

Mechanisms and Outcomes of Metta Meditation

by

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### Abstract

The positive effects of meditation-based interventions on a variety of mental and physical disorders is increasingly being recognized in the scientific community, specifically in the context of treatments such as Mindfulness Based Stress Reduction and Mindfulness Based Cognitive Therapy. While this is encouraging, the specific mechanisms by which such meditation-based interventions function is poorly understood. The present pilot feasibility study investigates the mechanisms and outcomes of metta meditation. Twenty three undergraduate students participated in a four week metta meditation program. Changes in levels of positive and negative affect, rumination, mindfulness, and symptoms of anxiety and depression were assessed. Results indicate that participants experienced a decrease of negative affect over the course of the study, but no other variables showed significant differences before and after meditation. Levels of anxiety and depression symptoms did not differ from a control group over the four weeks. While the program appears feasible, longer instruction time is suggested for future research. The results of this study inform upcoming investigations on potential mechanisms within meditation-based treatments, which may eventually allow clinicians to make more informed treatment decisions with specific groups of clients when employing such interventions.

*Keywords:* feasibility, metta, loving-kindness, meditation, mechanisms, outcomes

### Mechanisms and Outcomes of Metta Meditation

Mental health ailments are among one of the greatest social and economic stressors, accounting for 13% of mortality and disability due to disease worldwide (Collins et al., 2011). Moreover, it is estimated that mental illness is associated with a loss of \$317 billion per year in the United States through lost wages, loss of productivity, and the expense of governmental programs (Insel, 2008). Despite the high costs associated with mental health, individual treatment of many mental health concerns is often unavailable or unaffordable to a large portion of the population (WHO, 2007). This is due to the reality that individual treatment is often too expensive or requires an extensive period of time to be effective. To respond to this dilemma, there has been renewed research interest on mass delivery of successful health interventions and expansion of access to care (Collins et al., 2011). Mass delivery would enable treatments to become widely available to a large subset of the population and potentially cut costs associated with more narrowly and individually available treatments. Hence, innovative, effective, and economical group based treatments are important in addressing this need for mass delivery of mental health care.

One exciting direction in mass delivery of mental health interventions is meditation-based treatments. This new wave of treatment programs can be practiced and delivered in groups, but can also be practiced individually without much personal expense or advanced knowledge on the topic. In addition, therapists who deliver meditation interventions often do not require extensive training. However, while many meditation-based treatments appear to be effective for a range of mental health issues (Baer, 2003), the mechanisms by which they are efficacious are less well known. It is important to understand these mechanisms as through doing so, we may be able to target these interventions towards specific groups and thereby increase the

utility and positive outcomes of these treatments. If this can be accomplished, meditation-based treatments may be a fitting solution to the need for mass delivery of mental health care.

Therefore, this study is investigating the feasibility and efficacy of a group-based meditation protocol and the mechanisms by which it functions.

### **Mindfulness-based Interventions**

Many of the most popular and researched meditation-based interventions involve the cultivation of mindfulness. Mindfulness emphasizes paying close attention to the present moment and observing and accepting all thoughts and feelings as they come, without making judgments (Bishop et al., 2004). In effect, many mindfulness-based interventions attempt to increase this kind of awareness in daily life. Two of the most investigated mindfulness-based interventions are Mindfulness Based Stress Reduction (MBSR; Kabat-Zinn, 1990) and Mindfulness Based Cognitive Therapy (MBCT; Segal, Teasdale, & Williams, 2004)

**MBSR.** The initial objective of MBSR was to provide an adjunct intervention program based on mindfulness for patients who were not responding to traditional treatments. The main goal of this treatment program was to help patients more effectively deal with chronic stress, either on its own or surrounding pre-existing conditions (Kabat-Zinn, 2003). A typical MBSR program consists of eight weekly 2.5 hour sessions, which focus on mindfulness meditation, yoga, and other related mindfulness-based practices. In addition, the program asks participants to practice mindfulness at least 45 minutes a day (Kabat-Zinn, 1990). Preliminary research found that a MBSR program was able to significantly reduce self-report and objective measures of anxiety and panic in individuals with anxiety disorders, and that these reductions in anxiety persisted over 3-years (Miller, Fletcher, & Kabat-Zinn, 1995). Related research continued to find MBSR and other mindfulness-based interventions to be successful in conjunction with treatment

as usual (TAU) or as a treatment in and of itself for several other physical and mental disorders, such as chronic pain and stress (Kabat-Zinn, 2003; Kabat-Zinn, Lipworth, & Burney, 1985).

MBSR may also be effective in regulating social anxiety disorder (Goldin & Gross, 2010), speeding the treatment of psoriasis (Kabat-Zinn et al., 1998), fibromyalgia (Grossman, Tiefenthaler-Gilmer, Raysz, & Kesper, 2007), and improving quality of life and decreasing stress in cancer patients (Carlson, Speca, Patel, & Goodey, 2003).

In non-clinical populations, MBSR was found to reduce several distinct types of stress levels (Williams, Kolar, Reger, & Pearson, 2001) and burnout (Galantino, Baime, Maguire, Szapary, & Farrar, 2005). Interestingly, some of these positive outcomes have been found when conducting MBSR in-person as well as with recorded MBSR treatment (Kabat-Zinn, 2003). Hence, it is clear that MBSR has potential as an intervention for a wide variety of physical and mental disorders. However, the program requires a therapist certified in MBSR and a large time commitment, which may not be feasible as a mass delivery treatment. Furthermore, the exact mechanisms behind MBSR are unknown, thus, it may be that a shorter, more mindfulness meditation (MM) focused treatment may be just as effective as this longer and more complex program.

**MBCT.** Mindfulness Based Cognitive Therapy was initially developed by Segal, Teasdale, and Williams (2004) as an intervention to prevent depression relapse. This program incorporates mindfulness training, similar to Kabat-Zinn's MBSR program (1990), and integrates aspects of cognitive therapy (Segal et al., 2004). MBCT is an eight week program consisting of weekly two hour classes, while participants are expected to complete some type of daily "homework" assignment (Segal, Williams, & Teasdale, 2012). At its inception, MBCT was designed for individuals currently in remission from a major depressive episode, and has been

successful in reducing relapse in individuals who have experienced at least two major depressive episodes prior to treatment (Ma & Teasdale, 2004; Teasdale et al., 2000; van Aalderen et al., 2011), as well as adequately addressing treatment resistant depression (Kenny & Williams, 2007). This program has been extended to other mental health disorders and has also been found to be effective in reducing anxiety and mood symptoms of Generalized Anxiety Disorder (Evans et al., 2008), improving immediate outcomes of bipolar patients (Williams et al., 2008), and mental health improvements in cancer patients (Foley, Baillie, Huxter, Price, & Sinclair, 2010). Hence, while newer and more initially focused on a specific disorder than MBSR, MBCT also seems to be effective for a variety of disorders. However, it also requires a certified MBCT therapist and a large time commitment, calling into question the feasibility of MBCT as a mass delivery treatment.

### **Metta Meditation**

While mindfulness-based interventions have clearly received the most interest within meditation research in the clinical field, most MM-based programs do not represent pure MM training and rather merge MM and components of traditional interventions, such as cognitive-behavioral therapy (Kabat-Zinn, 1990). In doing this, the cost of such programs is increased to both the therapist and the practitioner, thereby reducing the treatments overall utility. This merging of treatment components may have occurred due to a lack of pure MM to effectively address common mental disorders. Hence, it is important to understand that there are other meditation modalities, such as metta meditation, that on their own may more effectively target differential components of disorders and relevant moderating factors (Hofmann, Grossman, & Hinton, 2011; Travis et al., 2009). Metta meditation guides the participant on developing a state of unconditional compassion or kindness to everyone – regardless of one’s current relationship

(Hofmann et al., 2011). Compassion meditation (CM), a practice that is very similar to metta meditation, leads the meditator to develop compassion, or genuine sympathy, for those who are suffering (Hofmann et al., 2011). In most traditional accounts of metta meditation and CM, they are grouped as the same kind of meditation. This grouping also tends to occur in relevant psychological research (Kabat-Zinn, 1990). Hence, they will be considered as similar constructs in the following analysis. Further, it is important to note that many traditional scholars of meditation state that mindfulness is an integral aspect of both metta meditation and CM (Bodhi, 2005; Kuan, 2008; Sangharakshita, 2008). Therefore, the effects of metta meditation and CM may showcase effects above and beyond mindfulness by itself. Whether this is the case or not is yet to be examined empirically.

Currently there are no manualized metta meditation-based programs that have received as much attention as MBSR or MBCT. However, researchers utilizing some form of metta meditation have encountered findings that suggest metta meditation may be efficacious in reducing chronic pain (Carson et al., 2005), increasing social connectedness (Seppala, 2009), and decreasing self-report anxiety and depression (Gilbert & Procter, 2006). However, these studies represent preliminary investigations into non-standardized versions of metta meditation as a clinical intervention method, and their promising results should only prompt further and more rigorous empirical research on metta meditation (Hofmann et al., 2011).

### **Mechanisms of Meditation**

Since there are preliminary findings of the effectiveness of meditation (both MM and metta) in producing symptomatic relief for a wide range of mental and physical health disorders, it is important to investigate the mechanisms by which this symptom reduction may occur. By

understanding the mechanisms, we may be better able to target these interventions towards specific groups.

**Mindfulness.** One of the key questions in evaluating mindfulness meditation (MM) based treatments is whether mindfulness itself leads to relief or if a more general mechanism, such as relaxation, is a cause. To this aim, Jain and colleagues (2007) examined the difference between MM and relaxation and found that while both relaxation and MM resulted in a decrease of stress and increase of positive mood states, MM had greater effects in doing so. This lends credence to the idea that there may be something unique to MM as an intervention, which potentially could be the cultivation of mindfulness. In further investigating this idea, both MBSR and MBCT are inspiring programs for the empirical advancement of mindfulness and meditation-based treatments, but because they consist of more potential mechanisms of action than simply mindfulness (Kabat-Zinn, 1990), it is important to dismantle these programs and find out exactly what is at work. In doing this, we can further understand how pure mindfulness, rather than mindfulness-based treatments, may be applied to specific groups. Regardless, several mechanisms of action from research on MBSR and MBCT have been proposed that may allow insight into the mechanisms of mindfulness.

One suggested mechanism of action is that mindfulness training decreases the tendency to ruminate and worry (Feldman, Greeson, & Senville, 2010; Jain et al., 2007; Kumar, Feldman, & Hayes, 2008; Ramel, Goldin, Carmona, & McQuaid, 2004). This effect of mindfulness-based meditation on rumination has been seen in a randomized control trial (Jain et al., 2007). As these traits are commonly linked with the development of depression and anxiety (Papageorgiou & Siegle, 2003), it is likely this is a main mechanism by which mindfulness training decreases these symptoms. Mindfulness training is also associated with activation of the anterior cingulate



cortex (ACC) and cerebral areas related to attention (Chiesa & Serretti, 2010; Hölzel et al., 2011). Correspondingly, such training may be responsible for greater emotion regulation and attentional regulation (Chiesa & Serretti, 2010; Hölzel et al., 2011; Tang et al., 2007). As most of the above mechanistic studies focused on MBSR, it is important to question whether these studies represent mechanisms of mindfulness or something else in the MBSR program. Further, it is imperative to understand how the mechanisms of metta meditation differ from MM based interventions.

**Metta.** Proposed mechanisms of metta meditation and CM include increasing positive affect, decreasing negative affect, and increasing self-compassion (Hofmann et al., 2011; Hutcherson, Seppala, & Gross, 2008). These proposed mechanisms generally fall in line with the traditional explanation for the positive outcomes of metta meditation in its original context (Gyatso & Cutler, 2009). Similarly, Fredrickson and colleagues (2008) found that individuals randomized into a metta meditation group experienced an increase of positive emotions, which resulted in increased social support, mindfulness, life satisfaction, and decreased depressive symptoms. Metta meditation or CM training is also found to be associated with lower stress-induced immune and behavioral responses (Pace et al., 2010). These mechanisms may also affect a variety of mental disorders, especially those that have affect dysregulation and stress difficulties. However, further research is necessary to confirm the above theories and test whether these mechanisms actually function to reduce symptoms of anxiety and depression.

### **Present Study**

Due to the dearth of mechanistic research on metta meditation and the increasing ambiguity of the mechanisms and outcomes by which metta meditation and MM differ, the present study aims to examine the feasibility of employing metta meditation in research and to

understand the mechanisms by which a metta meditation training potentially reduces self-report anxiety and depression symptomatology. Few studies have rigorously examined the mechanisms of metta meditation, and no study to date has examined the possible mechanisms while concurrently assessing change in anxiety and depressive symptomatology in a healthy population. This study will also assess for mechanisms commonly implicated in MM, such as rumination and self-report mindfulness, to assess for potentially similar effects.

Hence, one of our primary aims is to assess the feasibility of a standardized metta meditation protocol. Further, we will examine preliminary data of the effect of metta meditation on positive affect (PA) and negative affect (NA), rumination and self-report mindfulness, and anxiety and depressive symptomatology. We hypothesize that participants will experience significant increases in PA and decreases in NA. Additionally, they will experience a smaller, yet still significant, decrease in rumination and increase in mindfulness. Lastly, we hypothesize that participants will experience significant reductions in anxiety and depressive symptoms.

## **Method**

### **Participants**

Participants for this study were 23 undergraduate students (65.2% female) who ranged in age from 18-22 years of age ( $M_{\text{age}} = 19.09$  years;  $SD_{\text{age}} = 1.38$ ). Level of education of participants ranged from 12-15 years ( $M = 13.48$  years;  $SD = 1.2$ ). At intake, two of the participants were receiving treatment for depression. Both of these participants were in psychotherapy or counseling and one was receiving psychiatric medication. All participants were recruited from a subject pool that consisted of students currently enrolled in an introductory psychology course at a large Midwestern university. In order to fulfill a requirement of the course, students were given the option of participating for a specified number of hours in several

studies or writing several alternate paper assignments. In addition, a sample from a parallel study examining the help-seeking behavior of undergraduates was included as a control group when analyzing overlapping outcomes (i.e., anxiety and depression symptoms). Participants in this control group were 42 undergraduate students (78.6% female) who ranged in age from 18-19 years of age ( $M_{\text{age}} = 18.33$  years;  $SD_{\text{age}} = .477$ ).

### **Measures**

Demographic information, including date of birth, age, years of education, gender, marital status, and current treatment status for psychiatric conditions – specifically depression, was assessed at intake via a self-report questionnaire.

**Positive and negative affect.** Positive and Negative Affect was assessed using the Positive and Negative Affect Schedule (PANAS; Watson & Clark, 1999). The PANAS is a 30-item self-report measure that was used to assess levels of positive and negative affect during each week of the meditation sessions. Participants were asked to respond to single word feelings or emotions as describing the extent to which they have felt that way in the past two weeks. Responses are given on a 5-point Likert-scale with answers ranging from *very slightly or not at all* to *extremely*. The PANAS is reported to have high reliability and construct validity. (Crawford & Henry, 2004; Watson & Clark, 1999; Watson, Clark, & Tellegen, 1988). In this sample, the measure demonstrated excellent internal consistency for positive affect ( $\alpha = .93$ ) and good internal consistency for negative affect ( $\alpha = .85$ ).

**Rumination.** Rumination was assessed using the Ruminative Response Style Questionnaire (RRS; Nolen-Hoeksema & Morrow, 1991). The RRS is a 22-item self-report measure that was used to assess for levels of ruminative coping during each week of the meditation sessions. Participants are asked to indicate to which degree they generally do a

specific action when they feel down, sad, or depressed (*e.g., think about how alone you feel, think about how hard it is to concentrate*). Participants replied using a 4-point Likert-scale with responses ranging from *almost never* to *almost always*. Several studies have found the scale to have acceptable convergent and predictive validity (Butler & Nolen-Hoeksema, 1994; Nolen-Hoeksema & Morrow, 1991). In this sample, the measure demonstrated excellent internal consistency ( $\alpha = .90$ ).

**Mindfulness.** Mindfulness was assessed using the Five-Factor Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The FFMQ is a 39-item self-report measure that assessed levels of mindfulness during the first and last sessions. Further, the FFMQ assesses for levels of five different components of mindfulness (*i.e., describing, acting, non-judgmental, non-reacting, and observing*). Participants are asked to respond, using a 5-point Likert-scale, how frequently or infrequently they have had a certain experience in the last month (*e.g., I perceive my feelings and emotions without having to react to them, I easily put my beliefs, opinions, and expectations into words*). With college students, the FFMQ has been reported to have reasonable psychometric properties (Baer et al., 2006). In this sample, the measure demonstrated excellent internal consistency ( $\alpha = .90$ ).

**Anxiety symptomatology.** Anxiety symptoms were measured using the Generalized Anxiety Disorder questionnaire (GAD-7; Spitzer & Kroenke, 2006). The GAD-7 is a 7-item self-report measure that was used to assess for Generalized Anxiety Disorder symptoms (GAD) on the first and last sessions. The measure asks participants how often over the last two weeks they have been bothered by specific problems (*e.g., feeling nervous, having trouble relaxing*). Answers range from *not at all* to *nearly every day*. The GAD-7 has been found to be valid and

reliable in assessing GAD and its severity. In this sample, the measure demonstrated excellent internal consistency ( $\alpha = .90$ )

**Depressive symptomatology.** Depressive symptoms were measured using the Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001) on the first and last sessions. The PHQ-9 is a 9-item self-report measure that measures the severity of depressive symptoms by assessing common criteria present in individuals with a diagnosis of clinical depression (Kroenke & Spitzer, 2002). The measure asks participants to respond how often in the past two weeks they have been bothered by specific problems (*e.g., little interest or pleasure in doing things, poor appetite or overeating*). Answers range from *not at all* to *nearly every day*. The ninth item, which asks about suicidal ideation, was omitted in the present study per request from the Institutional Review Board. Kroenke and Spitzer (2002) note that this has minimal effect on the PHQ-9 score in a non-clinical sample. The PHQ-9 has been found to be a reliable and valid measure of depression severity (Kroenke & Spitzer, 2002; Kroenke et al., 2001). In this sample, the measure demonstrated acceptable internal reliability ( $\alpha = .69$ )

## **Procedure**

Participants signed up for the study through the introductory subject pool without any knowledge of the content of the study. They came to a predetermined room at the same time once a week for four weeks for the study. On the first week, individuals who signed up were introduced to the study and informed consent was obtained from all participants. Following this, they completed all the above surveys in-person and participated in the first meditation session. On weeks two and three, they completed only the RRS and the PANAS in-person prior to the meditation session. For the final week, participants completed the entire battery of surveys online the day after the last meditation session. The original study allowed for a maximum of fourteen

participants in each group, however in the actual sessions there were between seven and fourteen individuals per session.

The meditation instruction took place in a quiet room with meditation cushions and dim lights in order to mimic a meditation studio. Participants were asked to follow instructions given by an instructor on meditation. The instructor used an adapted script taken from the UCLA Mindful Awareness Research Center's meditation CD (see Appendix A). The non-adapted meditation sessions are available for public access and are used in the center's research. In order to make the sessions more personal, the author of the present paper, who is an experienced meditation practitioner, read the scripts to the participants during the meditation sessions rather than simply playing the CD. However, note that because the meditation sessions were completely scripted, no specific expertise is required on the part of the instructor, as leading the sessions simply involved reading the script in a calm voice. The same person read the script for all the sessions.

Participants were told that meditation outside of the actual sessions was not required. However, in order to account for participants' experience, a report of outside meditation was requested at the conclusion of the study.

### **Data Analysis**

Differences in positive affect, negative affect, rumination, and mindfulness by time were examined using a standard repeated measures framework. Further, linear trends in these variables were observed using a growth curve modeling framework. For rumination and affect, data was available from all four time points. For mindfulness, data was only collected during times 1 and 4.

In examining outcomes for which a control group was available (i.e., depression and anxiety), we conducted an analysis of covariance (ANCOVA) predicting time 4 depressive symptoms with gender and time 1 depressive symptoms as covariates. Similarly, we conducted an ANCOVA predicting time 4 anxiety symptoms with gender and time 1 anxiety symptoms as covariates. In the analysis of anxiety and depression symptoms, we utilized a control group from a parallel study that included identical time sampling, but only measured the PHQ-9 and GAD-7. All variables were analyzed controlling for sex.

### **Results**

23 participants initially enrolled in the study, while 18 attended at least three meditation sessions. Therefore, the study had a 78% retention rate over the four weeks. Due to individual absences, the mean amount of meditation instruction received per participant included in the analysis was 78 minutes. Further, beyond the meditation practice in the sessions, two participants personally engaged in an average of 38.75 additional minutes of unsolicited meditation practice per week. All variables were checked for normality. See Table 1 for means and SDs of all variables at their available time points.

[Insert Table 1 here]

#### **Positive and Negative Affect**

We examined mean differences in PA and NA across time using repeated measures. There was no impact of time on PA,  $F(3, 17.6) = 2.41, p = .10$ . However, there was a significant effect of time on NA,  $F(3, 52) = 3.95, p = .013$ . Specifically, there was a significant decrease of NA between time 1 and time 3,  $t(52) = 2.41, p = .02$ , followed by a significant increase from time 3 to time 4,  $t(52) = -3.25, p = .002$ . This significant increase in NA during time 4 was unexpected and this time coincided with mid-term examinations week. Therefore, we decided to

examine the linear trends in NA without time 4. Analysis of linear trends via growth curve modeling indicated no significant change in PA over time,  $F(1, 54) = 0.76, p = ns$ , and a significant decrease in NA over time,  $F(1, 36) = 6.42, p = .016$ .

### **Rumination and Mindfulness**

We examined mean differences in rumination and mindfulness across time using repeated measures. There was no impact of time on mindfulness,  $F(1, 33) < 0.00, p = ns$ . However, there was a significant effect of time on rumination,  $F(3, 21) = 4.21, p = .018$ . Specifically, rumination during time 4 was significantly higher than during time 1,  $t(21) = -2.28, p = .033$  and time 3,  $t(21) = -3.38, p = .003$ . This significant increase in rumination during time 4 was unexpected and this time coincided with mid-term examinations week. Therefore, we decided to examine the linear trends in rumination without time 4. Analysis of linear trends via growth curve modeling indicated no significant effects in rumination over time,  $F(1, 36) = 0.03, p = ns$ .

### **Anxiety Symptoms**

We examined differences between the meditation and the control group in anxiety symptoms at time 4 while controlling for anxiety symptoms at time 1 using an ANCOVA framework. There were no significant group differences in anxiety symptoms between the metta meditation and control group,  $t(56) = -0.37, p = ns$ .

### **Depression Symptoms**

We examined differences between the meditation and the control group in depression symptoms at time 4 while controlling for depression symptoms at time 1 using an ANCOVA framework. There were no significant group differences in depression symptoms between the metta meditation and control group,  $t(55) = 0.18, p = ns$ .

## **Discussion**



The present study aimed to examine the feasibility of a standardized metta meditation intervention and analyze a variety of mechanistic and preliminary outcome data. The metta meditation protocol proved highly feasible, with a retention rate similar to other metta meditation intervention research (Fredrickson et al., 2008; Hutcherson et al., 2008). There was also partial support for hypotheses concerning the mechanisms of metta meditation. Specifically, there was a significant decrease between sessions 1 and 3 in NA. However, we found no significant differences before and after the four sessions in PA, rumination, mindfulness, anxiety, or depression scores. For both NA and rumination, scores from the fourth session were unusually high. This potential confound may be due to the timing of the measures, as they were completed either during midterms, a time when many undergraduates are under significantly more pressure, or the week after spring break, when undergraduates may experience atypical mood fluctuations due to returning to classes. Due to this, analyses involving these variables were reexamined without time four scores, resulting in a significant decrease for NA and a null result for rumination.

### **Feasibility**

As the study recruited participants from an undergraduate subject pool, the participants were not aware of the content of the study prior to the first session. In addition, they were not told the study was longitudinal in nature before the first session. Yet, many participants expressed positive feedback of the meditation sessions and some even engaged in meditation outside of the weekly meetings, suggesting meditation training may be inherently enjoyable for some individuals. With these considerations, the retention rate of the present study was similar to other studies employing meditation-based interventions (Carson et al., 2005; Fredrickson et al., 2008), supporting the feasibility of such a protocol with participants without a prior interest in

meditation. Considering the metta meditation protocol, all participants were attentive to the instructions and appeared to be engaged with the research assistant who was conducting the sessions. All of these elements are important in supporting the feasibility of metta meditation interventions (Rounsaville, Carroll, & Onken, 2001). This feasibility is paramount, as an intervention that participants will not attend or actively participate in will have no effect, no matter how theoretically efficacious it may be. While the small sample size of the present study disallows any conclusions from non-significant findings, the feasibility outcomes of this study are relevant in informing future research investigating metta meditation.

### **Positive and Negative Affect**

We hypothesized that participants would experience an increase in PA and a decrease in NA. Interestingly, reported PA remained stable in all four sessions, whereas NA decreased from sessions 1 to 3 and significantly spiked in session 4. The lack of change in PA is not consistent with previous studies examining PA change due to metta meditation (Fredrickson et al., 2008). However, research on this mechanism of metta meditation is sparse and increases in PA have only been suggested as a potential mechanism, and the present study suggests contrary evidence. Decreases in NA were, however, consistent with previous literature on metta meditation (Carson et al., 2005). This lends further evidence to reduction of NA as a potential mechanism of metta meditation.

While the findings on NA were consistent, the contradictory findings on PA may be due to a variety of reasons pertaining to the present study. For instance, the amount of time that participants engaged in metta meditation training was much lower than in Fredrickson and colleagues study (2008), where participants engaged in meditation 5 days a week for 7 weeks. While short training in mindfulness may be sufficient to produce some changes (Jain et al.,

2007), 20 minutes a week may not be enough to observe significant changes in PA with metta training. Another major caveat in our findings regarding PA and NA was the lack of a control group. PA may have been lowering over time in the population our sample measured, which would have resulted in a hypothetically meaningful difference as our sample's PA remained stable. If this were the case then our results would be consistent with previous literature.

### **Rumination and Mindfulness**

We hypothesized that participants would experience a small, yet still significant, reduction in rumination and increase in self-reported mindfulness. However, we found that when ignoring the confounding fourth session rumination scores, participants' levels of rumination remained steady. Mean levels of mindfulness also did not significantly change. Few studies, if any, on metta meditation examine the effect on rumination and mindfulness, so any outcome is somewhat novel in the literature. It was hypothesized that metta meditation may affect these constructs as mindfulness training is traditionally an aspect of metta meditation (Bodhi, 2005; Kuan, 2008; Sangharakshita, 2008), and was consequently a component of the script for the present study. We may not have seen any effects on rumination or mindfulness as the mindfulness training component of the metta meditation script may have been too short to illicit significant change in these constructs. Further, most research on rumination is focused on mindfulness-based programs (Deyo, Wilson, Ong, & Koopman, 2009; Jain et al., 2007), so it is possible that rumination only changes in response to mindfulness-based approaches.

### **Anxiety and depression Symptoms**

Perhaps one of the most surprising outcomes of this study was the lack of a significant decrease in both anxiety and depressive symptoms. Contrary to our hypotheses, there was no difference in the change of anxiety or depression symptom levels between the meditation group

and the control group. Additionally, while there was no difference in the change, both groups experienced a similar trending increase in depression symptoms over time. As this occurred in both conditions, it is likely some external confounding factor caused these heightened levels, such as the progression of the semester and midterm examinations.

This lack of decrease in anxiety and depression levels is contrary to the findings of most published research on metta meditation that observe these outcomes (Carson et al., 2005; Fredrickson et al., 2008; Hofmann et al., 2011). The most plausible explanation for the results of this study is that the protocol lacked an adequate amount of metta meditation practice to observe significant results. Additionally, this study did not have a homework component, which is an aspect of most other intervention research on the topic (Hofmann et al., 2011). Further, because the sample represented a healthy population, there was less of a possibility for the reduction of both anxiety and depression levels.

### **Limitations and Future Directions**

This study had a number of limitations, such as a small sample size, the lack of a true control group, and the use of a new metta meditation protocol. Because of the small sample size, we had low power to find significant effects. Due to this, many potentially significant outcomes may have been undetected. Partially related to our small sample size, the study was unable to have a true control group as initially planned. While some measures from a similar study's control group were able to be used, the use of a true control group measured on all variables of interest would have been much more useful. Lastly, the metta meditation intervention program was not empirically validated. While this is currently an issue in all metta meditation research, future efforts should be devoted to creating a reliable and valid metta meditation program to use

for upcoming research. Further limitations and future directions in measuring specific mechanisms and outcomes in metta meditation research are suggested below.

**Positive and negative affect.** Further research should be conducted on the effects of metta meditation on PA and NA, as their status as a potential mechanism is currently unclear. In examining these constructs, future studies should increase training time and measure affect in additional ways, such as with an experience sampling method, which asks participants to report affect at random periods during the day outside of training. Additionally, if future studies find a similar unexpected increase in NA after the last session, this occurrence should be further investigated.

**Rumination and mindfulness.** As developing mindfulness is traditionally an integral aspect of metta training (Bodhi, 2005; Kuan, 2008; Sangharakshita, 2008), upcoming research on metta meditation will need to take this relationship into account. The present study suggests that mindfulness may not be a confounding factor in understanding the differential outcomes of metta and mindfulness meditation-based interventions. However, future studies should continue to examine this relationship, investigating both trait and state mindfulness levels, different factors of mindfulness (Baer et al., 2006), increased training time, and comparisons with a control group. Additionally, if future studies find a similar significant increase in rumination only after the last session, it will be necessary to further investigate what is occurring at this point.

**Anxiety and depression symptoms.** In examining the effect of metta meditation on anxiety and depression in future studies, researchers should examine if increased levels of metta meditation instruction and the inclusion of a homework component differentially affect these outcomes. Further, related studies should specifically target clinical or healthy populations and compare how they respond to metta meditation.

## **Conclusion**

The present study has provided further information on the mechanisms and outcomes of a metta meditation intervention. While such a program is feasible, it is likely that weekly meetings for four weeks or less and no outside practice does not provide enough training to see a noticeable change in most relevant measures. However, we did find promising effects on the impact of the intervention on NA. Mechanistically, the reduction of negative affect seems to be an important role by which metta meditation is efficacious, whereas the role of increasing positive affect remains unclear. The possibility of utilizing various kinds of meditation (e.g., mindfulness, metta, etc.) as a technique in more specified group therapy remains feasible, however the present study makes it clear that more research on metta meditation is needed prior to confidently implementing it in a clinical setting.

While this study represents preliminary research, future related research may eventually allow clinicians to deliver the most efficacious type of meditation-based treatment depending on the most salient complaints of a similar group of patients, assuming there is a meaningful difference between mechanisms of action in various meditation-based treatments. Moreover, in exploring the construct of mindfulness and how it differs from metta, it would be interesting and relevant for future research to focus on examining pure mindfulness interventions, similar to the manner in which this study examined a pure metta meditation program. In doing such research with metta and mindfulness training, clinical scientists may be in a better position to apply these novel intervention constructs in ways that may be more efficacious and economical compared to mindfulness-based treatments or other currently established interventions. In this manner, mindfulness and metta programs remain an exciting avenue as potential solutions in finding effective and widely-available interventions for a variety of mental health disorders.

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Table 1

*Descriptives of Variables by Time*

Measure	Session 1		Session 2		Session 3		Session 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Positive Affect	47.48	10.13	45.83	12.27	43.84	10.98	45.78	10.29
Negative Affect	27.13	7.28	25.94	6.81	23.84	5.71	29.44	8.15
Rumination	36.3	7.58	37.61	10.19	35.63	8.2	42.24	13.62
Mindfulness	128.4	19.05	-	-	-	-	129	16.72
Anxiety	4.78	4.92	-	-	-	-	5.11	4.51
Depression	4.61	3.31	-	-	-	-	5.83	4.15



## Appendix A

## Metta Meditation Script

**0:00**

5 Minutes – Mindfulness.

To begin this practice... let yourself be in a relaxed and comfortable position... we're going to practice the cultivation of positive emotions, in this case, metta, or loving kindness, which is the desire for someone to be happy.. or for yourself, to be happy. It's not dependent on something, it's not conditional... it's just a natural opening of the heart, to someone else, or to yourself...

Let us start this meditation by finding your meditation posture....Comfortable yet upright.. Relaxed, present....You can notice your body, seated here...Noticing the weight and movement and touch...letting your attention sink into your body, feeling it as though from the inside...relaxing...and then exploring what is here, what is true for you, in this moment...let your attention gently come to rest on your breathing...your breathe is your anchor, and it's the focus that you can always return to, its your home base.. so you can focus your attention on the gentle rising and falling of your breath in your abdomen or chest...Or in and out sensations of the air as it passes through your nostrils... you can visualize the air coming in and out of your body, as an ocean wave that enters your body and then slowly retreats... Feel one breath after the next, one breath at a time...what does one breath feel like in this very moment?...

[silence until the end of 5 minutes]

**5:00**

2 Minutes - Elicitation of Metta

Now let yourself bring to mind, someone who makes you feel joy, happiness, tenderness... See if you can bring that someone to mind, it could be a relative, a close friend, someone with not too complicated a relationship. Someone who when you think of them you feel joy. You could pick a child or, you can always choose a pet: a dog or a cat, a creature that it's fairly easy to feel love for. So let them come to mind. Have a sense of them being in front of you... you can feel them, sense them, see them... and as you imagine them, notice the body sensations that you're feeling... Maybe you feel some warmth.. or there is some heat to your face, a smile, a sense of expansiveness... notice also the emotions you may be experiencing... you may feel at peace and joyful..... This is loving kindness.

[Silence]

**Week 1. Benefactor and Self.****7:00****5 Minutes - [BENEFACTOR]**

Now call to mind someone for whom you feel a strong sense of gratitude or respect. Someone who has helped you or others, or supported you during difficult times. Someone who has improved your life or the life of those you love. Call this person to mind. Visualize them. Say their name to yourself. Recall the different ways they have helped you, or contribute to you or those you love.

Now with this person in your mind, begin to wish them well... we do this by silently repeating 4 phrases:

-----

**May you be safe**

**Maybe you be happy**

**May you be healthy**

**May you live with ease [Pause]**

----- **REPEAT x 3** -----

[Silence 1 min]

... When you say these words, have a sense of letting this loving kindness come from you and begin to touch this loved one. You might think in images, you might have a sense of color or light coming from you and towards them... you may think of an energy that extends from you towards them. The words may continue to bring on more of this feeling... may you be safe, may you be happy, may you be healthy, may you live with ease.

[SILENCE until end of 5 minutes]

**12:00****5-Minute [SELF]**

So as you're sending out these words and these feelings of loving kindness, now check into yourself and see how you're feeling inside... and now imagine that this loved one turns around and begins to send it back to you... Now if it's possible, and it's not always easy to do this, see if you can send loving kindness to yourself. You can imagine it coming down your body from your heart.. think to yourself:

-----

May I be safe and protected from danger...

Maybe I be happy and peaceful...

May I be healthy and strong...

May I have ease and well being...

-----

**May I be safe, may I be happy, may I be healthy, may I live with ease [ Pause – then repeat]**

-----

[SILENCE 1 minute]

Sometimes it is difficult to wish ourselves to be happy, to be well. If this is true for you, see if there are circumstances you can more easily experience friendship with yourself. Can you imagine yourself as a young child? Or times when you did something nice for others? Can you wish that version of yourself to be safe and protected, to be happy, to be healthy, to be at ease.

[Silence 1 minute]

Now if you're not feeling anything at this point or before in the meditation, it's not a problem... this is a practice that plants seeds, and if you're feeling something else other than loving kindness, just check into that. What is it I'm feeling? [brief silence] Then return to wishing loving kindness to yourself... may I be safe, may I be happy, may I be healthy, may I live with ease.

[Silence]

**18:00**

**[CLOSING]**

...we will end this meditation by gently bringing your attention back to your breath, your anchor. Focus again on your breathing... the gentle rising and falling of your breath in your abdomen or chest...Or in and out sensations of the air as it passes through your nostrils.

[Silence 1 minute]

You may now open your eyes.

**Week 2. Beloved Friend and Self.****7:00****5 Minutes - [Beloved Friend]**

Starting this week we will do something different. Now call to mind someone you consider a good friend. Call this person to mind. Visualize them. Say their name to yourself. Contemplate a likable quality or attribute of your friend.

Now with this person in your mind, begin to wish them well... direct the metta phrases towards them:

-----

**May you be safe**

**Maybe you be happy**

**May you be healthy**

**May you live with ease [Pause]**

----- **REPEAT x 3** -----

[Silence 1 min]

... If a different friend comes to mind, allow them to become the object of attention. If your mind wanders off into stories or plans, gently return to the repetition of the phrases. ...When you say these words, have a sense of letting this loving kindness come from you and begin to touch this friend. You might think in images, you might have a sense of color or light coming from you and towards them... you may think of an energy that extends from you towards them. may you be safe, may you be happy, may you be healthy, may you live with ease.

[SILENCE until end of 5 minutes]

**12:00****5-Minute [SELF]**

As you're sending out these words and these feelings of loving kindness, now check into yourself and see how you're feeling inside... and now imagine that this friend turns around and begins to send it back to you... Now if it's possible, and it's not always easy to do this, see if you can send loving kindness to yourself. You can imagine it coming down your body from your heart.. think to yourself:

-----

May I be safe and protected from danger...

Maybe I be happy and peaceful...

May I be healthy and strong...

May I have ease and well being...

**May I be safe, may I be happy, may I be healthy, may I live with ease [repeat]**

-----

[SILENCE 1 minute]

If it is difficult to wish yourself to be happy, to be well, imagine yourself as a young child, or times when you did something nice for others, now wish that version of yourself to be safe and protected, to be happy, to be healthy, to be at ease.

[Silence 1 minute]

Now if you're not feeling anything at this point or before in the meditation, it's not a problem... this is a practice that plants seeds, and if you're feeling something else other than loving kindness, just check into that. What is it I'm feeling? [brief silence] Then return to wishing loving kindness to yourself... may I be safe, may I be happy, may I be healthy, may I live with ease.

[Silence]

**18:00**

[CLOSING]

... we will end this meditation by gently bringing your attention back to your breath, your anchor. Focus again on your breathing... the gentle rising and falling of your breath in your abdomen or chest... Or in and out sensations of the air as it passes through your nostrils.

[Silence 1 minute]

You may now open your eyes.

### Week 3. Neutral Person and Self.

**7:00**

5 Minutes - [Neutral Person]

Starting this week we will again do something different. This time, call to mind someone you barely know. A neutral person. Someone you have not formed an instant liking or disliking. Maybe someone you tend to see occasionally, maybe a teller at a bank, or a cashier at a store you frequent, or a neighbor. Call this person to mind. Visualize them.

Reflect on the neutral person's wish to be happy, identical to your own, and direct the metta phrases towards them:

-----

**May you be safe**

**Maybe you be happy**

**May you be healthy**

**May you live with ease [Pause]**

----- **REPEAT x 3** -----

[Silence 1 min]

... If a different person comes to mind, allow them to become the object of attention. If your mind wanders off into stories or plans, gently return to the repetition of the phrases. ... When you say these words, have a sense of letting this loving kindness come from you and begin to touch this neutral person.

May you be safe, may you be happy, may you be healthy, may you live with ease.

[SILENCE until end of 5 minutes]

**12:00**

5-Minute [SELF]

As you're sending out these words and these feelings of loving kindness, now check into yourself and see how you're feeling inside... and now imagine that this person turns around and begins to send it back to you... Now see if you can send loving kindness to yourself. You can imagine it coming down your body from your heart.. think to yourself:

-----

May I be safe and protected from danger...

Maybe I be happy and peaceful...

May I be healthy and strong...

May I have ease and well being...

**May I be safe, may I be happy, may I be healthy, may I live with ease [repeat]**

-----

[SILENCE 1 minute]

If it is difficult to wish yourself to be happy, to be well, imagine yourself as a young child, or times when you did something nice for others, now wish that version of yourself to be safe and protected, to be happy, to be healthy, to be at ease.

[Silence 1 minute]

Now if you're not feeling anything at this point or before in the meditation, it's not a problem... this is a practice that plants seeds, and if you're feeling something else other than loving kindness, just check into that. What is it I'm feeling? [brief silence] Then return to wishing loving kindness to yourself... may I be safe, may I be happy, may I be healthy, may I live with ease.

[Silence]

**18:00**

[CLOSING]

...we will end this meditation by gently bringing your attention back to your breath, your anchor. Focus again on your breathing... the gentle rising and falling of your breath in your abdomen or chest...Or in and out sensations of the air as it passes through your nostrils.

[Silence 1 minute]

You may now open your eyes.

#### **Week 4. Difficult Person and Self.**

**7:00**

**[DIFFICULT PERSON]**

For the final two weeks, I want you to call to mind someone with whom you have experienced conflict, fear, or anger. Someone you dislike, maybe because they have hurt you or because they have qualities you dislike. Call this person to mind. Visualize them. Say their name to yourself. Now, contemplate a good thing about them. Imagine that this person also wishes to be happy. Think of any situation that helps you feel kindness towards this person. Maybe think of this person as a child, or think of this person being vulnerable, or think of any qualities of this person that you may like.

Now with this person in your mind, begin to wish them well...

-----

May you be safe and protected from danger...

Maybe you be happy and peaceful...

May you be healthy and strong...

May you have ease and well being...

[repeat]

-----

... If a different person comes to mind, allow them to become the object of attention. If your mind wanders off into stories or plans, gently return to the repetition of the phrases. ... When you say these words, have a sense of letting this loving kindness come from you and begin to touch this difficult person.

May you be safe, may you be happy, may you be healthy, may you live with ease.

[SILENCE until end of 5 minutes]

**12:00****[SELF]**

As you're sending out these words and these feelings of loving kindness, now check into yourself and see how you're feeling inside... and now imagine that this person turns around and begins to send it back to you... Now see if you can send loving kindness to yourself. You can imagine it coming down your body from your heart.. think to yourself:

-----

May I be safe and protected from danger...

Maybe I be happy and peaceful...

May I be healthy and strong...

May I have ease and well being...

**May I be safe, may I be happy, may I be healthy, may I live with ease [repeat]**

-----

[SILENCE 1 minute]

If it is difficult to wish yourself to be happy, to be well, imagine yourself as a young child, or times when you did something nice for others, now wish that version of yourself to be safe and protected, to be happy, to be healthy, to be at ease.

.

[Silence]

**18:00****[CLOSING]**

Now if you're not feeling anything at this point or before in the meditation, it's not a problem... this is a practice that plants seeds, and if you're feeling something else other than loving kindness, just check into that. What is it I'm feeling? [silence]... we will end this meditation by gently bringing your attention back to your breath, your anchor. Focus again on your breathing... the gentle rising and falling of your breath in your abdomen or chest...Or in and out sensations of the air as it passes through your nostrils.

[Silence for 1 minute]