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DOI

[10.1007/s12671-020-01557-6](https://doi.org/10.1007/s12671-020-01557-6)

Publication date

2021

Document Version

Final published version

Published in

Mindfulness

License

Article 25fa Dutch Copyright Act

[Link to publication](#)

Citation for published version (APA):

van der Meulen, R. T., Valentin, S., Bögels, S. M., & de Bruin, E. I. (2021). Mindfulness and self-compassion as mediators of the Mindful2Work Training on perceived stress and chronic fatigue. *Mindfulness*, 12(4), 936-946. <https://doi.org/10.1007/s12671-020-01557-6>

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Mindfulness and self-compassion as mediators of the Mindful2Work Training on perceived stress and chronic fatigue

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Accepted: 11 November 2020 / Published online: 20 November 2020
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Abstract

Objective There is increasing evidence that mindfulness-based interventions reduce stress and improve wellbeing in employees. However, less is known about the factors that mediate these effects. The aim of this study was to assess short- and long-term-mediating effects of mindfulness and self-compassion on the effects of the Mindful2Work training.

Methods Employees with burnout complaints ($N = 124$) filled in questionnaires concerning perceived stress, chronic fatigue, mindfulness, and self-compassion. Assessments took place before, directly after the training and at 6 weeks follow-up. The intervention consisted of 6 weekly sessions of 2 h, combining mindful physical activity, yoga, and mindful meditation, and a follow-up session 6 weeks later.

Results Multiple parallel and serial mediation analyses indicated that increases in mindfulness mediated the effects from pre- to post-test on stress and fatigue. Regarding the mindfulness facets; acting with awareness mediated the effects during the training on both stress and fatigue, and non-reactivity on stress. Furthermore, increases in self-compassion mediated the effects from post-test to follow-up on stress and fatigue. Lastly, it was found that during and after the training, increases in mindfulness led to more self-compassion, which in turn led to less stress (and after the training also to less fatigue).

Conclusion This study indicates that part of employees' stress and fatigue reduction over the course of the Mindful2Work training can be explained by increased mindfulness, and by increased self-compassion, directly and through increases of mindfulness.

Keywords Mediation · Stress · Fatigue · Mindfulness · Self-compassion

In recent years, specific mindfulness-based interventions (MBIs) have been developed to cater to the needs and circumstances of employees in corporate settings (e.g., Good et al. 2016; Huang et al. 2015; Klatt et al. 2009). Given the increases in occupational stress observed over the past decades (WHO 2010) and its negative effects on mental and physical health, it is not surprising that one of the main objectives of these MBIs lies in stress reduction (e.g., Chaskalson 2011).

Other objectives of MBIs in occupational settings are for instance improving employee wellbeing, emotional intelligence, or job performance (Reb and Choi 2014). Vonderlin et al. (2020) conducted a meta-analysis demonstrating that MBIs for employees effectively reduce stress, burnout, mental distress, and somatic complaints, while improving mindfulness, wellbeing, compassion, and job satisfaction. Effect sizes ranged from small to large (Hedge's $g = 0.32$ – 0.77) and were maintained at (at least) 3 months follow-up. Furthermore, there is some empirical evidence indicating positive effects of MBIs on productivity ($g = 0.35$) and work engagement ($g = 0.53$). However, due to the small number of studies and outliers among the effect sizes, these results should be interpreted with some caution (Vonderlin et al. 2020).

Understanding working mechanisms of psychological interventions is useful for optimizing treatment effectiveness and tailoring interventions to specific settings (Kazdin 2007). Multiple theoretical models describing working mechanisms of MBIs have been proposed, but for several MBIs it is

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not exactly known yet how they reach their effects (i.e., Baer 2010; Brown et al. 2007; Hölzel et al. 2011; Lindsay and Creswell 2017; Shapiro et al. 2006). For example, Hölzel et al. (2011) posit that attention regulation, body awareness, emotion regulation, and change in perspective on the self are important mechanisms through which MBIs reduce psychiatric- and stress-related symptoms and increase wellbeing. Lindsay and Creswell (2017) propose attention monitoring and acceptance skills as mechanisms of MBIs for improving psychological outcomes. Glomb et al. (2011) suggest several cognitive and emotional processes (e.g., increased response flexibility, increased working memory) that may lead to work-related effects (e.g., improved decision-making, improved ability to handle multiple demands). While these models are useful, there is also a need for empirical studies that investigate whether (or under what conditions) certain mechanisms have more impact than others on the outcomes of MBIs (Gu et al. 2015).

Gu et al. (2015) conducted a systematic review and meta-analysis of mediation studies on how MBIs improve mental health and wellbeing. They found strong evidence for cognitive and emotional reactivity, moderate consistent evidence for mindfulness, rumination, and worry, and preliminary but insufficient evidence for self-compassion and psychological flexibility as mechanisms underlying MBIs. Another systematic review concluded that mindfulness; worry; self-compassion; and meta-awareness are related to, predict or mediate reduction in post-treatment depressive symptoms or relapse risk, and could thus be crucial contributing factors to the positive effects of mindfulness-based cognitive therapy (MBCT) for recurrent depression (Van der Velden et al. 2015).

The most crucial question about how MBIs work, concerns whether or not their effects on psychological wellbeing are mediated by increases in (facets of) mindfulness as assumed by the founders of mindfulness-based stress reduction (MBSR) and MBCT (Kabat-Zinn 1982; Segal et al. 2002). Mindfulness as described by Baer (2006) covers five facets: observing (attending to or noticing internal and external stimuli, such as sensations, emotions, cognitions, sights, sounds, and smells), describing (noting or mentally labeling these stimuli with words), acting with awareness (attending to one's current actions, as opposed to behaving automatically or absent-mindedly), non-judging of inner experience (refraining from evaluation of one's sensations, cognitions, and emotions), and non-reactivity to inner experience (allowing thoughts and feelings to come and go, without attention getting caught up in them). Cultivation of mindfulness is suggested to lead to non-judgmental and non-reactive acceptance of all experiences, which in turn would lead to positive psychological outcomes (Kabat-Zinn 1982; Teasdale et al. 2000). Only a small number of studies have examined the mediational effects of the different facets of mindfulness on

psychological outcomes. Evidence is found for non-judging on depressive symptoms (Batink et al. 2013; Boden et al. 2012; Van Aalderen et al. 2012), acting with awareness on symptoms of post-traumatic stress disorder (PTSD; Boden et al. 2012), and non-reactivity as well as non-judging on perceived stress (Haenen et al. 2016). However, more studies are needed to establish which mindfulness facets most strongly mediate changes in which outcome measures of MBIs in different populations (Haenen et al. 2016).

The vast majority of the studies mainly focus on depressive symptoms as outcome measures (Gu et al. 2015; Van der Velden et al. 2015), while a large part of MBIs, for example in work settings, focus primarily on stress reduction or reducing fatigue and burnout complaints. Little is known about whether mindfulness is also mediating the effects of MBIs on these outcomes and which aspects of mindfulness are most important in mediating these positive effects. The few mediational studies that did include these outcomes showed some evidence for mindfulness as a mediator of the effects of MBIs on perceived stress and vital exhaustion (Bränström et al. 2010; Haenen et al. 2016; Nyklíček and Kuijpers 2008; Shapiro et al. 2008).

Next to (aspects of) mindfulness, self-compassion may also be an important mediator of the effects of MBIs on outcomes like stress. Self-compassion is defined by Neff (2003b) as “being kind and understanding toward oneself in instances of pain or failure rather than being harshly self-critical; perceiving one's experiences as part of the larger human experience rather than seeing them as isolating; and holding painful thoughts and feelings in mindful awareness rather than over identifying with them.” Self-compassion is a construct that is closely related to mindfulness, however, an important difference is that self-compassion, in contrary to mindfulness, explicitly emphasizes affective components, like feelings of care and concern and the urge to act upon one's feelings (Birmie et al. 2010). Neff and Dahm (2015) refer to mindfulness as a part of self-compassion; however, this encompasses only being mindfully aware of negative thoughts and feelings. Overlap between mindfulness and self-compassion is shown in validity investigations for the self-compassion scale (SCS; Neff 2003a) and other mindfulness measures (Brown and Ryan 2003). Although the current study focuses on MBIs, it is important to note that in more recent years, there is also a burgeoning field of studies concerning compassion-based interventions (CBIs) with a focus on developing (self-)compassion in clinical and non-clinical populations. Mindful self-compassion (MSC; Neff and Germer 2013) and compassion-focused therapy (CFT; Gilbert 2014) are the most commonly known. A meta-analysis showed the potential of CBIs on a range of outcomes (e.g., depression, anxiety, compassion, mindfulness); however, current studies still need to improve in methodological rigor, sample size etc. (Kirby et al. 2017). Perhaps not always as explicit and specific as for CBIs;

however, in MBIs, there is an intention to cultivate an inner climate of friendliness towards experiences—whether it be pleasant or unpleasant ones—approaching these with curiosity, equanimity, and compassion (Crane et al. 2017; Feldman and Kuyken 2011).

Increases in self-compassion may protect MBCT participants from the negative effects of cognitive reactivity, which were found in the control group using only antidepressants. Cognitive reactivity predicted more depressive complaints in the antidepressants group, but not in the MBCT group (Kuyken et al. 2010). Bergen-Cico and Cheon (2014) and Keng et al. (2012) found that although MBSR training significantly increased self-compassion, this increase did not mediate MBSR's effects on anger expression or anxiety in a non-clinical sample. Birnie et al. (2010) studied the impact of MBSR on self-compassion, mindfulness and stress in a community sample, and the associations between these measures. They found that changes in mindfulness predict changes in self-compassion, and self-compassion is associated with better psychological functioning. In line, Hollis-Walker and Colosimo (2011) found that self-compassion partially mediates the relationship between mindfulness and psychological wellbeing in a cross-sectional sample of undergraduate students. Although research concerning mediating effects of self-compassion in MBIs is currently still quite scarce, there is consistent evidence that self-compassion is associated with an individual's wellbeing (e.g., the meta-analysis by Zessin et al. 2015).

In mindfulness training, participants first acquire basic mindfulness skills and gradually learn how to deepen these skills and apply them in difficult situations (Feldman and Kuyken 2011). Acquiring mindfulness is a process that continues also after the MBI when participants are encouraged to keep on practicing. It might therefore be expected that different working mechanisms play a role concerning the initial effects of the MBI, when compared to longer term effects. It has been argued that attention monitoring skills begin to improve more immediately after practice, while acceptance may take longer to cultivate (Baer et al. 2012; Desbordes et al. 2015). Furthermore, the facet of observing is found to increase early, while describing increases later during the training. For the facets acting with awareness, non-reactivity to inner experience and non-judging of inner experience, mixed results are found (Baer et al. 2012; Labelle et al. 2015). Furthermore, it was found that the mindfulness facets observing and/or non-reactivity mediated the short-term effects of an MBI on depressed and angry mood, anxiety, and perceived stress in outpatients with diabetes mellitus types 1 and 2, whereas acting with awareness and/or non-judging mediated the long-term effects (Haenen et al. 2016). The authors argue that acting with awareness and non-judging may take more time to develop compared to observing mindfully and letting go of automatic reactions. In addition, Neff states mindfulness as a

necessary prerequisite for the development of self-compassion (Neff 2003b). This suggests that participants of an MBI first have to learn to develop mindfulness before they can practice being self-compassionate, which fits well with the structure of several MBIs.

The aim of the current study is to investigate mindfulness and self-compassion as possible mediators of the effects of the MBI “Mindful2Work,” in the short and the longer term. Previous studies concerning the feasibility, acceptability, and effects of Mindful2Work on employees with work-related stress demonstrated significant improvements on stress (effect sizes from 0.62 to 1.17), risk for dropout from work (effect sizes 0.55–1.00) and largest effects were found on personal goals such as “being more able to leave work at work,” “learn to better recognize my bodily stress signals,” “learn to better set my limits” (effect sizes 0.98–1.46). Effects on wellbeing (e.g., depression, stress, affect) and functioning work (e.g., mental and physical workability) were of medium size after training, lasting up to 6 months later and large effects were found at 1-year later measurements (De Bruin et al. 2017, 2020). In the current study, we expect that increases in mindfulness and self-compassion are mediating the effects of Mindful2Work, on perceived stress and chronic fatigue. In particular, we expect that mindfulness and self-compassion are not independent mechanisms, but that there may be a serial effect of mindfulness via self-compassion. In addition, facets of mindfulness were exploratory assessed as mediators.

Methods

Participants

The current study combined both samples of the previous Mindful2Work studies, encompassing 124 participants, 76.6% female ($n = 95$), with a mean age of 43.94 years ($SD = 10.21$, range 23–66). Participants were either self-selected or referred by their company doctor, all because of (at least moderate) work-related stress complaints. The majority of participants (75.8%, $n = 92$, 2.4% missing) had a score on or above the cut-off for risk for dropout from work on the Checklist Individual Strength, measuring chronic fatigue ($CIS \geq 76$; Beurskens et al. 2000). Their school levels were $n = 71$ (57.3%) university, $n = 29$ (23.4%) higher vocational education, $n = 6$ (4.8%) secondary vocational education, $n = 8$ (6.5%) secondary school, $n = 2$ (1.6%), other and $n = 8$ (6.5%) did not report on their educational background. $N = 102$ (92.8%) participants were born in Europe, $n = 4$ (3.2%) in Asia, $n = 1$ (0.8%) in North America, $n = 4$ (3.2%) in South America, $n = 2$ (1.6%) in Australia, $n = 2$ (1.6%) in Africa, and $n = 9$ (7.3%) did not report on their country of birth.

Procedure Flyers and posters, as well as announcements on social media were spread at workplaces and among company doctors. After a referral from the company doctor or applying for the MBI themselves, the employees took part in an intake session before the first training session, in which the content of the training was discussed and motivation for the training and daily home practice was verified. The measurement occasions included in this mediation study were administered online just before the training (pre-test), directly after the training (post-test) and 6 weeks after the training (follow-up). More measurements were taken for the purposes of the previous effect studies (see De Bruin and colleagues in 2017, 2020).

Intervention The Mindful2Work training, while including outdoors physical exercise and yoga, is grounded in the cultivation of mindfulness meditation as the overarching theme. The training consists of six weekly group sessions of two hours and a follow-up session 6 weeks later. Participants were encouraged to practice physical exercise, yoga, and daily mindfulness meditation at home (in total the homework took 20–30 min a day). This MBI is extensively described in the handbook “Mindful2Work” (De Bruin et al. 2018).

Measures

Stress and chronic fatigue were used as outcome measures in the mediation analyses. Stress was measured by the perceived stress scale (PSS; Cohen et al. 1983). The 10-items version of the PSS was used in this study (e.g., “I felt nervous and stressed”). Internal consistency at pre-test was good: Cronbach’s $\alpha = 0.88$. Chronic fatigue was assessed by the CIS (Beurskens et al. 2000). The CIS measures different facets of subjective fatigue and burnout and is validated for the working population (Vercoulen et al. 1994). The CIS consists of 20 items and is divided over four domains of (work-related) fatigue and exhaustion: subjective fatigue (e.g., “I feel tired”), reduced motivation (e.g., “I feel no desire to do anything”), reduced activity (e.g., “I don’t do much during the day”), and reduced concentration (e.g., “My thoughts easily wander”). Internal consistency at pre-test was good: $\alpha = 0.93$.

Mindfulness was measured with the short version of the Five Facet Mindfulness Questionnaire (FFMQ-SF; Bohlmeijer et al. 2011). The FFMQ-SF is a 24 items self-report questionnaire that consists of five domains of mindfulness: observing (e.g., “I pay attention to physical experiences, such as the wind in my hair or sun on my face”), describing (e.g., “I can easily put my beliefs, opinions, and expectations into words”), acting with awareness (e.g., “I rush through activities without being really attentive to them,” non-judging (e.g., “I tell myself that I shouldn’t be feeling the way I’m feeling”), and non-reactivity (“I watch my feelings without getting carried away by them”). The internal consistencies of the FFMQ total scale and facets were as follows:

total $\alpha = 0.82$, observing $\alpha = 0.79$, describing $\alpha = 0.85$, acting with awareness $\alpha = 0.82$, non-judging $\alpha = 0.83$, non-reactivity $\alpha = 0.78$. Self-compassion was assessed by the short version of the self-compassion scale (SCS-SF; Neff 2003a; Raes et al. 2011). The SCS-SF is a 12-items self-report questionnaire, based on six components of self-compassion: self-kindness, self-judgment, common humanity, isolation, mindfulness, and over-identification. Example items are as follows: “When I’m going through a very hard time, I give myself the caring and tenderness I need,” or “I’m disapproving and judgmental about my own flaws and inadequacies.” Cronbach’s alpha for SCS-SF total score at pretest was $\alpha = 0.91$.

Data Analyses

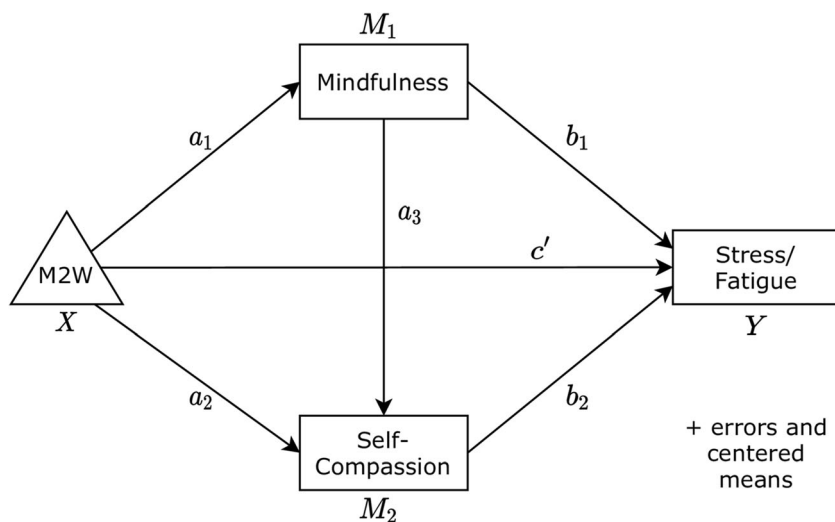
The mediation analyses follow the methods developed by Montoya and Hayes (2017). In order to address the research questions outlined above, we employed multiple serial and parallel mediation models. As opposed to simple mediation models, this approach allows to simultaneously assess multiple potential mediators. That is, the indirect effect via a particular mediator M_1 refers to its *specific* indirect effect, controlling for the indirect effects via all other mediators included in the model (analogous to the interpretation of partial regression coefficients in multiple regression).

Figure 1 provides a simplified conceptual representation of a serial mediation model (model 1), as assessed in the present study. It should be noted that the variable X , is implicit in the calculation of change scores, computed by subtracting the T2 from the T1 measurements. Expressed formulaically, the specific indirect effect via mediator M_1 is computed by taking the product a_1b_1 . The specific indirect effect via M_2 is correspondingly computed as a_2b_2 , while the serial effect via M_1 and M_2 is computed by taking the product $a_1a_3b_2$. The total effect c of X on Y is then partitioned into the indirect effects and the direct effect c' , which refers to the effect of X on Y when controlling for all specific indirect effects.

For the parallel mediation model (model 2), as presented in Fig. 2, there are five specific indirect effects. As opposed to the serial model, however, the mediators are assumed to act in parallel. As was the case for the serial mediation model, the total effect is partitioned into the indirect effects and the direct effect.

The estimation of standard errors (and confidence intervals) was performed using the percentile bootstrap method with 10,000 resampling iterations, following recommendations by Montoya and Hayes (2017). Effects are considered statistically significant if the lower and upper bounds of their 95% confidence interval do not contain zero. All analyses were performed in R (R Development Core Team 2011), employing the structural equation modeling package Lavaan (Rossee 2012).

Fig. 1 Conceptual representation of model 1: multiple serial mediation model for Mindful2Work and perceived stress or chronic fatigue via mindfulness and self-compassion



Results

In Table 1 the individual unstandardized paths coefficients of the multiple serial mediation model (model 1) are presented. Table 2 displays the individual unstandardized paths coefficients of the multiple parallel mediation model (model 2).

As presented in Table 3, for perceived stress, statistically significant specific indirect effects were observed for mindfulness ($a_1b_1 = -2.25$; 95% CI [- 3.61, - 1.10]) and the serial path via mindfulness and self-compassion ($a_1a_3b_2 = -0.41$; 95% CI [- 0.95, - 0.02]) during the training period, while the specific indirect effect via self-compassion ($a_2b_2 = -0.17$; 95% CI [- 0.54, 0.10]) remained non-significant. For the follow-up period, statistically significant specific indirect effects were found for

self-compassion ($a_2b_2 = -0.44$; 95% CI [- 1.04, - 0.06]) and the serial path via mindfulness and self-compassion ($a_1a_3b_2 = 0.20$; 95% CI [0.03, 0.47]), while no specific indirect effect was found for mindfulness ($a_1b_1 = 0.36$; 95% CI [- 0.16, 0.91]). The serial path via mindfulness and self-compassion was, unlike the other findings, in an unexpected (positive) direction. This has to do with the significant decrease in mindfulness after the training, while perceived stress remains stable. However, mindfulness and self-compassion were still positively related, also during the follow-up period.

For chronic fatigue as an outcome during the training period, we found a statistically significant specific indirect effect via mindfulness ($a_1b_1 = -6.14$; 95% CI [- 9.88, - 2.90]), while both the specific effect via self-compassion

Fig. 2 Conceptual representation of model 2: multiple parallel mediation model for Mindful2Work and perceived stress or chronic fatigue via the mindfulness facets

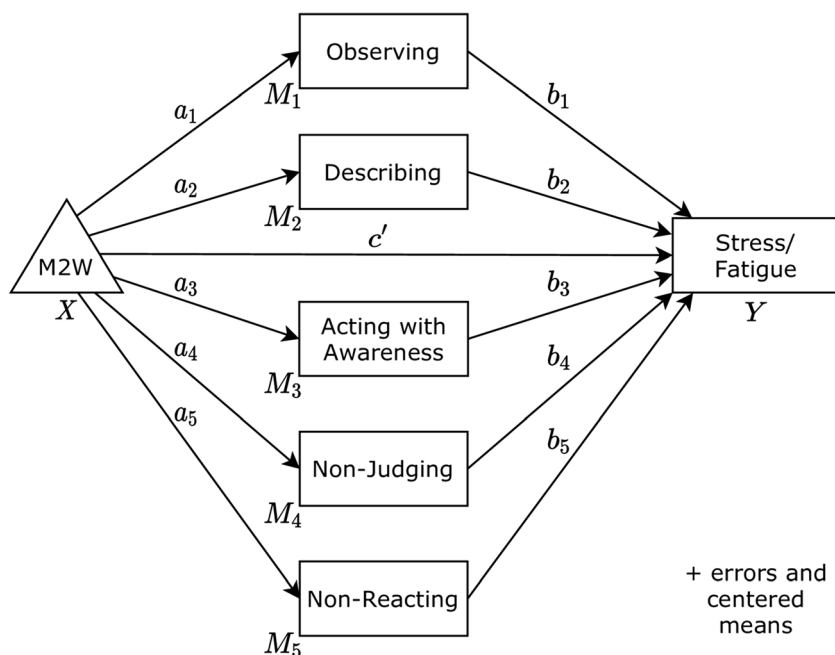


Table 1 Individual unstandardized coefficients in multiple serial mediation models

Treatment period (T1 to T2)					Follow-up period (T2 to T3)				
95% CIs					95% CIs				
Path	Estimate	SE	LL	UL	Path	Estimate	SE	LL	UL
Perceived stress									
a ₁ *	7.88	0.88	6.15	9.61	a ₁ *	- 4.84	1.11	- 7.06	- 2.64
a ₂	1.80	1.31	- 0.94	4.21	a ₂ *	2.29	0.91	0.55	4.08
a ₃ *	0.53	0.14	0.29	0.83	a ₃ *	0.22	0.09	0.05	0.39
b ₁ *	- 0.29	0.06	- 0.41	- 0.16	b ₁	- 0.07	0.05	- 0.17	0.03
b ₂ *	- 0.10	0.05	- 0.19	- 0.01	b ₂ *	- 0.19	0.06	- 0.33	- 0.07
Chronic fatigue									
a ₁ *	7.88	0.88	6.18	9.60	a ₁ *	- 4.84	1.12	- 7.10	- 2.70
a ₂	1.80	1.30	- 0.94	4.17	a ₂ *	2.29	0.91	0.52	4.04
a ₃ *	0.53	0.14	0.29	0.83	a ₃ *	0.22	0.09	0.04	0.39
b ₁ *	- 0.78	0.20	- 1.17	- 0.38	b ₁	- 0.22	0.22	- 0.63	0.22
b ₂	- 0.29	0.20	- 0.63	0.15	b ₂ *	- 0.73	0.27	- 1.27	- 0.23

Path refers to unstandardized path coefficients

*Indicates statistical significance, as the 95% confidence interval does not include zero; *SE*, bootstrapped standard errors; *CI*s, percentile bootstrap confidence intervals; *LL*, lower limit; *UL*, upper limit; based on 10,000 bootstrap samples

($a_2b_2 = - 0.52$; 95% CI [- 1.64, 0.52]) and the serial effect via mindfulness and self-compassion ($a_1a_3b_2 = - 1.21$; 95% CI [- 3.64, 0.50]) remained non-significant. Meanwhile, the follow-up periods showed statistically significant specific indirect effects for both self-compassion ($a_2b_2 = - 1.67$; 95% CI [- 3.80, - 0.22]) and the serial path via mindfulness and self-compassion ($a_1a_3b_2 = 0.76$; 95% CI [0.09, 2.04]) but no statistically significant specific indirect effect for mindfulness ($a_1b_1 = 1.05$; 95% CI [- 1.00, 3.42]).

Zooming in on facets of mindfulness, as displayed in Table 4, first for perceived stress during the training period, we found statistically significant specific indirect effects for acting with awareness ($a_3b_3 = - 1.08$; 95% CI [- 2.14, - 0.28]) and non-reactivity ($a_5b_5 = - 1.09$; 95% CI [- 2.01, - 0.23]), while the specific indirect effects for observing, describing and non-judging remained non-significant. During the follow-up period, none of the facets showed statistically significant indirect effects on perceived stress.

For chronic fatigue, during the training period, acting with awareness showed a statistically significant specific indirect effect ($a_3b_3 = - 3.26$; 95% CI [- 6.06, - 0.92]). The specific indirect effects via the facets observing, describing, non-judging, and non-reactivity remained non-significant, though the indirect effect of non-reactivity may be described as a trend ($a_5b_5 = - 2.89$; 95% CI [- 6.50, 0.17]). During the follow-up period, none of the facets showed statistically significant specific indirect effects.

Discussion

With excessive stress on the rise, MBIs are increasingly provided with the objective of reducing stress and burnout risks. Although evidence of the beneficial effects of MBIs is growing rapidly, little is known about the mechanisms through which MBIs might decrease stress and fatigue. The aim of this study was to examine whether the effects of an MBI on stress and chronic fatigue in employees are statistically mediated by increases in mindfulness and/or self-compassion. It was investigated if these mediators would explain changes in stress and chronic fatigue during the training period and/or after the training (from post-test to 6 weeks follow-up). Lastly, facets of mindfulness were examined as mediators, both during the training and during follow-up period, on the same outcome measures.

Mediational Effects of Increases in Mindfulness

The results of the mediation analyses showed that changes in mindfulness during the training mediated the effects of the MBI on perceived stress and chronic fatigue. These results indicate that mindfulness as a mediator may not only play an important role in reducing depression, as was already demonstrated by earlier studies (Van der Velden et al. 2015), but also in reducing (work) stress-related measures. These findings are in line with previous research proposing mindfulness as an MBI mechanism

Table 2 Individual unstandardized coefficients in multiple parallel mediation models

Treatment period (T1 to T2)					Follow-up period (T2 to T3)				
95% CIs					95% CIs				
Path	Estimate	SE	LL	UL	Path	Estimate	SE	LL	UL
Perceived stress									
a ₁ *	1.31	0.22	0.89	1.75	a ₁ *	− 1.08	0.26	− 1.58	− 0.57
a ₂ *	0.86	0.24	0.40	1.33	a ₂ *	− 1.65	0.37	− 2.40	− 0.93
a ₃ *	1.69	0.31	1.09	2.32	a ₃	0.04	0.29	− 0.54	0.62
a ₄ *	1.99	0.36	1.28	2.68	a ₄	− 0.45	0.40	− 1.24	0.34
a ₅ *	1.87	0.28	1.32	2.43	a ₅ *	− 1.63	0.41	− 2.46	− 0.86
b ₁	− 0.05	0.23	− 0.52	0.41	b ₁	0.11	0.26	− 0.37	0.66
b ₂	− 0.10	0.23	− 0.58	0.32	b ₂	0.05	0.16	− 0.26	0.36
b ₃ *	− 0.64	0.21	− 1.04	− 0.20	b ₃ *	− 0.81	0.29	− 1.34	− 0.23
b ₄	− 0.08	0.14	− 0.36	0.19	b ₄	− 0.15	0.18	− 0.52	0.18
b ₅ *	− 0.58	0.22	− 1.01	− 0.13	b ₅	− 0.09	0.16	− 0.40	0.21
Chronic fatigue									
a ₁ *	1.31	0.22	0.88	1.75	a ₁ *	− 1.08	0.26	− 1.60	− 0.59
a ₂ *	0.86	0.23	0.39	1.31	a ₂ *	− 1.65	0.38	− 2.41	− 0.93
a ₃ *	1.69	0.31	1.09	2.32	a ₃	0.04	0.29	− 0.54	0.61
a ₄ *	1.99	0.36	1.30	2.71	a ₄	− 0.45	0.40	− 1.23	0.34
a ₅ *	1.87	0.28	1.32	2.42	a ₅ *	− 1.63	0.41	− 2.45	− 0.84
b ₁	− 0.33	0.78	− 1.77	1.27	b ₁	− 1.06	0.91	− 2.79	0.83
b ₂	− 0.79	0.73	− 2.25	0.65	b ₂	− 0.49	0.61	− 1.66	0.72
b ₃ *	− 1.93	0.71	− 3.32	− 0.54	b ₃ *	− 1.35	0.64	− 2.62	− 0.09
b ₄	0.25	0.47	− 0.70	1.15	b ₄	− 0.32	0.50	− 1.34	0.65
b ₅	− 1.54	0.83	− 3.13	0.11	b ₅	0.19	0.77	− 1.31	1.72

Path refers to unstandardized path coefficients

*Indicates statistical significance, as the 95% confidence interval does not include zero; *SE*, bootstrapped standard errors; *CI*s, percentile bootstrap confidence intervals; *LL*, lower limit; *UL*, upper limit; based on 10,000 bootstrap samples

leading to increased mental health outcomes (Gu et al. 2015).

Looking more deeply into the facets of mindfulness during the training, it was found that increases in acting with awareness mediated the positive effects on both perceived stress and chronic fatigue. This implies that learning to be mindful in daily activities and taking more conscious actions are working mechanisms for reducing stress and fatigue. Informal meditation, short meditations during daily activities and doing physical exercises mindfully might, with their focus on “conscious doing,” have contributed to the (mediational) effects of acting with awareness. Furthermore, increases in non-reactivity significantly mediated the reductions on perceived stress. This indicates that letting emotions and thoughts pass by without having to act on them led to reduced stress in this population. These findings are partly in line with the findings of Haenen et al. (2016), who also investigated mindfulness facets as MBI mediators on perceived stress and fatigue (however not in employees but in patients with diabetes mellitus). They found

non-reactivity, but not acting with awareness, to be a significant mediator of the MBI effects on perceived stress during the training. Concerning fatigue no mediational effects of any of the mindfulness facets was revealed. Although they found no mediational effects of acting with awareness on stress or fatigue, during the follow-up period acting with awareness was found to be an important mediator for other outcome measures. Increases of acting with awareness eventually led to positive effects on depression, anxiety, vigor, and anger in these patients (Haenen et al. 2016).

While in this study mindfulness was an important mediator during the training period, during the follow-up period mindfulness and its facets did not mediate changes in perceived stress or chronic fatigue. It should be noted that there were also no significant changes in stress and fatigue during the follow-up period, as opposed to during the training period. Therefore, it is less likely to find mediational effects. Surprisingly, most mindfulness facets, except acting with awareness and non-judging, decreased

Table 3 Specific indirect effects and direct effect in multiple serial mediation models

Treatment period (T1 to T2)					Follow-up period (T2 to T3)				
95% CIs					95% CIs				
Path	Estimate	SE	LL	UL	Path	Estimate	SE	LL	UL
Perceived stress									
Mindfulness*	− 2.25	0.64	− 3.61	− 1.10	Mindfulness	0.36	0.27	− 0.16	0.91
Self-compassion	− 0.17	0.16	− 0.54	0.10	Self-compassion*	− 0.44	0.25	− 1.04	− 0.06
Mindfulness → self-compassion *	− 0.41	0.24	− 0.95	− 0.02	Mindfulness → self-compassion*	0.20	0.11	0.03	0.47
Direct*	− 1.66	0.71	− 3.01	− 0.22	Direct	− 0.61	0.61	− 1.80	0.60
Total*	− 4.49	0.58	− 5.62	− 3.35	Total	− 0.50	0.58	− 1.64	0.61
Chronic fatigue									
Mindfulness*	− 6.14	1.77	− 9.88	− 2.90	Mindfulness	1.05	1.13	− 1.00	3.42
Self-compassion	− 0.52	0.54	− 1.64	0.52	self-compassion*	− 1.67	0.94	− 3.80	− 0.22
Mindfulness → self-compassion	− 1.21	1.08	− 3.64	0.50	Mindfulness → self-compassion*	0.76	0.51	0.09	2.04
Direct*	− 7.41	2.12	− 11.77	− 3.31	Direct	− 1.79	1.98	− 5.49	2.17
Total*	− 15.29	1.81	− 18.98	− 11.74	Total	− 1.64	1.89	− 5.25	2.17

Path refers to unstandardized path coefficients

*Indicates statistical significance, as the 95% confidence interval does not include zero; *SE*, bootstrapped standard errors; *CI*s, percentile bootstrap confidence intervals; *LL*, lower limit; *UL*, upper limit; based on 10,000 bootstrap samples. → Denotes the serial path, defined as the product $a_1a_3b_2$

after the training. This might be explained by less practice since the training had ended, although the amount of homework practice was not registered. Another possible explanation is that the more mindful participants become, the more mindful they are about their (moments of) lack of mindfulness. Remarkably, although mindfulness decreased after the training, effects on perceived stress and chronic fatigue remained. It might be that (one of) the mindfulness facets that stayed high after the training, played an important role in the remaining positive effects on stress and fatigue during the follow-up period. In fact, it can be seen that continued improvement in acting with awareness after the training was significantly related to reductions in stress and chronic fatigue from post-test to follow-up (path b3), indicating that acting with awareness may play a role in beneficial effects in burned out employees also during follow-up period.

Mediational Effects of Increases in Self-Compassion

For self-compassion, a serial indirect mediational effect was found for perceived stress: during the training, participants' mindfulness increased, which was associated with increases in self-compassion, which was in turn associated with less perceived stress. As expected, although it did not reach statistical significance, the same trend was found concerning chronic fatigue. These results are in line with previous findings that suggest changes in mindfulness predict changes in self-compassion, and changes in

self-compassion are subsequently associated with better psychological functioning (Birnie et al. 2010; Hollis-Walker and Colosimo 2011). During the training no specific indirect was found for self-compassion alone, controlling for the serial effect involving mindfulness, for stress or chronic fatigue.

Interestingly, during the follow-up period, increases of self-compassion mediated the positive effects of the MBI on perceived stress and chronic fatigue, not only as part of the serial path involving mindfulness but also directly. This indicates that self-compassion contributes, alone and in combination with mindfulness, to reductions in stress and fatigue. Burned out employees often pay too little attention to their own needs and limits, demand too much of themselves and are harsh instead of loving towards themselves. A shortage of self-compassion may have played an important role in the disastrous consequences of being burned out. For this reason, it is not surprising that learning to be more self-compassionate helps this population reduce stress and fatigue. The finding that self-compassion alone only was a significant mediator during the follow-up period might be explained by the structure of the MBI that focuses more explicitly on self-compassion later during the training (week 5). A related explanation is that self-compassion can only be developed after having acquired a certain level of mindfulness, in line with Neff's theoretical framework pointing out mindfulness as a prerequisite for being self-compassionate (Neff 2003b).

Limitations and Future Research

Although there are good theoretical justifications for the assumptions made on the directionality of effects in the present study, these cannot be read from the data. Furthermore, assessments took place at three time points and may not have revealed the complexity of the associations among changes in mindfulness, self-compassion, and the outcome measures. More time points, also during the training, would provide a more specific view of how mindfulness (facets) and self-compassion play a role in the effects on stress and fatigue. Lastly, this study did not include an active control group. Therefore, we cannot be sure that effects are due to the training and whether mindfulness and self-compassion mediated the effects of the training. However, a recent Mindful2Work effect study showed that during wait-list period no effects were found on stress, fatigue, mindfulness, or self-compassion (De Bruin et al. 2020). For this reason, it can be assumed that the (mediational) effects are due to the Mindful2Work training.

It should be noted that Mindful2Work is an MBI that also included outdoors physical exercise and yoga in all sessions and homework. Both the physical exercise and yoga were practiced with mindful awareness. Meta-analyses and reviews

show that both physical exercise (Sirois et al. 2015; Xia et al. 2019) and yoga (Riley and Park 2015) might be positively related to or increase mindfulness and/ or self-compassion, which may lead to positive effects on stress and fatigue. Future research could focus on the effects of the specific elements: physical exercise, yoga, and mindfulness, to be able to attribute changes in the mediators and outcomes to particular components of the intervention. In this way, effects of interventions could be further enhanced.

Some MBIs include long formal practice in one position (sitting or lying down). It could be that shifting the focus of the MBI to frequent practicing awareness in daily life, during activities, would lead to larger increases in acting with awareness, which in turn might result in larger reductions in complaints like stress or fatigue. Furthermore, in many MBIs self-compassion plays only an indirect role. It might be that with a more explicit focus on self-compassion practice, positive effects on stress and fatigue could be enhanced. An alternative to enhance these effects could be to extend the MBI with a self-compassion training, such as the MSC program (MSC; Germer and Neff 2019). Future research could compare the effects on stress and fatigue of adapted MBIs versus traditional MBIs to know whether the adaptations, in increased focus on self-compassion and/or practicing mindfulness in daily life, will lead to larger effects.

Table 4 Specific indirect effects and direct effect in multiple parallel mediation models

Treatment period (T1 to T2)					Follow-up period (T2 to T3)				
95% CIs					95% CIs				
Path	Estimate	SE	LL	UL	Path	Estimate	SE	LL	UL
Perceived stress									
Observe	- 0.07	0.31	- 0.77	0.49	Observe	- 0.12	0.29	- 0.75	0.40
Describe	- 0.08	0.21	- 0.53	0.30	Describe	- 0.09	0.27	- 0.62	0.46
ActAware*	- 1.08	0.47	- 2.14	- 0.28	ActAware	- 0.03	0.25	- 0.56	0.48
NonJudge	- 0.15	0.29	- 0.74	0.39	NonJudge	0.07	0.13	- 0.12	0.39
NonReact*	- 1.09	0.45	- 2.01	- 0.23	NonReact	0.14	0.27	- 0.33	0.75
Direct*	- 2.04	0.71	- 3.36	- 0.58	Direct	- 0.47	0.72	- 1.93	0.89
Total*	- 4.52	0.57	- 5.64	- 3.43	Total	- 0.50	0.57	- 1.60	0.64
Chronic fatigue									
Observe	- 0.43	1.06	- 2.68	1.58	Observe	1.14	1.05	- 0.86	3.32
Describe	- 0.68	0.67	- 2.15	0.53	Describe	0.81	1.05	- 1.16	3.00
ActAware*	- 3.26	1.30	- 6.06	- 0.92	ActAware	- 0.05	0.44	- 0.99	0.83
NonJudge	0.50	0.96	- 1.28	2.54	NonJudge	0.14	0.34	- 0.43	0.98
NonReact	- 2.89	1.72	- 6.50	0.17	NonReact	- 0.31	1.25	- 2.52	2.39
Direct*	- 8.52	2.17	- 12.77	- 4.26	Direct	- 3.37	2.28	- 7.87	1.07
Total*	- 15.27	1.82	- 18.88	- 11.74	Total	- 1.64	1.88	- 5.25	2.12

Path refers to unstandardized path coefficients

*Indicates statistical significance, as the 95% confidence interval does not include zero; *SE*, bootstrapped standard errors; *CI*s, percentile bootstrap confidence intervals; *LL*, lower limit; *UL*, upper limit; based on 10,000 bootstrap samples

Authors' Contributions RvdM wrote the paper and collaborated on the data analysis. SV collaborated on the conceptualization, data analysis, and writing of the of article. SMB collaborated on the study design and editing of the final manuscript. EIDB designed the study and collaborated on the conceptualization and editing of the article.

Funding This study was partly supported by a grant from MIND, Netherlands Foundation for Mental Health.

Compliance with Ethical Standards

All procedures were in accordance with the ethical standards of the institutional and/or national research committee of the University of Amsterdam and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all participants included in the study.

Competing interests Susan M. Bögels and Esther I. de Bruin are authors of the Mindful2Work books for which they receive royalties. Susan M. Bögels offers Mindful2Work teacher training for which she receives a honorarium.

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