Delayed-Onset Muscle Soreness and its prevention in humans: a proteomic analysis unravels modifications of glycolytic enzymes and contractile proteins expression

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DOMS (Delayed-Onset Muscle Soreness), a clinical condition triggered by eccentric exercise, affects muscle cells at a biochemical level in a poorly understood fashion. The objective of the present study was to examine muscle proteome modifications induced by a strenuous eccentric exercise that follows, or not, a specific training aimed to prevent DOMS. Six healthy subjects were submitted to biopsies in the rectus femoris in three conditions: (1) at rest, (2) 24 hours after a provocation of 90 eccentric contractions of the quadriceps, (3) 24 hours after a similar provocation preceded by 5 sessions of eccentric training. The first provocation induced marked changes in three indirect markers of muscle damage (elevation of the plasma creatine kinase activity, muscle stiffness and soreness). After the second provocation, the symptoms of DOMS were reduced confirming the protective effect of the eccentric training. Muscle protein extracts were subjected to a 2D-DIGE proteomic analysis. Surprisingly, we observed that contractile proteins, which already decreased after the first provocation, were reduced further to a lower level together with other contractile proteins after the second provocation. Furthermore, the expression of several glycolytic enzymes decreased only after the second provocation. One hypothesis to explain such an observation is a switch to more intense oxidative metabolism in response to training. These findings suggest first that the loss of contractile proteins is not responsible for the onset of DOMS and second that a switch to oxidative metabolism could underlie the beneficial effect of the specific training that attenuates the DOMS.