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Acceleration-based training: A new mode of training in senescent rats improving performance and left ventricular and muscle funcitons

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Abstract:

High intensity training (HIT) has been shown to improve maximal aerobic capacity and muscle protein synthesis but has not yet been investigated in senescent rats. We hypothesized that the change of speed (acceleration) during each bout of HIT acts as a stimulus responsible for the adaptations of the organism to exercise. Twenty two month-old (mo) rats (n = 13) were subjected to a short acceleration protocol (20–30 min) of exercise, comprising 3 independent bouts of acceleration and compared to an age-matched sedentary group (n = 14). The protocol was repeated twice a week for two months. Following the protocol, performance, cardiac function, muscle mechanics, and the cellular and molecular pathways that are implicated in exercise adaptations were investigated. This new training, comprising only 16 sessions, improved maximal oxygen uptake ($\dot{V}O_{2peak}$; + 6.6%, $p < 0.05$), running distance (+ 95.2%; $p < 0.001$), speed (+ 29.7%; $p < 0.01$) and muscle function of 24 mo rats in only 8 weeks. This new training protocol induced cardiac hypertrophy and improved fractional shortening (47.3% *vs.* 41.1% in the control group, $p < 0.01$) and ejection fraction. Moreover, it also improved the mechanics of skeletal muscle by increasing developed force (+ 31% *vs.* the control group, $p < 0.05$) and maximal mechanical efficiency, activated the IGF1/mTOR/Akt pathway, and reduced the Smad2/3 pathway. Our results clearly show that the change in speed is a stimulus to control cardiac and skeletal muscle mass. This acceleration-based training is not time-consuming and may be adaptable for athletes, the elderly or chronic disease patients in order to improve strength, oxidative capacity, and quality of life.

Full text:
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