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POPULAR SCIENCE ABSTRACT

Whole-body wibration training (WBV) has become a popular method for increasing muscle strength and power throughout all forms of sport, recreation and rehabilitation. The research project aims at answering the following questions: (1) does whole-body vibration modify electrophysiological properties of motoneurones?; (2) how WBV influences various types of motoneurons?; (3) is 5-weeks duration of WBV sufficient to induce significant changes in motoneurons?; (4) how changes in electrophysiological properties of motoneurons can be linked to changes in contractile properties of motor units? Studies performed on rats will focus on electrophysiological properties of hindlimb motoneurons, most commonly studied in the experiments concerning motor control in an animal model. Wistar rats will be sujected to a 5-week whole-body vibration training on a PowerPlate vibration platform. After the period of WBV, acute experiments will be performed on both groups of rats under general anaesthesia, with a method of intracellular recording and stimulation of motoneurons from L4-L5 spinal segments. The study will focus on action potential parameters of motoneurons, motoneurons' excitability and characteristics of their steady state firing (SSF). The consistent control and experimental groups (of the same sex, age and origin) will enable direct comparison of results. The research problem of the study is based on methods, commonly used by the research team of the Department of Neurobiology at the Uniwersity School of Physical Education in Poznań. The applicants have unrestricted access to necessary equipment and have long-term experience in these experimental procedures.

The essence of WBV is activation of muscle spindle endings, located between muscle fibers, by the vibration stimulus generated by a platform. This results in Ia excitation of α-motoneurons what initiates a muscle contraction in order to maintain body balance and stabilize posture. However, knowledge about influence of vibrations on organism is fragmentary - positive effects on muscle strength and efficiency, as well as on bone turnover have been reported, what results in frequent usage of the WBV training in rehabilitation and physiotherapy. Therefore the expected results of this study constitute a next element of basic knowledge, necessary to achieve complex picture of WBV effects, but will also contribute to verification of application of vibration devices in sport training, rehabilitation treatment and prophylaxis.

Studies performed in the Department of Neurobiology on the influence of WBV on motor unit contractile properties indicated adaptive changes in motor units, mainly of the FF, but also FR and S types. Likely explanations of the observed effects are changes in electrophysiological properties of α-motoneurons innervating trained muscles. However, this has not been investigated yet. Our knowledge about neuronal adaptation to altered physical activity (either increased or decreased) and factors influencing neuro-muscular system is still limited. Therefore, answers to research questions of this project will be a substantial contribution to science. The research problem is not a randomly selected piece of a field in neurophysiology, but forms a continuation of studies focused on determining the influence of WBV on motor unit properties, osteo-articular system and markers of inflammation. The gathered data will not only contribute to basic knowledge, but will also help creating more efficient and safe training protocols for WBV used both for sportsmen and disabled people. The research project under this application is a subject of the PhD study of the main author and will be completed by the PhD dissertation, and publication of the results in a peer-reviewed paper in English.