

Exercise can modify fat tissue in ways that improve health—even without weight loss

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Exercise is one of the first strategies used to treat obesity-related health problems like type 2 diabetes and other cardiovascular disease, but scientists don't understand exactly how it works to improve metabolic

health.

To that end, University of Michigan researchers examined the effects of three months of exercise on people with obesity, and found that exercise can favorably modify abdominal subcutaneous adipose tissue, the fat tissue just beneath the skin, in ways that can improve metabolic health—even without weight loss.

Surprisingly, moderate and high-intensity exercise yielded the same positive changes in fat tissue composition and structure, and [fat cells](#) shrank a bit even without weight loss, said principal investigator Jeffrey Horowitz, U-M professor of kinesiology.

The findings appear in *The Journal of Physiology*. Co-first authors are U-M doctoral student Cheehoon Ahn and Ben Ryan, U-M postdoctoral research fellow now at the U.S. Army Research Institute of Environmental Medicine.

Exercise changed how fat tissue looks and behaves

The study aimed to better understand the effects of exercise on metabolic health in people with obesity. Thirty-six adults with obesity were placed into either a moderate-intensity exercise group (45 minutes, 70% of maximum heart rate) or a high-intensity exercise group (10 one-minute intervals at 90% [maximum heart rate](#) interspersed with 60 seconds of low-intensity active recovery).

Blood samples and biopsies of abdominal fat were collected the day after the 12-week sessions ended and again three days later. There was no exercise between these tests. Results for both exercise groups showed several structural changes in fat tissue, including slightly smaller fat cells and more of them, increased collagen type, increased capillary density, and changes in proteins that regulate body fat remodeling.

Horowitz said many of the changes in factors regulating body fat remodeling seen one day after exercise were no longer significant on day 4 of testing, and this underscores the importance of regular, sustained exercise.

Improvements disappeared when exercise stopped

Many adaptations to exercise training are effective in enabling a person to exercise longer or harder, Horowitz said.

"However, most of the benefits of exercise that improve metabolic health in people at risk for metabolic health complications or those who have metabolic disease stems from the response to each exercise session—and these responses to exercise are relatively short-lived, often lasting only a few days at most," he said. "This is one of the big reasons why it is so important to be physically active most days."

The finding about moderate and [high-intensity exercise](#) yielding similar responses could be good news for people who prefer to avoid the more demanding high-intensity interval training, or HIIT.

Moderate exercise just as beneficial as HIIT

"Our findings suggest that options are open," Horowitz said. "The similar response between HIIT and more conventional moderate-intensity exercise was among the bigger surprises to us. It is impressive that we observed very similar responses despite rather large differences in the exercise stimulus (exercise time, kcals expended, intensity) between these two training programs."

While the findings aren't related to [weight loss](#), they are related to metabolic health and [disease prevention](#) in people with obesity, and these in turn impact quality of life, Horowitz said.

"Even though some of our favorable outcomes were relatively short-lived, some are longer lasting, like capillary density of fat tissue and fat cell structure," he said. "Therefore, we hypothesize that a physically active lifestyle may help protect people from developing some chronic [metabolic health](#) complications if or when they do gain weight as they age, and evidence strongly indicates that most of us, even regular exercisers, gain weight as we age."

Horowitz said it's important for people to understand that fat tissue is simply where our bodies store extra energy, and it's not the reason people gain weight.

"Weight gain can only occur if you eat more calories than you expend. And in situations when we do gain weight, especially to the point where people are approaching or become obese, it is ideal to have so-called healthy fat tissue in which to store this extra energy."

Several of the lab's recent studies, and a new five-year project launching soon, focus on understanding how [exercise](#) may favorably impact [fat tissue](#) in ways to make it a safer haven in which to store fat, if and when people experience [weight gain](#) or weight regain.

More information: Cheehoon Ahn et al, Exercise training remodels subcutaneous adipose tissue in adults with obesity even without weight loss, *The Journal of Physiology* (2022). [DOI: 10.1113/JP282371](https://doi.org/10.1113/JP282371)

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