The Influence of the Menstrual Cycle on Spinal Nociceptive Processes and Pain Perception

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Introduction

Research suggests pain perception is influenced by the menstrual cycle, with pain being generally enhanced during the luteal (premenstrual) phase. At this time, however, it is unclear how menstrual phase influences pain. For example, it is unknown whether the menstrual cycle exerts influence at spinal or supraspinal levels, or whether the relationship between spinal and supraspinal nociception is altered. To examine these issues, healthy women were tested during the follicular and luteal phases of the menstrual cycle. Spinal nociceptive processing was assessed from the nociceptive flexion reflex (NFR), a spinal reflex elicited by activation of A-delta fibers. Pain perception was also assessed at each testing session from electrocutaneous pain threshold, electrocutaneous pain tolerance, and pain ratings of suprathreshold electric stimuli.

Objective

To determine if menstrual cycle phase influences spinal nociceptive processes, pain perception, and/or the relationship between spinal nociceptive processes and pain perception

Participants

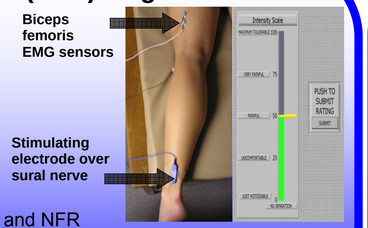
- Healthy Female Participants: *N* = 41
  - Participant Characteristics: White, non-Hispanic (71%); married (73%); employed full-time (56%); yrs of education = 15 (*SD* = 1.79); average age = 31.00 yrs (*SD* = 8.86)
- Exclusion Criteria:
  - <18 years of age
  - Failure to regularly cycle within 2 months of study inclusion
  - Use of hormone preparations within past 6 months
  - Pregnant within past 6 months
  - Menopausal or post-menopausal
  - Current acute illness
  - Cardiovascular, neurological, circulatory, and/or hearing problems
  - Chronic pain condition (e.g., back pain)
  - Recent use of analgesic medication
  - Current use of anxiolytic and/or antihypertensive medication
  - Recent psychological trauma

Procedure

- Data are taken from a larger study examining the relationship between the menstrual cycle and pain sensitivity, physiological pain processing, and the emotional modulation of pain
- Participants went through a testing session on two different occasions, once during the follicular and once during the luteal phase of their menstrual cycle, with starting phase counterbalanced across participants
- During the testing session, participants went through a variety of pain procedures, including pressure pain assessment, NFR threshold assessment, emotional controls of nociception, electrocutaneous pain threshold and tolerance, and ischemic pain threshold and tolerance
- Data presented here are taken from the NFR threshold assessment and electrocutaneous pain threshold and tolerance

Nociceptive Flexion Reflex (NFR) Magnitude

Baseline NFR Window

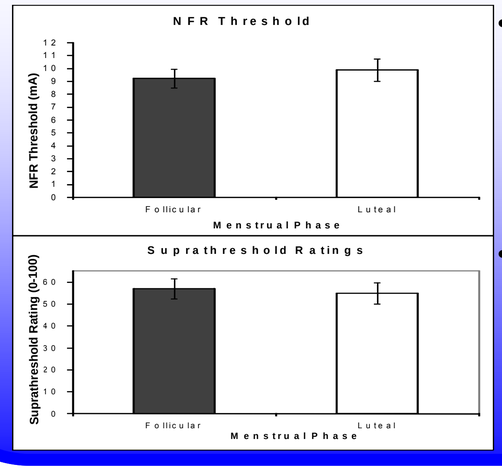


Biceps femoris EMG sensors

Stimulating electrode over sural nerve

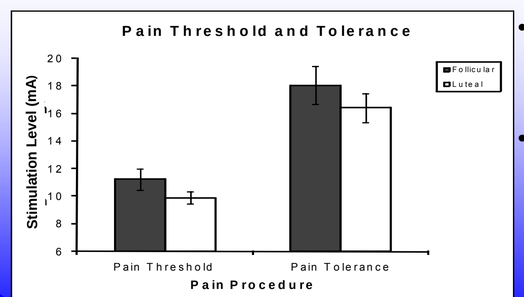
- NFR is a spinally-mediated protective withdrawal reflex elicited by Aδ fiber activation, and NFR magnitude correlates with pain ratings
- **NFR magnitude** = mean of biceps femoris EMG in 90-150 ms post-stimulus interval minus mean of 60 ms pre-stimulus interval, divided by the pooled standard deviation (Cohen's *d* value)
- **Pain Ratings made following each stimulation**

Results: NFR Threshold & Suprathreshold Pain Ratings



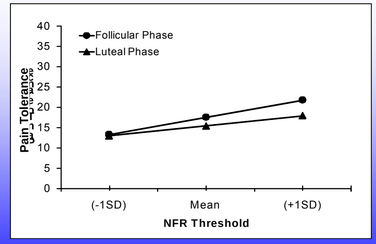
- Main effect of menstrual phase not significant (*F*[1, 29] = .27, *p* = .61) for NFR threshold
- Main effect of menstrual phase not significant (*F*[1, 34] = .52, *p* = .48) for suprathreshold ratings

Results: Pain Threshold & Tolerance



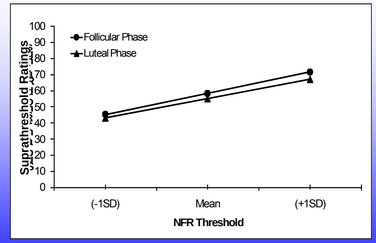
- Main effect of menstrual phase significant (*F*[1, 33] = 5.03, *p* < .05) for pain threshold
- Main effect of menstrual phase significant (*F*[1, 29] = 4.50, *p* < .05) for pain tolerance

Results: NFR Threshold & Pain Tolerance



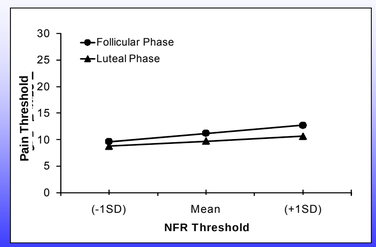
- NFR threshold significantly predicted pain tolerance (*F*[1,61] = 17.60, *p* < .001)
- Menstrual phase did not moderate the relationship between NFR and pain tolerance (*F*[1,42] = 2.31, *p* = .14)

Results: NFR Threshold & Suprathreshold Pain Ratings



- NFR threshold significantly predicted pain ratings (*F*[1,68] = 9.46, *p* < .01)
- Menstrual phase did not moderate the relationship between NFR and suprathreshold ratings (*F*[1,53 = .05, *p* = .82)

Results: NFR Threshold & Pain Threshold



- NFR threshold significantly predicted pain threshold (*F*[1,66] = 6.36, *p* = .01)
- Menstrual phase did not moderate the relationship between NFR and pain threshold (*F*[1,50] = .68, *p* = .41)

Conclusions

- Results indicated NFR threshold and suprathreshold pain ratings were not influenced by menstrual phase, but pain threshold and tolerance were lower during the luteal phase
- NFR threshold was a significant predictor of all measures of pain perception, but menstrual phase did not moderate the relationship between NFR and pain
- Thus, menstrual phase appears to influence pain perception without altering spinal nociception or the relationship between spinal nociception and pain