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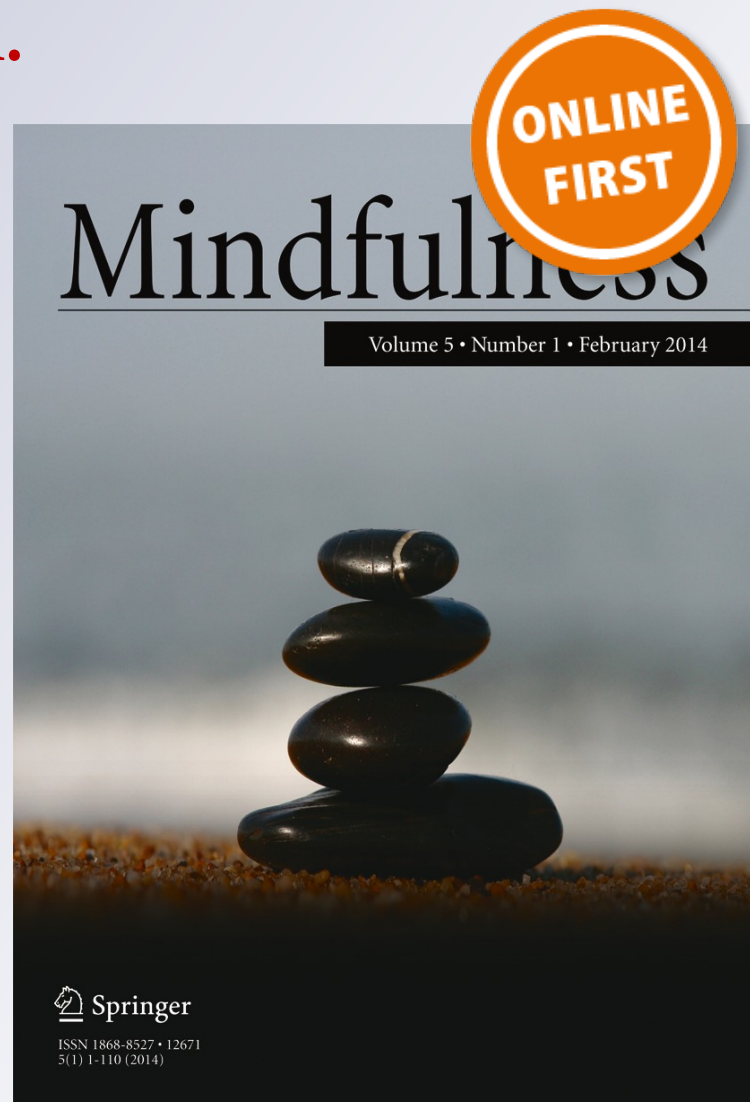
Alexandre Heeren, Sandrine Deplus, Virginie Peschard, François Nef, Ilios Kotsou, Christophe Dierickx, Laurie Mondillon, et al.

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Does Change in Self-reported Mindfulness Mediate the Clinical Benefits of Mindfulness Training? A Controlled Study Using the French Translation of the Five Facet Mindfulness Questionnaire

Alexandre Heeren · Sandrine Deplus · Virginie Peschard · François Nef · Ilios Kotsou · Christophe Dierickx · Laurie Mondillon · Donald J. Robinaugh · Pierre Philippot

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Abstract Mindfulness training improves mental health and psychological functioning. Although several questionnaires have been developed to measure mindfulness, the Five Facet Mindfulness Questionnaire (FFMQ) is currently one of the most widely used scales. However, uncertainty remains about whether the effects of mindfulness training can be unambiguously attributed to change in self-reported mindfulness. The present study was designed to answer three major questions: First, relative to a wait-list group, does participation in mindfulness training lead to changes in self-reported mindfulness among a mixed sample of individuals presenting stress-related problems, illness, anxiety, and chronic pain? Second, are changes in mindfulness associated with changes in psychological distress? Third, do changes in mindfulness mediate the effects of mindfulness training on the decrease in psychological distress? We used the French translation of the FFMQ in a Belgian sample. Relative to

a wait-list control, mindfulness training led to a change in self-reported mindfulness and psychological distress. Further, changes in mindfulness mediated the effects of mindfulness training on a decrease in psychological distress.

Keywords Mindfulness training · FFMQ · MBIs

Introduction

Mindfulness training is an intervention derived from Buddhist practice that teaches participants to maintain their attention on their present experience, without judgment or analytical processing (Kabat-Zinn 1982). In numerous meta-analyses, mindfulness-based interventions (MBIs) have been shown to alleviate a variety of clinical conditions. For instance, MBIs exhibit medium to large effects for anxiety and mood disorders (Hofmann et al. 2010; Vollestad et al. 2012); medium effects in the reduction of anxiety and mood symptoms among patient suffering from somatic illness such as cancer, diabetes, chronic fatigue, and heart disease (Hofmann et al. 2010); and medium to large effects for the reduction of stress, pain, and other symptoms in people with illnesses such as psoriasis, fibromyalgia, chronic pain, and heart disease (Baer 2003; Grossman et al. 2004). Moreover, MBIs may improve cognitive processing (e.g., Greenberg et al. 2012; Heeren et al. 2009; Lutz et al. 2013).

The findings from these meta-analyses suggest that MBIs are clinically effective interventions. However, uncertainty remains about whether the effects of MBI can be unambiguously attributed to a change in mindfulness resulting from the training.

A. Heeren (✉) · S. Deplus · V. Peschard · F. Nef · I. Kotsou · P. Philippot
Psychological Sciences Research Institute, Université catholique de Louvain, Louvain-la-Neuve, Belgium
e-mail: alexandre.heeren@uclouvain.be

C. Dierickx
Unité de Psychologie Clinique Cognitive et Comportementale - Clinique Psychologique et Logopédique de l'Université de Liège, Université de Liège, Liège, Belgium

L. Mondillon
Laboratoire de Psychologie Sociale et Cognitive, CNRS UMR 6024, Université de Clermont-Ferrand, Clermont-Ferrand, France

D. J. Robinaugh
Department of Psychology, Harvard University, Cambridge, MA, USA

In other words, the mechanism by which MBIs affect change in these conditions remains unclear. In order to evaluate proposed mechanisms of change, researchers must first confirm the successful induction of change in the proposed mechanism. That is, they must demonstrate that MBIs do indeed lead to increases in mindfulness and that the magnitude of change in mindfulness is related to the magnitude of change in the outcome of interest (symptom reduction, e.g., Heeren et al. 2011a; MacLeod et al. 2009).

Recently, several questionnaires have been proposed for assessing mindfulness skills (e.g., Baer et al. 2004; Brown and Ryan 2003; Buchheld et al. 2001). These self-reports assess a general tendency to be mindful in daily life, exhibit good psychometric properties, and are significantly correlated with each other (Baer et al. 2006). One of the most commonly used is the Five Facet Mindfulness Questionnaire (FFMQ) (Baer et al. 2006, 2008), which assesses five elements of mindfulness. These include *Observing* (i.e., attending to or noticing internal and external stimuli, such as emotions, cognitions, sights, sounds, or smells), *Describing* (i.e., noting or mentally labeling these stimuli with words), *Acting with awareness* (i.e., attending to one's current actions, as opposed to behaving automatically or absent-mindedly), *Non-judging of inner experience* (i.e., refraining from evaluation of one's sensations, cognitions, and emotions), and *Non-reactivity to inner experience* (i.e., allowing one's thoughts and feelings to come and go, without reacting to them). Confirmatory factor analyses have corroborated this five-factor solution in several samples although the Observing scale often does not fit the model in nonmeditating student samples (Baer et al. 2006, 2008). The FFMQ has shown good internal consistency and correlations in the expected directions with many variables predicted to be related to mindfulness (Baer et al. 2006).

In addition, the FFMQ has shown strong psychometric properties in several languages. For instance, Heeren et al. (2011b) translated the FFMQ into French and found support for the five-factor structure using confirmatory factor analyses. Similar results have been reported in Italian (Romanelli and di Berardino 2010), Chinese (Deng et al. 2011), Spanish (Cebolla et al. 2012), Japanese (Sugiura et al. 2012), Dutch (de Bruin et al. 2012), and Swedish (Lilja et al. 2011).

Despite this large and growing body of research on the FFMQ, only a few studies have examined whether FFMQ scores mediate the effects of mindfulness programs in clinical settings. Carmody and Baer (2008) reported that increases in FFMQ scores mediated the effect of mindfulness-based stress reduction (MBSR) (Kabat-Zinn 1982) on psychological health in a mixed sample of individuals presenting stress-related problems, illness, anxiety, and chronic pain. However, this study was uncontrolled and examined only an aggregate score for the FFMQ rather than testing each subscale separately. Baer et al. (2012) examined weekly change in FFMQ scores and perceived stress among MBSR participants and

found that significant change in FFMQ scores preceded a significant change in perceived stress and that change in FFMQ scores over the first 3 weeks predicted change in perceived stress over the course of MBSR. This study also was uncontrolled and did not show full mediation.

In a controlled trial, Bränström et al. (2010) reported that increased FFMQ scores mediated the effects of an MBSR program on psychological distress relative to a wait-list condition among patients suffering from cancer. Interestingly, they found that not all of the subscales were related to the outcome variables. Indeed, the Observing subscale was related to improvement in positives states of mind, but was the only subscale unrelated to reduction of psychological distress. However, because their sample was limited to individuals with cancer, it is unclear if these findings would generalize to a broader population of individuals suffering from a more diverse set of conditions.

The present study was designed to overcome these limitations, by answering three major questions: First, in comparison to a wait-list group, would participation to a mindfulness training lead to changes in FFMQ scores among a mixed sample of individuals presenting stress-related problems, illness, anxiety, and chronic pain? Second, would potential changes in FFMQ be related to changes in psychological distress? Finally, would changes in mindfulness mediate the effects of mindfulness training on psychological distress? Both total scores and subscales scores for the FFMQ were examined.

Method

Participants

Participants were eligible for the study if they had (a) no prior training in mindfulness or another form of meditation, (b) no current substance abuse, and (c) no plans to change their psychotropic medications or psychological treatment during the training.

Consistent with Carmody and Baer (2008), we used a transdiagnostic approach and recruited participants with stress-related problems, illness, anxiety, and chronic pain. We did not assess their specific diagnoses. However, their levels of psychological and somatic distress were assessed at baseline (see below).

The study design was quasi-experimental with a between-subject variable (Mindfulness vs. Wait-list) and a within-subject variable (pretest vs. posttest). The study was advertised during information sessions for individuals inquiring about an eight-session mindfulness program and presented as an investigation of the effect of mindfulness training on different psychological variables. Participants were not randomly allocated to conditions: those who started the program

immediately constituted the mindfulness group ($n=24$), while those who had to wait for a future course because of scheduling issues constituted the wait-list control group ($n=26$). Participants' characteristics are displayed in Table 1.

Measures

Psychological distress was assessed using the French versions of the Beck Depression Inventory (BDI-II) (Beck et al. 1996) and the Symptom Check-List-90-R (SCL-90-R) (Derogatis 1977), both of which have shown strong psychometric properties (Beck et al. 1996; Tatu et al. 1994). For the BDI-II, Cronbach's alpha in the current sample was 0.85 at baseline and 0.81 at posttraining. The Global Severity Index (GSI) of the SCL-90-R was used to assess the level of general psychopathological symptoms. Cronbach's alpha in the current sample was 0.90 at baseline and 0.92 at posttraining.

Mindfulness was assessed using the French version of the FFMQ (Baer et al. 2006, 2008), a 39-item self-report measure assessing the level of mindfulness in daily life. As mentioned above, it includes five facets of mindfulness: Observing, Describing, Acting with awareness, Non-judging of inner experience, and Non-reactivity to inner experience. Items are rated on a 5-point scale ranging from 1 (never or very rarely true) to 5 (very often or always true). Heeren et al. (2011b) have reported good psychometric and structural properties of the French adaptation of the scale. Cronbach's alpha of the total scale in the current sample was 0.88 at baseline and 0.91 at posttraining [Cronbach's alphas were 0.75, 0.87, 0.81, 0.86, and 0.77 at baseline and 0.77, 0.80, 0.79, 0.76 and 0.81 at posttraining for Observing, Describing, Acting with awareness, Non-judging of inner experience, and Non-reactivity to inner experience at baseline, respectively].

Procedure

The mindfulness training was an adaptation of mindfulness-based cognitive therapy (MBCT) (Segal et al. 2002). MBCT was designed for the prevention of depressive relapse. We adapted it for our sample by modifying the psycho-education component of the program (sessions 4 and 5) to target stress, anxiety, and depression rather than just depression. Otherwise, all sessions and exercises followed the MBCT protocol (see

Heeren and Philippot 2011, for previous studies using this adaptation of the program). The training was provided by three psychologists with training in cognitive and behavioral interventions, at least 8 years of clinical practice, and who had previously been trained in mindfulness-based psychological interventions (i.e., MBSR and MBCT).

For the mindfulness group, a baseline assessment was held just before the intervention and a second assessment was held just after the last session of the intervention ($M=56.04$ days, $SD=0.81$). For the wait-list group, a time interval ($M=55.54$ days, $SD=1.42$) similar to the Mindfulness group was used. There was no significant difference between the groups in intersession interval [$t(48)=1.52$, $p=0.13$, $d=0.44$]. Upon completion of the entire study, participants were fully debriefed.

Data Analysis

Power Analysis

An a priori power analysis was conducted to determine the appropriate total sample size for testing hypotheses with the primary outcome variables. Based upon previous meta-analyses on the effects of mindfulness-based intervention on psychological distress (e.g., Hofmann et al. 2010), we expected a medium effect size of $d=0.5$. Setting the level of α at 0.05, power ($1-\beta$) at 0.80 and expecting a conservative correlation of $\rho=0.50$ between repeated measurements, the power analysis (G*Power 3.1.3) (Faul et al. 2007) indicated that a total sample size of 34 participants with 17 participants per group would yield an adequate power to detect a medium effect size.

Data Analytic Plan

Statistical analyses were performed using the SPSS software package (SPSS Inc. 2009). The significance level was set at 0.05. Missing values were imputed using the last-observation-carried-forward method (Hollis and Campbell 1999). Imputations were necessary for only three participants and did not exceed 0.2 % of the posttraining data.

To examine whether mindfulness training led to a significant change at posttraining as compared to the wait-list, mixed linear models were used. Univariate sets of data were submitted to 2 (group: mindfulness vs. wait-list) $\times$ 2 (time: baseline, posttraining) mixed analyses of variance (ANOVAs) with repeated measurement on the last factor. Multivariate sets of data were submitted to 2 (group) $\times$ 2 (time) multivariate repeated measures of analyses of variance (MANOVAs) including the different scores at baseline and posttraining as dependent variables. We used Bonferoni's corrected t test to examine post hoc comparisons. All variables (except condition)

Table 1 Participants' characteristics as a function of group allocation (standard deviations in parentheses)

	Mindfulness group	Wait-list group
<i>n</i>	26	24
Age	41.71 (12.10)	39.73 (12.86)
% female	53.33	46.66
Years of education	18.79 (1.99)	18.69 (2.07)

were grand-mean centered to account for multicollinearity issues (Tabachnick and Fidell 2006).

To examine whether changes in mindfulness mediate changes in outcome measures, we use the procedure described by MacKinnon et al. (2007). This procedure tests the product of the coefficients for the effects of (a) the independent variable (contrast coded: mindfulness training=+1, wait-list=-1) to the mediator (difference from baseline to posttraining on mindfulness scores) (alpha) and (b) the mediator to dependent variable when the independent variable is taken into account (beta). This procedure is a variation on the Sobel (1982) test that accounts for the nonnormal distribution of the alpha–beta path through the construction of asymmetric confidence intervals. Mediation models are statistically significant when the confidence interval of the indirect path (alpha–beta) does not overlap with zero (MacKinnon et al. 2007).

Results

Group Characteristics

Preliminary analyses indicated no significant differences among the groups at baseline on any of the demographic variables, symptom measures, or mindfulness scores (all p -values >0.05). Means and standard deviations for all variables appear in Tables 1 and 2.

Change in Mindfulness

We first subjected the FFMQ total scores to a 2 (group: mindfulness, wait-list) $\times$ 2 (time: baseline, posttraining) ANOVA. The ANOVA revealed a main effect of time [$F(1, 48)=69.62, p<0.01, \eta^2=0.59$] and a group $\times$ time interaction

[$F(1, 48)=12.74, p<0.01, \eta^2=0.21$]. A t test computed on scores at posttraining showed a significant difference between groups [$t(48)=4.37, p<0.01, d=1.27$].

We then subjected the FFMQ subscale scores to a 2 (groups: mindfulness, wait-list) $\times$ 2 (time: baseline, posttraining) MANOVA. The MANOVA revealed a significant multivariate main effect of time [Wilks' $\lambda=0.49, F(5, 44)=9.07, p<0.01, \eta^2=0.51$] and a significant group $\times$ time interaction [Wilks' $\lambda=0.60, F(5, 44)=5.85, p<0.01, \eta^2=0.40$]. Univariate tests showed a significant group $\times$ time interaction for each subscale [Observing, $F(1, 48)=18.14, p<0.01, \eta^2=0.27$; Describing, $F(1, 48)=12.61, p<0.01, \eta^2=0.21$; Acting with awareness, $F(1, 48)=9.98, p<0.01, \eta^2=0.17$; Non-judging of inner experience, $F(1, 48)=5.50, p<0.05, \eta^2=0.10$; Non-reactivity to inner experience, $F(1, 48)=17.10, p<0.01, \eta^2=0.26$]. At posttraining, the groups differed in each of the FFMQ subscales [Observing, $t(48)=6.38, p<0.01, d=1.84$; Describing, $t(48)=3.82, p<0.01, d=1.1$; Acting with awareness, $t(48)=2.78, p<0.01, d=0.08$; Non-judging of inner experience, $t(48)=3.69, p<0.01, d=1.07$; Non-reactivity to inner experience, $t(48)=4.80, p<0.01, d=1.39$]. Data appear in Table 2.

Self-reported Measures of Psychological Distress

For the BDI, the ANOVA revealed a main effect of time [$F(1, 48)=11.62, p<0.01, \eta^2=0.20$], qualified by a significant time $\times$ condition interaction [$F(1, 48)=4.63, p<0.05, \eta^2=0.09$]. At posttraining, there was a difference between groups [$t(48)=2.06, p<0.05, d=0.60$]. Data appear in Table 2.

For the SCL-90-R, the ANOVA revealed a main effect of time [$F(1, 48)=5.85, p<0.05, \eta^2=0.11$] qualified by a significant time $\times$ condition interaction [$F(1, 48)=5.06, p<0.05, \eta^2=0.10$]. At posttraining, there

Table 2 Changes in psychological distress and mindfulness as a function of condition and time (standard deviations in parentheses)

	Mindfulness group		Wait-list group	
	Baseline	Posttraining	Baseline	Posttraining
BDI	10.42 (5.96)	4.46 (3.80)***	9.27 (7.63)	7.92 (7.38)
GSI	0.66 (0.42)	0.44 (0.33)***	0.62 (0.33)	0.63 (0.39)
Observing	26.54 (4.43)	31.08 (3.06)***	24.89 (4.32)	24.35 (4.25)
Describing	26.88 (6.13)	30.67 (4.02)***	26.81 (5.88)	25.46 (5.43)
Acting with awareness	20.79 (6.74)	29.08 (3.50)***	23.19 (4.13)	24.81 (6.73)
Non-judging	24.46 (7.72)	31.83 (4.96)***	23.42 (5.46)	26.54 (5.16)*
Non-reactivity	17.79 (4.16)	24.21 (3.46)***	17.73 (4.38)	18.19 (5.15)
Mindfulness (FFMQ total)	116.46 (20.54)	146.88 (13.14)***	116.04 (14.52)	128.23 (16.56)

BDI-II Beck Depression Inventory-II, GSI Global Severity Index (SCL-90-R)

Observing, Describing, Acting with awareness, Non-judging of inner experience, and Non-reactivity to inner experience are facets of the Five Facets Mindfulness Questionnaire. Mindfulness is the total score of the Five Facets Mindfulness Questionnaire. For all types of measures, there were no significant differences in baseline between groups according t test comparisons

* $p<0.05$; *** $p<0.001$ (significant difference between pre- and posttraining in each group according to paired t test comparisons)

was a difference between groups [$t(48)=2.29$, $p<0.05$, $d=0.66$]. Data appear in Table 2.

Mediational Analyses

We first examined whether change in the FFMQ total scores mediated the impact of mindfulness training on the change in BDI and SCL-90 scores from baseline to posttraining.

Consistent with a statistically significant mediation for SCL-90-R, the 95 % confidence interval of the indirect path (alpha-beta) did not contain zero (see Table 3). The same pattern of results was observed for the BDI. These findings suggest that an increase in mindfulness mediated the effects of mindfulness training on general psychopathology and symptoms of depression.

We also examined whether change in each facet of the FFMQ mediated the impact of mindfulness training on change in BDI and SCL-90 R scores. As shown in Table 3, the analyses revealed that three of the facets were involved in significant mediational models: (1) change in the Observing subscale score statistically mediated the change in BDI scores; (2) change in the Describing subscale score statistically mediated the change in SCL-90-R; and (3) change in the Non-reactivity subscale score statistically mediated both the change in SCL-90-R and BDI.

Table 3 Mediational analyses testing the impact of change in mindfulness mediates on the outcomes

Mediators	Dependent variables	95 % confidence interval of the indirect path (alpha-beta)	
		Lower limit	Upper limit
Δ Mindfulness	Δ GSI	<i>-0.091</i>	<i>-0.001</i>
	Δ BDI-II	<i>-3.03</i>	<i>-0.510</i>
Δ Observing	Δ GSI	-0.001	0.005
	Δ BDI-II	<i>0.010</i>	<i>0.150</i>
Δ Describing	Δ GSI	<i>-0.170</i>	<i>-0.020</i>
	Δ BDI-II	-2.230	0.320
Δ Acting with awareness	Δ GSI	-0.760	1.220
	Δ BDI-II	-0.170	0.020
Δ Non-judging	Δ GSI	-0.090	0.010
	Δ BDI-II	-2.800	0.130
Δ Non-reactivity	Δ GSI	<i>-0.120</i>	<i>-0.001</i>
	Δ BDI-II	<i>-3.640</i>	<i>-0.420</i>

Δ FFMQ (total score) is the difference from baseline to posttraining for the Five Facet Mindfulness Questionnaire (total score). Δ Observing, Δ Describing, Δ Acting with awareness, Δ Non-judging, and Δ Non-reactivity are the difference from baseline to posttraining for each of the five facets, respectively. Δ GSI is the difference from baseline to posttraining for the Global Severity Index (SCL-90-R). Δ BDI-II is the difference from baseline to posttraining for the Beck Depression Inventory-II. Statistically significant mediational models are in italics

Discussion

The primary purpose of this study was to answer three major questions: First, would the participation in mindfulness training lead to changes in levels of mindfulness among a mixed sample of individuals presenting stress-related problems, illness, anxiety, and chronic pain? Second, would changes in mindfulness be related to changes in psychological distress? Third, would the changes in mindfulness mediate the effects of mindfulness training on psychological distress?

Regarding our first question, participants who received the mindfulness training reported decreased depressive and psychopathological symptoms after the training. This observation is consistent with previous studies and meta-analyses suggesting that mindfulness training decreases psychopathology (Baer 2003; Grossman et al. 2004; Shapiro et al. 1998; Williams et al. 2001) and supports the notion that mindfulness training addresses a range of basic skills that are involved in a large array of psychological difficulties (for a review, see Philippot and Segal 2009).

Regarding our second question, participants who received mindfulness training reported an increase in mindfulness as indexed by all FFMQ scores. Participants in the wait-list group showed no such changes. These results are also consistent with previous findings and suggest that the training modified the psychological processes of interest as intended. Moreover, it should be noted that FFMQ items refer to daily life rather than to elements of the training sessions. Hence, our findings suggest that the changes induced by mindfulness training generalized to different types of situations.

Regarding the third question, our results are consistent with the notion that mindfulness training exerts its beneficial effect on psychopathological symptoms through an increased tendency to be mindful in daily life. These observations support the conclusion that the self-reported symptom change observed in this study can be attributed to increases in mindfulness resulting from the mindfulness training. The findings add to a growing body of empirical support for a central tenet of several MBI approaches: that practicing mindfulness should increase the use of mindfulness in the daily life, which in turn should lead to decreased psychological distress.

Mediational analyses also suggested that the FFMQ facets may differentially mediate changes in psychological distress. In particular, both the Observing and the Non-reactivity facets mediated the effect of mindfulness training on depression. By contrast, effects on general psychopathological symptoms were mediated by the increased capacities in Describing and Non-reactivity to inner experience. These differential relationships with outcome measures support the relevance of measuring facets separately and provide interesting information about the processes that may underlie mindfulness training. Results for the nonreactivity facet are convergent with Barlow and colleagues' proposal that emotional acceptance reduces

psychological distress (Campbell-Sills et al. 2006; Levitt et al. 2004). Results for the describing facet are consistent with the recent neuroscience findings demonstrating that verbal labeling of affect modulates brain responses to emotional stimuli (e.g., Hariri et al. 2000; Lieberman et al. 2007) and with evidence showing that describing the details of emotional experience reduces psychological distress (Raes et al. 2009; Vrielynck et al. 2010). Results for the observing facet may reflect an increased ability to shift attention flexibly rather than becoming rigidly absorbed in any particular class of stimuli (Baer et al. 2008) and are consistent with the recent work in experimental psychopathology supporting the utility of interventions that directly target attention control (e.g., Heeren et al. 2013; Wadlinger and Isaacowitz 2011).

The present study has several limitations. First, participants were not randomly assigned to the mindfulness vs. the wait-list groups. Future studies with random allocation are clearly needed to ensure the reliability of the preliminary findings reported here. Second, the sample size is relatively small for the purposes of conducting mediational analyses. Moreover, without demonstration of a temporal precedence of the changes in mindfulness, conclusions about the role of specific facets in mediating the effects on psychological distress should be drawn with caution. Replications in larger samples measuring change in mindfulness and psychopathology at successive points in time are needed. Third, because we did not collect follow-up data, it is unclear whether group differences were long lasting or simply a transient effect. Fourth, we did not diagnose participants. It is possible that change in the five mindfulness facets may differ as a function of the nature of the disorder. Moreover, all the participants were relatively well-educated and French-speaking Belgian Caucasian individuals. Therefore, our findings may not generalize to populations with other characteristics. Fifth, consistent with previous studies (e.g., Baer et al. 2008), the internal consistency of the Observing facet of the FFMQ was less than ideal. As a consequence, findings involving this facet should be interpreted with caution. Finally, we only used self-report assessment. As argued by MacLeod et al. (2009), training may exert an impact on self-report measures without actual changes in the processes of interest, and demand effects must be considered. Future studies might use mindfulness measures not limited to self-report. For instance, behavioral measurement of mindfulness, such as that developed by Burg and Michalak (2011), may be used.

Despite these limitations, the present study adds to a small but growing literature exploring whether change in mindfulness skills mediate the clinical benefits of mindfulness training. The present findings show that mindfulness training leads to increases in self-reported mindfulness skills and decreases in psychological distress. Further, changes in mindfulness statically mediated the effects of mindfulness training on psychological distress, and specific facets of mindfulness

were differentially important in reducing different forms of psychological distress. Results also provide additional support for the utility of the French translation of the FFMQ.

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