Introduction

Pain catastrophizing is a maladaptive coping process associated with enhanced pain. However, the mechanisms explaining the catastrophizing and hyperalgesia relationship have yet to be established. One mechanism by which catastrophizing could enhance pain is heightened sympathetic arousal, because experimental evidence suggests sympathetic activation leads to hyperalgesia. The ratio of low frequency to high frequency (LF/HF) heart rate variability (HRV) can be used to assess the relative contribution of sympathetic control over cardiac function. Given this, the present study examined whether pain catastrophizing was associated with a tendency toward testing sympathetic activation, as measured from HRV.

Objectives
- The purpose of this study was to determine whether HRV contributes to the catastrophizing and hyperalgesia relationship.

Participants
- 178 Healthy Volunteers
  - Characteristics: female (61%), White non-Hispanic (71%), single (55%), and employed full-time (27%); average age = 36 yrs (SD=14)
- Exclusion Criteria:
  - < 18 years of age
  - Current acute illness
  - Cardiovascular, neurological, and/or circulatory problems
  - Recent use of anxiogenic, antidepressant, anxiolytic, or antidepressive medication
  - Recent psychological trauma
  - Specific phobia of snakes or spiders
  - Chronic pain condition
  - Raynaud's disease

Procedure
- Consent + Health screening = Electrode application
- Pain Catastrophizing Scale (PCS) Administration: Traditional catastrophizing instructions
- 5 min rest: Heart rate variability recording
- Emotional modulation of startle (data not relevant to present study)
- Nociceptive Flexion Reflex (NFR) and Pain Ratings
- Stimulating electrode in vastus lateralis
- NFR is a spinal reflex elicited by the activation of A-delta fibers
- NFR defined as biphasic femoral EMG activity in the 90-150 ms post-stimulus window
- NFR threshold correlates highly with pain threshold

Sensitivity
- Pain Threshold: Ascending series of .65 mA stimulations presented, threshold = first stimulus (in mA) rated ≥50 on rating scale
- Pain Tolerance: Ascending series continued until pain rating of 100 achieved or max intensity (40 mA) reached
- McGill Pain Questionnaire (MPQ): Self-report measure used to rate experience of pain during sensitivity testing. See subscales below:
  - NPS Sensory - reflects sensory aspect of pain experience (e.g., throbbing, burning)
  - MPQ Affective - reflects affective aspect of pain experience (e.g., tiring, fearful)
  - MPQ Visual Analog Scale (VAS) - Measure of overall intensity of total pain experience
- MPQ Present Pain Index (PPI) - Measure of current pain intensity during experimental procedure

Pain Data Analysis
- 13 item self-report measure that aims to determine the extent to which an individual engages in catastrophic or biased thinking by focusing on and exaggerating the effects of painful stimuli as well as negatively evaluating one's ability to deal with pain.
- Traditional catastrophizing instructions: "Please indicate the degree to which you have been thinking about your pain during the last week, using the scale below."
- Situation-specific catastrophizing instructions: "Thinking back to your experience during the last week, please rate the degree to which you thought about your pain during each of the following situations.

Heart Rate Variability
- LF/HF HRV reflects cardiac parasympathetic activity.
- HF HRV reflects cardiac parasympathetic activity.
- Ratio of LF/HF HRV is used to assess the sympathovagal balance, with higher values representing greater sympathetic activity.

Results
- NFR Window Baseline: NFR threshold correlates highly with pain threshold
- Pain Ratings made following each stimulation
- 90-150 ms post-stimulus window

Pain Sensitivity
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Conclusions
- LF/HF HRV was not correlated with pain catastrophizing and pain outcomes.
- Situation-specific pain catastrophizing was positively correlated with MPQ pain ratings.
- These findings suggest that individual differences in sympathetic control over cardiac activity does not contribute to the catastrophizing and hyperalgesia relationship, but future research is needed to determine whether the same holds true for persons suffering from chronic pain.

Table 1: Correlation Matrix

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*p < .05 (2-tailed); **p < .05 (2-tailed)

Note: LF/HF HRV = Ratio of low frequency-high frequency; MPQ = McGill Pain Questionnaire; PPI = Present Pain Index; PCS = Pain Catastrophizing Scale; SS = Situation specific.

* LF/HF HRV was not correlated with pain catastrophizing and pain outcomes.
* Situation-specific catastrophizing was positively correlated with MPQ pain ratings.
* These findings suggest that individual differences in sympathetic control over cardiac activity does not contribute to the catastrophizing and hyperalgesia relationship, but future research is needed to determine whether the same holds true for persons suffering from chronic pain.