Heat shock proteins in exercised human skeletal muscle

av

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Akademisk avhandling

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Abstract


Exercise is considered as an important stressor accompanied by concerted molecular and cellular changes leading to adaptations at the level of skeletal muscle size and function. An important protein family produced by cells in response to stressful conditions is the heat shock proteins (HSPs). It is suggested that the different HSPs play specific roles in acute and long-term responses to exercise-induced stress. The overall aim of this thesis was to explore the expression of four different HSPs (αB-crystallin, HSP27, HSP60 and HSP70) in human skeletal muscle exposed to exercise, with a special emphasis on the role played by HSP27 in the hypertrophy of human skeletal muscle.

One of the major findings was the fibre type-specific expression of HSPs in resting human skeletal muscle, including the preferential expression of HSP27 in fast type II muscle fibres. Another finding was the occurrence of training background-related differences in the expression of HSPs. Also, a cytoplasmic relocation of HSP27, occurring specifically in type II muscle fibres, was shown in response to a single bout of resistance exercise. Interestingly, there were no corresponding changes in response to an endurance exercise bout, suggesting that HSP27 may be specifically involved in the adaptations to resistance exercise. In order to test this hypothesis, an in-vitro exercise model based on the electrical pulse stimulation (EPS) of muscle cells was developed. The EPS protocol, including an 8 h restitution period, induced a significant hypertrophy of muscle cells together with molecular changes similar to those previously described in response to exercise in humans. The role of HSP27 in the hypertrophy of human muscle cells was examined through the downregulation of HSP27. Based on data from morphological and microarray analyses, findings indicate that HSP27 is not mandatory for the hypertrophy of human muscle cells. Overall, the present thesis clarified the expression of different HSPs in human skeletal muscle and provided an in-vitro-based approach for the elucidation of the exact role played by HSPs in the adaptations of human skeletal muscle to exercise.

Keywords: Endurance training, Resistance training, Muscle Fibre Type, Electrical Pulse Stimulation, Muscle Hypertrophy

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