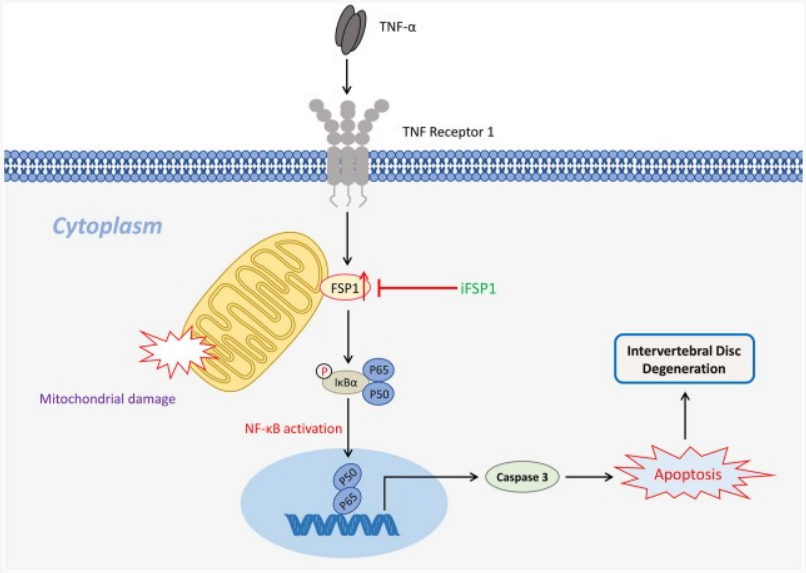
New study reveals key protein's role in spinal disc degeneration

GA, UNITED STATES, March 24, 2025 /EINPresswire.com/ -- A recent study has unveiled the pivotal role of Ferroptosis Suppressor Protein 1 (FSP1) in intervertebral disc degeneration (IDD), a primary cause of chronic lower back pain. Researchers discovered that FSP1, when upregulated by the inflammatory cytokine TNFα, accelerates disc degeneration through caspase 3-dependent apoptosis and mitochondrial damage. This finding positions FSP1 as a promising therapeutic target for IDD, potentially offering relief to millions suffering from persistent back pain.



The schematic depicting a proposed model for the function of ferroptosis suppressor protein 1 (FSP1) in intervertebral disc degeneration.

Lower back pain is a global health crisis, impacting more than 70% of individuals at some point in their lives. Intervertebral disc degeneration (IDD) is a major contributor to this widespread issue, marked by the deterioration of spinal discs, which leads to chronic pain and disability. Despite its high prevalence, the molecular mechanisms driving IDD are still not well understood. Chronic inflammation, particularly involving the cytokine TNFα, has been linked to disc degeneration, but the exact molecular pathways remain unclear. Given these challenges, there is an urgent need to explore the underlying mechanisms of IDD to uncover effective treatments.

Published (DOI: 10.1016/j.gendis.2024.101251) on February 28, 2024, in Genes & Diseases, researchers from Shandong University and their collaborators have identified Ferroptosis Suppressor Protein 1 (FSP1) as a central factor in intervertebral disc degeneration. The study demonstrates that TNFα upregulates FSP1, which in turn drives disc degeneration via caspase 3-dependent apoptosis and mitochondrial dysfunction. This new insight into the molecular pathways of IDD highlights the potential of targeting FSP1 as a strategy to slow or even reverse disc degeneration and the chronic pain it causes.

The study reveals that FSP1 is significantly upregulated in degenerative human nucleus pulposus (NP) tissues and rat NP cells exposed to TNFα. Using advanced RNA sequencing and various experimental approaches, the researchers found that inhibiting FSP1 reduces TNFα-mediated apoptosis and mitochondrial damage. This suggests that FSP1 is a key mediator in the inflammatory pathway that drives disc degeneration. Surprisingly, although FSP1 is traditionally known as a ferroptosis suppressor, its involvement in apoptosis within the context of IDD was previously unexplored. The study also showed that inhibiting FSP1 does not trigger ferroptosis in NP cells, indicating its role in IDD is primarily through regulating apoptosis. These findings provide a novel and crucial insight into the mechanisms of disc degeneration.

“This study provides a crucial understanding of how FSP1 contributes to intervertebral disc degeneration through TNFα-mediated apoptosis,” said Dr. Xinyu Liu, the corresponding author of the study. “Our findings suggest that targeting FSP1 could be a promising strategy to alleviate chronic back pain and improve the quality of life for millions of patients worldwide.”

The discovery of FSP1's role in IDD paves the way for innovative therapeutic approaches. Targeting FSP1 could lead to the development of drugs that inhibit its activity, potentially reducing inflammation and apoptosis in intervertebral discs. This could offer more effective treatments for chronic back pain, reducing the need for invasive surgeries and long-term pain management strategies. Furthermore, a deeper understanding of FSP1’s molecular role could facilitate the development of personalized medicine, tailoring treatments to individual patients based on their specific inflammatory and degenerative profiles. This research marks a significant step forward in IDD science and offers promising prospects for more targeted, effective therapies in the future.

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