tested the main effects of condition (meditation vs control) and trait mindfulness on the reappraisal subscale of emotion regulation as measured by the SERI (Katz et al., 2017). Step 2 tested for an interaction, with trait mindfulness treated as a continuous moderator in

the effect of condition on reappraisal. The results showed Step 1 to be nonsignificant ($F(2, 73) = 0.60$, $p = .55$, $R^2 = .02$). Step 2 ($F(3, 72) = 1.29$, $p = .283$, $R^2 = .05$) showed no evidence of a significant interaction between condition and trait mindfulness on reappraisal ($b = 0.66$, $p = .11$). This suggests that participants' enhancements in reappraisal following a short meditation intervention were not moderated by their innate levels of trait mindfulness.

Condition x Trait Mindfulness on Acceptance

A hierarchical moderated regression analysis was conducted to test the hypothesis that the relationship between condition and acceptance would be moderated by trait mindfulness. Step 1 tested the main effects of condition (meditation vs control) and trait mindfulness on the acceptance subscale of emotion regulation as measured by the SERI (Katz et al., 2017). Step 2 tested for an interaction, with trait mindfulness treated as a continuous moderator in the effect of condition on acceptance. The results showed Step 1 to be nonsignificant ($F(2, 73) = 1.18$, $p = .31$, $R^2 = .03$). Neither condition ($b = -0.03$, $p = .89$) nor trait mindfulness ($b = 0.20$, $p = .13$) demonstrated a significant main effect on the acceptance subscale. Step 2 was also found to be nonsignificant ($F(3, 72) = 0.79$, $p = .50$, $R^2 = .03$), indicating no evidence of a interaction when trait mindfulness was treated as a moderator in the effect of condition on acceptance ($b = -0.05$, $p = .84$). In other words, participants' enhancements in acceptance following a short meditation intervention were not moderated by their innate levels of trait mindfulness.

DISCUSSION

In Experiment 1, we hypothesized that: 1) there would be a main effect of condition, with participants in the meditation group showing greater enhancements in emotion regulation than those in the control, 2) there would be a main effect of trait mindfulness, with low trait mindfulness participants showing greater enhancements in emotion regulation than high trait mindfulness participants, and 3) an interaction would occur, with participants in the meditation condition who also have low trait mindfulness showing the greatest enhancements in emotion regulation overall. Based on the results, our hypotheses for both of the main effects and the interaction effect were rejected.

In a previous study, Greif and Kaufman (2021) demonstrated a significant interaction between short-term meditation and trait mindfulness on emotion regulation. Specifically, they found that short-term meditation enhances emotion regulation, with low trait mindfulness individuals showing greater enhancements than high trait mindfulness individuals (Greif and Kaufman, 2021). Experiment 1 did not replicate these findings as there was no evidence of this interaction, or any other interaction effect. In the General Discussion, we discuss this contradiction in detail and suggest possible explanations behind

these results. For the main effect of condition in Experiment 1, our hypothesis was rejected since participants in the meditation condition did not show greater emotion regulation enhancements compared to the control. Previous research has shown inconsistent data on the effect of short-term meditation on emotion regulation, and so further research is required to determine the true nature of this effect (Edwards and Loprinzi, 2018; Greif and Kaufman, 2021; Valim et al., 2019). Contrary to our predictions, Experiment 1 did not demonstrate evidence that low trait mindfulness individuals would show greater emotion regulation enhancements than high trait mindfulness individuals. In the General Discussion, we consider possible explanations behind our lack of significant main effects for both trait mindfulness and condition. Before this, however, we examine these same concepts within the context of a long-term meditation intervention. The literature on long-term interventions is more extensive than that on short-term, but there is still a lack of research on how trait mindfulness moderates meditation-induced enhancements in emotion regulation following long-term meditation. In Experiment 2, the authors employ a longer meditation intervention in an effort to bridge this gap.

EXPERIMENT 2

There is considerable literature demonstrating that long-term meditation enhances emotion regulation, but less research examines how trait mindfulness moderates this relationship. As such, in Experiment 2, the investigators recruited another group of participants at a separate time point and tested the effects of a 10-day meditation intervention—a shortened version of the 22-day intervention used by Mrazek et al. (2022) and similar to those from other studies (Long et al., 2021; Menezes and Bizzaro, 2015; Zhang et al., 2019). After the 10-day intervention, participants completed the same stress-inducing task from Experiment 1 before being assessed for their emotion regulation abilities (Katz et al., 2017). Participants also completed the same trait mindfulness questionnaire from Experiment 1 (Brown and Ryan, 2003). Based on previous research, we hypothesized that participants in the meditation condition would demonstrate greater enhancements in emotion regulation following a stressful task than those in the control. For trait mindfulness, based on prior studies, we hypothesized that participants with high trait mindfulness would show greater enhancements in emotion regulation after a stressful task than low trait mindfulness individuals. For the interaction, we hypothesized that participants in the meditation condition who also had high trait mindfulness would show the greatest enhancements in emotion regulation out of all groups.

METHOD

Participants

Sixty-nine undergraduates (M = 19.99 years-old, SD = 1.64) from a university in California participated in the experiment for $25 payment. More extensive demographics were taken on the participants in Experiment 2 versus Experiment 1 because Experiment 2 was conducted with another honors thesis student whose experimental question specifically examined race and gender. There were 51 participants that identified as female (73.9%), 13 identified as male (18.8%), two identified as non-binary or third gender (2.90%), one identified as male and female (1.45%), one identified as female and non-binary (1.45%), and one preferred not to say (1.45%). For racial demographics, 27 participants identified as Asian, 15 as White, 11 as Latino or Hispanic, two as Black or African American, seven as other, nine as one or more race, and one chose not say. All participants were accepted into the study and there were no exclusionary criteria. Participants were recruited via the same email listserv process from Experiment 1. Additionally, flyers were posted around the university campus to advertise the experiment and the study interest form was posted on the researchers' social media accounts. Lastly, the study was approved by the university's Institutional Review Board.

Design

The current study was a between-subjects design with condition (meditation vs control) as the independent variable, emotion regulation (measured via reappraisal and acceptance subscales) as the dependent variable, and trait mindfulness as a measured continuous moderator. Condition was operationalized by having participants randomly assigned to either a meditation (10-day meditation intervention; 72 minutes total) or an active control (10-days of Lumosity; 60 minutes total). Trait mindfulness was measured using the Mindful Attention Awareness Scale (MAAS) developed by Brown and Ryan (2003). Emotion regulation was measured using the Reappraisal and Acceptance subscales of the State Emotion Regulation Inventory (SERI) developed by Katz et al. (2017) following a stressful task before and after the meditation.

Measures and Apparatus

Meditation Intervention. Participants in the meditation condition completed the 10-day program called Finding Focus (Mrazek et al., 2022). This was a longer focused-attention meditation that had participants complete one meditation (either a 12-minute lesson or a 4-minute exercise) per day. Participants were able to join Finding Focus by creating an account and inputting an add code for this study specifically. This code also allowed the researchers to keep track of each participant as they progressed through the program.

Control Condition. Participants in the control condition completed 10 days of the online brain training program, Lumosity. For each of the 10 days, participants completed 2 Lumosity games/puzzles that were each 2-3 minutes long. This program was chosen because it was free of meditation and mindfulness exercises, had a user-friendly interface, and was similar in design to the Finding Focus program. This was chosen because it has similar exercises and tasks to complete daily and tracked participant's participation. [24]

Stress-Inducing Task. To induce mild emotional stress, all participants completed the Emotional Stressor Task as was used in Experiment 1 (Katz et al., 2017). Reference the *Measures and Apparatus* section for Experiment 1 for more details.

State Emotion Regulation Inventory (SERI). To measure emotion regulation, all participants completed the State Emotion Regulation Inventory (SERI) as was used in Experiment 1 (Katz et al., 2017). Reference the *Measures and Apparatus* section for Experiment 1 for more details.

Mindful Attention Awareness Scale (MAAS). As in Experiment 1, the moderator of trait mindfulness was measured using the Mindful Attention Awareness Scale (MAAS) (Brown and Ryan, 2003). Reference the *Measures and Apparatus* section for Experiment 1 for more details.

Procedure

Upon arrival, participants were given a brief introduction to the study and told that the experiment was about the effects of self-improvement apps. They were informed that they would complete a series of cognitive tasks and personality questionnaires, do 10 days of short exercises on a self-improvement app, and then return for another series of questionnaires. After this introduction, they were given a sticky note with their unique participant ID number and guided to one of the computers to begin the survey conducted via Qualtrics. Once they inputted their participant ID, participants were guided through the consent process. To obtain consent, participants were first informed of the potential risks to the study, which included mild to moderate emotional distress. They were also directed to the university's free Counseling and Psychological (CAP) services in the event that they needed assistance working through any painful emotions during or after the experiment. They were also informed of the benefits of participating, for example, contributing to the furthering of scientific knowledge. It is important to note that in order to avoid biased responses, participants were not informed that the study would be looking at the effects of mindfulness meditation. This piece of information was withheld until the debrief form at the end of the experiment. After reading through the consent form, participants either consented or did not consent to participating in the experiment. Lastly, as in Experiment 1, this study was conducted in collaboration with two other honors thesis students. Many of the described questionnaires and tasks are therefore unrelated to the present research, but will still be mentioned for academic integrity.

After the consent process, all participants completed a task unrelated to the present research called the Persistence, Effort, Resilience, and Challenge-Seeking (PERC) Task—a computer-based puzzle task designed to assess participants on these aforementioned qualities (Porter et al., 2020). They then completed another unrelated task called the Sustained Attention to Response Task (SART), a computer task designed to test participants' sustained attention to digits on a screen by timing their pressing of a key in response to pre-specified numbers (Robertson et al., 1997). Next, participants completed the Mindful Attention Awareness Scale to measure mindfulness as a trait (MAAS; Brown and Ryan, 2003). They then completed five other questionnaires unrelated to the present research: the Toronto Mindfulness Scale to measure state-like mindfulness experiences during meditation, the Cambridge Depersonalization Scale to capture participants' experiences of depersonalization over the last six months, a question about their level of meditation experience, the Mind-Wandering Questionnaire to assess the frequency of both deliberate and spontaneous mind-wandering, and the Clinician Administered Dissociative States Scale to measure present-state dissociative symptoms (Bremner et al., 1998; Lau et al., 2006; Mrazek et al., 2013; Sierra and Berrios, 2000). After completing these pre-intervention measures, participants were randomly assigned to either the meditation or control condition. They were instructed to input the number on the sticky note at the bottom corner of their computer (either a "1" or "2"). This was then used to randomly assign them to either the meditation ("1") or control ("2") condition. Depending on the condition, they were then guided through the process of downloading the FindingFocus app (meditation) or Lumosity (control). Once participants had successfully downloaded the app and created an account, they were instructed to check back in with the researcher. As their final step, participants were given a sheet of instructions for their respective condition and instructed to return to the same location on a scheduled date/time 10 days later.

Over the next 10 days, participants completed the tasks on their respective apps and tracked their progress by sending daily screenshots to the official email account for the study. After the 10 days, participants returned to complete one final series of tasks and questionnaires. They were asked their name, given a sticky note with their participant ID, and guided to a computer to begin the survey. After inputting their ID, they were asked to estimate the percentage of their assigned intervention that they completed over the past 10 days (i.e.,"0%", "50%", "80%", or "100%"). Next, they redid the following tasks and questionnaires from the pre-intervention survey: the PERC Task, SART, Mind-Wandering Questionnaire, Toronto Mindfulness Scale, and Clinician Administered Dissociative States Scale. After this, they completed the Emotional Stressor Task (Katz et al., 2017) and the State Emotion Regulation Inventory (Katz et al., 2017), but this time, they were asked to recall a different unpleasant experience compared to the pre-intervention measure. Participants then answered a series of demographic questions unrelated to the present research. Finally, all participants were debriefed on the true nature of the study and informed of their right to withdraw consent. They were thanked for their participation,

compensated $25 in cash, and given the researchers' contact information should they think of any questions or concerns regarding the study. All data was collected through Qualtrics and inputted into an Excel spreadsheet and analyzed using R statistical software.

RESULTS

Condition x Trait Mindfulness on Reappraisal

A hierarchical moderated regression analysis was conducted to test the hypothesis that the relationship between condition and reappraisal would be moderated by trait mindfulness. Step 1 tested the main effects of condition (meditation vs control) and trait mindfulness on the reappraisal subscale of emotion regulation as measured by the SERI (Katz et al., 2017). Step 2 tested for an interaction, with trait mindfulness treated as a continuous moderator in the effect of condition on reappraisal. The results showed Step 1 to be nonsignificant ($F(2, 67) = 0.38$, $p = .68$, $R^2 = .01$). Neither condition ($b = 0.08$, $p = .75$) nor trait mindfulness ($b = -0.15$, $p = .45$) demonstrated a significant main effect on reappraisal. Step 2 was also found to be nonsignificant ($F(3, 66) = 0.93$, $p = .43$, $R^2 = .04$), indicating no evidence of a significant interaction when trait mindfulness was treated as a moderator in the effect of condition on reappraisal ($b = 0.57$, $p = .16$). In other words, participants' enhancements in reappraisal following a long meditation intervention were not moderated by their innate levels of trait mindfulness.

Condition x Trait Mindfulness on Acceptance

A hierarchical moderated regression analysis was conducted to test the hypothesis that the relationship between condition and acceptance would be moderated by trait mindfulness. Step 1 tested the main effects of condition (meditation vs control) and trait mindfulness on the acceptance subscale of emotion regulation as measured by the SERI (Katz et al., 2017). Step 2 tested for an interaction, with trait mindfulness treated as a continuous moderator in the effect of condition on acceptance. The results showed Step 1 to be nonsignificant ($F(2, 67) = 1.47$, $p = .24$, $R^2 = .04$). Neither condition ($b = 0.32$, $p = .11$) nor trait mindfulness ($b = 0.10$, $p = .50$) demonstrated a significant main effect on acceptance. However, Step 2 was found to be significant ($F(3, 66) = 2.31$, $p = .08$, $R^2 = .09$), indicating evidence of a significant interaction when trait mindfulness was treated as a moderator in the effect of condition on acceptance ($b = 0.59$, $p = .05$; see Figure 1). Overall, an additional 5.3% of variance was explained in Step 2, indicating that participants' enhancements in acceptance following a long meditation intervention were moderated by their levels of trait mindfulness.

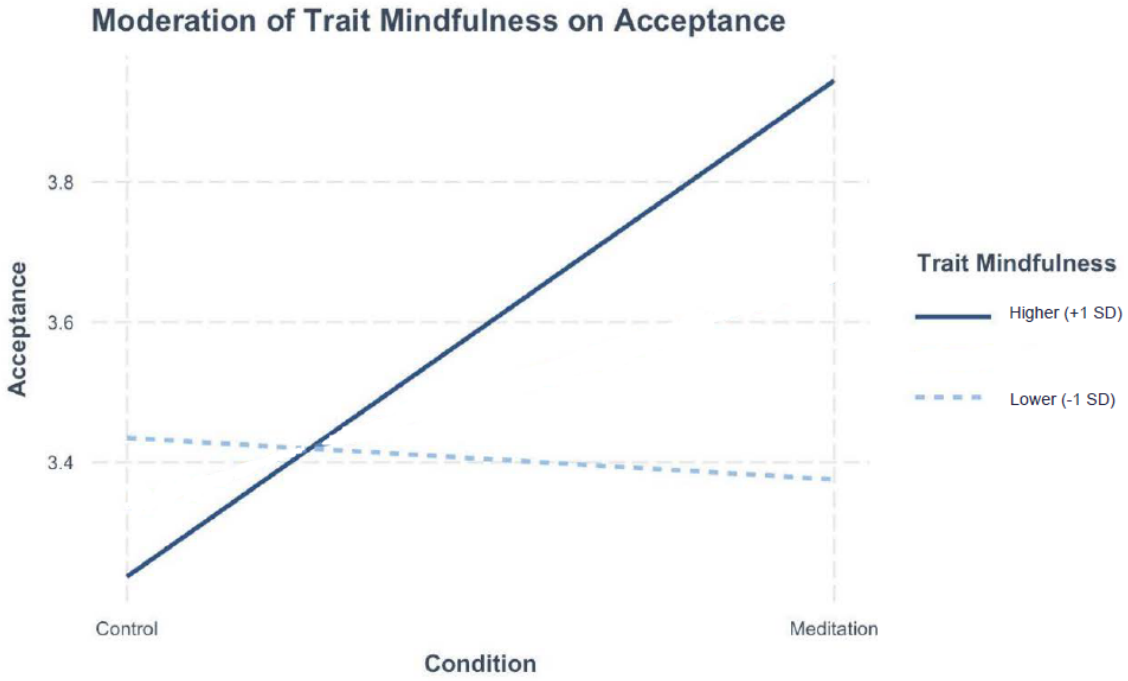

Figure 1. Effect of condition (Lumosity control versus Finding Focus meditation intervention) on acceptance as moderated by trait mindfulness. Solid dark blue line demonstrates that higher trait mindfulness individuals show more significant enhancements in acceptance than low trait mindfulness individuals (dash light blue line) when exposed to a meditation intervention (significant at p=.05).

Ad Hoc Analyses: Correlation Between Trait Mindfulness and Intervention Dosage

Although the results of the interaction analysis suggested that trait mindfulness moderates meditation-induced enhancements, it is possible that high trait mindfulness individuals simply completed more of the intervention than low trait mindfulness individuals. In this case, their greater enhancements in emotion would not be moderated by the quality of trait mindfulness, but rather the dosage of interventions completed. Trait mindfulness has been associated with goal-orientation and intrinsic motivation, and so this explanation is certainly plausible (Kalafatoğlu and Turgut, 2019). To examine this possibility, a Pearson's correlation analysis was conducted to assess the relationship between trait mindfulness and self-reported adherence (i.e., the estimated percentage of the intervention completed by participants). Interestingly, the results showed a negative correlation, indicating that as participants' trait mindfulness increased, they completed less—not more—of the intervention, ($r(68) = -0.26$, $p = .03$). This provides further evidence of an interaction between condition and trait mindfulness because it confirms that high trait mindfulness individuals did not show greater enhancements due to higher intervention completion rates. Instead, high trait mindfulness individuals actually completed less of the intervention and still managed to show greater enhancements

compared to low trait mindfulness individuals. This affirms the significance of the interaction demonstrated by Step 2 of the hierarchical moderated regression analysis, and provides further evidence for the role of trait mindfulness in moderating meditation-induced enhancements.

DISCUSSION

In Experiment 2, we hypothesized that: 1) there would be a main effect of condition, with participants in the meditation group showing greater enhancements in emotion regulation than the control, 2) there would be a main effect of trait mindfulness, with participants on the higher end of trait mindfulness showing greater enhancements in emotion regulation than lower trait mindfulness participants, and 3) an interaction would occur, with participants in the meditation condition who also have high trait mindfulness showing the greatest enhancements in emotion regulation overall. Based on the results, our hypotheses for both main effects were rejected. However, we did find evidence for the interaction effect on acceptance skills, but not reappraisal skills for emotion regulation.

Prior research indicates that amongst individuals who complete a long-term meditation intervention, those with high trait mindfulness show more significant enhancements in emotion regulation than low trait mindfulness individuals (Kiken et al., 2015; Verhaeghen, 2012). In accordance with previous studies, Experiment 2 found evidence of this interaction effect—thus demonstrating that as one's trait mindfulness increases, so do their enhancements in acceptance-based emotion regulation skills following a long-term meditation. In the General Discussion, we discuss the implications of this finding in more detail. For our hypothesized main effect of condition in Experiment 2, our hypothesis was rejected since we did not find significant results for the effect of long-term meditation in enhancing emotion regulation. This contrasts previous research, which demonstrates that meditation interventions ranging from 2-8 weeks enhance emotion regulation (Long et al., 2021; Patel et al., 2018; Zhang et al., 2019). For the main effect of trait mindfulness on emotion regulation in Experiment 2, our hypothesis was also rejected. Although previous research has demonstrated that individuals with high trait mindfulness have greater ER enhancements compared to low trait mindfulness individuals, we did not find evidence of this main effect (Kiken et al., 2015; Verhaeghen, 2012). In the General Discussion, we discuss possible explanations for our lack of significant main effects as well as improvements that could be included in future studies.

GENERAL DISCUSSION

The purpose of these studies was to examine the effects of short- and long-term meditation interventions on emotion regulation, evaluate the role of trait mindfulness in moderating this relationship, and determine whether the relationship varies across short and long-term meditation conditions. The effects of long-term meditation on emotion regulation have been studied considerably, but similar research on short-term meditation is less common and filled with discrepancies. The present study aimed to clarify these inconsistencies, therefore making the effects of short- versus long-term meditation more comparable. This study also addressed the lack of research on how trait mindfulness moderates meditation-induced enhancements in emotion regulation, and furthermore, whether this varies across short- and long-term interventions. In the two experiments reported here, the effects of short-term (10 min) and long-term (10-days) meditation interventions were examined by measuring emotion regulation abilities following a stress-inducing task. Trait mindfulness was also measured in both experiments via a self-report questionnaire (Brown and Ryan, 2003). Although neither experiment showed main effects for meditation and trait mindfulness on emotion regulation, the results of Experiment 2 showed a significant positive interaction between long-term meditation and trait mindfulness on the acceptance factor of emotion regulation skills. The findings of Experiment 1, however, did not demonstrate any significant interaction between a short-term meditation and trait mindfulness on emotion regulation.

Of the little research that has been done on trait mindfulness, studies using long-term meditation interventions demonstrate evidence of an interaction between meditation and trait mindfulness on emotion regulation (Kiken et al., 2015; Verhaeghen, 2012). Specifically, prior research shows that trait mindfulness moderates the effect of meditation on enhanced emotion regulation, with increasing trait mindfulness leading to more significant enhancements (Kiken et al., 2015; Verhaeghen, 2012). The results from Experiment 2 were mixed, providing evidence for the role of trait mindfulness in moderating meditation-induced enhancements in acceptance skills related to emotion regulation, but not in reappraisal skills related to emotion regulation. This indicates that trait mindfulness may act as a catalyst for enhancing emotion regulation following long-term meditation—an idea that has been proposed, but not significantly evidenced by previous research (Greif and Kaufman, 2021). Prior literature has also demonstrated a correlation between trait mindfulness and increased attention, which as mentioned in the introduction, is the theorized cognitive mechanism behind how meditation enhances emotion regulation (Menezes et al., 2012; Verhaeghen, 2012). This correlation could potentially explain why trait mindfulness positively moderates meditation-induced enhancements in emotion regulation. Individuals with higher trait mindfulness also have increased attention abilities, and since meditation acts on attention, this may make them more apt to reaping its benefits (Verhaeghen, 2012). Although more studies are needed,

the present study has expanded on this, furthering the evidence of the relationship between meditation and trait mindfulness. This interaction also demonstrates the potential for individuals' predisposed qualities (i.e., trait mindfulness) to affect how significantly they benefit from meditation interventions. However, given that the present study found a significant interaction for only the acceptance aspect of emotion regulation and not reappraisal, future studies should examine whether meditation is more closely related to some elements of emotion regulation than others.

Limited research has also examined the interaction between short-term meditation and trait mindfulness on emotion regulation. In the one study, short-term meditation was found to yield greater enhancements in emotion regulation amongst low versus high trait mindfulness individuals (Greif and Kaufman, 2021). The lack of significant results in Experiment 1 contradicted these findings, and instead showed no evidence that trait mindfulness moderates the effect of short-term meditation on emotion regulation. Unfortunately, there are not many studies on trait mindfulness and the effects of short-term meditation specifically. The study by Greif and Kaufman (2021) was also only a pilot study with a relatively small sample size, and so it was unclear whether the present study would be able to replicate their results. The contradicting findings found in Experiment 1 indicate that the relationship between these factors is still unclear. Additional studies with larger and more diverse sample sizes are needed to better understand if and how short-term meditation interventions and trait mindfulness interact to affect emotion regulation. Finally, due to the limited nature of recruiting from an undergraduate university, it is possible that some participants participated in both the short-term and long-term studies. It may be that since these participants had already experienced the tasks and measures, they could not provide an accurate comparison between the effect of short-term and long-term meditation interventions on emotion regulation, and whether trait mindfulness moderates that relationship. Future replications of this study should track participants more closely to avoid potential overlap, as well as recruit more diverse sample sizes to reduce compromising the validity of the results.

For the main effect of condition, neither Experiment 1 nor Experiment 2 demonstrated a significant effect of meditation on emotion regulation compared to an active control. As mentioned in the introduction, previous studies have found conflicting evidence of whether meditation significantly enhances emotion regulation. Some found that meditation interventions as short as 10-minutes can enhance emotion regulation (Edwards and Loprinzi, 2018; Greif and Kaufman, 2021), while others found it to be ineffectual (Valim et al., 2019). Because of these discrepancies, our insignificant results are relatively unsurprising and suggest that short-term meditation may not be long enough to enhance emotion regulation. However, more research is needed to confirm this. Additionally, since Experiment 1 did not include a baseline measure of emotion regulation, it is difficult to determine whether the nonsignificant results were due to baseline differences in emotion regulation skills or the effects of the stress-inducing situation and

short-term meditation. Future studies should include these baseline measures to more accurately assess the impact of short-term meditation interventions on individuals' emotion regulation abilities.

For long-term meditation interventions, there is significant evidence that it enhances emotion regulation (Long et al., 2021; Menezes and Bizzaro, 2015; Sauer-Zavala et al., 2012). Interestingly, our results from Experiment 2 contradicted these findings, leading us to believe there were limitations in our study. A possible explanation could be attention fatigue as a result of completing so many post-intervention tasks, both related and unrelated to the present study. As mentioned previously, current theories on the cognitive mechanisms behind meditation suggest that it enhances emotion regulation via attention (Menezes et al., 2012). It is plausible that the 10-day intervention did improve participants' attention by training them to focus on the breath, but due to the large number of post-interventions tests they were required to complete, that focused attention was strained across too many cognitive tasks—thus leading to the lack of significant main effects. Future studies with increased funding and resources should take this into account and restrict the post-meditation tasks to those related to emotion regulation in order to isolate a potential main effect.

Another possible explanation behind our lack of main effects of meditation on emotion regulation is that our chosen meditation intervention, Finding Focus, was not sufficiently comparable to long-term interventions used in previous studies. Most previous studies included at least 100 minutes of active meditation practice, whereas Finding Focus only had 24 minutes of active meditation and then 48 minutes of meditation lessons (Menezes and Bizzaro, 2015; Sauer-Zavala et al., 2012). These lessons are certainly useful for learning about meditation, but since they are not equal to active meditation practice, it is possible that there was not enough true meditation over the 10-days to enhance emotion regulation. The low amount of meditation practice in Finding Focus also makes it relatively easy to complete, and so perhaps more intensive meditation interventions would yield significant effects. Another explanation behind our results is that although 10-days counts as a long-term intervention, it is not quite long enough to enhance emotion regulation as has been done in previous studies (Sauer-Zavala et al., 2012; Zhang et al., 2019). Our relatively small sample size may have also contributed to our lack of a significant effect for meditation. If we had more power in our study, it is possible we could have found a main effect as has been shown in prior research (Long et al., 2021; Menezes and Bizzaro, 2015; Sauer-Zavala et al., 2012). In addition to the small size of our sample, future replications of this study could benefit from incorporating additional information regarding participants, such as psychiatric diagnoses. It is possible that our sample was too heterogeneous to capture main effects of meditation on emotion regulation. Participants with diagnoses such as Attention-Deficit/Hyperactivity Disorder, for example, may have a harder time completing a focused attention meditation. By removing these potentially

confounding variables, the results could more accurately represent the effects of the meditation intervention.

With regards to trait mindfulness, our results did not find a significant main effect on emotion regulation in Experiment 1 or Experiment 2. For Experiment 1, we predicted that low trait mindfulness individuals would have greater emotion regulation enhancements than high trait mindfulness individuals. For Experiment 2, we reversed this prediction. Although these hypotheses were based on prior research, the literature on trait mindfulness is fairly limited in the context of both short and long-term meditation (Kiken et al., 2015; Greif and Kaufman, 2021; Verhaeghen, 2012). It was therefore unclear whether we would be able to replicate previous results, and since we were unable to do so, it is possible that trait mindfulness does not have a main effect on emotion regulation following both short and long-term meditation. However, our insignificant results could have also been due to limitations in our study. For instance, in future research, it may be helpful to use a more in-depth measure of trait mindfulness such as the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006). This scale has 39 items whereas the Mindful Attention Awareness Scale (MAAS) we used only had 15. Our study needed a shorter scale due to time constraints, but future studies could use the FFMQ as a more comprehensive measure of trait mindfulness. Overall, although the present study did not find any significant main effects for trait mindfulness, future research should be done to more accurately assess its impact on emotion regulation following short and long-term meditation interventions.

A few comments are necessary regarding our choice of measurement and experimental design for emotion regulation. Our chosen measure of emotion regulation, the State Emotion Regulation Inventory (SERI), is useful because it measures specific emotion regulation strategies (i.e., reappraisal and acceptance; Katz et al., 2017). However, we must recognize that this could potentially be a disadvantage because it does not measure emotion regulation overall. In future replications of this study, more comprehensive scales like the Difficulties in Emotion Regulation Scale (DERS) or the State Difficulties in Emotion Regulation Scale (S-DERS) could be used to get a broader measurement of emotion regulation (Gratz and Roemer, 2004; Lavender et al., 2017). Secondly, in future studies, it may be useful to include a manipulation check after the stress-inducing task—for example, a mood state questionnaire or a state anxiety assessment. This will ensure that emotional stress is indeed being induced, therefore requiring participants to use their emotion regulation abilities as measured by the SERI. Future studies may also choose to consider biological markers of stress (i.e., increased heart rate, skin conductance, etc.) as a manipulation check versus relying on self-reports alone (Scavone et al., 2020). Addressing these comments in future experiments will provide a broader encompassing and less-biased measurement of emotion regulation, allowing for a more accurate assessment of its relationship to both meditation and trait mindfulness.

Conclusion

Overall, the results of this study indicate that despite previous literature demonstrating that long-term meditation can increase emotion regulation abilities following a stressful situation, this is not always observed. Short-term meditation is even less promising in this regard, and although the current body of literature is not extensive, the present study did not find evidence that brief meditation has any impact on emotion regulation. Furthermore, in addition to this lack of clarity regarding meditation's impact on emotion regulation, the present study also found evidence for variations in this impact based on dispositional qualities like trait mindfulness. Individuals with higher trait mindfulness, or a person's ability to be in the present moment in a nonjudgmental and nonreactive way, show greater enhancements in acceptance emotion regulation skills than individuals with lower trait mindfulness. Meditation interventions are not unanimously causational in terms of the benefits they claim to reap on the human body. Instead, individual differences play a role in the direction and extent to which a person is impacted by the intervention. Although this conclusion complicates meditation's reputation as an undoubtedly beneficial practice to incorporate into one's life, it also provides valuable direction for how meditation should be used as its popularity increases in popular culture and the field of mental health. The findings of this study have implications for how meditation is implemented into mental health treatments, for example, tailoring interventions to reap maximum emotion regulation enhancements based on individuals' dispositional qualities. This approach could also be incorporated into popular culture meditation, for instance, into the design of meditation phone apps or in podcast discussions on the cognitive benefits of meditation. By changing the narrative on meditation in pop culture, people can make better use of the interventions and gain a holistic understanding of how meditation acts differently on different people—and therefore on them.

Lastly, the results of our study serve as a reminder that although two people might receive the same "experience" on paper—for example, a short or long-term meditation—how their bodily actually experiences it is unique and dependent on their dispositional qualities. Whether researchers examine human behavior through a biological, psychological, or sociological lense, this is an important perspective to keep in mind. The "input" from the external world may be the same when it enters the human brain, but the way it exits and manifests in individual and societal-level action is dependent on the unique processes and qualities within each person. Psychology and the social sciences in general should bear this in mind when designing studies, interpreting results, and observing the processes that drive both individual and systematic human behavior.

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