State anxiety moderates the effects of paced breathing on pain perception, but not on spinal nociception


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Introduction
- Slow, paced breathing is often used as a strategy to cope with pain, but there are few well-controlled studies of its efficacy. Moreover, it is unclear whether variables such as state anxiety influence the relationship between paced breathing and pain. The present study assessed whether state anxiety moderated the effects of breathing rate (normal, slow, fast) on pain report and the nociceptive flexion reflex (NFR), a physiological correlate of spinal nociception.

Objective
- To assess whether state anxiety moderates the relationship between breathing rate and pain report as well the relationship between breathing rate and NFR

Exclusion Criteria:
- Pain report as well the relationship between breathing rate and NFR
- To assess whether state anxiety moderates the effects of breathing rate and pain report as well the relationship between breathing rate and NFR

Participants
- 30 Healthy Participants
- Participant Characteristics: white, non-Hispanic (80%); female (66%); employed fewer than 40 hours/week (57%); yrs of education = 15 (SD = 2); average age = 21 yrs (SD = 5.5)
- Exclusion Criteria:
  - <18 years of age
  - Respiratory problems
  - History of panic attacks
  - Current acute illness
  - Cardiovascular, neurological, or circulatory problems
  - Chronic pain condition (e.g., back pain)
  - Recent use of anesthetics, analgesic, and/or anesthetic medication
  - Recent psychological trauma
  - Body mass index > 35
  - Recent use of antidepressant, anxiolytic, and/or antihypertensive medication
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Measurement of Subjective Pain
- Participants rated survey questions regarding how they feel “right now” on a scale from 1 (not at all) to 4 (very much so)
- STAI scores were used to categorize participants into low vs. high anxiety groups based on a median split
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Experimental Procedure
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Breathing Manipulation
- Breathing was paced from a gauge that filled during inhales and emptied during exhalles (left)
- Respiration rate was verified with a respiration belt (right)

Nociceptive Flexion Reflex (NFR)
- NFR is a spinal reflex elicited by the activation of A-delta fibers
- NFR threshold correlates with pain threshold, NFR magnitude correlates with pain ratings
- NFR defined as biceps femoris EMG activity in the 90-150 ms post-stimulus interval

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Data Analysis
- Linear mixed model analyses were used
- STA1 scores were used to categorize participants into low vs. high anxiety groups based on a median split
- Anxiety groups did not differ in their normal breathing rate (Low=15.1 breath/min; High=14.8 breath/min; p = .787)

Results: Means and Standard Error of the Means
- Pain Ratings made after each stimulation
- Pain Threshold: stimulus level (in mA) rated ≥ 50

Results: Anxiety as Moderator
- Pain lower during slow compared to normal breathing in individuals with low anxiety (p < .02, d < .08). Fast and slow breathing did not differ.
- For persons with high anxiety, fast breathing increased pain relative to normal and slow breathing (p < .003, d=1.3)

Conclusions
- These results confirm prior studies indicating paced breathing modulates pain perception, but extends that research to suggest that slow breathing only reduces pain for persons with relatively low anxiety. By contrast, highly anxious individuals only benefit from avoiding fast breathing.
- Moreover, given that these effects were not observed for NFR, the modulation of pain by paced breathing does not involve descending brain-to-spinal cord circuitry.