Attentional Modulation of the Nociceptive Flexion Reflex and Anxiety Sensitivity

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Introduction

Pain and the nociceptive flexion reflex (NFR) are modulated by attention. It is unknown whether psychological traits are related to attentional modulation of pain/NFR. Healthy, pain-free participants were enrolled in a study (OK-SNAP) that assessed variables associated with pain processing. Participants completed the Anxiety Sensitivity Index-Revised (ASI-R) and viewed affective pictures, during which NFR magnitudes and pain ratings were gathered in response to electric stimulations to the sural nerve.

Participant Characteristics

- **Participants (*N* = 257)**
  - NHW = non-Hispanic White
  - NA = Native American
- **Exclusion criteria:**
  - < 18 years of age
  - BMI > 35
  - Current acute illness, psychotic symptoms, chronic pain condition, or inability to speak/read English, cardiovascular, neurological, and/or circulatory problems, and recent use of analgesic, antidepressant, anxiolytic, antihypertensive medications
- Participant characteristics are reported by NFR modulation groups (pain modulation group compositions differ) - refer to Methods section for an explanation of group creation

	NFR Inhibitors			NFR No Modulation			NFR Facilitators		
Variable	**N**	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**
Age (years)	80	27.90	12.47	83	27.77	11.45	96	30.32	13.90
Male/Female	41/39	-	-	40/43	-	-	41/55	-	-
NHW/NA/Other	43/18/16	-	-	40/22/21	-	-	47/24/25	-	-

Methods

Nociceptive Flexion Reflex (NFR)

- The NFR is a spinally-mediated, pain-related reflex elicited by Aδ fiber activation
- The size of the NFR is correlated with pain ratings, but is an independent marker of spinal nociception
- NFR magnitude is determined by measuring biceps femoris activity in the 90-150 ms post-stimulus window
- NFR magnitude = mean rectified EMG of 90 to 150 ms post-stimulation interval minus mean of rectified EMG from -60 to 0 ms prestimulation interval divided by the average standard deviation of the rectified EMG from the two intervals

Group Creation

- 3 groups were created based on modulation during distraction (no modulation of pain/NFR, inhibited pain/NFR, facilitated pain/NFR)
- NFR Inhibitors = NFR magnitude < -0.1, NFR No Modulation = NFR magnitude –0.1 to 0.1, NFR Facilitation = NFR magnitude > 0.1
- Pain Inhibitors = Pain ratings < -2, Pain No Modulation = Pain ratings –2 to 2, Pain Facilitators = Pain ratings > 2

Anxiety Sensitivity Index—Revised (ASI-R)

- The ASI-R is a measure of fear of anxiety symptoms with four subscales: somatic symptom interpretation, fear of cognitive dyscontrol, fear of publicly displaying anxiety, and fear of cardiac symptoms of anxiety
- Participants completed the ASI-R during a battery of questionnaires gathered before physiological data recording

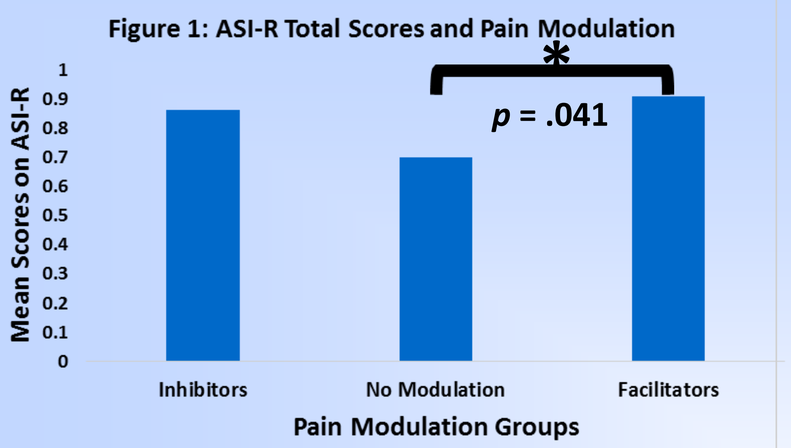
Emotional Controls of Nociception (ECON) Paradigm

- 8 pleasant, 8 neutral, and 8 unpleasant pictures were presented in random order
- Each picture was shown for 6 seconds with a 12-22 second inter-picture interval
- Participants received painful stimulations to the ankle during 50% of the pictures (balanced across picture contents) and during 6 inter-picture intervals
- After each stimulation, participants rated their experienced pain intensity on a visual analog scale (VAS, 0-100)

Attentional Modulation

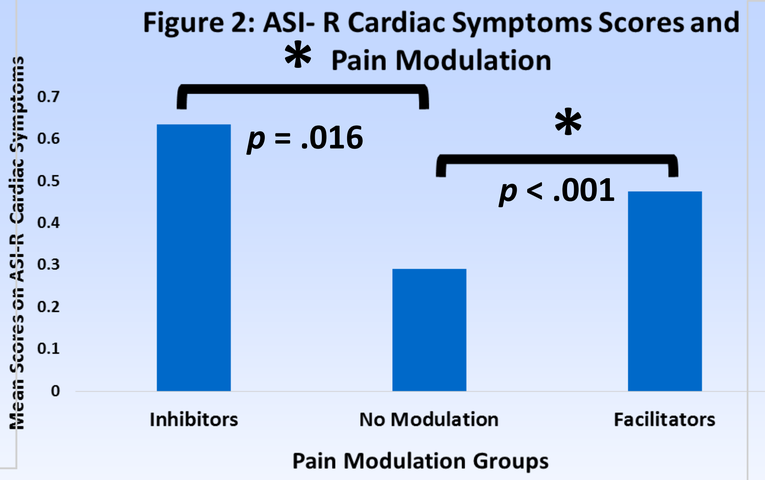
- For this study, attentional modulation was defined as the difference between pain/NFR evoked without pictures (no distractor) to those evoked during neutral pictures (distractor)

Figure 1: ASI-R Total Scores and Pain Modulation



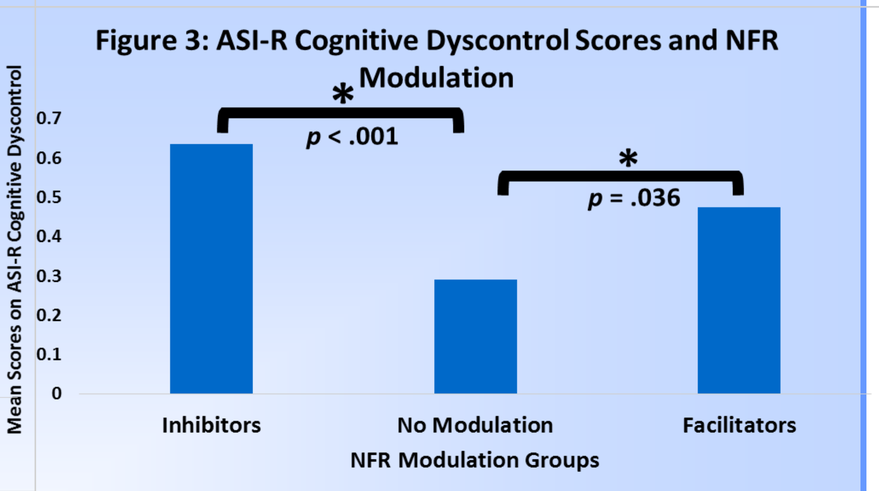
F(2, 235) = 3.49, *MSE* = 0.227, *p* = .032

Figure 2: ASI- R Cardiac Symptoms Scores and Pain Modulation



F(2, 235) = 7.82, *MSE* = 0.186, *p* = .001

Figure 3: ASI-R Cognitive Dyscontrol Scores and NFR Modulation



F(2, 232) = 10.32, *MSE* = 0.213, *p* < .001

Data Analysis

- Outliers on the ASI-R were identified through Wilcox's MAD-median and replaced with the nearest non-outlier neighbor value
- One-Way Analysis of Variance
  - Dependent Variables: ASI-R Total, Somatic Symptom Interpretation, Fear of Cognitive Dyscontrol, Fear of Publicly Displaying Anxiety, Fear of Cardiac Symptoms of Anxiety
  - Independent Variables: NFR/Pain modulation groups

Results

- In Figure 1, the "no pain modulation" group had lower anxiety sensitivity than the "facilitator" group
- In Figure 2, the "no pain modulation" group had less fear of cardiac symptoms of anxiety than the "inhibitor" or "facilitator" groups
- In Figure 3, the "no NFR modulation" group had less fear of cognitive dyscontrol related to anxiety than the "inhibitor" or "facilitator" groups

Conclusions

- The pain facilitation group exhibited greater anxiety sensitivity and fear of cardiac symptoms than the no pain modulation group
- The no NFR modulation group exhibited greater fear of cognitive dyscontrol than the NFR facilitation and inhibition groups
- Individuals with a fear of cardiac symptoms may facilitate pain during a neutral distractor, whereas individuals with a lower fear of cognitive dyscontrol may not modulate NFR during a neutral distractor
- Future studies are needed to examine the mechanisms for this disparity

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