

Bending Not Breaking

Citation for published version (APA):

Meesters, A. (2022). *Bending Not Breaking: Flexibility and mindfulness as resilience factors for pain and recovery*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20220928am>

Document status and date:

Published: 01/01/2022

DOI:

[10.26481/dis.20220928am](https://doi.org/10.26481/dis.20220928am)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

SUMMARY

Acute pain is an important sensation that serves a protective role, as it informs the body about potential physical harm or illness. However, acute pain loses its adaptive function when it transitions into chronic pain. As described in the general introduction in **chapter 1**, various psychosocial factors influence pain perception and the transition from acute to chronic pain, with psychological flexibility (including its subcomponents emotional and cognitive flexibility) and mindfulness being among those factors. However, the role of psychological flexibility in the development of chronic pain (i.e., non-recovery) remains largely unknown.

This dissertation aimed to gain insight into the link between psychological flexibility and mindfulness, and pain experience and recovery. Specifically, experimental studies investigated the protective role of two components of psychological flexibility (i.e., emotional and cognitive flexibility) and mindfulness against high pain levels and slow recovery from pain and of wounds. The following questions were addressed: 1) What is the relationship between two aspects of emotional flexibility (i.e., flexible emotional responsiveness and affective flexibility) and tolerance for and recovery from experimentally induced pain (**chapter 2**)? 2) Does affective flexibility have additive predictive value in explaining the experience of pain, above and beyond that of cognitive flexibility (**chapter 3**)? 3) Does mindfulness influence pain experience and recovery, and is this effect mediated by affective and/or cognitive flexibility (**chapter 4**)? Does mindfulness affect the recovery of wounds, and is this effect mediated by physiological wound healing processes (**chapter 5**)?

In a first cross-sectional observational study, pain was induced by means of an ischemic pain task (**chapter 2**). We found that two aspects of emotional flexibility (i.e., flexible emotional responsiveness and affective flexibility) were related to recovery from pain. Specifically, individuals who displayed more flexible emotional responding reflected in more distinct facial expressions (i.e., more divergent corrugator responses) to alternating positive and negative stimuli were more likely to recover faster in terms of pain unpleasantness. This study also found support for a relationship between more flexible switching between emotional contexts and faster recovery from pain. Participants who were more capable to switch attention away from neutral toward the affective meaning of positive stimuli were more likely to recover faster from pain with regards to pain intensity ratings. In disagreement with our hypotheses, none of the emotional flexibility measures was related to pain tolerance.

In order to test the additive value of affective flexibility in explaining the experience

of pain above and beyond that of cognitive flexibility, our second study contained both a measure of affective flexibility and a non-affective measure of general cognitive flexibility (**chapter 3**). Results did not provide evidence for associations between affective and general cognitive flexibility, and experimentally induced heat pain threshold, pain tolerance and retrospective pain experience.

Chapter 4 describes an experimental study that investigated the effects of a mindfulness induction on pain experience and recovery, as well as on cognitive and affective flexibility. An ischemic pain task was used to induce pain. It was hypothesized that participants in the mindfulness group would display a higher pain tolerance and reduced subjective stress ratings compared to participants in the control condition. Also, we expected faster recovery in terms of pain intensity and pain unpleasantness ratings in the mindfulness group. In addition, mindfulness was expected to improve both cognitive and affective flexibility. However, findings did not support any of our hypotheses. Although mindfulness was successfully induced, results showed no effect on pain tolerance, subjective stress ratings, and recovery in terms of pain intensity and pain unpleasantness ratings, nor on cognitive and affective flexibility.

Chapter 5 presents the results of an experimental study examining the effects of an 8-week Mindfulness-Based Stress Reduction (MBSR) program on recovery, measured as the healing speed of skin blisters, and explored local pro-inflammatory cytokine and growth factor levels in wound fluid as potential mediators of recovery. We found no evidence for the hypothesis that MBSR would improve the healing speed of skin wounds. However, post hoc analyses showed that larger improvements in mindfulness were linked to larger reductions in skin permeability at day 3 and 4 after wounding. Furthermore, results showed that MBSR participants exhibited lower levels of pro-inflammatory cytokines and growth factors such as interleukin (IL)-8, and placental growth factor (PIGF) in wound fluid after 22 h as compared to waiting-list control participants. Post hoc findings demonstrated that larger improvements in mindfulness were associated to greater decreases in IL-1 β and IL-8 22 h after blistering. In sum, this study provided preliminary evidence for the potential beneficial effects of mindfulness meditation on early stages of wound healing, and of local pro-inflammatory cytokine and growth factor levels in wound fluid as mediators of recovery.

Lastly, **chapter 6** provides a summary of the main findings of this dissertation, followed by a discussion of these findings in relation to previous literature, future research, and research implications. Altogether, the findings of the current dissertation did not uniformly point to associations among psychological flexibility (i.e., emotional and cognitive flexibility), mindfulness, pain experience, and recovery (i.e., pain recovery and recovery of wounds). However, present work does provide first indications of

relations between emotional flexibility and recovery from pain and of beneficial effects of mindfulness for wound healing. Future studies are therefore necessary to disentangle when and how constructs like psychological flexibility (i.e., emotional and cognitive flexibility) and mindfulness exert their influence on pain experience and recovery from pain and of wounds. The current dissertation may inspire future studies to continue this line of research. A deeper understanding of psychological flexibility and mindfulness as potential resilience factors for pain and recovery may ultimately lead to novel avenues for the development of prevention programs as well as new intervention strategies.