

High intensity interval training can reverse frailty at advanced age, preclinical study finds

August 4 2017, by Ellen Goldbaum



Credit: University at Buffalo

Growing older may not have to mean growing frail. A preclinical study has revealed that brief periods of intense physical activity can be safely administered at advanced age, and that this kind of activity has the potential to reverse frailty.

Published in the *Journal of Gerontology A* in June by University at

Buffalo researchers, the study is the first to investigate whether a novel, short-session regimen of high-intensity interval training (HIIT) can be safe and effective in older populations.

The study was conducted on two groups of a dozen [mice](#), each 24 months old, which correlates roughly to 65 years old in human terms. All the mice had been sedentary up until that age. While cautioning that the study was done in mice, the authors state that the results could have significant application to humans.

"We know that being frail or being at risk for becoming frail puts people at increased risk of dying and comorbidity," said Bruce R. Troen, MD, senior author on the study with Kenneth L. Seldeen, PhD, who is first author.

Troen is professor and chief of the Division of Geriatrics and Palliative Medicine in the Department of Medicine, Jacobs School of Medicine and Biomedical Sciences at UB, a geriatrician with UBMD Internal Medicine, and a physician-investigator with the Veterans Affairs Western New York Health Care System. Seldeen is research assistant professor of medicine at UB.

"These results show that it's possible that high-intensity interval training can help enhance quality of life and capacity to be healthy," Troen said.

The results were striking with mice exhibiting "dramatic" improvements in numerous measurements, including strength and physical performance.

No longer frail

One of the most significant findings was that by the end of the study, five of six mice found to be frail or pre-frail at baseline improved, and

four were no longer frail.

"Those four mice who had exhibited the kinds of deficits that correlate to frailty in humans improved to a completely robust level," said Troen. "The HIIT actually reversed frailty in them."

Troen and Seldeen developed mouse equivalents for measures that assess human frailty, including ways to evaluate [grip strength](#), endurance and gait speed, so that they could establish baseline levels and then compare those with results once the study was complete.

"Because the performance measures for the mice are directly relevant to clinical parameters, we think this program of exercise is quite applicable to humans," said Troen. "We're laying a foundation so we can do this in people and so we can understand how to tailor it to individuals so they can successfully implement this."

Similar to the way that an athletic trainer might individualize a fitness program for a client, Troen and Seldeen tailored intensity levels to each mouse.

"While the mice are genetically identical, they aren't phenotypically identical," Seldeen explained, "so we customized the exercise program to each mouse, first finding out what each one was capable of at baseline, and then increasing or decreasing the intensity depending on the performance of the mouse during the study."

HIIT was well-tolerated

The 10-minute exercise program involved a three-minute warm-up, three intervals of one minute of high intensity and one minute at lower intensity, and a final minute of higher intensity on an inclined treadmill. The exercises were done three times a week over 16 weeks. All exercises

were well-tolerated by the mice.

There were dramatic improvements in grip strength, treadmill endurance and gait speed. The mice showed greater muscle mass and an increase in total mitochondria, the energy factories of cells.

"Increased mitochondrial biomass allows you to utilize oxygen more efficiency," Troen explained. "With HIIT, we saw both mitochondrial increase and an improvement in muscle quality and fiber size in these mice."

As to why HIIT results in such significant benefits to those who engage in it, Troen said that it has to do with the stress to which it subjects the body.

"Exercise stresses the system and the body can respond beneficially," he explained. "We believe that the intensity of individualized HIIT provides a more significant but manageable stress so the body responds more robustly to these short, vigorous periods of exercise.

"In other words, you get more bang for your buck."

Troen and Seldeen cautioned that anyone considering HIIT should check with their physician first.

Provided by University at Buffalo

Citation: High intensity interval training can reverse frailty at advanced age, preclinical study finds (2017, August 4) retrieved 24 April 2024 from <https://medicalxpress.com/news/2017-08-high-intensity-interval-reverse-frailty.html>

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