

Reliability of conditioned pain modulation in a healthy population: investigating the influence of distraction, pain catastrophising, and sleep.

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INTRODUCTION

Conditioned pain modulation (CPM)

- “pain inhibits pain” - painful stimulus inhibits or subdues the perception of pain produced by a second co-occurring painful stimuli at a distant body site.

This current study aimed

- to assess the validity and differences between two conditioning stimuli to elicit CPM responses; a standard experimental pain inducing stimulus compared to a real-life back pain-inducing stimulus.
- Evaluate the independent influence of cognitive distraction, pain catastrophising, and subjective sleep disruptions on CPM response.

METHODS

Participants were **healthy young adults** (Experiment 1: n = 57, 84.2% females, mean age 19.4 years; Experiment 2: n = 118, 79.7% females, mean age 19.5 years).

Two identical **quantitative sensory testing** (QST) sessions a week apart and completed **Pain Catastrophising Scale** (PCS), **Pittsburgh Sleep Quality Index** (PSQI) and a daily **sleep diary** in-between.

QST to determine **CPM response: Pressure Pain Threshold (PPT_h)** assessed on the right upper shoulder/forearm alongside two conditioning stimuli to induce pain on the contralateral side of the body: **Cold Pressor Task (CPT)** and **Bag Holding Task (BHT)**.

Experiment 2 – two **cognitive distractor tasks** as conditioning stimuli to examine distraction effects.

RESULTS

CPM index was derived by calculating the percent change of PPT_h during the conditioning stimulus to PPT_h prior to conditioning stimulus ($(\text{Mean PPT}_{h \text{ during CS}})/(\text{Mean PPT}_{h \text{ prior CS}}) \times 100$)

VALIDITY OF TWO CONDITIONING STIMULI FOR ELICITING CPM RESPONSE: THE COLD PRESSOR TASK VS. BAG HOLDING TASK

Pressure pain threshold with **cold pressor task** elicited **strongest CPM response** in both experiments (7.69%, 29.16%).

Bag holding task showed a **weak CPM response** (-2.07%, 4.34%).

IS CPM RESPONSE DUE SOLELY TO COGNITIVE PROCESSES OR A ROBUST PHYSIOLOGICAL PHENOMENON?

Distraction tasks engaged pain inhibition and elicited CPM response but of **less magnitude** (~11%) compared to the cold pressor stimulus (29%).

ARE THERE DIFFERENCES IN PAIN CATASTROPHISING AND SLEEP IN THOSE WITH IMPAIRED CPM RESPONSE (< 100%) COMPARED WITH NORMAL CPM RESPONSE (< 100%).

Experiment 1 – **CPM non-responders** (n = 10) vs. responders (n = 44) Non-responders reported **higher pain catastrophising** scores (M = 22.30, SD = 12.13) than responders (M = 14.60, SD = 9.73), U = 137.00, z = -1.85, p < .05.

Experiment 2 – **CPM non-responders** (n = 12) vs. responders (n = 91). Non-responders reported non-significant trends towards **subjective poorer sleep** (longer sleep onset latency and lower sleep efficiency) and **significantly less total sleep time** (Table 1).

Figure 1. Conditioning stimuli used to elicit CPM response

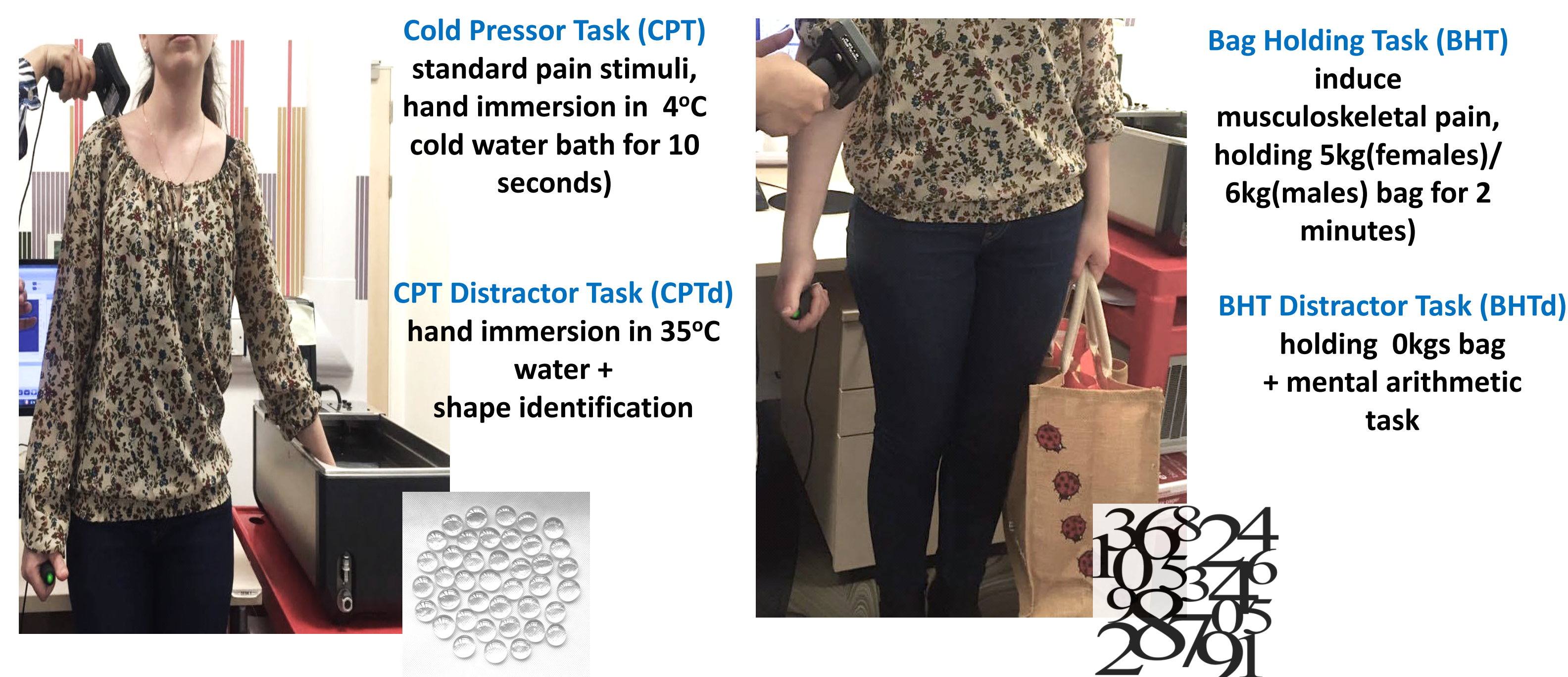


Figure 2. CPM index across all conditioning stimuli

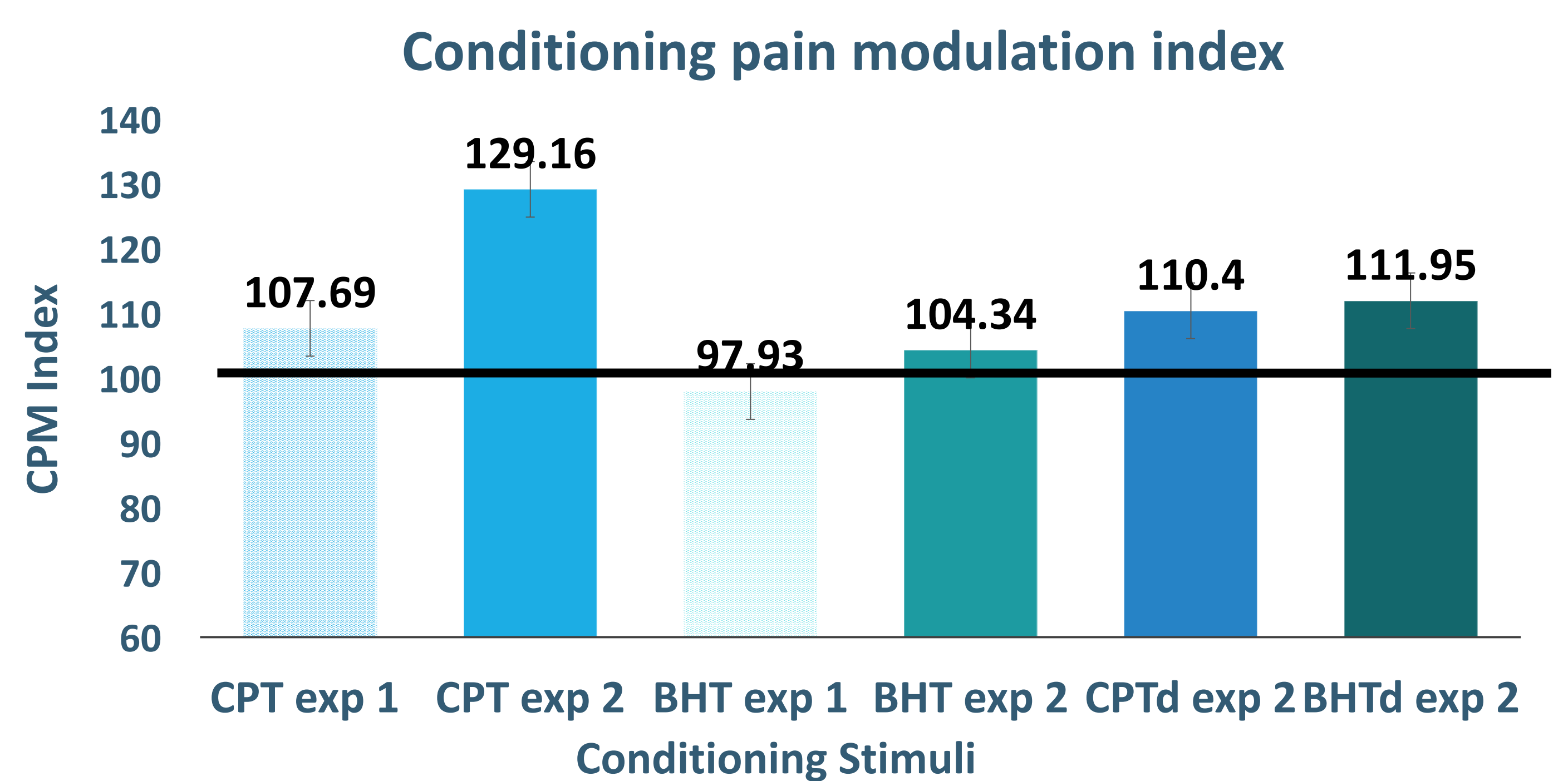


Table 1. Subjective sleep reports for individuals with impaired CPM response compared with normal responders

	CPM non-responders (n = 12)	CPM responders (n = 91)	Mann-Whitney U test
PSQI (Sleep quality)	6.33 (2.77)	5.97(2.86)	n/s
Sleep onset latency (SOL) (mins)	30.43 (28.86)	19.59 (16.41)	n/s
WASO duration (mins)	9.11 (12.00)	6.56 (9.13)	n/s
Total sleep time (TST) (mins)	404.28 (68.06)	453.39 (69.18)	U = 331.0 z = -2.21*
Sleep efficiency (SE) (%)	90.64 (8.61)	94.03 (4.76)	n/s

Means values are presented with standard deviations in parentheses
***p < 0.001 **p < 0.01 *p < 0.05

CONCLUSIONS

- Bag holding task** as a conditioning stimulus **did not reliably elicit CPM response** in this sample of healthy participants.
- CPM is a robust physiological mechanism **independent of cognitive distraction**.
- Tentative preliminary evidence that **less efficient CPM response** may be associated with **pain catastrophising** and **shorter sleep duration**.
- Further studies needed to explore the specific **temporal relationship between sleep disturbances and CPM responses**, especially in chronic pain patients.