



Identification of morphological markers of sarcopenia at early stage of aging in skeletal muscle of mice

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Abstract:

The gastrocnemius muscle (GM) of young (3 months) and aged (12 months) female wildtype C57/BL6 mice was examined by light and electron microscopy, looking for the presence of structural changes at early stage of the ageing process. Morphometrical parameters including body and gastrocnemius weights, number and type of muscle fibers, cross section area (CSA), perimeter, and feret's diameter of single muscle fiber, were measured. Moreover, lengths of the sarcomere, A-band, I-band, H-zone, and number and CSA of intermyofibrillar mitochondria (IFM), were also determined. The results provide evidence that 12 month-old mice had significant changes on skeletal muscle structure, beginning with the reduction of gastrocnemius weight to body weight ratio, compatible with an early loss of skeletal muscle function and strength. Moreover, light microscopy revealed increased muscle fibers size, with a significant increase on their CSA, perimeter, and diameter of both type I and type II muscle fibers, and a reduction in the percentage of muscle area occupied by type II fibers. Enhanced connective tissue infiltrations, and the presence of centrally nucleated muscle fibers, were also found in aged mice. These changes may underlie an attempt to compensate the loss of muscle mass and muscle fibers number. Furthermore, electron microscopy discovered a significant age-dependent increase in the length of sarcomeres, I and H bands, and reduction on the overlapped actin/myosin length, supporting contractile force loss with age. Electron microscopy also showed an increased number and CSA of IFM with age, which may reveal more endurance at 12 months of age. Together, mice at early stage of aging already show significant changes in gastrocnemius muscle morphology and ultrastructure that are suggestive of the onset of sarcopenia.

Keywords:

sarcopenia, aging, CSA, type II muscle fibers, mitochondria

Published In:

Experimental Gerontology , 83 , pp. 22 - 30