According to the size principle, type I and II fibers are recruited in a fixed order. In literature, an inconsistency exists however in the submaximal exercise intensity at which type II fibers are activated. This could be explained by differences in the methodology of determining muscle fiber activation or in the mode of the exercise. The aim of this study was to investigate the recruitment of type I and type II fibers during a 45-min cycle exercise at 75% VO2max.

Six subjects participated in the study. Exercise intensity, as percentage of the maximal dynamic muscle force during the cycle exercise, was determined on an isokinetic bike by means of strain gauges mounted inside the pedals. The exercise intensity of 75% VO2max corresponded to 38% of the maximal dynamic muscle force on the pedals. Muscle fiber recruitment was assessed by a decline in the phosphocreatine (PCr) to creatine (Cr) ratio in individual fibers and by a decline in the periodic acid Shiff (PAS) stain intensities, indicative of glycogen depletion. Biopsies of the vastus lateralis muscle were taken at rest and at several time points during the cycle exercise, two at each time point. From the first biopsy single fibres were isolated and their PCr/Cr ratios and PAS staining intensities determined. Cross sections of the second biopsies were stained with PAS. In both biopsies the fibers were classified as type I or type II fibers with myosin ATPase.

Within 1 min of exercise both type I and, though to a lesser extent, type II fibers were recruited. Furthermore, the PCr/Cr ratio revealed that the recruited fibers remained active during the whole 45 min of exercise. The PAS staining, on the other hand, proved inadequate to fully demonstrate fiber recruitment even after 45 min of exercise.

We conclude that during cycling exercise type II fibers are recruited at lower force levels than previously reported for isometric contractions, possibly due to the dynamic character of the cycling exercise. Furthermore, changes in the PCr/Cr ratio proved to be more sensitive in determining fiber activation than changes in the PAS staining intensity.

References:

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