POSSIBLE ROLE OF HSPS IN THE REPEATED BOUT EFFECT?
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Immediately following maximal unaccustomed eccentric exercise, small HSPs accumulate in the cytoskeleton, concomitant with a reduction of the cytosolic sHSP amount (Paulsen et al., submitted). The delayed response is characterized by enhanced HSP expression and HSP70 accumulation in the cytoskeleton. It is suggested that HSPs are involved in refolding of denatured proteins and in the proper folding and localization of newly synthesized polypeptides.

The HSP response after a repeated bout of eccentric exercise is hardly investigated. One striking feature of the repeated bout effect is the faster recovery of force-generating capacity. A faster recovery indicates adaptations in muscle fibers, in which HSPs with their cytoprotective function might play an important role to assist in improved recovery.

The aim of this study was to examine the HSP response following two bouts of maximal unaccustomed eccentric exercise separated in time by 3 weeks.

Nine healthy students performed 70 maximal, unilateral eccentric actions with the arm flexors, biopsies were taken one and 96 hrs after exercise. Force-generating capacity was followed by regular physical tests. Three weeks after the first bout, the protocol was repeated and biopsies taken one hour post exercise. Following homogenization, muscle tissue was subcellular fractionated and the HSP response examined by western blotting.

Force-generating capacity dropped to 50% of pre-exercise values immediately after both bouts. After bout two, recovery of muscle function was significantly faster. Small HSPs accumulated in the cytoskeleton one hour post exercise after both bouts. Whereas the cytosolic amount of small HSPs was considerably reduced after bout one, the reduction was significantly diminished or absent after bout two, despite a similar accumulation in the cytoskeleton. No accumulation of HSP70 in the cytoskeleton was found one hour after bout one, but HSP70 accumulation was present after bout two. At the same time, the cytosolic amount was elevated, indicating increased total HSP70 amount.

The hallmark of the repeated bout effect, a significant faster recovery of muscle function, was confirmed in our subjects. As one of multiple adaptations in muscle fibers, the HSP response might play an essential role by protecting the cells from stress-induced alterations in protein structure and function. Denaturation of myofibrillar proteins probably occurred after both work-loads, but the rapid refolding of non-native proteins by HSPs might contribute to a faster recovery of muscle function after repeated eccentric muscle actions.

In conclusion, the total amount of small HSPs and HSP70 was elevated in the repeated bout and the accumulation of small HSPs and HSP70 in the cytoskeleton was more pronounced following bout two. We interpret our observations as support for a role of HSPs in regaining cellular homeostasis, although no causal relationship can be established with our design.


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