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Effect of adapted physical exercise on satellite cells from skeletal muscles of old mice: ex vivo and in vitro analyses

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Aging is characterized by loss of skeletal muscle mass termed sarcopenia, which contributes to frailty, disability and premature death (1). The mechanisms leading to sarcopenia are manifold, the decline in muscle regeneration efficiency playing a crucial role. In the absence of specific therapies, studies have stressed the importance of physical exercise as an effective approach to prevent/limit the sarcopenic drive (2,3). We investigated the effect of adapted exercise on the number and myogenic properties of satellite cells (SCs) in the quadriceps femoris and gastrocnemius muscles of old mice (28 months). Both muscles contain about 90% of type II fibers, which are especially affected by sarcopenia (4). We compared old exercised mice with old sedentary mice, adult sedentary mice (12 months) being the control. SCs were identified and quantified ex vivo; the proliferation and differentiation potential of SC-derived myoblasts from the three groups of mice was studied in vitro. Ultrastructural morphology and immunocytochemistry at light and electron microscopy level localized molecular markers of SC activation and protein factors involved in RNA transcription and splicing. Results showed that: 1) physical exercise induces an increase in the total number as well as activated fraction of SCs compared with sedentary old specimens; 2) myoblasts from exercised old muscles show morphological features and nuclear activity quite similar to myoblasts from adult subjects, whereas myoblasts from non-exercised old muscles exhibit structural and functional alterations suggestive of a reduced metabolic activity; 3) myotubes differentiated from myoblasts of exercised old muscles resemble those from adult myoblasts, whereas myotubes from non-exercised old muscles show marked structural alterations. Physical exercise induces numerical increase and activation of SCs in old muscles and improves their capability to differentiate into structurally and functionally complete myotubes. Adapted physical exercise may represent a non-pharmacological approach to stimulate SCs, enhancing muscle quality at very advanced age.

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References

[1] Ryall et al. (2008) Biogerontol 9:213
[2] Zancanaro et al. (2007) Eur J Histochem 51:305
[3] Bautmans et al. (2009) Acta Clin Belg 64:303
[4] Larsson et al. (1978) Acta Physiol Scand 103:31

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