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The changes of p-Akt/MuRF1 proteins expressions in rats' soleus muscle following three preconditioning exercise under simulated acute microgravity

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Objective To observe the effect of three training ways, aerobic training, resistance training and aerobic combined with resistance training on cross-section and p-Akt/MuRF1 proteins expressions in rats' soleus under simulated acute microgravity, the purpose of this study was to explore its roles in preconditioning exercise and the appropriate training methods to prevent the muscle atrophy in acute microgravity.
Methods 32 male SD rats (aged 6 wk) were randomly distributed into four groups: control group (CON, n=8), aerobic training group (AER, n=8), resistance training group (RES, n=8) and aerobic combined resistance training group (ACR, n=8). The training groups were trained once every other day, while CON was not trained. Rats in AER trained on an animal treadmill with the 0° at the speed of 35 m/min for 45 minutes. The rats in AER were trained by running resistance method, loaded with 50% of its weight in the tail of the rat, each training section included 4-repetition of 15-second 35° climbing on treadmill at the speed of 15 m/min, with the interval of 30 seconds between repetitions ， and 3 minutes between sections, each circle comprised 3 sections, and 2 circles at a time. The rats of ACR were requested to carry out an aerobic training(25min) and a resistance training(1 circles) in training day. After 6 wk training, all rats were under the simulated acute microgravity (hindlimb suspension), the 6th-day soleus muscles were excised and muscle cells cross-section area(CSA) were observed, and p-Akt/MuRF1 proteins expressions were analyzed by Western blot.
Results 1) After 5 days of acute microgravity stimulation, the CSA of soleus muscles of rats in the three training groups were larger than those in CON, and RES and ACR have statistical significance (P<0.05, P<0.01). In three training models, ACR was significantly greater than the aerobic training group and resistance training group (P<0.05), and RES was significantly greater than AER (P<0.05).
2) Compared with CON, the p-Akt protein expression in the soleus muscle of rats in AER was significantly decreased (P<0.01), while it was increased in both RES and ACR, and in ACR increased significantly (P<0.01). Among the three training methods, the p-Akt proteins expressions in the soleus muscle of rats in ACR was significantly higher than AER (P<0.01)and RES (P<0.05).
3) Compared with CON, the MuRF1 proteins expressions in soleus muscle of rats in ACR are not significantly change (P>0.05), while AER and RES increased significantly (P<0.01, P<0.05). At the same time, the MuRF1 proteins expressions in soleus muscle of rats in AER and RES is significantly higher than ACR (P<0.01), and AER is significantly higher than that RES (P<0.01).
Conclusions Three training models have certain effects on preventing muscle atrophy in the acute microgravity environment, and the effect of aerobic combined resistance training is the best, which may relate to up-regulating the p-Akt proteins expressions in skeletal muscle and inhibiting the MuRF1 proteins expressions in the acute microgravity environment.