Mindfulness-Meditation effects on fMRI-based Pain Signatures of Nociception, Negative Affect, and Placebo

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Introduction

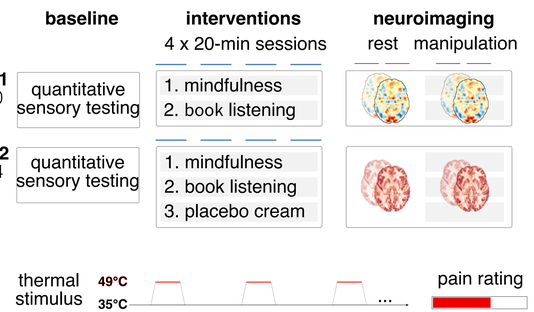
- Mindfulness meditation has been shown to reduce experimental and clinical pain
- How it modulates brain responses to pain remains unclear

- We investigate the brain targets of mindfulness for pain relief, using fMRI-based pain signatures of
1. Sensory Pain (**N**eurologic **P**ain **S**ignature[6])
2. Extra-sensory Pain (**S**timulus-**I**ntensity-**I**ndependent **P**ain **S**ignature[8])
3. Affective Pain (**N**egative **A**ffect **S**ignature[5])

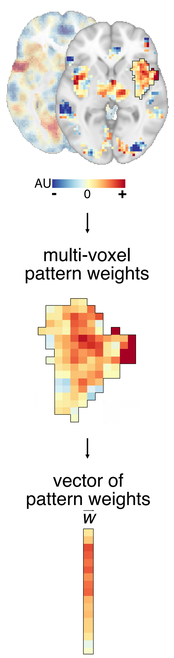
- **Hypothesis**: from previous work[123], we hypothesize that meditation will lower sensory (NPS) and affective (NAS) pain signature responses, and not those related to placebo (SIIPS)

Methods

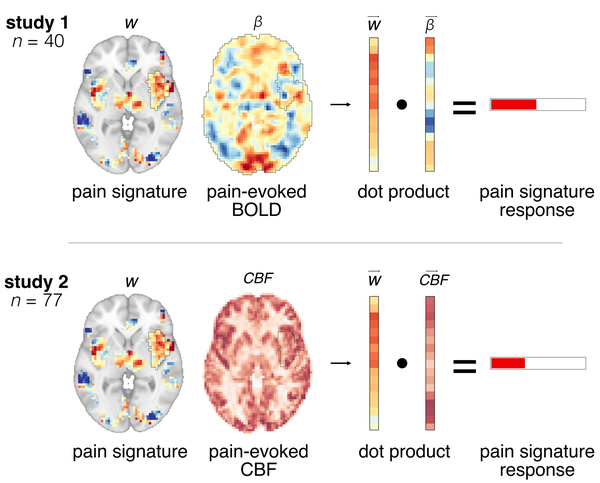
a. Experimental Design



b. Pain Signatures

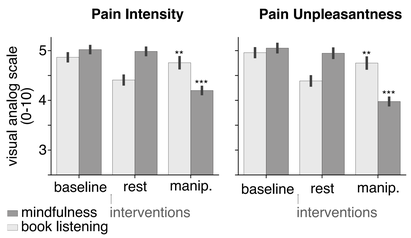


c. Pain Signature Responses

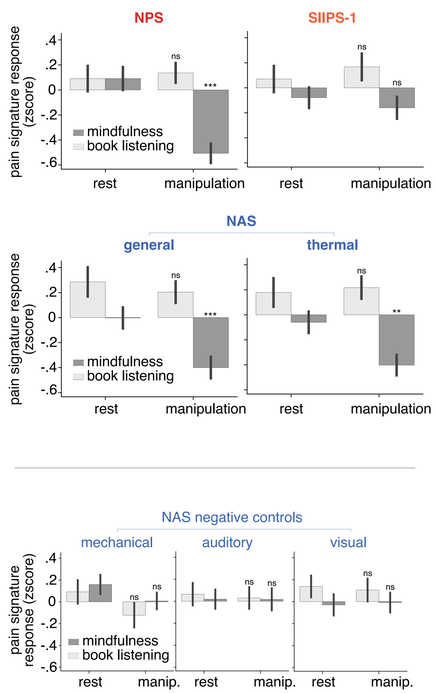


Results

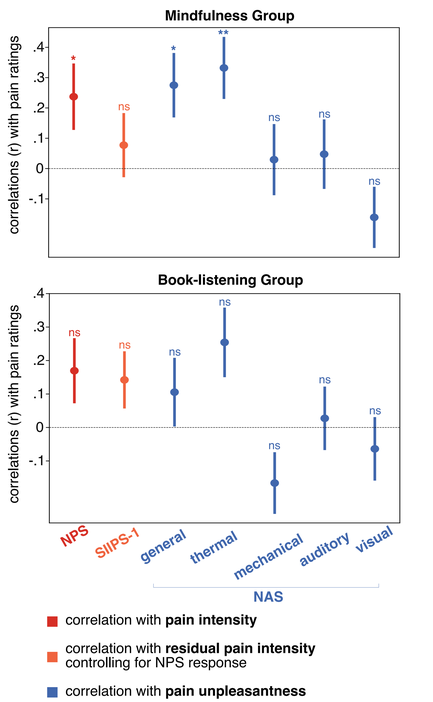
a. Pain Ratings
studies 1 and 2



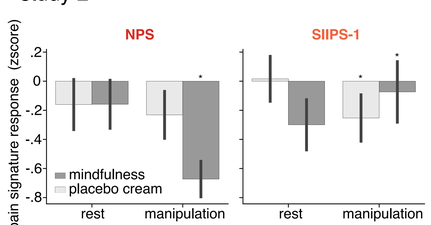
b. Pain Signature Responses
studies 1 and 2



c. Pain Ratings vs Pain Signature Responses
studies 1 and 2

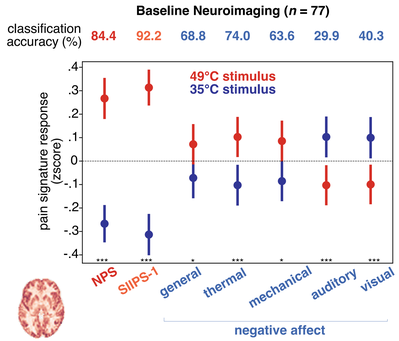


d. Mindfulness Meditation vs Placebo Cream
study 2



FDR-corrected p-values = ns q ≥ .05, * q < .05, ** q < .01, *** q < .001
error bars = standard error of the mean

e. Validating Pain Signatures with Perfusion fMRI
study 2



Conclusions

- Mindfulness meditation significantly reduced both pain intensity (↓32%) and unpleasantness (↓40%)
- In contrast, controls showed increased pain ratings

- Mindfulness decreased general and thermal-specific negative affect brain signatures (NAS), as well as the Neurologic Pain Signature (NPS), but did not modulate the placebo-related signature (SIIPS-1)

- Correlations support a link between mindfulness-induced pain reduction and decreased sensory and negative affect specific fMRI activity

References

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Acknowledgments

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NIH National Center for Complementary and Integrative Health