

# Neurophysiological Mechanisms Supporting Mindfulness Meditation–Based Pain Relief: an Updated Review

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## ABSTRACT

This review looks at recent neuroscientific discoveries on how mindfulness alleviates pain. It's found that mindfulness reduces pain using brain processes that are unique and change with the level of meditative training. Neuroimaging studies confirm that mindfulness consistently lessens both experimental and clinical pain through various, unique, non-opioidergic mechanisms. These results highlight the potential of mindfulness techniques to provide lasting relief in pain symptoms.

## Shortcomings of Pharmacological Pain Therapies

Recent evidence suggests opioid treatments may worsen chronic pain and carry significant risks. Alternative chronic pain treatments, like spinal cord stimulation, have limitations. Consequently, therapies incorporating contemplative practices, aiming to strengthen self-regulation and address root causes of pain, are emerging. Mindfulness meditation, in particular, has been shown to reduce affective pain by focusing on real-time self-awareness, offering a promising approach.

## Neurophysiology and Non-pharmacological Pain Modulation

Pain is processed and adjusted through complex interactions involving peripheral sensory pathways, spinal cord, and brain areas. This pain information is refined in the brain, adding context. Cognitive techniques, like altering mood, adjusting expectations, and focusing attention, can mitigate pain through a shared inhibitory mechanism. While many treatments involve activating the brain's descending pain control, mindfulness meditation might work differently, bypassing certain traditional pathways.

## Mindfulness and Mindfulness-Based Therapies

Mindfulness meditation, with roots in ancient Southeast Asia, emphasizes present-moment awareness. Various mindfulness-based therapies, like MBSR, have demonstrated significant benefits in health conditions, particularly in alleviating pain-related symptoms. These practices effectively address emotional facets of pain, promoting enhanced pain acceptance, reduced stress, and diminished depression. The precise neural underpinnings of these benefits are still being researched.

## Therapeutic Usefulness and Benefits

Mindfulness-based therapies have shown promising results in addressing chronic pain. Studies indicate that such therapies not only alleviate pain but also mitigate factors causing opioid-treated patients to develop opioid use disorder. This therapeutic approach might help address the ongoing opioid crisis by reducing patients' dependence on opioids for pain management. Mindfulness interventions modify how pain is perceived, turning it into neutral sensory information. While the underlying neural mechanisms of these benefits are still under investigation, early findings are encouraging. The neuroscience of mindfulness in pain management is still evolving, but its potential in providing a holistic approach to tackle both the physical and psychological aspects of pain is evident.

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