Cellular adaptation contributes to calorie restriction-induced preservation of skeletal muscle in aged rhesus monkeys.

We have previously shown that a 30% reduced calorie intake diet delayed the onset of muscle mass loss in adult monkeys between ~16 and ~22 years of age and prevented multiple cellular phenotypes of aging. In the present study we show the impact of long term (~17 years) calorie restriction (CR) on muscle aging in very old monkeys (27-33 yrs) compared to age-matched Controls. Muscle mass was preserved in very old calorie restricted (CR) monkeys compared to age-matched Controls. Immunohistochemical analysis revealed an age-associated increase in the proportion of Type I fibers in the VL from Control animals that was prevented with CR. The cross sectional area (CSA) of Type II fibers was reduced in old CR animals compared to earlier time points (16-22 years of age); however, the total loss in CSA was only 15% in CR animals compared to 36% in old Controls at ~27 years of age. Atrophy was not detected in Type I fibers from either group. Notably, Type I fiber CSA was ~1.6 fold greater in VL from CR animals compared to Control animals at ~27 years of age. The frequency of VL muscle fibers with defects in mitochondrial electron transport system enzymes (ETS(ab)), the absence of cytochrome c oxidase and hyper-reactive succinate dehydrogenase, were identical between Control and CR. We describe changes in...
ETS(ab) fiber CSA and determined that CR fibers respond differently to the challenge of mitochondrial deficiency. Fiber counts of intact rectus femoris muscles revealed that muscle fiber density was preserved in old CR animals. We suggest that muscle fibers from CR animals are better poised to endure and adapt to changes in muscle mass than those of Control animals.

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