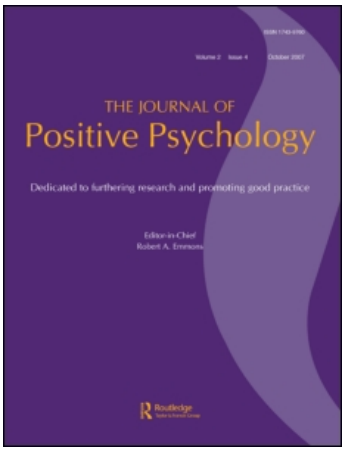

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Intensive mindfulness training-related changes in cognitive and emotional experience

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Intensive mindfulness training-related changes in cognitive and emotional experience

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This study examined the role of intensive mindfulness training on changes in day-to-day experiential processing, psychological symptoms, resilience, and well-being in two groups of community adults ($N = 69$). Using both quasi-experimental and longitudinal methods, the study found that intensive training, operationalized as 10–12 hours of formal mindfulness practice per day for 1 month, was significantly related to increases in training-specific experiential processing capacities, namely trait mindfulness and decentering (reperceiving), in comparison to pre–post-training wait-list controls. In both training groups combined, mindfulness, decentering, and acceptance increased over the pre-training to 1-month follow-up period. Intensive mindfulness training was also related to declines in anxiety and enhanced both subjective well-being and self-compassion from pre-training to follow-up in the two training groups. Finally, increases in trait mindfulness and acceptance were related to improvements in psychological symptoms, well-being, and resilience. Future directions for this novel area of mindfulness research are discussed.

Keywords: mindfulness; decentering; acceptance; meditation; mental health; psychological well-being; psychological resilience

Introduction

With the increasing popularity of mindfulness training in medical and other clinical settings, the question of how best to examine the effects of such training has become important. Research on the topic has predominantly focused on mindfulness-based and mindfulness-integrated therapies, including Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990) and Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2002), that have brought mindfulness practice into clinical treatment protocols. This research has made an important contribution, demonstrating that mindfulness interventions may have significant mental health benefits in a wide range of clinical and non-clinical populations, as recent meta-analytic reports suggest (Baer, 2003; Grossman, Niemann, Schmidt, & Walach, 2004). While these results are encouraging, there are still important questions concerning the mental health benefits of mindfulness. First, mindfulness-based therapies like MBSR and MBCT are multimodal, in which mindfulness practice is part of an intervention package that also includes didactic instruction (on stress, for example), gentle physical exercise (i.e., yoga), and social support. Also, these interventions typically require participants to engage in only brief periods of daily mindfulness practice (e.g., 30–45 minutes). Thus, research on mindfulness-based therapies leaves unclear whether mindfulness practice itself is responsible for the demonstrated positive effects of the interventions, and whether intensive mindfulness practice will also have mental health benefits.

The study of intensive mindfulness practice provides an opportunity to investigate key issues relevant to mindfulness interventions, and the present study was designed to address three such issues. First, does intensive mindfulness training have mental health benefits, as mindfulness-based therapies have shown? Second, if such benefits accrue in intensive training, are they limited to psychological symptoms (the focus of most mental health-relevant mindfulness research to date) or do benefits extend to positive outcomes of traditional interest to scholars of mindfulness (e.g., Walsh & Shapiro, 2006), including psychological well-being and resilience? Third, what capacities trained in intensive practice (e.g., mindfulness, acceptance) are related to the psychological outcomes observed?

Research on mindfulness practice, psychological effects, and processes

As already noted, most research on mindfulness practice over the past 25 years has been conducted using short-term, multimodal interventions. To date,

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few studies have investigated intensive mindfulness practice, such as it is readily found at meditation retreat centers around the world, in which participants practice mindfulness for many hours a day over a period of days, weeks, or even months. However, several pioneering studies have assessed the relation of such intensive practice to cognitive, emotional, and behavioral changes. For example, Slagter et al. (2007) demonstrated that 3 months of intensive mindfulness meditation significantly sharpened participants' attentional abilities, specifically by decreasing the 'attentional blink' deficit, the tendency to miss a stimulus presented in close succession to an initial stimulus. Chambers et al. (2008) found that 10 days of intensive mindfulness training improved novice meditators' executive functioning (working memory and attention), self-reported dispositional mindfulness, and psychological symptoms (depression and rumination) as compared to a wait-list control group. Two other, preliminary, studies reported declines in psychological distress (e.g., depression and anxiety) among individuals completing a 10-day training in mindfulness and related practices (Al-Hussaini, Dorvlo, Antony, Chavan, Dave, & Purecha, 2001; Ostafin, Chawla, Bowen, Dillworth, Witkiewitz, & Marlatt, 2006). Using a similar intensive training model, Bowen et al. (2006) found decreases in alcohol and substance use after prison release among course-completing inmates relative to treatment-as-usual controls. However, it is notable that several case reports have found mental health declines in psychologically fragile participants of intensive meditation training (e.g., Sethi & Bhargava, 2003; Walsh & Roche, 1979). Thus, it is still unclear whether and in what ways intensive mindfulness practice has mental health benefits, and the present research was designed to address this primary question.

The second focus of this study concerned the range of benefits observed in intensive mindfulness practice. Clinical mindfulness research conducted to date has focused on psychological symptom reduction, including depression, anxiety, and other indicators of pathology and sub-clinical mental health problems. Traditional mindfulness training, for example, conducted in Buddhist contexts, has emphasized the benefits that training may accrue for the enhancement of positive psychological qualities, including acceptance, self-compassion, and psychological wellness or happiness (e.g., Walsh & Shapiro, 2006). Research on trait mindfulness has shown that more mindful individuals report greater capacities for self-compassion, subjective well-being, and other positive psychological qualities (e.g., Baer, Smith, & Allen, 2004; Brown & Ryan, 2003) but, with the exception of one MBSR study by Shapiro, Brown, and Biegel (2007), little research has examined whether such qualities can accrue through mindfulness training. In an attempt to broaden the scope of inquiry into the effects of mindfulness training, the present research examined the effect of intensive mindfulness training on both psychological symptoms and positive psychological functioning.

The third focus of the present research was to examine whether qualities specifically trained through mindfulness practice relate to psychological symptoms, well-being, and resilience outcomes. Mindfulness research to date has primarily focused on outcomes rather than on processes through which mindfulness training may enhance these outcomes. Several mechanisms for the salutary effects of mindfulness training have been proposed, three of which we examine here: mindful attention, acceptance, and decentering or reperceiving (Baer, 2003; Brown, Ryan, & Creswell, 2007; Segal et al., 2002; Shapiro, Carlson, Austin, & Freedman, 2006).

Mindfulness concerns a sustained attention to external events and internal (psychological and somatic) experiences as they occur (Brown & Ryan, 2003; Kabat-Zinn, 1990). Decentering (or reperceiving) refers to the capacity to take a detached or objective stance on one's thoughts and emotions (Fresco et al., 2007; Shapiro et al., 2006). This implies a shift in conscious processing wherein individuals identify less with the content of mental events (thoughts, emotions) and more with the awareness of those events. These two constructs are related, in that decentering appears to be a form of experiential or mindful processing in which attention is turned inward to the observation of psychological states. Both can be contrasted with the conceptually driven mode of processing in which occurrences are habitually filtered through cognitive appraisals, evaluations, memories, beliefs, and other forms of cognitive manipulation (see reviews by Brown & Cordon, 2009; Brown et al., 2007). A third proposed mechanism is acceptance, which refers to the tendency to tolerate, or even approach, unwanted internal experiences rather than avoid them. Acceptance may develop through the ongoing application of mindful attention to internal experiences that can occur in training contexts (Shapiro et al., 2006).

The recent development of validated measures of mindfulness (e.g., Baer et al., 2004; Brown & Ryan, 2003; Walach, Bucheld, Buttenmuler, Kleinknecht, & Schmidt, 2006), decentering (Fresco et al., 2007), and acceptance (e.g., Bond et al., 2008; Hayes at al., 2004) has created opportunities to investigate whether differences in the processing of events and experiences are related to improvements in mental health and psychological well-being. Initial research suggests that this is so. For example, Shapiro et al. (2007) showed that relative to control participants, those completing MBSR reported increased mindfulness, as measured by the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) and these training-specific

increases were related to reductions in stress, anxiety, and rumination among student mental health counselors. Fresco et al. (2007) reported that depressed patients who responded to Cognitive Behavior Therapy reported significantly greater gains in decentering compared with anti-depressant medication responders. In addition, higher levels of decentering post-treatment were associated with the lower rates of relapse in an 18-month follow-up period. Finally, Carmody and Baer (2008) found that acceptance and other mindfulness training skills were enhanced in participants completing an MBSR intervention. Because mindful attention, decentering, and acceptance are key processes thought to be cultivated in mindfulness training, the clinical intervention research reported here suggests that increases in these processes could also be expected over the course of intensive training. This recent research also offers a basis to suggest that increases in these processes may be related to positive changes in psychological functioning during and following intensive mindfulness training.

The present research

The present study was designed to address three primary hypotheses: (1) intensive mindfulness training will be related to reductions in psychological symptoms, as has been observed in clinical mindfulness interventions; (2) intensive mindfulness training will be related to enhanced positive psychological outcomes, including well-being and resilience; and (3) key processes (mindfulness, decentering, and acceptance) thought to accrue during mindfulness training will be related to beneficial mental health outcomes. Specifically, we examined whether attending a 4-week intensive mindfulness training would result in lower levels of depressive and anxiety symptoms and increases in subjective well-being and a form of psychological resilience called self-compassion (Neff, 2003, in press). This question was addressed both in comparing pre–post training change relative to a wait-list control group, and also by assessing change from pre-training to 1-month follow-up in two groups receiving the same training. We also examined whether increased levels of mindfulness, decentering, and acceptance were related to the assessed indicators of mental health, well-being, and resilience.

Method

Participants

Participants ($N = 69$) were attendees at one of two 4-week residential mindfulness meditation trainings held in Northern California. Recruitment was conducted by mail and in person at the training site. Of the 39 participants who began the study in training Group A, 36 (92%) completed all assessments while in training Group B, 33 of 38 participants completed pre-test and post-test assessments, and 29 of these 38 (76%) participants completed the follow-up assessment.[1]

Across the groups, most participants were female (71%) and Caucasian (84%). Most were American citizens; several participants were European and Mexican. The age of participants ranged from 27 to 76 years ($M = 53.3$ years). Both groups were well-educated, with most participants reporting college degree (39%) or graduate degree (49%) completion. The average annual personal income across groups was US$49,362 ($SD =$ US$37,954) and average household income was US$83,902 ($SD =$ US$70,762). Participants' previous meditation practice experience varied widely, from 2 to 31 years ($M = 13.54$, $SD = 8.91$), as did meditation retreat history (range = 0 to 2555 days, $M = 189.91$, $SD = 385.04$) and weekly hours of meditation practice (range = 0.3 to 27.5, $M = 5.05$, $SD = 4.26$). Training groups A and B did not differ on any demographic, economic, practice, or training expectancy variables, all ps > 0.05.

Study procedures and design

All individuals who registered for the 2-month trainings at the study site were informed of the study through a pre-invitation mailing from the site director. Trainees were given the option to opt out of further study correspondence at that time. Only one individual chose to do so. All pre-training packets were completed before the training began and were returned either by postal mail within 1 week prior to training, or on-site in a drop box within several hours prior to the start of training. On-site completion of study materials was coordinated by site staff under the direction of the first author (KO). All prospective participants received an identical cover letter, consent form, and questionnaire packet. Post-training measures were completed at the end of the retreat, and most participants did so prior to departure, while several participants completed these measures within several days of departure and returned the packet by postal mail. Follow-up measures were distributed and returned by postal mail. For each complete assessment packet returned, a $5 donation was made to the site's training scholarship fund.

The study used a hybrid quasi-experimental and longitudinal design of this form:

Group A: $O_{1A}\ X\ O_{2A}\quad O_{3A}$
Group B: $O_{1B}\quad O_{2B}\ X\ O_{3B}\ O_{4B}$

The Os represent assessment points for the two training groups, each 1 month apart. Identical assessments of mindfulness, decentering, acceptance, and the four psychological symptoms and well-being variables

were distributed by mail or in person at the training site and returned at the site or in stamped, self-addressed envelopes at each time point. The *X*s represent the two training periods. Training Group A completed measures within 2 weeks of beginning their training (pre-test; O_{1A}) and then completed measures at post-test (O_{2A}), and at a 1-month follow-up point (O_{3A}).

Training Group B began the training 1 month after Group A did, and for this 1-month pre-training interval they served as a wait-list, pre-test (O_{1B}) to post-test (O_{2B}) control group for the first set of analyses of mindfulness training effects (matched control analyses). Group B also completed measures post-training (O_{3B}) and at a 1-month follow-up point (O_{4B}), providing a second sample to test the primary questions of this study (longitudinal analyses). Although Group B completed four assessments and Group A only three assessments, preliminary analyses showed no significant group differences on subjective measures at each relevant point of comparison for these longitudinal analyses: pre-test (O_{1A} *vs.* O_{2B}), post-test (O_{2A} *vs.* O_{3B}), and follow-up (O_{3A} *vs.* O_{4B}), all $ps > 0.05$. Therefore, analyses based on pre-test to follow-up changes used both groups combined.

Mindfulness training

All attendees followed a structured schedule of silent mindfulness meditation practice (10–12 hours/day), interspersed with didactic instruction and other activities, including exercise and work. Training focused on mindfulness of sensory and kinesthetic experience, emotions, thoughts, and other psychological states. Attendees were to refrain from non-essential talking and participation in other, discursive activities such as reading and writing. Although the training time included several activities, participants spent the majority (~70%) of their waking hours engaged in formal mindfulness practice. It was also emphasized repeatedly to participants that a continuity of mindfulness practice should be maintained into the non-formal meditation activities of the retreat (work, exercise, meals, etc). The schedule for both retreats was almost identical.

Measures

Demographic, economic, and training characteristics

Measures of age, gender, ethnicity, and education level were administered at pre-test, as were open-ended measures of personal and household income. History of meditation experience was assessed with one open-ended item: 'How many months or years have you been practicing meditation with some regularity?' Frequency of meditation practice (average minutes or hours per week) over the past year and number of past meditation training retreat days were each assessed with one open-ended item. Finally, expectations for the upcoming training were assessed with one item on a 1 (*not at all*) to 10 (*extremely*) scale: 'How much do you believe this month-long retreat will benefit you?'

Training processes

Mindfulness was measured using both the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003; sample $\alpha = 0.90$) and the Freiburg Mindfulness Inventory (FMI; Walach et al., 2006; $\alpha = 0.90$). The 15-item trait MAAS was developed to measure mindful attention and awareness in day-to-day life on a 6-point scale (*almost always* to *almost never*). Items include, 'I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.' The 14-item trait FMI was developed using a similar conceptualization of mindfulness as the MAAS, and has been validated with samples of individuals receiving meditation training. The FMI uses a 4-point Likert scale (*rarely* to *almost always*). Items include, 'When I notice an absence of mind, I gently return to the experience of the here and now.'

To assess decentering or reperceiving, the 20-item Experiences Questionnaire (EQ; Fresco et al., 2007; $\alpha = 0.86$) was used. Items include, 'I can observe unpleasant feelings without being drawn to them.' The 10-item Acceptance and Avoidance Questionnaire-II (AAQ-II; Bond et al., 2008; $\alpha = 0.81$) was used to measure experiential avoidance, the tendency to avoid unwanted experiences or, said differently, the tendency to accept unwanted experiences. Items on the AAQ-II include: 'My painful experiences and memories make it difficult for me to live a life that I would value.'

Psychological symptoms, well-being, and resilience

To assess these key aspects of mental health, well-validated scales tapping several cognitive and affective dimensions of experience were used. Two primary indicators of mental health are depressive symptoms and anxiety; these were measured with the well-known Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971) depression and anxiety subscales ($\alpha = 0.89$ and $\alpha = 0.79$, respectively). The POMS uses a five-point Likert scale from 0 (*not at all*) to 4 (*extremely*). Items are adjectives describing psychological symptoms such as *sad, helpless, gloomy, restless, panicky*, and *terrified*.

Subjective well-being (SWB) was assessed through measures of affective state and life satisfaction; these have been considered the primary components of SWB (Diener, 1984). Affective state was measured using the 20-item Positive and Negative Affect Schedule

(PANAS; Watson, Clark, & Tellegen, 1988). Example adjectives included *interested* and *enthusiastic* (positive affectivity) and *distressed* and *afraid* (negative affectivity). An affect balance score was computed by subtracting negative affect ($\alpha = 0.83$) from positive affect ($\alpha = 0.88$) scores after first zero-centering each. Life satisfaction was measured with the 5-item Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985; $\alpha = 0.77$). An example item is: 'The conditions of my life are excellent.' Affect balance and life satisfaction were moderately correlated ($r = 0.51$, $p < 0.0001$); thus, an overall SWB score for each person was calculated from the mean of the affect balance and life satisfaction scores for further analyses (cf., Sheldon, Ryan, Deci, & Kasser, 2004).

The 26-item Self-Compassion Scale (SCS; Neff, 2003; sample $\alpha = 0.85$) was used to measure a form of psychological resilience. The SCS assesses an attitude of kindness toward the self, particularly under conditions of perceived failure or felt inadequacy, based on an aggregate of responses on 6 subscales: self-kindness, common humanity, mindfulness, and self-judgment, isolation, and over-identification (items on the latter three subscales were reverse-scored). Items were scored on a 5-point scale and included, 'I try to be loving toward myself when I'm feeling emotional pain' and 'When times are really difficult, I tend to be tough on myself' (reversed). Total self-compassion scores were computed by summing the mean subscale scores (Neff, 2003).

Statistical analyses

A multilevel modeling approach was used for all primary data analyses (MLM; e.g., Bryk & Raudenbush, 1992; Kreft & deLeeuw, 1998). The MLM approach is well suited to hierarchically nested data structures in which a lower level unit of analysis (level 1; e.g., repeated measures of psychological characteristics) is nested within a higher level of analysis (level 2; e.g., groups). Other advantages for longitudinal designs include the ability to retain cases for which missingness is present, and the ability to test and control for serial autocorrelation, which commonly occurs in repeated measures data (West & Hepworth, 1991). The MIXED procedure in SAS was used to estimate all models (SAS Institute, 1992, 1997). To examine the magnitude of statistically significant effects independent of sample size, Cohen's *d* estimates (Cohen, 1988) were used where appropriate.

To enhance interpretability of the model intercept parameters, the predictor variables were pre-treated (Bryk & Raudenbush, 1992; Schwartz & Stone, 1998). Level 2 continuous variables measured at the beginning of the study, including retreat expectancy and meditation experience, were centered around the sample mean, while level 2 categorical variables that did not include a meaningful zero value in the original scaling (gender, age, group, time) were re-scaled to include zero. Level 1 variables were person-centered.

Before beginning the primary analyses, all continuous level 1 and level 2 variables were checked for skewness and kurtosis and corrected where necessary. Specifically, two outlying values in SWB were winsorized (Tabachnick & Fidell, 2007), as were several outlying depressive symptoms scores. Positive skewness in POMS depressive symptoms and anxiety was corrected with a square-root transformation of each variable. Unconditional multilevel means models established that there was significant variation at both the between-subjects level ($ps < 0.05$) and the within-subjects level ($ps < 0.0001$) in each of the repeated measures, both when including matched control data (first two time points of assessment), and when including longitudinal data (three training retreat-based time points). This indicated that there was meaningful variation to predict at both between-subjects (group) and within-subjects (time) levels.

Results

Preliminary *t*-test and bivariate correlation analyses showed no significant effects of the demographic, retreat history, or weekly practice time variables on the outcomes (all $ps > 0.05$) so these variables will not be further considered. Years of meditation experience was correlated with several of the training process variables at each time point ($ps < 0.05$) and, along with training benefit expectancy, was also correlated with several of the outcome variables at each time ($ps < 0.05$). These control variables were therefore retained for the relevant primary analyses.

Relation of mindfulness training to mental health and well-being change

We first examined whether intensive mindfulness training would be associated with changes in psychological symptoms, well-being, and resilience. This was tested in two ways. First, we examined whether Group A participants would show changes in the psychological variables over the pre–post training interval (O_{1A} to O_{2A}) relative to Group B, which served as a matched, wait-list control for this time interval (O_{1B} to O_{2B}). Second, we examined changes in psychological outcomes from pre-retreat to follow-up for both groups (O_{1A} to O_{3A} for Group A and O_{2B} to O_{4B} for Group B). In these analyses, Group B was no longer used for control comparisons, but rather as a second training sample to examine the replicability of training-related changes across time and groups. These analyses are

Table 1. Mean (and SD) values at pre-training and post-training time points for training Group A and pre-training (wait list) Group B.

	Training Group A			Pre-Training Group B			
Variable	Immediate pre-training	Post-training	*d*	One month pre-training	Immediate pre-training	*d*	p_{inter}
Psychological symptoms, well-being, and resilience							
POMS depression	7.44 (5.62)	6.78 (4.97)	0.12	10.36 (7.57)	8.30 (6.78)	0.29	0.49
POMS anxiety	10.17 (4.32)	10.38 (4.63)	0.05	10.88 (5.52)	12.64 (7.67)	0.26	0.29
Subjective well-being	3.80 (1.36)	4.24 (0.88)	0.38	3.44 (1.43)	3.62 (1.37)	0.13	0.34
SCS self-compassion	20.35 (3.11)	20.50 (3.39)	0.05	19.56 (3.60)	20.09 (3.50)	0.15	0.50
Training processes							
MAAS mindfulness	3.78 (0.65)	4.33 (0.71)	0.81	3.90 (0.58)	4.00 (0.51)	0.18	0.01
FMI mindfulness	39.26 (6.84)	45.25 (4.42)	1.04	38.33 (5.79)	38.16 (6.43)	0.03	0.0001
EQ decentering	3.52 (0.41)	3.84 (0.38)	0.81	3.54 (0.40)	3.49 (0.43)	0.12	0.0001
AAQ acceptance	50.39 (8.22)	51.18 (6.26)	0.11	49.49 (10.82)	51.55 (7.29)	0.22	0.48

Notes: $N = 69$. POMS = Profile of Mood States; SCS = Self-Compassion Scale; MAAS = Mindful Attention Awareness Scale; FMI = Freiburg Mindfulness Inventory; EQ = Experiences Questionnaire; AAQ = Acceptance Action Questionnaire. The *d* column shows Cohen's *d* effect sizes based on unadjusted means. The p_{inter} column shows group × time interaction significance levels in multilevel models.

also important because they reveal whether psychological changes are sustained beyond the immediate post-training period.

Table 1 (top portion) shows the mean scores on the psychological symptoms, well-being, and resilience variables at pre- and post-test for both groups. At pre-test, POMS depressive symptoms were low, while POMS anxiety scores were average relative to published norms for healthy treatment-seeking adults (McNair et al., 1971). Self-compassion scores were also very similar to norms (Neff, 2003).

In the first matched control set of analyses, we tested the proposed group × time interaction effects on each outcome separately while controlling for the main effects of group and time. Also, because preliminary analyses showed that years of meditation experience and expected benefit were related to several of the pre-test and post-test psychological variables, these variables were included in the relevant models. MLM analyses indicated no significant changes in psychological symptoms, well-being, and resilience in the training group (Group A) relative to the control, or pre-training group (Group B) over the pre- to post-test, month-long period (all ps > 0.29) and, as Table 1 shows, the pre- to post-test Cohen's *d* effect sizes were small for both groups.

Years of meditation experience was a significant main effect predictor in all models; specifically, more experience was associated with lower depressive symptoms ($p < 0.05$) and anxiety ($p < 0.01$), and higher SWB ($p < 0.05$) and self-compassion ($p < 0.001$). Changes in these outcomes were not conditioned by meditation experience in these models (i.e., there were no time × meditation experience interaction effects, all ps > 0.23). Expected benefit of the training produced a main effect increase in SWB ($p < 0.01$).

Turning to the second, longitudinal analytic approach to training-related psychological change outlined above, we included data from pre-training to 1-month follow-up from both groups together. Descriptive statistics and primary MLM results are displayed in Table 2 (top portion). MLM analyses were performed by regressing the three repeated measures of each psychological variable onto group, time, the group × time interaction, and any control variables that preliminary analyses showed were correlated with the psychological variables at any of the three time points, namely years of meditation experience and anticipated benefit from training, along with serial autocorrelation in the dependent variable. In these MLM analyses, the main effect of time was of central interest, and a non-significant group effect would suggest that the overall changes observed were replicable across both groups. The group × time interaction was of interest in showing whether the groups varied in the specific location of changes (e.g., pre-to-post retreat vs. post-retreat to follow-up). When the main effect of time was significant, post-hoc Tukey-Kramer tests were used to examine the location of change: between pre-retreat and post-retreat, and between post-retreat and follow-up. The comparatively conservative Tukey-Kramer tests were also used to examine the nature of group × time interaction effects, given the number of simple main effects tests involved.

Regarding the psychological symptoms variables, there was a significant decline in POMS anxiety ($p < 0.01$); no main effect of time on POMS depressive symptoms was observed, $p > 0.49$. There were significant increases across groups (i.e., main effects of

Table 2. Mean (and SD) values at pre-training, post-training, and follow-up time points for training groups A and B combined.

Variable	Pre-training	Post-training	Follow-up	*d*	p_{time}
Psychological symptoms, well-being, and resilience					
POMS depression	7.86 (6.17)[a]	6.90 (5.48)[a]	7.42 (6.68)[a]	0.07	0.49
POMS anxiety	11.35 (6.23)[a]	9.59 (4.84)[b]	9.62 (4.59)[b]	0.32	0.01[†]
Subjective well-being	3.70 (1.42)[a]	4.38 (1.07)[b]	4.34 (1.03)[b]	0.52	0.0001[†]
SCS self-compassion	20.02 (2.80)[a]	20.14 (2.36)[a]	21.32 (2.12)[b]	0.52	0.0001[†]
Training processes					
MAAS mindfulness	3.89 (0.59)[a]	4.47 (0.74)[b]	4.47 (0.53)[b]	1.03	0.0001
FMI mindfulness	38.73 (6.62)[a]	45.18 (5.14)[b]	43.32 (5.87)[c]	0.73	0.0001
EQ decentering	3.51 (0.41)[a]	3.78 (0.41)[b]	3.82 (0.41)[b]	0.76	0.0001
AAQ acceptance	50.94 (7.76)[a]	51.76 (7.19)[a]	54.70 (6.98)[b]	0.51	0.0001

Notes: $N = 69$. POMS = Profile of Mood States; SCS = Self-Compassion Scale; MAAS = Mindful Attention Awareness Scale; FMI = Freiburg Mindfulness Inventory; EQ = Experiences Questionnaire; AAQ = Acceptance Action Questionnaire. The *d* column shows Cohen's *d* effect sizes based on unadjusted pre-training and follow-up means. The p_{time} column shows significance levels for the main effect of time in multilevel models. Superscripts with different letters designate adjacent mean scores differing at $p < 0.02$ or less.
[†]Significant group × time interaction effects were also found on these variables.

time) in SWB and SCS self-compassion (both ps < 0.0001). No main effects of group were found on these well-being and resilience variables. Table 2 shows that the effect sizes of the pre-training to follow-up changes in these mental health variables were moderately large. Post-hoc tests showed that across groups, POMS anxiety decreased from pre- to post-retreat ($p < 0.01$) and then stabilized until follow-up ($p > 0.88$). A similar pattern was seen for an increase in SWB ($p < 0.0001$ and $p > 0.66$, respectively). Self-compassion did not change from pre- to post-retreat ($p > 0.83$), but increased significantly from post-retreat to follow-up ($p < 0.001$).

The main effects of time reported here were conditioned by significant group × time interactions for POMS anxiety ($p < 0.01$), SWB ($p < 0.05$), and self-compassion ($p < 0.05$). Tukey-Kramer tests showed that on POMS anxiety, only Group B showed a decline over time, namely from pre- to post-retreat, $p < 0.001$. Post-hoc tests also showed that the SWB increase from pre- to post-retreat was significant only from Group B ($p < 0.0001$); however, Group A showed a significant increase in SWB from pre-retreat to follow-up ($p < 0.05$), indicating that change did occur for both groups over the full study interval. A similar group difference was seen for self-compassion, in that an increase from post-retreat to follow-up was significant for Group A ($p < 0.01$); Group B showed a significant increase in self-compassion from pre-retreat to follow-up ($p < 0.001$), indicating that significant change by follow-up occurred for both groups, but at different times over the course of the study.

The expected benefit and meditation experience control variables were significant predictors in several of these models. Specifically, participants who anticipated more benefit from the retreat were significantly more likely to report higher levels of SWB over time, $p < 0.05$. More meditation experience predicted higher SWB ($p < 0.05$) and self-compassion ($p < 0.01$) over time. In sum, these results indicate that intensive mindfulness training was associated with beneficial changes in several indicators of psychological symptoms, well-being, and resilience that were maintained over time and generally replicated across two independent groups.

Relation of mindfulness training to process change

As a prelude to examining whether changes in mindfulness training processes would be related to mental health changes, we tested whether intensive mindfulness training would be associated with changes in mindfulness, decentering, and acceptance. These questions were tested in the same two ways as with psychological symptoms, well-being, and resilience changes outlined above. Table 1 (bottom portion) shows the mean scores on the training processes over time for both groups. Scores on MAAS mindfulness were comparable to published community adult average scales scores (Brown & Ryan, 2003), as were decentering scores (Fresco et al., 2007). FMI mindfulness scores were slightly higher than published scores for community adults (Walach et al., 2006). Norms for AAQ-II acceptance are not yet available.

As was done in the prior matched control analyses, we tested the proposed group × time interaction effects on each outcome while controlling for the main effects of group and time. Years of meditation experience and expected benefit were included in these models where preliminary analyses indicated they were significant predictors. As before, serial autocorrelation in the dependent variable was also controlled. MLM analyses

indicated significant change in the training group relative to controls in pre- to post-training MAAS mindfulness ($p < 0.01$), FMI mindfulness ($p < 0.0001$), and decentering ($p < 0.0001$). There was no significant group × time interaction in acceptance ($p > 0.48$). As indicated by the Cohen's *d* estimates shown in Table 1 (bottom portion), the magnitude of the changes in these process variables was large.

Years of meditation experience was a significant main effect predictor in all models; specifically, more experience was associated with higher MAAS mindfulness ($p < 0.01$), FMI mindfulness ($p < 0.05$), decentering ($p < 0.05$), and acceptance ($p < 0.01$). Changes in these training processes were not conditioned by meditation experience, all ps > 0.27.

Regarding the longitudinal analysis that combined both training groups, Table 2 (bottom portion) displays the descriptive statistics and primary MLM results. Statistically significant changes across the pre-retreat to follow-up period were seen for MAAS mindfulness, FMI mindfulness, EQ decentering, and AAQ acceptance, all ps < 0.0001. The Cohen's *d* effect size estimate was large for both mindfulness and decentering and moderate for acceptance. No group or group × time interaction effects were found on these training process variables. Post-hoc Tukey-Kramer tests confirmed that both MAAS- and FMI-measured mindfulness and EQ decentering scores increased significantly from pre-retreat to post-retreat (all ps < 0.0001). Post-retreat levels of MAAS mindfulness and decentering were maintained at follow-up (i.e., no significant change from post-retreat to follow-up, ps > 0.59). Interestingly, FMI-measured mindfulness scores decreased significantly from post-retreat to follow-up ($p < 0.01$). AAQ acceptance scores did not change significantly from pre-to-post retreat but did increase from post-retreat to follow-up, $p < 0.01$.

Both meditation experience and expected benefit control variables were significant predictors in these models, such that more meditation experience was related to higher scores on both mindfulness variables, decentering, and acceptance, all ps < 0.05. Participants who anticipated more benefit from the retreat were significantly more likely to report higher levels of FMI mindfulness and decentering, both ps < 0.05. In general, these results indicate that intensive mindfulness training was associated with beneficial changes in mindfulness, decentering, and acceptance that were maintained over time and that replicated across two independent training groups.

Relating changes in mindfulness training processes to mental health changes

We next tested whether changes in the training process variables would be related to changes in psychological symptoms, well-being, and resilience over the study period. As described already, all outcomes except depressive symptoms showed significant change over the pre-training to follow-up period (see Table 2). Because this analysis simply asked whether magnitude of change in the outcomes was predicted by magnitude of change in training processes, all four outcomes were included in these analyses. Preliminary bivariate correlation analyses showed that the two measures of mindfulness (MAAS and FMI) and the EQ measure of decentering were moderately to highly intercorrelated at each time point. The MAAS and FMI *r*s were 0.62, 0.49, and 0.64 at times 1–3, respectively, all ps < 0.0001; across time, MAAS scores were moderately correlated with EQ decentering, average $r = 0.59$, all ps < 0.0001. The average FMI–EQ correlation was $r = 0.75$, all ps < 0.0001. Thus, to simplify the analyses and circumvent multicollinearity problems, scores on these three measures were combined into an average mindfulness score. This was justified by the fact that, as noted in the Introduction, mindfulness and decentering are closely related constructs, such that decentering appears to be a form of mindful processing of psychological experience.

Multilevel models were constructed to assess the relative contribution of mindfulness and acceptance to psychological symptoms, well-being, and resilience change. These models used data from three time points (pre-training, post-training, and follow-up) for members of both retreat groups combined. In four constructed models, the repeated measures data from each of the four mental health variables was regressed on the repeatedly measured data from the two process variables, along with the same predictors included in the previous analyses of mental health: time, group, the group × time interaction, and the control variables, namely, serial autocorrelation and where relevant, meditation experience and expected benefit.

Table 3 displays the results of the MLM analyses. A decline in POMS depressive symptoms was associated with an increase in mindfulness ($p < 0.05$) and acceptance ($p < 0.001$). In the model examining change in POMS anxiety, neither of the process variables was significantly associated with changes in the outcome, although an increase in mindfulness was marginally related to a decline in anxiety ($p < 0.10$). Increases in mindfulness ($p < 0.0001$) and acceptance ($p < 0.05$) were related significantly to an increase in SWB from baseline to follow-up. Finally, increases in both process variables were significantly related to an increase in self-compassion (both ps < 0.0001).[2] Because the self-compassion variable included a mindfulness subscale, it was important to determine whether the significant relation between changes in mindfulness and self-compassion were dependent on this subscale. Thus an additional model was constructed using self-compassion outcome scores that did not include the

Table 3. Multilevel model results showing relations between changes in training process variables and changes in mental health over pre-training, post-training, and follow-up time points for training groups A and B combined.

	Depressive symptoms	Anxiety	Subjective well-being	Self-compassion
Predictor	*F* value	*F* value	*F* value	*F* value
Expected benefit	–	–	7.22**	–
Years of meditation	–	3.44^{+}	3.98*	8.45**
Group	0.39	0.01	0.21	0.00
Time	2.64^{+}	0.67	1.28	15.45****
Group × time	1.23	5.19**	3.23*	4.35*
Mindfulness	5.85*	2.73^{+}	16.81****	46.47****
Acceptance	12.34***	2.22	4.83*	15.52****

Notes: $N = 69$. Autocorrelation results are not shown. The mindfulness predictor is a composite of scores from the mindfulness and decentering measures.
$^{+}p < 0.10$; $*p < 0.05$; $**p < 0.01$; $***p < 0.001$; $****p < 0.0001$.

mindfulness subscale. The results of this model were almost identical to those already reported with the full Self-Compassion Scale scores.

Discussion

To date, little research has examined whether intensive mindfulness training is associated with positive changes in mental health. The present longitudinal study found significant gains in several such indicators, including anxiety, subjective well-being, and self-compassion from pre-training to a 1-month post-training follow-up point in two separate groups of community adult trainees. Among the four outcomes assessed, only depressive symptoms did not show change over the study period. However, depressive symptoms scores were low at baseline, allowing little room for sample-wide improvement over time. The null result on this outcome, as well as improvements on the other three outcomes suggests that intensive mindfulness training is not harmful for unselected community adults and may have benefits for psychological functioning. Importantly, this study found that the changes in mental health extended beyond the protected training environment into post-training daily life.

This study also found evidence for enhancements in processes thought to be developed during mindfulness practice, namely mindfulness, decentering, and acceptance. Compared to pre-training (wait-list) controls, the first training group showed significant pre- to post-training increases in mindfulness (on two measures) and decentering, and both training groups showed improvements on all three processes from pre-training to the follow-up point. Interestingly, a lagged improvement effect was observed in acceptance, which increased only during the month following training. This may be because acceptance is an attitude more readily apparent when daily life stresses require re-appraisal. In contrast, mindfulness and decentering are processes more readily brought to bear on all experience. It is also true that these processes are the central focus of mindfulness training, so improvement during the training period is expectable.

Finally, this study found that increases in training processes, particularly mindfulness and acceptance, were related to improvements in psychological symptoms, well-being, and resilience over the study period. Specifically, increased mindfulness and acceptance were related to a decline in depressive symptoms, and increases in both training variables were associated with increases in subjective well-being and self-compassion. This evidence provides a basis for future research to examine more carefully which of these processes are responsible for reductions in psychological symptoms and increases in well-being and resilience.

The results of this study are generally consistent with research testing the efficacy of MBSR and other mindfulness-based interventions, which have also shown training-related improvements in mindfulness (e.g., Brown & Ryan, 2003; Shapiro et al., 2007) and in psychological symptoms and well-being (Baer, 2003; Grossman et al., 2004). It is also consistent with research showing that intervention-based enhancements of trait mindfulness and acceptance are associated with improvements in well-being and self-compassion (Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Shapiro et al., 2007). This research suggests an avenue to improve the psychological functioning of those individuals not appropriate for clinical mindfulness interventions such as MBSR and other, short-term mindfulness training methods (Bowen et al., 2006; Marlatt & Gorden, 1985) that target stressed or distressed individuals with little or no mindfulness practice experience. Intensive mindfulness practice may be best suited to those who, as in the present sample, have previous practice experience and are in good mental health.

While not of direct interest to this research, the present study found that more meditation experience was associated with higher baseline, as well as greater improvements in mindfulness, decentering, acceptance, and both SWB and self-compassion. The association with mindfulness is consistent with theory (Kabat-Zinn, 1990) and with recent evidence showing that cortical regions associated with attention and sensory processing are thicker in meditation practitioners (Lazar et al., 2005). The fact that years of meditation experience was associated with better mental health at baseline merits further, longitudinal research to test the directional relation between them.

Limitations and further research

Several limitations of the present study are noteworthy. First, the study was quasi-experimental and longitudinal in design, and without randomization any conclusions regarding mindfulness training 'effects' are premature. However, the fact that many of the study results were replicated across two independent groups strengthens the quasi-experimental and correlational findings. Second, although the format of the mindfulness training was standard, and very similar across the two training groups, the training was not manualized and under control of the researchers. That said, the mindfulness practice instruction and training format was offered from within a longstanding training tradition. It also offered a naturalistic model from within which to study intensive mindfulness training and practice.

Third, the design of the present study could not disclose whether mindfulness training itself, rather than social support, the break from daily routines, and other factors could account for the positive psychological changes observed in this study. However such factors are not obvious alternative explanations for the results seen in this study. Formal and informal mindfulness practice was the single major activity in which participants engaged during the training. Also, changes in mindfulness itself were associated with changes in the study outcomes. Social support was largely limited to the mere presence of others since the training was held in silence; also, while intensive mindfulness meditation training provides a break from normative day-to-day routines, it is not a vacation for most people, not only because of the intensive formal training schedule but also because it is not easy to sustain attention for hours on end to the various states of mind that typically occur during meditative practice. But a definitive answer to the question of active ingredients in intensive mindfulness training must await experimental research that actively controls or tests alternative explanations.

A final limitation of the study is that the psychological symptoms, well-being, and resilience variables assessed were limited in number and in type, given that all were self-report-based. Future research could benefit from including more measures, and supplementing self-report measures with objective behavioral or neurological indices to assess psychological outcomes more comprehensively. Such research could also extend follow-up time to determine how long-lasting the benefits of intensive mindfulness training are.

Despite such methodological limitations, the findings of this study offer preliminary evidence that intensive mindfulness practice may generate significant positive changes in psychological functioning among healthy community adults. Empirical study of intensive mindfulness practice is very new, and the present findings offer support to the growing body of knowledge on mindfulness interventions and their associated outcomes, and offer promise for future research addressing the mechanisms and consequences of intensive mindfulness training.

Notes

1. Since the multilevel modeling to be used here allows for missingness, data from all 69 participants was retained for analyses.
2. Additional models were tested that included decentering as a separate predictor, along with the combined mindfulness (MAAS and FMI) scale scores and the acceptance scores. Increases in decentering were related to increases in self-compassion ($p < 0.05$); decentering was not a significant predictor in the other three models ($ps > 0.90$). Both mindfulness and acceptance were significant predictors in the depressive symptoms, SWB, and self-compassion models (all $ps < 0.05$).

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