

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

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## Background

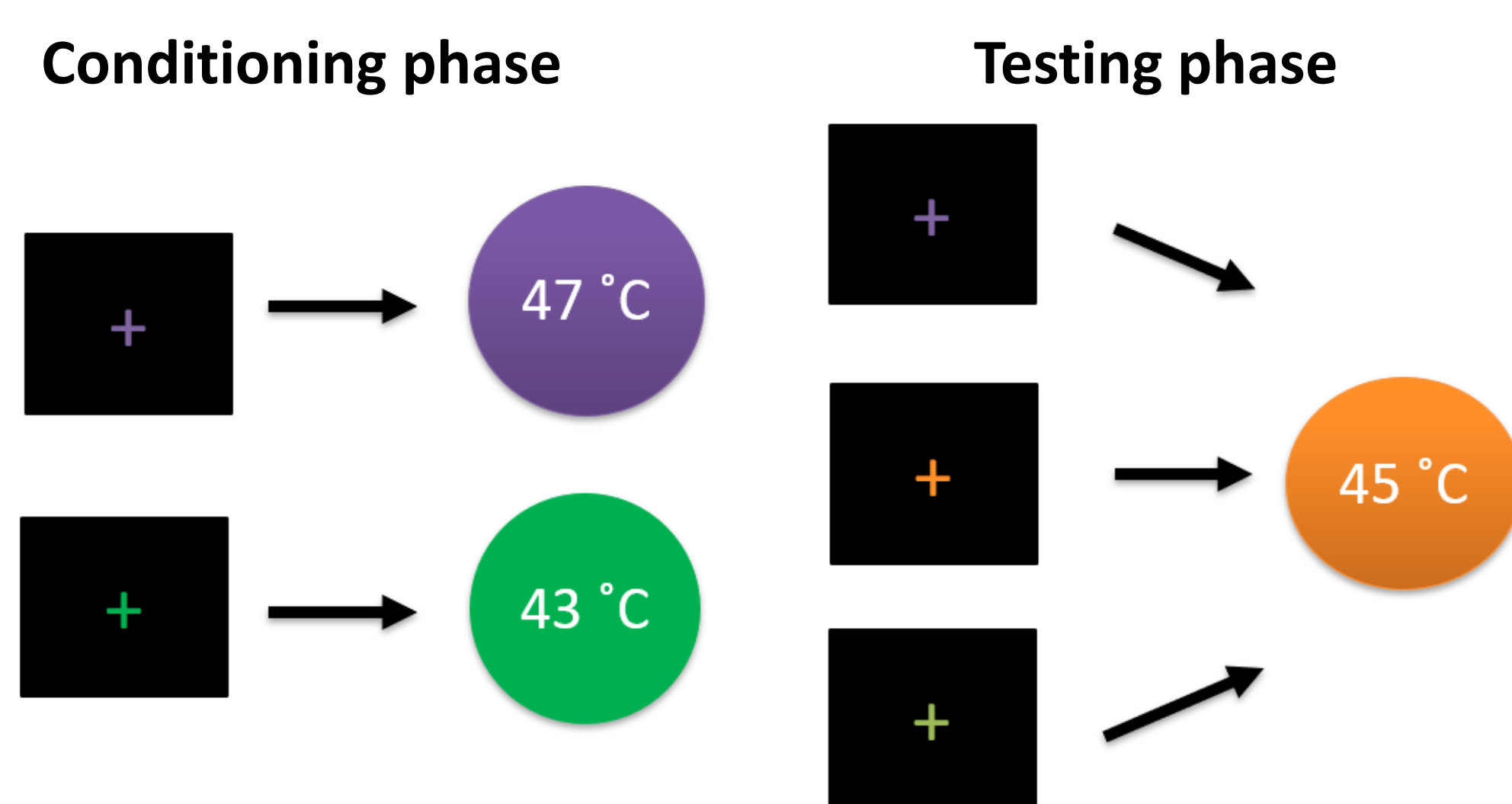
Even though mindfulness has been shown to alleviate chronic pain symptoms, little is known about how it confers these benefits. Neuroimaging evidence suggests that mindfulness-induced hypoalgesia is achieved via increased attention to sensory information and reduced cognitive-evaluative processing; a pattern opposite to what is observed in other regulation strategies, e.g. suppression and reappraisal<sup>(1)</sup>. 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 <sup>(2)</sup>
- Trait Pain Catastrophizing Scale <sup>(3)</sup>

### State measures:

- Toronto Mindfulness Scale <sup>(4)</sup>
- Situational Pain Catastrophizing Scale <sup>(5)</sup>

### 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

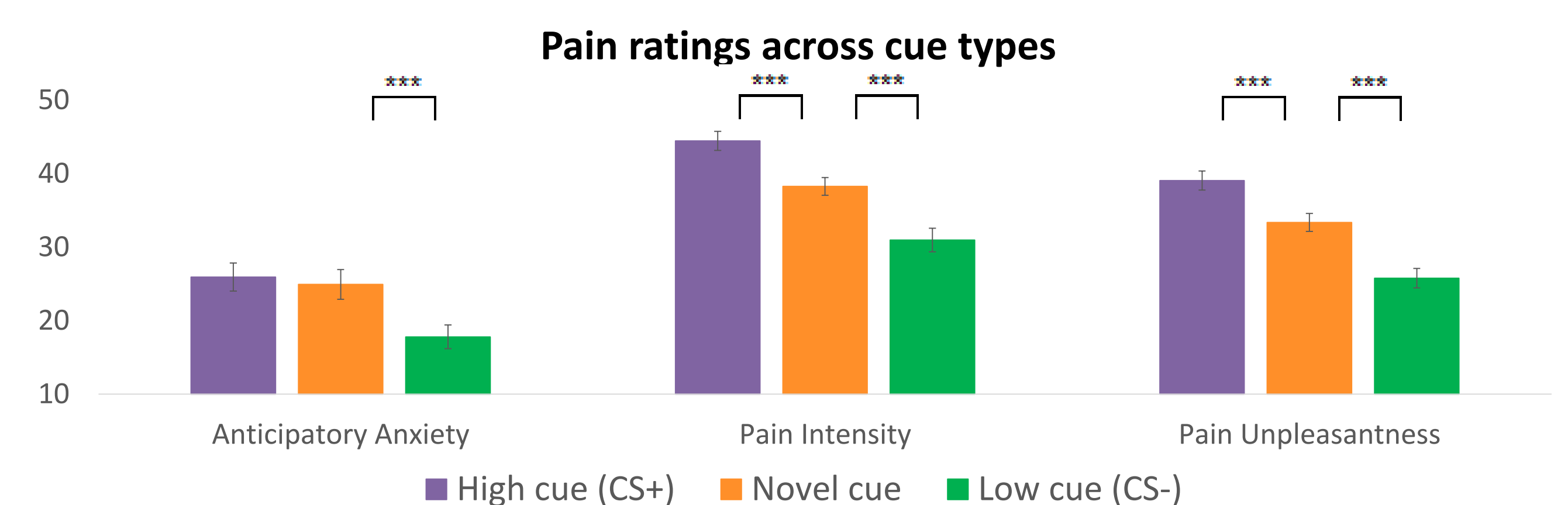


### Trial timeline

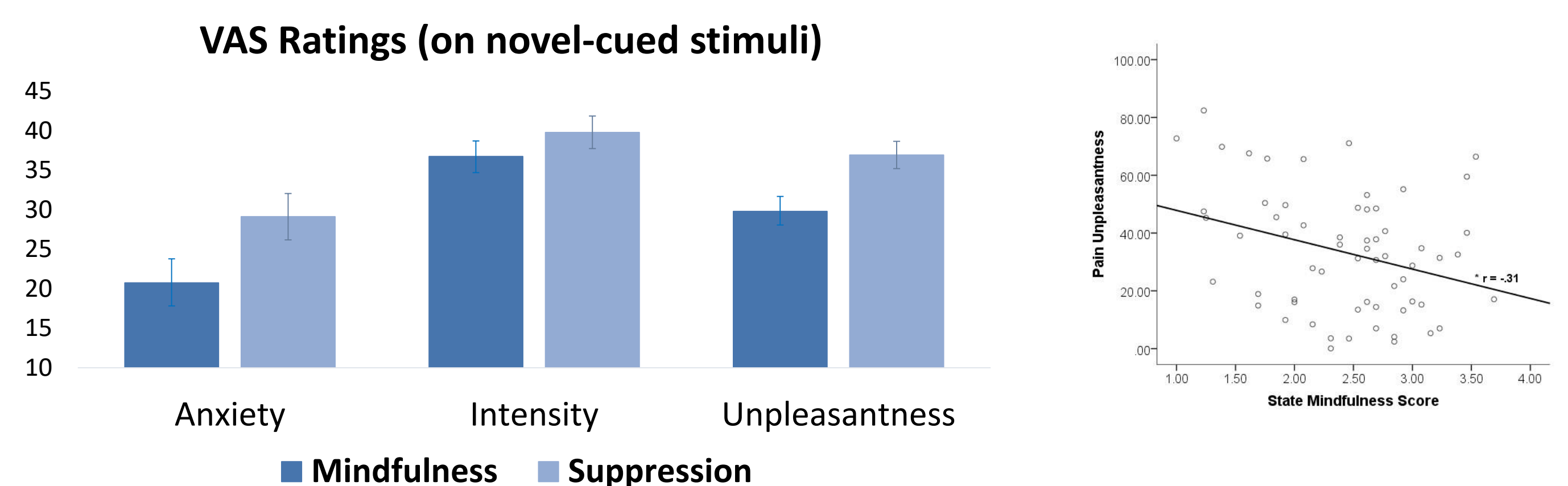


## Results

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

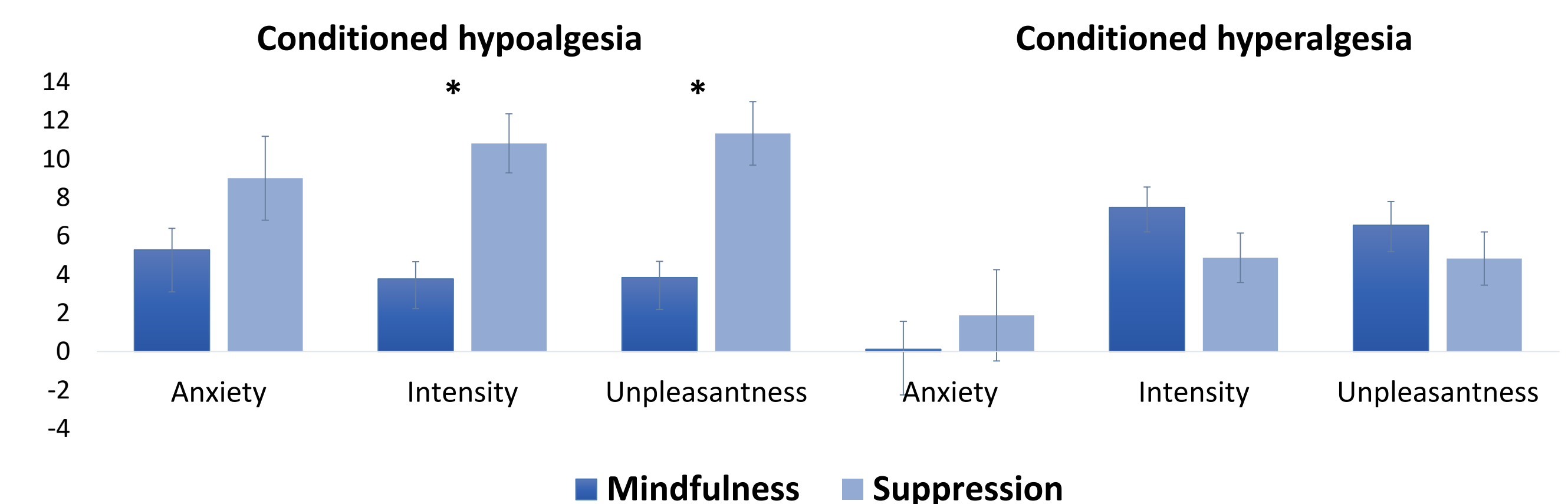


- **Hypothesis 1: Group differences in pain ratings (on the novel cued stimuli)**



- 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

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