

Sex Differences in How the Body Reduces Pain

Meditation for pain relief may work differently in females and males, suggesting different approaches to treating pain depending on sex.

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Pain—and how well pain treatments work—differs between the sexes. Females are more likely to experience chronic pain than males. Studies have also shown that opioid painkillers are less effective in females.

Several systems inside the body contribute to the perception of pain and the response to pain treatments. One of the most important is called the endogenous opioid system. It naturally produces chemicals that reduce pain. Opioid-based medications work by tapping into this system.

To better understand whether sex-based differences in the endogenous opioid response contribute to differences in pain, researchers led by Dr. Fadel Zeidan from the University of California, San Diego analyzed data previously collected in two small, NIH-funded clinical trials. Both trials tested whether an endogenous opioid response was required for people to feel pain reduction during meditation. Past studies had shown that meditation techniques can help reduce some types of pain, including back pain, for some people.

One of the trials enrolled people with chronic back pain. The other enrolled people without chronic pain of any kind. A total of 98 people—51 females and 47 males—participated in the studies. In both trials, the researchers randomly assigned participants to learn either mindfulness meditation or another meditation technique that didn't focus on mindfulness. The volunteers then practiced their meditation during exposure to a painful but harmless heat source on their leg over two sessions.

After the participants underwent pain exposure, they randomly received either an infusion of the drug naloxone, which blocks the endogenous opioid system, or saline. They then underwent pain exposure again while practicing their meditation techniques.

All participants received both infusions over the two sessions without knowing which was which. They reported their levels of pain before and after the infusions. In the new study, Zeidan and his colleagues looked at whether changes in pain during meditation differed between the sexes. Results appeared on October 14, 2024, in [PNAS Nexus](#).

For males and females, both types of meditation significantly lowered levels of pain during saline infusion. However, in males, the pain relief from meditation disappeared when they received naloxone. This shows that the endogenous opioid system mediates the effects of meditation on pain in males.

In contrast, females had no substantial drop in pain relief during meditation when they received naloxone. This suggests that a different mechanism is responsible for controlling pain relief in females.

“There are clear disparities in how pain is managed between men and women, but we haven’t seen a clear biological difference in the use of their endogenous systems before now,” Zeidan says. “This study provides the first clear evidence that sex-based differences in pain processing are real and need to be taken more seriously when developing and prescribing treatment for pain.”

More studies are needed to directly measure sex differences for other pain-reduction strategies.

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