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# Changes in Ruminative Thinking Mediate the Clinical Benefits of Mindfulness: Preliminary Findings

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**Abstract** We investigated whether the clinical benefits of mindfulness training are mediated by a reduction in maladaptive rumination and an increase in adaptive rumination. Participants in eight-session mindfulness training were assessed before and after treatment, while waiting-list controls were assessed at similar times. For the mindfulness training, a treatment manual was derived from the mindfulness-based cognitive therapy procedure and adapted to account for the consequences of stress, anxiety, and depression rather than just depression. Replicating previous findings, results indicate that mindfulness training, as compared to the waiting-list condition, reduces general psychopathology. It was also found that mindfulness training reduces maladaptive rumination and increases adaptive rumination. Mediational analyses further suggest that clinical benefits of mindfulness required changes in ruminative mode of processing. Results are discussed in terms of Teasdale et al.'s assumption that mindfulness training is effective because it reduces maladaptive rumination.

**Keywords** Mindfulness · Meditation · Modes of processing · Rumination · Psychological change processes

## Introduction

In recent years, a series of studies have established the efficacy of mindfulness training for a range of mental health problems, including mood and anxiety disorders (e.g., Baer 2003; Grossman et al. 2004). In her meta-analysis of the

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efficacy of mindfulness-based interventions, Baer (2003) concluded that these interventions may help to alleviate a variety of mental health problems and improve psychological functioning. However, the mechanisms underlying these effects are only in the preliminarily stages of examination.

Teasdale et al. (1995) have suggested that mindfulness training is effective because it reduces maladaptive rumination. In fact, these authors have theorized that mindfulness training defuses the cognitive interlock that occurs automatically during maladaptive rumination. Furthermore, in their description of the mindfulness-based cognitive therapy (MBCT), Segal et al. (2002) emphasize the importance of disengaging attentional focus from ruminative thoughts. Indeed, during mindfulness training, attention is redirected from intrusive thoughts to an arbitrary concrete focus (e.g., breathing sensations), thereby preventing further elaboration of the intrusive thoughts. Bishop et al. (2004) argue that this concrete focus inhibits secondary elaborative and high-level processing of the thoughts, feelings, and sensations that arise in the stream of consciousness. Congruently, some studies have shown that mindfulness training reduces rumination (e.g., Kingston et al. 2007; Ramel et al. 2004). In sum, a consensus emerges to suggest that mindfulness training might promote effective mood regulation through disengaging from automatic and maladaptive modes of rumination.

Recently, a series of studies suggests that ruminative thinking appears as a transdiagnostic process (e.g., Aldao and Nolem-Hoeksema 2010; Dudley et al. 2010; Mansell et al. 2009). At a process level, maladaptive rumination involves predominantly high-level construal about self and mood (e.g., why an action is performed, what might be its ends and consequences) and reduced concreteness of thinking (for a review, see Watkins 2008). Such thinking

is likely to engender negative overgeneralization (e.g., I'm always failing), which is known to increase the vulnerability towards developing an emotional disorder (e.g., Gibbs and Rude 2004; van Minnen et al. 2005). In contrast, low-level construal involves concrete representations (e.g., representations of the specific "how" details of an action, and of the means to an end). It has been typically related to adaptive ruminative thinking.

Regarding ruminative processes, Watkins et al. (2008) have observed in three successive studies that participants trained to adopt a low-level processing mode were less emotionally reactive following failure in a stressful task as compared to participants trained to adopt a high-level mode. More recently, Watkins et al. (2009) have observed the effect of training dysphoric individuals, during a 1-week program, to become more concrete and specific in their thinking. They observed that this training significantly reduced emotional disturbance, rumination, and self-criticism and increased concreteness-of-problem descriptions. Congruently, experimental studies have observed that manipulating the level of construal in emotional information processing results in significant variations in emotional regulation (for a review, see Philippot et al. 2007). For instance, it has been observed that voluntarily recalling an emotional event in a low-level mode produces less intense emotional responses (Neumann and Philippot 2007; Philippot et al. 2006) and cardiovascular arousal (Schaefer et al. 2003) than recalling it at a high-level and abstract mode.

There is some empirical evidence to support the notion that mindfulness promotes low level of construal processing and prevents high level of construal processing. For instance, it has been observed that mindfulness training increases the capacity to recall an emotional event in specific detail and reduces the number of emotional events recalled in a generic and abstract way (Heeren et al. 2009; Williams et al. 2000). However, no study to date has *directly* examined the effect of mindfulness training on level of processing in rumination. Furthermore, no study to date has directly examined Teasdale et al.'s (1995) assumption that mindfulness training is effective because it reduces maladaptive rumination (taking the level of processing into account).

The aim of the present study is to investigate whether the potential reduction in psychopathological symptoms following mindfulness training is mediated by a reduction in maladaptive rumination. Conversely, mindfulness training is expected to increase adaptive rumination, which is processing at a low level of construal. Eventually, these changes should lead to more adaptive mental functioning during difficulties. In the present study, we especially target intrusive thoughts as the hallmark of maladaptive functioning when confronted with emotional difficulties.

## Method

### Participants

The study design was quasi-experimental with a between-subjects variable (Mindfulness group vs. Waiting-list control) and a within-subject variable (pre-test vs. post-test). 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 well-being indexes. Participants were informed of the procedure, inclusion and exclusion criteria, and ethical considerations. Each participant provided informed consent. Exclusion criteria that were reported were: (1) prior training in mindfulness or in another form of meditation, (2) other planned psychological interventions during the study, (3) present drug dependency or abuse, (4) known cerebral lesion, cerebral tumor, or neurological disease, and (5) use of psychopharmacotherapy. Participants were not randomly allocated to conditions: Participants who started the program immediately constituted the Mindfulness group, while those who had to wait for a next course because of scheduling issues constituted the Waiting-List controls.

For the Mindfulness group, 37 people who could start the program immediately volunteered to participate. Among them, six met the exclusion criteria (prior training in mindfulness or in another form of meditation) and were not included in the study. Two additional participants were excluded from the analyses because they missed two training sessions. All analyses for the Mindfulness group were conducted on the remaining 29 participants (18 women) who completed all of the training sessions. Participants ($M = 48.76$ years old, $SD = 2.59$, range $= 23–75$) had at least a secondary school degree and were predominantly university graduates.

For the Waiting-list group, 20 people who had to wait for the next course of a mindfulness program volunteered to participate in the study. Eight participants were excluded from the study, as they reported having prior experience with mindfulness meditation. All analyses for the Waiting-list group were conducted on the remaining 12 participants (nine women). Participants ($M = 47.00$ years old, $SD = 5.06$, range $= 22–71$) had at least a secondary school degree education and were predominantly university graduates. The characteristics of the groups are displayed in Table 1.

### Measures

*Ruminative Mode of Processing* The short form of the Cambridge Exeter Rumination Thinking Scale (Mini-CERTS; Barnard et al. 2007; French adaptation, Douilliez et al. 2010. The Mini-CERTS (Cambrigde-Exeter Repeti-

**Table 1** Participants' characteristics as a function of group assignment

|  | Mindfulness Group | Waiting-List Group |
| --- | --- | --- |
| Age | 48.75 (13.95) | 47.80 (17.48) |
| Years of education | 18.45 (1.53) | 4.08 (1.29) |
| SCL-90-R (GSI) | .99 (.58) | .77 (.49) |

Standard deviations are in parentheses. None of the means differ between groups

*SCL-90-R* Symptoms Checklist-90-Revised (global score index)

tive Thought Scale): A short questionnaire to assess constructive and unconstructive repetitive thinking, unpublished). The confirmatory factor analyses clearly established that the Mini-CERTS is constituted by two dimensions, one reflecting adaptive rumination and the other maladaptive rumination (Douilliez et al. 2010. The Mini-CERTS (Cambrigde-Exeter Repetitive Thought Scale): A short questionnaire to assess constructive and unconstructive repetitive thinking, unpublished). The two dimensions are moderately and negatively correlated, suggesting that the modes partly compete with each other. This suggests that activating adaptive rumination might inhibit maladaptive rumination and vice versa. This scale comprises 15 items rated on a 1–4 scale (1=almost never, 4=almost always), and the scoring consisted of summing the items for each subscale. The French version showed good internal consistency for each of the two subscales.

*Symptom Checklist-90-R (SCL-90-R; Derogatis 1977)* The global score index (GSI) of the SCL-90-R was used to assess the level of psychopathological symptoms.

Procedure

For mindfulness training, a treatment manual was derived from Segal et al. (2002). This manual, designed specifically for the prevention of depressive relapse, was adapted to account for the consequences of psychological stressors as in the original program of Kabat-Zinn (1982). This adaptation exclusively concerned the psycho-education component of the program (sessions 4 and 5) that targeted stress, anxiety, and depression rather than just depression. Except for this wider psycho-educative focus, all sessions followed exactly Segal et al. (2002) program and comprised exactly the same exercises. The training was instructed by two PhDs in psychology, with at least 10 years of CBT training and who had previously been trained in mindfulness-based psychological interventions (i.e., MBSR and MBCT). They were naïve about the hypotheses of this study.

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

($M$=51.52 days, SD=11.85), while the two sessions for the Waiting-list group were held at a similar time-interval ($M$=46.86 days, SD=7.69). Questionnaires were electronically delivered. There was no difference between the groups in inter-session time, $t(39)=1.77$, $p=.09$. Upon completion of the entire study, participants were fully debriefed.

## Results

Group Equivalence

At pre-treatment, preliminary analyses indicated that the groups were not significantly different on the SCL-90-R (GSI), $t(39)=1.24$, $p=.22$; the mini-CERTS factor assessing maladaptive mode of thinking, $t(39)=.487$, $p=.629$; as well as on age, $t(39)=.341$, $p=.74$; gender; $\chi^2$ (1, $N=41$)=.4631, $p=.427$; and years of education, $t(39)=.857$, $p=.397$. However, there was a slight significant difference between groups on the adaptive mode of thinking, $t(39)=2.18$, $p=.04$.

General Statistical Analyses

The main analyses consisted of 2×2 mixed-design ANOVAs with group (Mindfulness vs. Waiting-list) as a between-subjects factor, and time as a within-subject factor (pre-treatment vs. post-treatment).

Before performing the analysis, we examined the skewness and kurtosis of the data. However, all parameters were not between −1 and 1, indicating that the data were not univariately normally distributed and leptokurtic distributions were observed. The present measures addressed emotional reactions and behaviors that can be absent or present with varying frequency, making non-normality likely (MacDonald and Ho 2002). Using standard normal theory estimators with such data could produce estimation problems (Blunch 2008). Therefore, due to leptokurtic distributions in the data, logarithmic transformations were used.

*Psychopathological Symptomatology* A mixed-design ANOVA conducted on the GSI of the SCL-90-R showed a main effect of time, $F(1,39)=19.239$, $p<.001$, $\eta^2_p=.33$, as well as a significant group×time interaction, $F(1,39)=24.80$, $p<.001$, $\eta^2_p=.39$. As reported in Table 2, follow-up analyses indicated that the Mindfulness group, which initially showed the same level of symptomatology as the Waiting-list group, reported a significant symptom reduction after the intervention, with no changes observed in the Waiting-list group.

*Ruminative Mode of Thinking* For the maladaptive rumination dimension, a mixed-design ANOVA showed a main

**Table 2** Psychological changes as a function of group and time

|  | Waiting-list group | | Mindfulness group | |
| --- | --- | --- | --- | --- |
|  | Pre-treatment | Post-treatment | Pre-treatment | Post-treatment |
| Adaptive | 17.42 (3.37) | 17.58 (3.89) | 14.76 (3.60) | 19.66 (4.23)* |
| Maladaptive | 21.67 (3.65) | 21.83 (3.63) | 20.79 (5.72) | 14.68 (4.69)** |
| GSI | .77 (.49) | .84 (.58) | .99 (.58) | .46 (.436)** |

Standard deviations are in parentheses. The "*"indicates a significant difference between pre- and post-intervention in that group according to paired $t$ test comparisons. For all types of measures, there were no significant differences in the first session between groups according $t$ test comparisons.

*Adaptive*, the adaptive rumination dimension of the Mini-CERTS; *maladaptive*, the maladaptive rumination dimension of the Mini-CERTS; *GSI*, the global score index of the Symptoms Checklist-90-Revised

*$p<.01$; **$p<.001$

effect of time, $F(1,39)=7.01$, $p<.02$, $\eta^2_p=.15$, as well as a significant group×time interaction, $F(1,39)=7.59$, $p<.001$, $\eta^2_p=.17$. For the adaptive rumination dimension, due to the significant differences between groups at pre-treatment, a mixed-design analysis of covariance (ANCOVA) was conducted with adaptive rumination scores at pre-treatment and post-treatment as dependent variable and as the adaptive rumination scores centered at pre-treatment as a covariate. The mixed-design ANCOVA showed a main effect of time, $F(1,38)=37.80$, $p<.001$, $\eta^2_p=.48$, qualified by a significant group×time interaction, $F(1,38)=4.274$, $p=0.46$, $\eta^2_p=.11$.

Mediational Analyses

Mediational analyses were performed using criteria suggested by Baron and Kenny (1986), with a slight adaptation for a within-subject design: For each dependent and mediator variable, a difference score was computed between the two measurement times.

*Changes in Maladaptive Rumination as a Mediator* To examine whether changes in general symptomatology were mediated by changes in maladaptive rumination, we performed regression analyses in a model containing the difference score in maladaptive rumination as a mediator and the difference score in general symptomatology as a criterion and condition (contrast coded: Waiting-list group=−1, MBCT group=1) as a predictor. When predictors were simultaneously used, multiple regression analyses revealed statistically significant predictions of changes in maladaptive rumination, $\beta=.37$, $B=.026$, SEB=.008, $t(39)=3.15$, $p<.005$, and a statistically significant prediction of condition, $\beta=.51$, $B=.293$, SEB (standard error of the computed value of B)=.068, $t(39)=4.293$, $p<.005$, on change in general symptomatology. The Sobel (1982) test also proved statistically significant, $Z=3.17$, $p<.001$. This pattern of results is indicative of the presence of a partial mediation:

Changes in maladaptive rumination partially mediate the impact of MBCT on clinical symptomatology. We also ran regression analyses on all of the mediational models by centering the data of mediator and dependent variables. Results showed similar patterns as the original analysis.

*Changes in Adaptive Rumination as a Mediator* To examine whether changes in general symptomatology were mediated by changes in adaptive rumination, we performed regression analyses in a model containing the difference score in adaptive rumination as a mediator and the difference score in general symptomatology as a criterion and condition (contrast coded: Waiting-list group=−1, MBCT group=1) as a predictor. When predictors were simultaneously used, multiple regression analyses revealed statistically significant predictions of changes in adaptive rumination, $\beta=.45$, $B=.042$, SEB=.011, $t(39)=3.821$, $p<.001$, and a statistically significant prediction of condition on change in general symptomatology, $\beta=.46$, $B=.26$, SEB=.067, $t(39)=3.918$, $p<.002$. The Sobel (1982) test also proved statistically significant, $Z=3.28$, $p<.001$. This pattern of results is indicative of the presence of a partial mediation: Changes in adaptive rumination partially mediate the impact of MBCT on clinical symptomatology. We also ran regression analyses on all of the mediational models by centering the data of mediator and dependent variables. Results showed similar patterns as the original analysis.

Because all variables were measured at the same two points in time (pre- and post-treatment), the direction of causality cannot be clearly definitely determined and alternative mediational models are possible. Hence, we also examined whether the impact of treatment condition (contrast coded: Waiting-list group=−1, Mindfulness group =1) on changes in each ruminative thinking mode was mediated by changes in general psychopathology (GSI). We also ran regression analyses on all of these alternative models. However, results indicated no significant effects of mediation.

## Discussion

Overall, the hypotheses addressed in the present study were supported. First, the study replicates previous findings showing a diminution of the global score of the SCL-90-R following the mindfulness training (e.g., Shapiro et al. 1998; Williams et al. 2001). These results are congruent with meta-analyses reporting that mindfulness training reduces a variety of psychological problems (e.g., Baer 2003; Grossman et al. 2004). This supports the notion that mindfulness training addresses a basic skill in self-regulation, a skill whose deficit might be involved in a large array of psychological difficulties.

Second, this study reveals that mindfulness training decreases maladaptive rumination and increases adaptive rumination. This pattern of results supports the notion that mindfulness inhibits secondary and more elaborative processing (e.g., Bishop et al. 2004). It is also consistent with the hypothesis developed by Teasdale et al. (1995) that mindfulness training is effective by interfering with the cognitive interlock between the propositional and schematic systems. Such an interlock is indeed especially prevalent in a maladaptive ruminative mode of thinking, which was reduced by mindfulness training in the current study. The present data are also consistent with recent studies showing that mindfulness training reduces rumination (e.g., Kingston et al. 2007; Ramel et al. 2004), and extended this notion to the nature and processes of the ruminative mode of thinking.

Third, it was found that changes in ruminative thinking mediate the clinical benefits of mindfulness. The present study reveals that changes in ruminative mode of thinking mediate the impact of mindfulness training on the general level of psychopathology. These findings are clearly consistent with the hypothesis that mindfulness training has an indirect effect on the reduction of general psychopathology through both the decrease of maladaptive and the increase of adaptive modes of thinking.

At the theoretical level, the present findings support the notion that mindfulness training is effective because it reduces maladaptive rumination. Additionally, it also increases adaptive rumination, suggesting that both these changes lead to the reduction in symptoms. Our results are also consistent with previous experimental studies indicating that low level of construal processing (as compared to high level) can be changed (e.g., Neumann and Philippot 2007; Philippot et al. 2006). Future conceptual formulation of mindfulness should take this into account.

At a clinical level, these data are consistent with previous accounts demonstrating that deficits in level of construal can be rehabilitated (e.g., Watkins et al. 2008). In this perspective, mindfulness training is in line with recent developments in cognitive bias modification (e.g., MacLeod et al. 2009). It can be considered as a specific cognitive bias modification strategy targeting clients' ruminative mode.

The present study suffers from several limitations. First, as there was no training for the comparison group, a placebo effect cannot be excluded. Second, although great care was devoted to checking the equivalence between groups on all relevant dimensions, participants were not randomly allocated to the conditions. One cannot exclude that the present results could be due to a non-specific group factor and not necessarily due to mindfulness training, especially since there was no measure for assessing change in mindfulness. Third, although the assessor did not conduct the mindfulness training sessions, he was not blind to group allocation. The impact of this limitation is however limited by the high standardization of the self-reported assessment. Fourth, we only examined the clinical benefits of mindfulness immediately after training, and we did not examine whether these benefits were maintained in the medium or long term. Therefore, future studies could extend the current research by adding a long-term follow-up assessment. Fifth, although the treatment manual was clearly specified and strictly followed by the experimented instructors, there was no procedure for assessing treatment fidelity.

In conclusion, the present preliminary findings support the notion that mindfulness training leads to a reduction of general psychopathology. It was also found that mindfulness reduces maladaptive ruminative thinking and increases adaptive ruminative thinking. Further, the study suggests that the clinical benefits of mindfulness training are enhanced by changes in ruminative mode of thinking.

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