Introduction

Pain catastrophizing is associated with enhanced pain outcomes, but little is known about whether the catastrophizing and pain relationship changes across the menstrual cycle. The present study assessed the relationship between (i.e., situation-specific) and trait (i.e., traditional) pain catastrophizing and pain sensitivity in healthy women during the mid-follicular, ovulatory, and late-luteal phases, which were verified by salivary sex hormone levels. Pain sensitivity was assessed from electric pain threshold/tolerance, nociceptive flexion reflex threshold (NFR; measure of spinal nociception), suprathreshold pain ratings, ischemia pain threshold/tolerance, and sensory and affective ratings of electric and ischemic stimuli. Trait catastrophizing was measured on a day prior to any laboratory pain testing, whereas state catastrophizing was assessed at each phase after delivery of electric stimuli.

Objective

To examine the relationship between pain catastrophizing and pain sensitivity (e.g., electric and ischemia pain threshold/tolerance, sensation/ affective pain ratings) across the menstrual cycle.

Participants

Healthy Female Participants: N = 54
- Participant Characteristics: White, non-Hispanic (85%), single (48%), employed (63%), age range = 29.06 years (SD = 8.21), average years of education = 15.4 (SD = 2.5), average menstrual cycle length = 30 days (SD = 4.05), average length of luteal phase = 15 days (SD = 3.11)
- Exclusion Criteria:
  - <18 yrs of age
  - Failure to regularly cycle within 2 months of study inclusion
  - Use of hormone preparations within past 6 months
  - Ménopause or post-ménopause
  - Cardiovascular, neurological, circulatory problems
  - Chronic pain condition (e.g., back pain)
  - Recent use of anxiolytic medication
  - Use of any anxiolytic, antidepressant, and/or antihypertensive medication

Procedure

- Tested during three phases: mid-follicular, ovulatory, and late-luteal
- Testing order was counterbalanced
- Menstrual phase and ovulation were verified via daily symptom diaries, international menopause assessment, and salivary estradiol and progesterone
- During each testing session:
  - Informed consent obtained
  - Restroom and stimulating electrodes applied
  - NFR threshold and pain threshold assessed by sending electrical stimulations to the left ankle over the sural nerve
  - Ischemia pain threshold and tolerance assessed

Methods: Electric Pain Sensitivity Assessment

- Stimulating electrodes were placed on the foot and lower leg
- NFR Window
- Nociceptive Flexion Reflex (NFR): A spinally mediated protective withdraw reflex elicited by Aδ fiber activation mediated protective withdrawal reflex elicited by Aδ fiber activation
- NFR Threshold: Ischemia pain. EEG activity in the 50-150 ms post-stimulus window
- Stimulus intensity (mA) required to reliably elicit NFR
- Correlates with pain threshold
- Pain threshold: Stimulus intensity (mA) at which pain was first experienced (rated ≥ 50 on the NRS)
- Pain Tolerance: Stimulus intensity (mA) that participant rated as 100 on the NRS, or 50 mA maximum

Ischemia Pain Threshold/Tolerance

- Procedure:
  - 2 minutes of hand exercises at 50% maximum grip strength
  - 15 sec. of arm elevation for esangulation
  - Micromass pressure cuff inflated to 220 mmHg
  - Arm lowered and blood pressure cuff left inflated until participant reached maximum tolerance
  - Pain was rated continuously
- Ischemic Pain Threshold: Time (in seconds) when participant first indicated ischemia as being painful (>50) on the NRS
- Ischemic Pain Tolerance: Time (in seconds) when participant indicated ischemia pain threshold as 100 (or >50) on the NRS

McGill Pain Questionnaire Ratings

- MPQ Sensory—reflects sensory aspect of pain experience (e.g., throbbing, burning)
- MPQ Affective—reflects affective aspect of pain experience (e.g., tiring, fearful)
- Questionnaire administered following electric and ischemic pain stimulus procedures

Results: Behavioral Pain Measures

- Ischemic Pain Threshold: Time (in seconds) when participant indicated ischemia pain threshold as 100 (or >50) on the NRS
- Ischemic Pain Tolerance: Time (in seconds) when participant indicated ischemia pain threshold as 100 (or >50) on the NRS

Results: McGill Pain Questionnaire

- Item (Cats.): Trait Catastrophizing; SS = Situation-Specific (State) Catastrophizing
- Trait pain catastrophizing had a negative relationship with NFR Threshold during the late-luteal phase and the mid-luteal phases, but less so during ovulation
- Trait catastrophizing had a stronger positive relationship with suprathreshold ratings during the early-follicular phases than during the late-follicular and late-luteal phases
- Trait catastrophizing had a stronger positive relationship with suprathreshold ratings during the mid-luteal phase compared to the late-luteal and mid-follicular phases

Results: Sensory & Affective Pain Ratings

- (A) State catastrophizing was positively related to electric sensory, ischemic sensory, and nociceptive pain ratings, but this relationship was stronger during ovulation than the mid-follicular and late-luteal phases
- (B) State catastrophizing was positively related to electric affective ratings, but the relationship was stronger during ovulation than the mid-follicular and late-luteal phases
- (C) State catastrophizing was positively related to ischemia affect ratings, but this relationship did not significantly vary by menstrual phase
- (D) There was a positive relationship between trait catastrophizing and ischemia affect ratings except during the ovulation phase

Conclusions

- State catastrophizing had a negative relationship with NFR Threshold during the luteal phase and the mid-luteal phases, but less so during ovulation
- Trait catastrophizing had a stronger negative relationship with NFR Threshold during the ovulation phase than both the late-luteal and mid-follicular phase
- Trait catastrophizing had a stronger positive relationship with suprathreshold ratings during the mid-luteal phase compared to the late-luteal and mid-follicular phases

- In addition, some relationships were moderated by menstrual cycle phase

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