Chapter 5
Experimental Approaches to Loving-Kindness Meditation and Mindfulness That Bridge the Gap Between Clinicians and Researchers

Christopher J. May, Kelli Johnson, and Jared R. Weyker

Introduction

Mindfulness meditation (MM) and loving-kindness meditation (LKM) are two broad types of meditation stemming from the Buddhist tradition. MM has numerous salutary effects in both clinical and non-clinical populations (Brown, Ryan, & Creswell, 2007; Chiesa & Serretti, 2011; Cullen, 2011; Eberth & Sedlmeier, 2012; Goyal et al., 2014; Grossman, Niemann, Schmidt, & Walach, 2004; Kabat-Zinn, 2003; Ludwig & Kabat-Zinn, 2008). Increasingly, researchers are also investigating kindness-based meditations (for reviews, see Galante, Galante, Bekkers, & Gallacher, 2014; Shonin, Van Gordon, Compare, Zangeneh, & Griffiths, 2014a). MM and LKM emphasize different psychological domains (Wallace & Shapiro, 2006). Mindfulness practice cultivates attention, typically to the breath, with an awareness of phenomena arising in the body, mind, and environment (Shonin, Van Gordon, Griffiths, 2014b). Loving-kindness meditation cultivates the affective domain as the practitioner directs heartfelt intentions to others (Salzberg, 1995). Because psychiatric conditions, such as depressive and anxiety disorders, involve both attention and affect, mindfulness and loving-kindness meditations may provide complimentary therapeutic interventions.

A small number of studies have begun to directly examine the relative effects of these two types of meditation (Barnhofer, Chittka, Nightingale, Visser, & Crane, 2010; Crane, Jandric, Barnhofer, & Williams, 2010; Feldman, Greeson, & Senville, 2010; Lee et al., 2012; May, Weyker, Spengel, Finkler, & Hendrix, 2014). Barnhofer et al. (2010)

C.J. May (✉) • J.R. Weyker
Carroll University, Waukesha, WI, 53186, USA
e-mail: cmay@carrollu.edu

K. Johnson
SUNY Stony Brook, Stony Brook, NY, 11794, USA

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demonstrated that both MM and LKM increased left-hemisphere anterior EEG asymmetry, a pattern associated with positive affect. Interestingly, participants scoring higher on a measure of brooding tended to respond more strongly to MM while low brooders exhibited a greater leftward shift following LKM. May et al. (2014) found that MM and LKM both increase mindfulness and positive affect, with LKM having a greater effect on positive affect. May et al. (2014) also identified a dissociation where MM had a greater impact on self-acceptance, while LKM had a greater effect on participants' sense of presence. Feldman, Greeson, and Senville (2010) found that MM increased decentering (viewing thoughts and emotions from a more objective point of view) relative to LKM and progressive relaxation. In Lee et al. (2012), MM was associated with enhanced sustained attention and changes in attention-related brain areas not seen in LKM. MM and LKM also led to the recruitment of distinct brain networks in processing affective images. Collectively, these studies suggest that particular types of meditation practice may be more helpful for a given personality/disposition, disorder, or symptom. A natural follow-up research program would be to match meditation types with individual psychological profiles.

Research on contemplative practices, such as MM and LKM, is complicated, however, by the substantial individual differences in response to beginning meditation. May et al. (2014) found that 48–71 % of the study variance was attributable to individual differences, rather than assignment to MM or LKM groups. A number of studies have also shown either no or minimal associations between meditation time and significant effects (Carmody & Baer, 2008, 2009; Davidson et al., 2003; Leppma, 2011). This should not be taken to mean that there is no effect of practice time—indeed, long-practicing monks exhibited striking differences compared to novice meditators (e.g., Lutz, Greischar, Rawlings, Ricard, & Davidson, 2004)—but rather that there is substantial variability in the relationship between meditation time and observed effects. Some individuals may respond rapidly, while others more slowly. There are also likely to be nonlinear effects of practice time, with periods of relative gain or stagnancy.

High between-subject variability means that studies must have higher sample sizes in order to isolate experimental effects. This need for higher sample sizes is further compounded when comparing two or more types of meditation. The different effects of MM and LKM reported by Barnhofer et al. (2010), Feldman, Greeson, and Senville (2010), Lee et al. (2012), and May et al. (2014) were derived from sample sizes much too small to be considered robust. Their results should therefore be regarded as suggestive. Obtaining large sample sizes can be problematic for contemplative research, however. Experimental studies assessing changes over time in response to a treatment generally require more resources, in terms of time, labor, and money, than do cross-sectional or correlational studies. Moreover, for meditation research, experienced meditators should be used to providing initial instruction to meditation-naïve participants (Crane, Kuyken, Hastings, Rothwell, & Williams, 2010; Kabat-Zinn, 2003; Shonin & Van Gordon, 2014). Participants should also have opportunities to discuss difficulties arising in their practice and receive informed feedback from a teacher. These best practices put constraints on the number of participants that can be ably taught meditation at a time.

One remedy to the difficulty of obtaining adequate sample sizes for comparing the effects of different types of meditation is to more extensively employ single-subject experimental designs. Single-subject designs focus on an individual, such as a patient, exemplifying the idiopathic approach (Molenaar, 2004). In these designs, the subject serves as their own control. For example, patient or client symptoms can be compared during periods when they have been instructed to meditate with periods when they have been instructed not to meditate. Single-subject designs differ from case studies in that there is an explicit manipulation (e.g., whether and when a patient is practicing a certain type of meditation) and thus are considered experiments (for an accessible review, see Kratochwill et al., 2010). Because clinical work is also typically idiopathic, there may be a natural synergy between clinicians and single-subject experimental designs. Importantly, multiple single-subject experiments can be collated for collective analysis (see Shadish, 2014a). This presents an opportunity to "crowdsource" the experimental study of meditation, effectively distributing the relatively high cost of conducting such work. In other words, the clinician can, and we believe should, play a vital role in advancing the science of meditation.

In the next section, we present an example of a single-subject experiment looking at the relative effects of MM and LKM. We conducted this experiment with multiple subjects, simulating a clinician that is working with multiple patients. As we will discuss at the end, the results from this experiment further reinforce the value, if not the need, for an idiopathic approach to studying meditation.

Experiment

We conducted an exploratory alternating-treatment experiment to examine the relative effects of mindfulness and loving-kindness meditation. Though an alternating-treatment experiment is a type of single-subject design, we simultaneously conducted the experiment with 16 participants. Participants with no previous regular meditation practice were recruited through campus advertisements. Participants alternated weekly over the course of 8 weeks between MM and LKM.

Guided meditations created by the first author (a practitioner of 10 years) were provided to participants. They were asked to practice at least 4 days per week for 15 min at a time. In MM, participants were instructed to attend to their breathing, returning their attention to their breath whenever they noticed their mind had wandered. In the loving-kindness meditation, participants directed intentions ("may you be well; may you be happy; may you be free from suffering") first to a loved one and then to themselves.

Each week, participants completed the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Baer et al., 2008) and the Profile of Mood States-Short Form (POMS; Curran, Andrykowski, & Studts, 1995; Shacham, 1983). The FFMQ contains subscales for "observing," "describing," "acting with awareness," "non-reacting," and "nonjudging." Participants were asked how frequently they had had certain experiences (e.g., "I perceive my feelings

and emotions without having to react to them," "I find it difficult to stay focused on what's happening in the present") in the past week on a 5-point scale. In the POMS, participants were asked to rate to what extent each of 37 adjectives (such as tense, cheerful, bitter, and lively) described how they had been feeling in the past week on a 5-point scale. We also employed additional measures, such as the Navon task and heart rate variability; however we are able to demonstrate all pertinent points using results from just the FFMQ and POMS. For the sake of brevity and clarity, we omit those other measures (results were consistent with those to be presented). The FFMQ and POMS took participants 5–10 min to complete.

During our alternating-treatment experiment, there were a total of seven alternations between meditation conditions (A-1-B-2-A-3-B-4-A-5-B-6-A-7-B). Half of the participants began with MM, while the other half started with LKM. We predicted that the data would follow one of two patterns: a sawtooth pattern where scores increased in the first transition, decreased in the second, and alternated for the remaining transitions or the reverse sawtooth pattern where scores decreased in the first transition, increased in the second, and alternated for the remaining transitions. Given seven transitions in which scores either increased or decreased, there are $2^7 = 128$ permutations of these transitions.[1] The probability of obtaining one of the two predicted patterns is 2/128 or 0.015. The probability of obtaining 6 transitions following the predicted patterns within the range of 7 transitions is $6/128 = 0.047$.[2] We therefore considered six or more consecutive pattern-following transitions as statistically significant evidence for a causal effect of meditation type on a particular dependent variable.

Results

For the FFMQ, three participants exhibited a significant effect of meditation type on the "observing" facet (see Fig. 5.1). For all three, "observing" scores decreased following a week of mindfulness meditation and increased after a week of loving-kindness meditation. One individual had systematically higher "acting with awareness" scores following MM compared to LKM. Another participant scored higher on the "nonjudging" scale of the FFMQ following LKM compared to MM. Three participants scored differentially from week to week on the "non-reacting" subscale of the FFMQ. One participant scored lower following MM, while two participants scored lower following LKM. One participant with lower "non-reacting" scores following MM also had lower "observing" scores following MM. Indeed, their total FFMQ score was lower following MM compared to LKM.

[1] Some scores did not change in successive weeks. We believe, however, that adding the possibility of unchanged scores to that of increased and decreased scores would produce an excessively conservative probability: $2/(3^7) = 0.0009$.

[2] The six possible hypothesized combinations of increasing (I) and decreasing (D) scores were IDIDIDI, IDIDIDD, IIDIDID, DIDIDID, DIDIDII, and DDIDIDI.

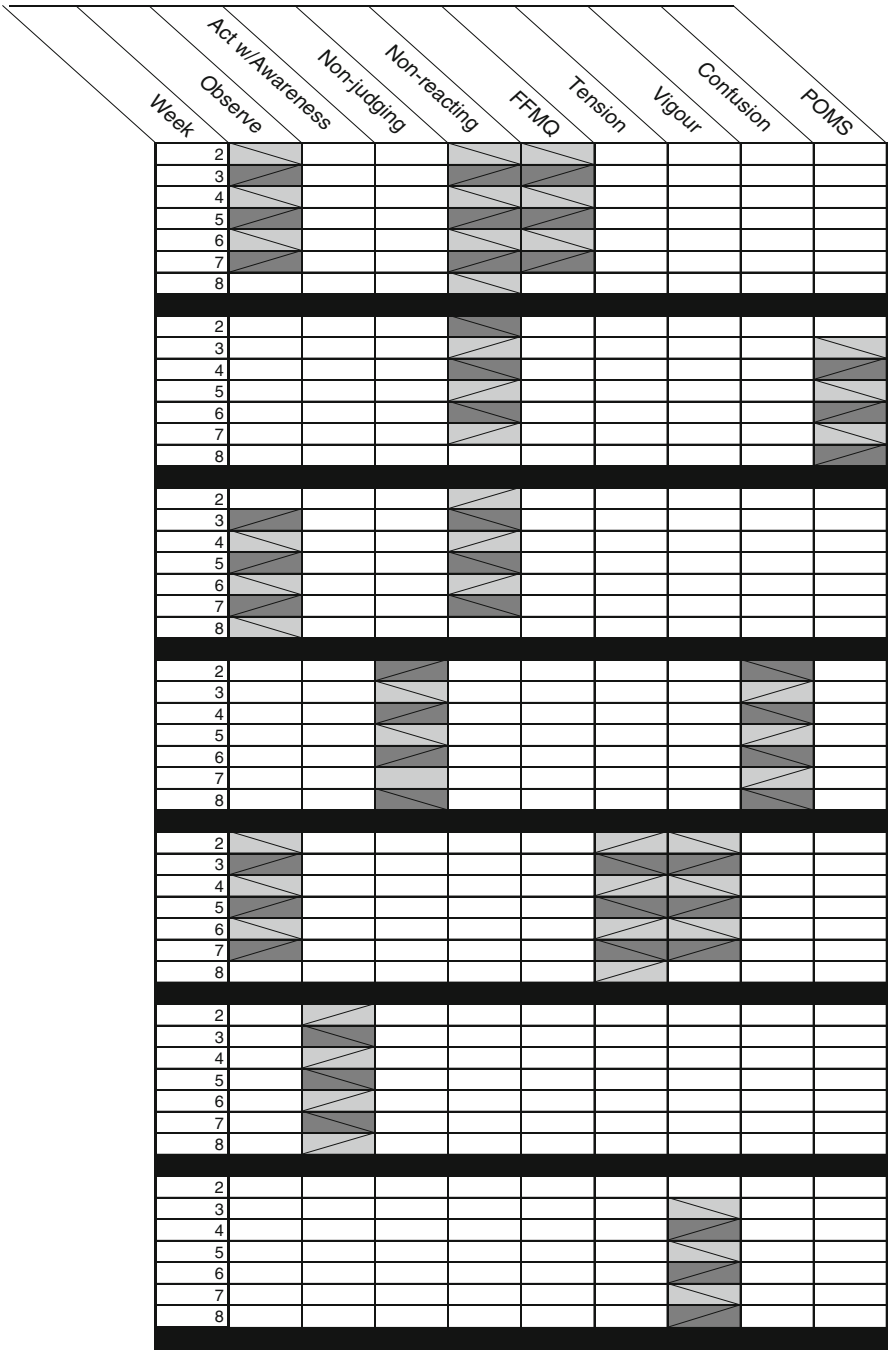

Fig. 5.1 Weekly changes in FFMQ and POMS scores following a week of mindfulness meditation (MM) or loving-kindness meditation (LKM). Only participants and variables with significant effects are included in the graph. *Light gray shading* indicates participants had practiced MM in the previous week; *dark gray shading* corresponds to LKM in the previous week. *Diagonal lines* extending from the *upper left* to the *lower right* indicate decreases in scores from the previous week. *Diagonal lines* extending from the *lower left* to the *upper right* denote increases in scores from the previous week. A *single block of rows* starting from week 2 and ending at week 8 corresponds to a single individual

For this participant, LKM led to higher levels of mindfulness. However, a second participant, who scored more highly on the "non-reacting" subscale following MM, scored lower on the "observing" facet during the same testing periods. For this individual, the two types of meditation had a differential impact on aspects of mindfulness.

On the Profile of Mood States scale, one individual self-reported lower tension following weeks of LKM. This same individual systematically reported heightened vigor and increased "observing" after practicing LKM. For this individual, LKM had greater salutary effects than MM. A second participant also reported more vigor after a week of LKM. Another participant noted greater feelings of confusion following MM; this corresponded with decreased "nonjudging" scores during the same periods. Lastly, one individual reported higher positive emotions (as indexed by the total POMS score) following LKM as well as decreased "non-reacting" scores. LKM had both positive and negative effects for this particular individual.

There are three particularly notable effects in our data:

1. MM and LKM exerted a differential impact on separate aspects of mindfulness ("observing," "non-reacting") in one individual; they exerted a consistent effect in another.
2. MM and LKM had a differential impact on the same variable ("non-reacting") across multiple individuals while having a consistent effect across individuals for other variables ("observing," "vigor").
3. LKM produced both positive and negative effects in the same individual (increased "non-reacting" and decreased positive emotion).

These three effects vividly demonstrate the extent of variability—both between and within subjects—in response to beginning meditation. Neither MM nor LKM have the same effects on all individuals. Indeed, they could have opposing effects in different individuals. Within an individual, one type of meditation may be more beneficial for a particular outcome, while another outcome may be more sensitive to an alternative practice. Finally, some individuals may have a relatively negative response to one type of meditation compared with another (see also Crane, Jandric et al. 2010).

These results are very conservative. Participants should be measured multiple times within each phase of a single-subject experiment (Kratochwill et al., 2010). Rather than assessing participants once at the end of each week of MM or LKM, a more robust experiment would have participants rate their levels of mindfulness and emotion more frequently. We were unable to determine the natural variability for a particular variable with just one data point each week. Without an estimate of the variability from week to week, which would permit a more robust inference of the mean for each week, results were more likely to deviate from the predicted sawtooth pattern. Despite this limitation, we nonetheless observed a number of illustrative effects.

These results highlight the importance of an idiopathic approach to the study of mindfulness and meditation. Group analyses of this data would not reveal effects of meditation type on any variable (Johnson, Weyker, & May, 2013). However, with a single-subject design, we were able to determine that certain types of meditation

had demonstrable effects for particular individuals. In group analyses, individual differences can obscure individual effects. This complicates using evidence-based practice (see Spring, 2007) with patients. In general, the higher the individual variability in a particular domain, such as meditation, the less the average effect reported in the literature will be reflective of a particular individual. For this reason, clinicians may find single-subject designs both more appealing and more useful.

The academic study of meditation would also benefit from the wide-scale use by clinicians of single-subject experiments. Limitations imposed by the resource-intensiveness of longitudinal meditation research can be mitigated by distributing the load over hundreds of clinicians. To maximally profit from this work, the field should develop an international database for clinicians and researchers to publish their data and methods. Even in the absence of such a database, however, experiments can be collated by individual researchers and analyzed using increasingly sophisticated methods (see Moeyaert, Ferron, Beretvas, and Van den Noortgate, 2013; Shadish, Kyse, and Rindskopf, 2013; Shadish, 2014a, 2014b). With sufficient adoption, researchers will be better positioned to determine the effects of different meditation types (or combinations of practices) for particular personality profiles, disorders, or symptoms. This, in turn, would provide clinicians with more skillful means for improving the mental health of their patients.

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