

Reduced Perceptual Bias in Mindfulness? Evidence from a Pain-Cueing Paradigm

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Background

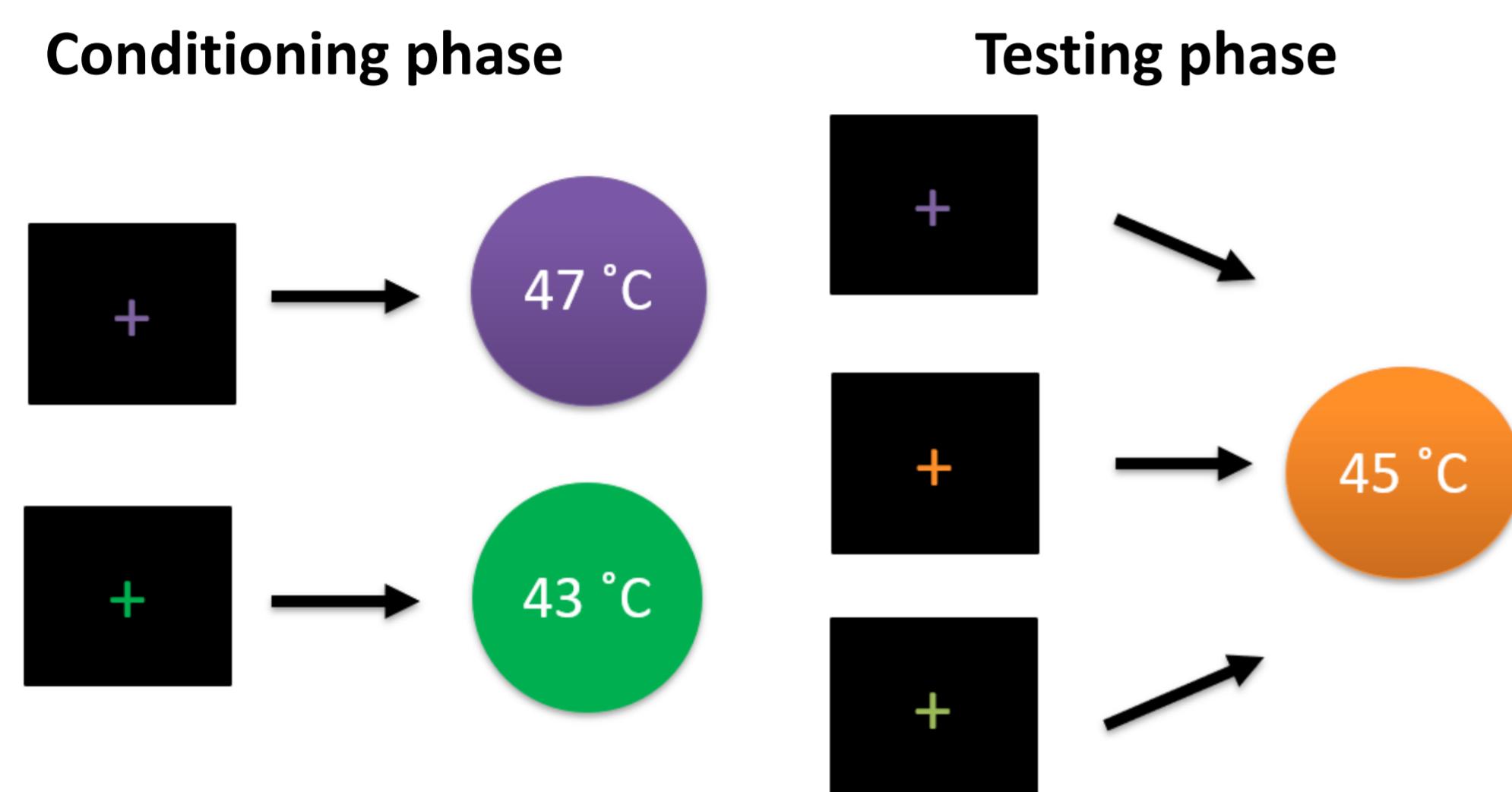
Even though mindfulness has been shown to alleviate chronic pain symptoms, little is known about how it confers these benefits. Neuroimaging evidence suggests that mindfulness-induced hypoalgesia is achieved via increased attention to sensory information and reduced cognitive-evaluative processing; a pattern opposite to what is observed in other regulation strategies, e.g. suppression and reappraisal⁽¹⁾. Accordingly, recent predictive coding models posit that mindfulness may lead to prioritization of incoming sensory information over prior expectations. The current study provides the first empirical test of this hypothesis using a pain-cueing paradigm, which has been shown to reliably elicit conditioned hypoalgesic and hyperalgesic effects.

It was hypothesised that, relative to a suppression group, participants allocated to a mindfulness group would report:

- (1) lower anticipatory anxiety, pain intensity and pain unpleasantness levels (measured on a novel cue i.e. immune from conditioning effects)
- (2) reduced cue-induced hypoalgesic (placebo-like) and hyperalgesic (nocebo-like) effects.

Methods

Pain-cueing paradigm:



➤ Reliably elicits cue-induced perceptual biases i.e. identical temperatures are perceived as more painful if preceded by the purple (CS+) cue and less painful if preceded by the green (CS-) cue. Cues were counterbalanced across participants.

Participants: 68 participants (50% female; mean age = 26.85, SD = 7.35; 6 participants were removed from the final analysis as they failed to notice the cue-stimulus contingency or reported it incorrectly)

Mindfulness vs Suppression:

- Participants were randomly allocated to listen to a 10-mins recording of either mindfulness (n = 31) or suppression (n = 31) instructions

Trait measures:

- Five Facet Mindfulness Questionnaire⁽²⁾
- Trait Pain Catastrophizing Scale⁽³⁾

State measures:

- Toronto Mindfulness Scale⁽⁴⁾
- Situational Pain Catastrophizing Scale⁽⁵⁾

Pain ratings (Visual Analogue Scales (0-100)):

- Anticipatory Anxiety, Pain Intensity and Pain Unpleasantness

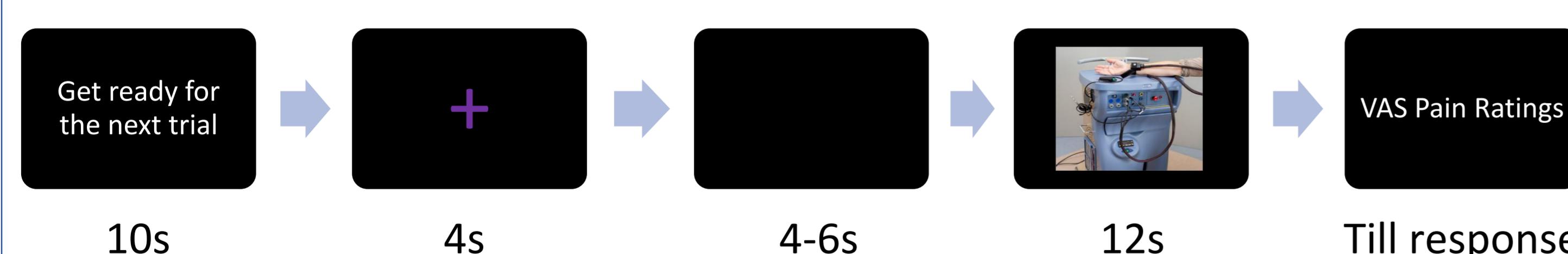
Nociceptive stimulation:

- Individually calibrated heat stimuli administered with a thermode (Somedic, MSA). Temperatures that elicited pain ratings of 40, 60 and 80 during the calibration procedure were used for the low, medium and high stimuli respectively.

Procedure

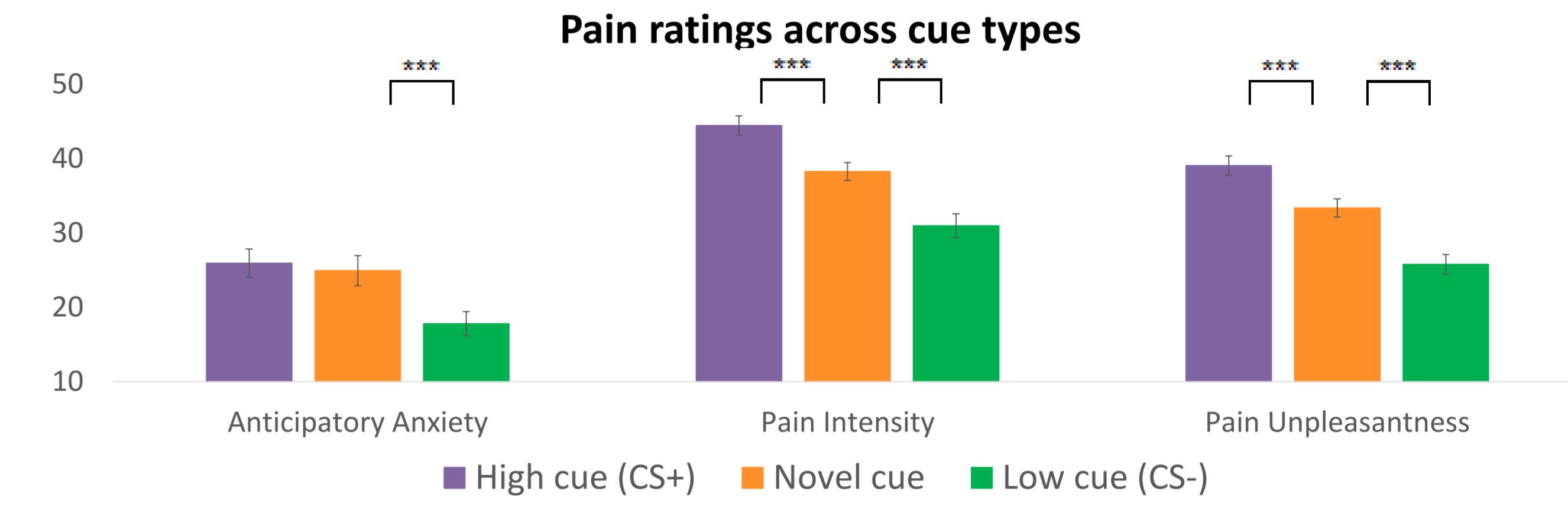


Trial timeline



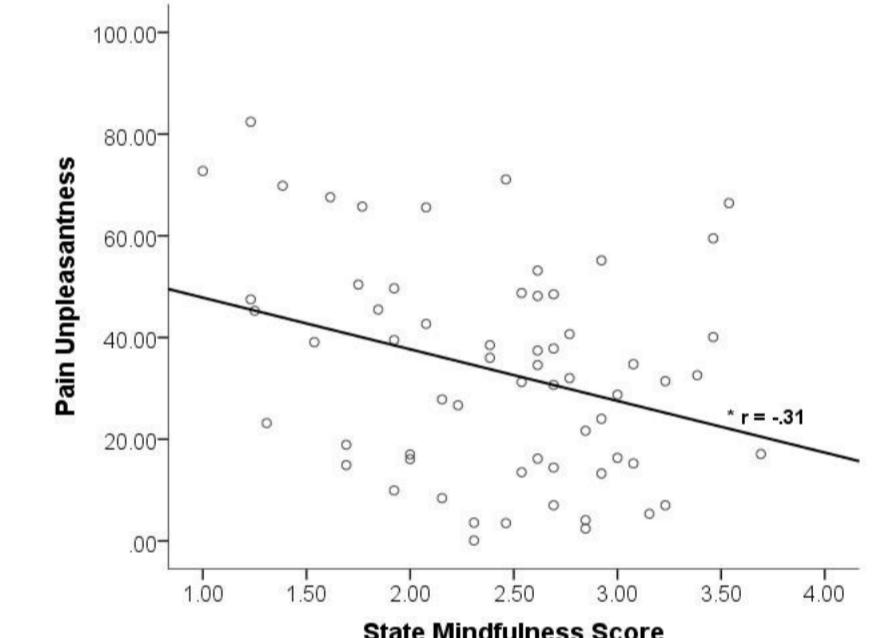
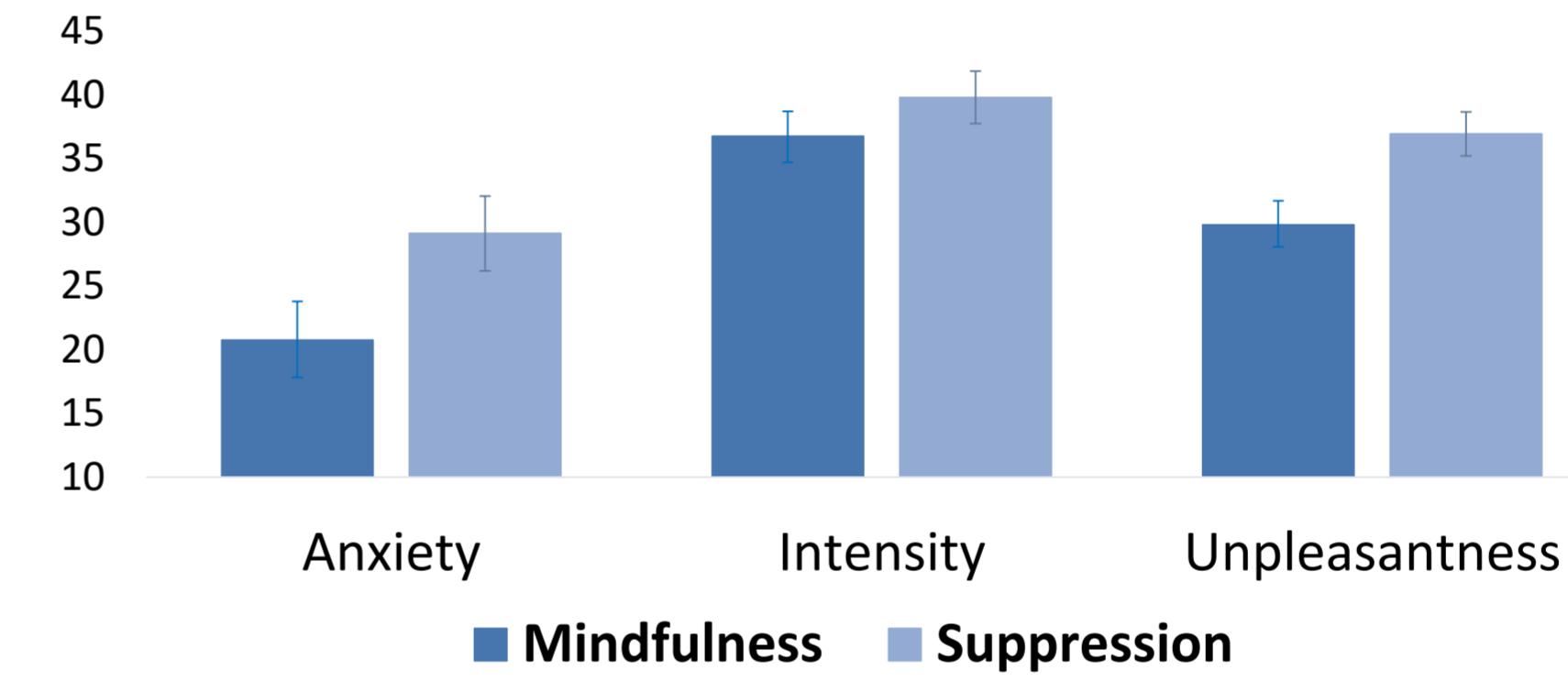
Results

- The pain-cueing paradigm was successful in inducing conditioned hypoalgesic and hyperalgesic effects.



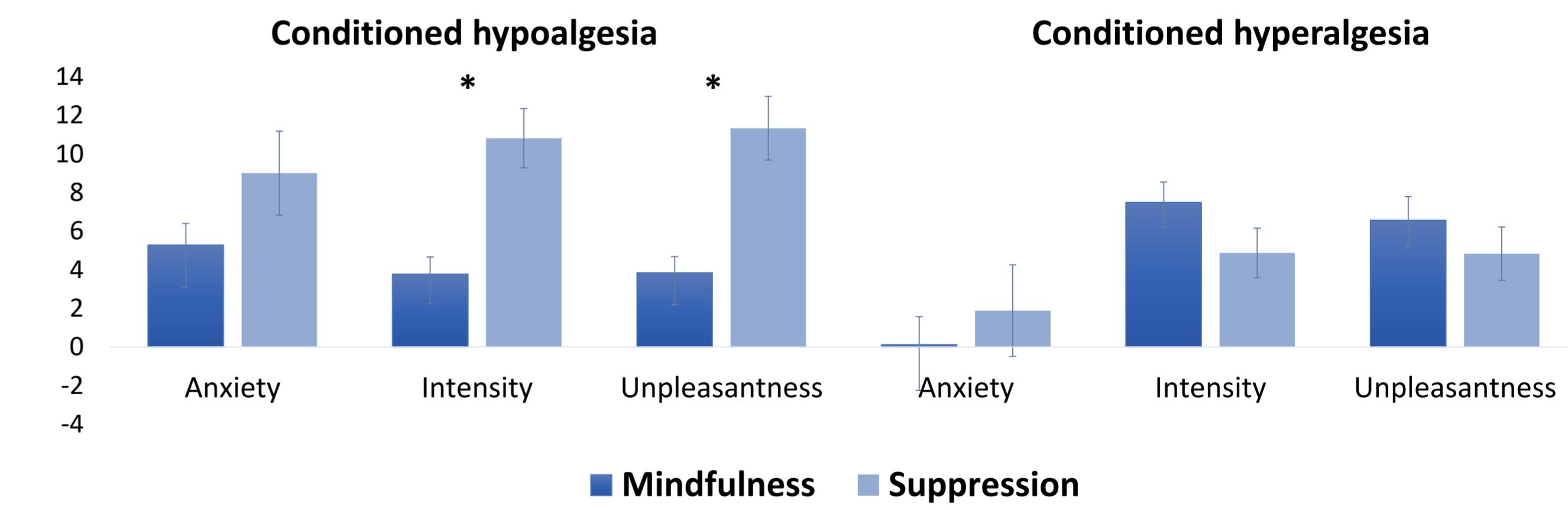
➤ Hypothesis 1: Group differences in pain ratings (on the novel cued stimuli)

VAS Ratings (on novel-cued stimuli)



- No between-group differences in anticipatory anxiety, pain intensity and pain unpleasantness (p's all > .05)
- However, higher levels of state mindfulness were associated with lower anticipatory anxiety, pain intensity and pain unpleasantness (r's ranging from -.29 to -.44, p's all < .05).

➤ Hypothesis 2: Group differences in conditioned hypoalgesia and hyperalgesia



- The mindfulness group reported smaller cue-induced hypoalgesic effects with regards to pain intensity ($F(1,60) = 9.241, p = .004, \eta_p^2 = .133$) and pain unpleasantness ($F(1,60) = 10.023, p = .002, \eta_p^2 = .143$).
- No between-group differences in terms of cue-induced hyperalgesia (p's all > .05).
- State mindfulness was also linked to lower cue-induced hypoalgesic but not hyperalgesic effects.

Discussion

- The findings provide partial support for the hypothesis that pain experience in mindfulness is less likely to be shaped by prior expectations.
- Mindfulness led to reduced cue-induced hypoalgesia, but not cue-induced hyperalgesia. A potential explanation is that hyperalgesic/nocebo effects may be more resistant to modulation, due to their aversive nature.
- Nevertheless, future ought to investigate whether a more intensive mindfulness intervention or a sample of experienced meditators may be more successful at modulating hyperalgesic/nocebo effects.
- Given that maladaptive/exaggerated expectations constitute a core factor in several psychological disorders, the approach outlined here may offer considerable promise in delineating the underlying mechanisms of mindfulness.

References

- Gard, T., Högl, B. K., Sack, A. T., Hempel, H., Lazar, S. W., Vaitl, D., & Ott, U. (2011). Pain attenuation through mindfulness is associated with decreased cognitive control and increased sensory processing in the brain. *Cerebral cortex*, 22(11), 2692-2702.
- Baer, R. A., Smith, G. T., Lykins, E., Burton, D., Kretschmer, J., Sawyer, S., ... & Williams, J. M. G. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment*, 15(3), 329-342.
- Sullivan, M. J., Bishop, S. R., & Pivik, J. (1995). The pain catastrophizing scale: development and validation. *Psychological assessment*, 7(4), 524.
- Lau, M. A., Bishop, S. R., Segal, Z. V., Bills, T., Anderson, N. D., Carlson, L., ... & Devins, G. (2006). The Toronto mindfulness scale: Development and validation. *Journal of clinical psychology*, 62(12), 1445-1467.
- Campbell, C. M., McCauley, L., Bounds, S. C., Mathur, V. A., Conn, L., Simango, M., ... & Fontaine, K. R. (2012). Changes in pain catastrophizing predict later changes in fibromyalgia clinical and experimental pain report: cross-lagged panel analyses of dispositional and situational catastrophizing. *Arthritis research & therapy*, 14(5), R231.