RUNNING TRAINING INCREASES HEAT SHOCK PROTEINS IN WHITE REGION OF LATERAL GASTROCNEUMIUS MUSCLES OF RATS

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Heat shock proteins (HSPs) play important roles in protecting cells from stress by acting as a molecular chaperon. HSPs are categorized by their molecular weight, and the HSPs above 70kD have been well investigated. It is known that endurance training results in increases in HSP72 expression, but limited information is available concerning other HSPs for their responses to training, and whether frequency of training affects changes in HSPs. Therefore, the aim of this study was to examine the effects of training frequency on expression of several HSPs in gastrocnemius muscle of rats.

All experimental procedures were conducted in accordance with the Japanese and American Physiological Society Guide for the care and use of Laboratory Animals, and this study was approved by the local Animal Ethics Committee. Twenty F344 male rats (6-week) were placed into control (n=7) or trained group (n=13). The rats of the trained group had running (30 m/min) on a motor-driven treadmill 3 (T3, n=7) or 6 days (T6, n=6) per week for 6 weeks. The running duration was 60 min for the T3 group and 30 min for the T6 group, thus the total workload was the same between groups. The control group did not perform any training. After 48h of the last training session, lateral gastrocnemius muscles were extracted and weighed, and white and red regions of the muscles were separated, then homogenated individually. The expression levels for HSPs of 73, 72, 60, 40, 25kD, and αB crystallin were determined using a western blotting method.

No significant increases in expression of any of the HSPs in the red region were evident after training for both T3 and T6 groups. In contrast, the expression levels of all HSPs except for HSP73 and HSP60 in the white region increased significantly (P<0.05) after training for both groups without any significant differences between groups. The magnitude of increase in the expression levels of HSP72, 40, 25, and αB crystallin after training was 2.3, 2.2, 1.4, and 2.5 times, respectively compared with the control. The expression level of HSP72, 60, 40, 25, and αB crystallin in the red region was 3.5, 1.4, 1.9, 1.9, and 3.7 times greater compared with that in the white region for the control group, but no significant difference was evident for HSP73 between the red and white regions.

It appears that no significant increases in HSP expression in the red region after training were associated with the higher expression of the HSPs already existed at the baseline. On the other hand, the increased expression of HSPs in the white region was likely due to the increased recruitment of the muscle fibers of the white region in the training. No significant difference between T3 and T6 group suggests that the total training load rather than frequency contributes to the increases in HSPs.

It was concluded that the increases in HSP expression after endurance training were region-specific, and was not influenced by training frequency.

Keywords: Animal Experiment, Endurance Training, Skeletal Muscle