

# Strength training protects against muscle pain by activating androgen receptors

March 31 2022

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Resistance or strength training protects against the development of muscle pain in mice—and does so by activating androgen receptors, reports a basic science study in *PAIN*, the official publication of the

International Association for the Study of Pain (IASP).

The study supports the role of testosterone and male sex hormone (androgen) receptors in preventing or relieving muscle pain in response to resistance training, according to the report by Kathleen A. Sluka, PT, Ph.D., FAPTA, and colleagues of The University of Iowa, Iowa City. "This information provides a scientific basis for the use of [strength training](#) as a therapeutic tool clinically for individuals with [chronic musculoskeletal pain](#)," the researchers write.

## **Testosterone mediates benefits of exercise on muscle pain**

Exercise is commonly prescribed for patients with many types of chronic pain, such as [low back pain](#), osteoarthritis, and fibromyalgia. Although many studies have examined the analgesic effects of exercise, less is known about how resistance training affects musculoskeletal pain. Previous studies by the same research group found that testosterone protects against the development of increased pain (hyperalgesia).

Graduate student Joseph Lesnak, PT, designed a new model to assess the effects of resistance training on muscle pain in mice. Strength training is a commonly used treatment by physical therapy clinicians for management of pain. In the experimental setup, mice climbed a ladder with small weights gently attached to their tails.

Tests confirmed that ladder-climbing was an effective form of resistance training, resulting in increased strength of the front paws. Activity-induced muscle pain was induced in some groups of mice by injection of a mild acid solution. The goal was to evaluate how resistance training affected the development of musculoskeletal pain, including the effects of testosterone levels and androgen receptors.

"Eight weeks of resistance training prior to induction of the pain model blocked the development of muscle pain in both male and female mice," Dr. Sluka and coauthors write. However, once muscle pain was established, the ladder-climbing exercise alleviated pain only in male mice. Exercise also led to short-term increases in testosterone in male mice, but not females.

To confirm the effects of testosterone on muscle pain, the researchers performed further experiments using an [androgen receptor](#)- blocking drug. Animals that received the androgen blocker during resistance training did not develop the protective effect against muscle pain. Once the exercise-induced protective effect was present, it was unaffected by the androgen blocker.

"These data suggest that activation of [androgen receptors](#) is required for the protection against activity-induced muscle pain that is produced by the resistance training program," the researchers write. The findings in their [animal model](#) may provide useful insights into the use of exercise as a treatment for chronic pain.

"Since both aerobic and resistance training-based exercise produce analgesia, clinicians may want to consider patient preferences when prescribing exercise modes," Dr. Sluka and colleagues write. The analgesic effect appears to be systemic, suggesting that strength training does not need to be targeted at the painful muscles for therapeutic benefits.

The results also suggest that [resistance training](#) will be more effective in preventing [muscle pain](#), rather than alleviating it. "This suggests that exercise should be continued in the absence of symptoms to prevent against future development of musculoskeletal pain," the researchers conclude.

**More information:** Joseph B. Lesnak et al, Resistance training protects against muscle pain through activation of androgen receptors in male and female mice, *PAIN* (2022). [DOI: 10.1097/j.pain.0000000000002638](https://doi.org/10.1097/j.pain.0000000000002638)

Provided by Wolters Kluwer Health

Citation: Strength training protects against muscle pain by activating androgen receptors (2022, March 31) retrieved 31 January 2024 from <https://medicalxpress.com/news/2022-03-strength-muscle-pain-androgen-receptors.html>

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