Inflammatory Mechanisms in Sarcopenia: The unknown benefits of exercise training

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Reactive oxygen species (ROS) are generated through the combined actions of environmental pollutants, cellular stress, mitochondrial dysfunction and oxidative metabolism. ROS, along with metabolic intermediates of both glucose and lipid metabolism, activate inflammatory reactions that signal catabolic pathways linked to muscle atrophy. These inflammatory reactions involve the production of cytokines and acute-phase proteins. The elevated concentration of these inflammatory mediators in the circulation in elderly people has been termed “inflamm-aging”. These inflammatory factors both promote further catabolism and significantly impair anabolic responses, thus limiting protein synthesis. Exercise is a potent activator of stress and inflammatory responses in skeletal muscle. This acute response, unlike chronic inflammation associated with age-ing, is a necessary for remodelling and protein synthesis following exercise. Surprisingly few studies have examined how age influences stress responses to exercise, or the adaptation that occurs with regular exercise (training). In a study comparing the cytokines generated within the skeletal muscle of young and elderly men, our preliminary data demonstrates no greater gene and protein expression of potent inflammatory cytokines, including Interleukin-6 (IL-6), Interleukin-8 (IL-8) and Monocyte Chemotactic Protein 1 (MCP-1) in the resting state. Furthermore, somewhat surprisingly, the response to acute resistance exercise appeared greater in the older subjects, suggesting a heightened responsiveness. Following 12 weeks of progressive strength training, the inflammatory response during exercise recovery was similar in elderly men compared with the young men. Thus elderly individuals appear not to have greater basal skeletal muscle cytokine concentrations, nor do they have a diminished response to resistance exercise. Further analysis of localisation and actions of cytokines on both regenerative and catabolic pathways are required. Importantly, inflammation and ROS-mediated damage are significant components of the muscle loss experienced in advanced age. However, the insights into which catabolic factors are significant, and how they are regulated, is lacking.