



Effects of Different Exercise on the Expression of White Fat Browning Proteins in Growing Rats

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Objective The prevention of obesity in children and adolescents can reduce the risk of obesity and various chronic diseases in adulthood. In recent years, it has been found that inducing browning of white fat can regulate energy balance and inhibit fat accumulation. Exercise as a healthy intervention can regulate energy balance by affecting the browning of white fat. However, the effect of exercise on the browning of white fat during the critical period of growth and development is not yet known, and the effect of different exercise methods on the browning of different location of white fat is inconsistent. Therefore, this study intends to explore the effects of different exercise methods on the expression of browning-related proteins of peripheral white adipose tissue and browning-related genes of hypothalamus in growing rats through animal experiments, and to explore the relationship between them.

Methods 30 Male, 3-week-old SD rats were randomly divided into three groups, C group: Control group (sedentary, n=10); MD group: moderate-intensity training group (MD group, n=10), and high-intensity intermittent training group (HIIT group, n=10). MD group exercise program: 60% VO₂max exercise for 60 minutes, 5 times a week for a total of 4 weeks. HIIT group exercise program: 85% ~ 90% VO₂max exercise 6min, 50% VO₂max exercise interval 4min, repeated 6 times. 5 times a week for a total of 4 weeks. The exercise intensity was adjusted based on the maximal oxygen uptake measurement every 2 weeks. Three groups of rats were weighed once a week. After the experiment, anesthesia was performed with 10% chloral hydrate 50 mg/Kg (body weight) in the abdominal cavity to rapidly separate the hypothalamus, Perirenal and epididymal fat and put into liquid nitrogen and transfer these to -80°C refrigerator for testing. The expression of POMC, NPY, LEPR and GRP78 mRNA in hypothalamus was determined by RT-PCR. The expression of PRDM16 and UCP1 protein in perirenal white fat was measured by Western Blot.

Results 1. The weight of the three groups of rats increased continuously within 4 weeks of exercise intervention. Compared with group C, the weight of group E and group H increased slowly from the second week ($p < .05$). 2. The increase in absolute weight and relative weight of visceral fat in MD group and HIIT group was significantly lower than that in C group ($p < .01$); the increase in absolute weight and relative weight of visceral fat in MD group was significantly lower than HIIT group ($p < .05$). 3. Compared with group C, the expression of PRDM16 protein in WAT of the kidneys in group MD was significantly increased ($p < .01$), and the UCP1 protein expression was significantly increased ($p < .01$). Compared with group C, there was no significant difference in PRDM16 and UCP1 protein expression in WAT of HIIT group ($p > .05$). 4. Compared with group C, the expression of NPY mRNA in hypothalamus in group MD was significantly decreased ($p < .01$), POMC, LEPR, GRP78 mRNA expression had no significant difference ($p > .05$); Compared with group C, there was no significant difference in the expression of hypothalamus POMC, NPY, LEPR and GRP78 mRNA in HIIT group ($p > .05$). 5. There was a negative correlation between the expression of NPY mRNA in hypothalamus and the expression of PRDM16 protein in white fat ($p < .01$).

Conclusions Moderate-intensity exercise for 4 weeks in the growth and development period of rats can decrease NPY expression in hypothalamus of rats and induce white-to-brown phenomena in perirenal adipose tissue, but not in HIIT.