

Mindfulness meditators show altered neural activity related to attention, working memory, cognitive inhibition and emotional processing

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Introduction

Mindfulness meditation has been shown to have beneficial effects on stress, anxiety, depression, and cognitive performance^{1,2}. Improved attentional function is suggested to underlie these improvements³. However, little research has tested this suggestion by examining brain activity.

Aims

- 1) To determine whether meditators show altered brain activity related to attention across a range of cognitive tasks.
- 2) To obtain a more sophisticated understanding of how brain activity differs in meditators, in order to understand what underlies their improved cognitive performance and mental health.

Methodology

Long term meditators (N = 34, minimum = 2 years of practice, 2 hours per week) and healthy controls (N = 36, no meditation experience) completed five cognitive tasks while EEG was recorded. All tasks required attention. Specific tasks also measured short-term memory, behavioural inhibition, cognitive inhibition, emotional inhibition, and cognitive performance during distraction. Behavioural performance was compared between the groups. Comparisons were also made of the distribution of brain activity (reflecting which brain areas were activated) and the overall strength of brain activity.

Behavioural Results (all $p < 0.05$)

Meditators showed higher accuracy on all tasks. This suggests meditators were better able to remember items seen a brief time before, focus on the important aspects of stimuli to select responses, inhibit habitual responses, and attend to task relevant stimuli during distraction. The increased performance was not the result of slower responses to increase accuracy as reaction times did not differ.

References

- 1) Hofmann, S. G., Sawyer, et al. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of consulting and clinical psychology*, 78(2), 169.
- 2) Khoury, B., Sharma, M., et al. (2015). Mindfulness-based stress reduction for healthy individuals: A meta-analysis. *Journal of psychosomatic research*, 78(6), 519-528.
- 3) Tang, Y.-Y., Ma, Y., et al. (2007). Short-term meditation training improves attention and self-regulation. *Proceedings of the National Academy of Sciences*, 104(43), 17152-17156.

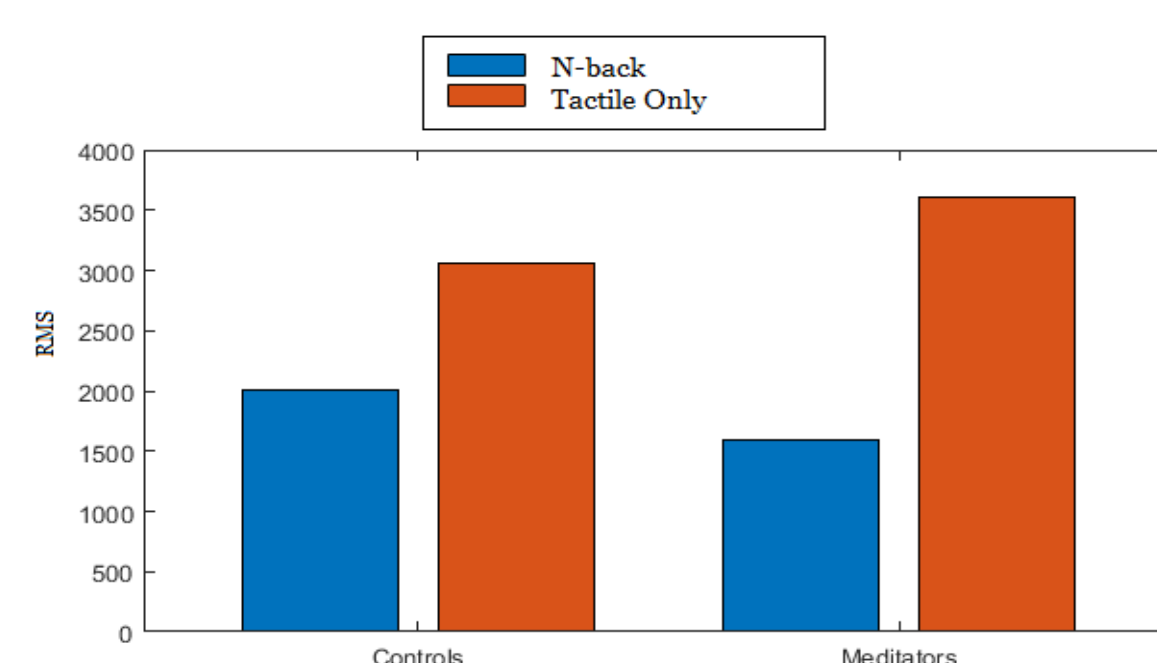
Neural Results (all $p < 0.05$)



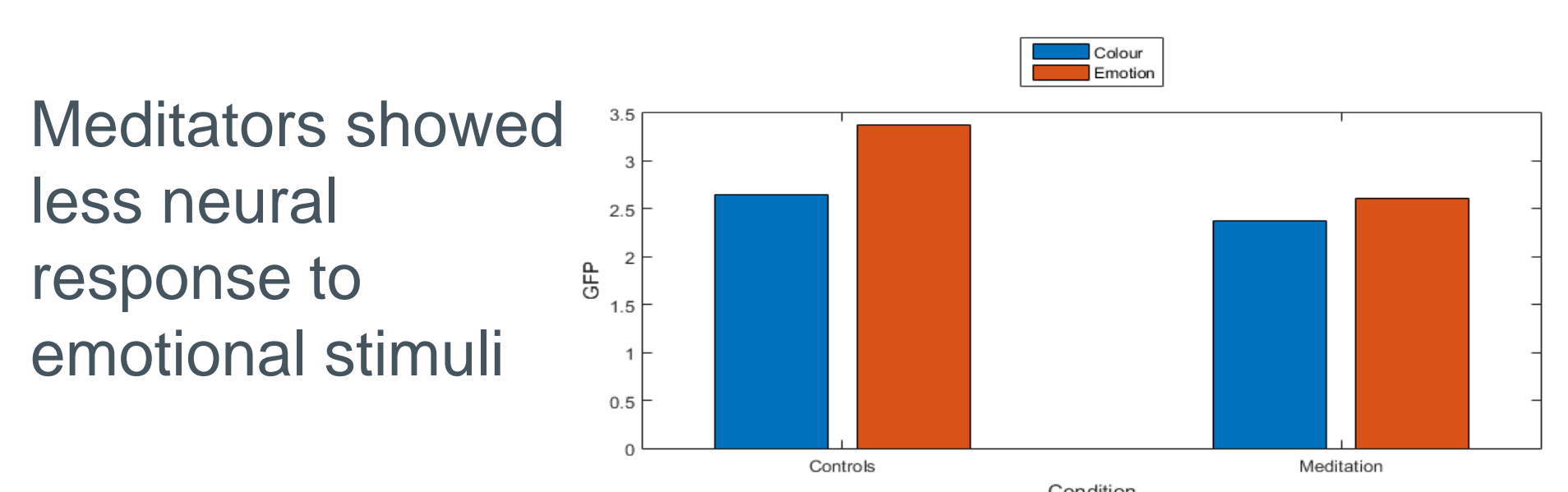
Meditators showed more neural activity in the inhibition task, related to sustained attention



Meditators showed more neural activity in the left temporal lobe during the working memory task



Meditators showed more modulation of alpha activity during distraction (related to neural inhibition)



Meditators showed less neural response to emotional stimuli

Conclusions

Training attention with meditation leads to improved cognitive performance, often while generating less neural activity. Cognition related differences in neural activity in long term meditators depend on the task, suggesting meditators brains are more able to adapt to task requirements (rather than simply generating more activity in a particular brain wave). This increased adaptability may underlie the improvements in cognition and mental health from mindfulness meditation.