Slow to fast transitions of fibre type proportions in well trained endurance runners

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Skeletal muscle fibre type is influenced by inheritance, anatomical position and neural innervation. Fibre type is also influenced by factors such as exposure to an altered endocrine or exercise milieu. The past decade provided the evidence that fibre type transformation results in hybrid fibres with mixed expression of myosin heavy chain isoforms (MHC). But, the extent of fibre transformation in human subjects between different sub-types is controversial, especially in athletes who are already well-trained. The aim of this study was to determine the effect of high intensity interval training (HIT), superimposed upon competitive runners' normal training volume.

Eleven runners were recruited and subjected to a 6 week HIT intervention protocol. Maximal exercise tests and muscle biopsies were performed pre and post HIT. HIT was individualized for each athlete's ability and was 94 % of the peak treadmill speed obtained in the pre training maximal test and ranged from 18.8 to 20.8 km/h. Muscle biopsy samples were freeze dried, dissected into single fibres for which MHC isoform contents were analysed by SDS-PAGE. All data are presented as mean $\pm$ SEM.

Baseline training volume and training intensity was 35.1 $\pm$ 5.2 km per week and 16.4 $\pm$ 0.2 km/h, respectively. Peak treadmill speed increased significantly after training ($P < 0.05$). Fibre type proportions (in percentage) depicted in brackets below represent pre vs. post training. There was a trend for % type I fibres to decline ($P = 0.08$ Wilcoxons signed rank test) from pre to post HIT (47.6 $\pm$ 5.8 vs. 41.1 $\pm$ 3.9), whereas means for the other pure fibre types remained similar (type IIa: 33.4 $\pm$ 4.4 vs. 37.2 $\pm$ 5.3; and type IIx: 3.6 $\pm$ 1.7 vs. 4.0 $\pm$ 1.7). Four different types of hybrid fibres were seen: types I/IIa and IIax and Iax (a triple hybrid) and Ix. Percentages of each subtype of hybrid fibres did not change with the change in training, although means ranged between 0.4 and 7.5 % pre and 0.2 and 10.3 % post training. Nevertheless, lack of change in means may have been due to individual variations as shown by the following two significant correlations: Intensity of interval training correlated negatively with the change in % type I fibres ($r = -0.71$, $P < 0.05$) and positively with the change in % type IIax hybrids ($r = 0.69$, $P < 0.05$).

Therefore, the speed of high intensity training is important for alterations in MHC composition of skeletal muscle. Although a fast to slow transition of fibre type is a known response to the initiation of training and several key intracellular signals for this have been identified, the observed slow to fast transition in this study is a novel finding. Since endurance training itself did not change, the intracellular mechanisms for our finding are likely to be different and remain to be elucidated.