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POPULAR SCIENCE ABSTRACT

The project aimed at determining adaptive changes of motor unit contractile properties and in rat medial gastrocnemius muscle evoked by a high intensity endurance training on a treadmill and juxtaposition of the basic contractile properties of motor units with the magnitude of the expression of sarco(endo)plasmic reticulum Ca^{2+} ATP-ase type 2 (SERCA2) and myosin heavy chain isoform 1 (MyHC1) as well as markers of mitochondrial biogenesis in the time course of endurance training i.e. after 2, 4 and 8 weeks of training. The results considerably enlarged the knowledge concerning effects of the endurance training. The main observations concerned: 1. changes in contractile properties of motor units, the smallest functional units of skeletal muscles composed of one motoneuron and a group of muscle fibers innervated exclusively by this neuron, 2. changes in markers of mitochondrial biogenesis (mtDNA/nDNA, mitochondrial protein expression) and 3. changes in myosin heavy chain isoform type 1 expression (MyHC1) and expression of sarcoendoplasmic reticulum Ca^{2+} ATP-ase 2 (SERCA2). in the time course of the training content of Project revealed for the first time plasticity of motor unit contractile properties in muscles of endurance trained individuals. Three basic physiological types of motor units were studied: fast-twitch fatigable (FF), fast-twitch resistant to fatigue (FR) and slow-twitch (S) and a progression of their properties in a time scale (2, 4 and 8 weeks) of training was analyzed. The applied training resulted in a transformation of a part of FF motor units into FR type. Results indicated also that adaptive changes are selective and concern predominantly FR units which increased the fatigue resistance and shortened twitch time parameters. The last observation was connected with modification of the force-frequency relationship indicating that motor units of trained animals need higher activation rate (firing rate of motoneurons) to develop necessary level of force. These adaptive changes were visible in all groups of trained animals, including those trained only 2 weeks.

A content and activity of muscle proteins was analyzed for two parts of the studied medial gastrocnemius muscle, the slow one (red, MGS) and the fast one (white, MGF). A process of mitochondrial biogenesis was revealed by specific markers predominantly in MGS, however only in a group of animals trained for 8 weeks. The expression of MyHC1 and SERCA2 A were not modified by training.

Therefore, the study revealed that early adaptation in resistance training is an effect of modification of functional contractile properties of fast (mainly FR) motor units which are evident in a group trained for 2 weeks. These processes proceed mitochondrial biogenesis which appears after 8 weeks of endurance training.