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The effect of high versus low cognitive load on the development of nociceptive hypersensitivity: The roles of sympathetic arousal, sex and pain-related fear
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Abstract
Background: According to limited-capacity theories of attention, less attentional resources remain available when engaging in a high- versus a low-demanding cognitive task. This may reduce the perceived intensity and the evoked cortical responses of concomitant nociceptive stimuli. Whether and how the competition for limited attentional resources between a cognitive task and pain impacts the development of long-lasting hypersensitivity is unclear. Methods: Eighty-four healthy participants were randomized into a low or high cognitive load group. Low-frequency electrical stimulation (LFS) of the skin was used to induce secondary hypersensitivity. We hypothesized that performing the high-load task during LFS would reduce the development of hypersensitivity. We examined whether painfulness, nonpain-related sympathetic arousal, or sex related to hypersensitivity, by assessing intensity and unpleasantness of mechanical pinprick stimulation. During task execution, we recorded steady-state evoked potentials evoked by LFS and skin conductance level for sympathetic arousal. Afterwards, participants reported task difficulty and LFS-related fear. For the primary outcomes, we used mixed analysis of variances. Results: The results confirmed the difference in cognitive load. Although LFS successfully induced hypersensitivity, the high-load task did not reduce its development. Next, the steady-state evoked potentials did not differ between groups. Hypersensitivity correlated positively with pain-related fear and negatively with skin conductance level before LFS, despite the lack of group differences in skin conductance level. We did not find any sex differences in hypersensitivity. Conclusions: These results do not confirm that high cognitive load or sex modulate hypersensitivity, but show associations with pain-related fear and non-pain-related sympathetic arousal. Significance: Previous research has mainly focused on cognitive load effects on the perception of acute painful stimuli. Yet this study extends our understanding by investigating cognitive load effects on the development of long-lasting secondary hypersensitivity, a common aspect in numerous persistent pain conditions. As cognitive tasks are presented during a painful procedure inducing secondary hypersensitivity, we test the long-lasting effects of cognitive load. Additionally, we used psychophysiological measurements to explore potential underlying mechanisms involving limited attentional resources and sympathetic arousal. © 2023 European Pain Federation - EFIC ®.

Index Keywords
adult, arousal, Article, cognition, cognitive load, continuous electroencephalography, electrostimulation, evoked response, fear, female, human, human experiment, male, mechanical hypersensitivity, mechanical stimulation, nociceptive pain, nociceptive stimulation, normal human, pain intensity, pinprick test, sex difference, skin conductance, skin stimulation, sympathetic nerve, task performance, working memory

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