Effects of exercise training on mitochondrial content and dynamics

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Mitochondrial dynamics proteins are critical for mitochondrial turnover and maintenance of mitochondrial health. Examination of whole skeletal muscle homogenates from younger (18-30 years old) and older (68-73 years old) healthy adults found no difference in mitochondrial content as measured by citrate synthase activity and the abundance of mitochondrial respiratory complex proteins, cytochrome oxidase IV (COXIV) and NADH:ubiquinone oxidoreductase subunit A9 (NDUFA9). Interestingly, there was an increase in the abundances of the mitochondrial dynamics proteins, mitofusin-2 (Mfn2) and mitochondrial dynamics protein 49 (MiD49) in muscle from older compared with younger adults. We hypothesized that the increased abundance of the mitochondrial dynamics protein were a protective mechanism in the muscle from older adults and that muscle health could be preserved with exercise training, which would result in a downregulation of Mfn2 and MiD49 protein contents. High-Intensity Interval Training (HIT) is a potent training modality and in both young and older adults. HIT in both younger and older adults resulted in mitochondrial adaptations, with increases in citrate synthase activity and mitochondrial content as measured by COXIV and NDUFA9 protein. In younger adults, Mfn2 protein content increased with HIT yet in older individuals Mfn2 protein content decreased (MacInnis *et al.*, 2017; Wyckelsma *et al.*, 2017).

These findings reveal (i) a similar mitochondrial content in muscle from young and healthy older adults; (ii) an increase in the abundance of Mfn2 and MiD49 protein contents in muscle from older compared with younger adults; (iii) a robust increase of mitochondrial content following HIT exercise in muscle from both younger and older adults and (iv) a different response in Mfn2 protein content in skeletal muscle of younger and older adults following HIT training.

MacInnis MJ, Zacharewicz E, Haikalis ME, Martin BJ, Skelly LE, Tarnopolsky MA, Murphy RM, Gibala MJ. (2017) Superior mitochondrial adaptations in human skeletal muscle after interval compared to continuous single-leg cycling matched for total work. *J Physiol*, **595:** 2915-2930.

Wyckelsma VL, Levinger I, McKenna MJ, Formosa L, Ryan MT, Petersen AC, Murphy RM. (2017) Preservation of skeletal muscle mitochondrial content in older adults: a relationship between mitochondrial dynamics, fibre type and exercise training. *J Physiol*, **595:** 3345-3359.