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Effects of hypoxia and/or endurance exercise on autophagy of skeletal muscle in rats with nutritional obesity

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Objective The globalization of obesity has become an important factor threatening human health, and the rational health of the solution has driven the exploration of experts and scholars. For this reason, this experiment uses hypoxia and exercise as interventions for 8 weeks. Changes of autophagy-related factors LC3 mRNA, p62 mRNA and energy regulation factor AMPKα2 mRNA, and cell stress-inducing factor Sestrin2 mRNA after hypoxia and/or combined endurance exercise, and explored the effect of hypoxia endurance exercise on autophagy of skeletal muscle cells To provide a reasonable experimental basis for exploring hypoxic exercise to lose weight and to prevent or reduce autophagy-related diseases.
Methods First, a nutritional obese rat model fed with high-fat diet for 8 weeks was constructed and randomly divided into 8 groups: the normoxia group (A), the normoxic group (AE), and 16.3%. Oxygen quiet group (B) and 16.3% hypoxic exercise group (BE), 13.3% hypoxic quiet group (C), 13.3% hypoxic exercise group (CE), 11.3% hypoxic quiet group (D), 11.3% low Oxygen exercise group (DE), 10 in each group, and continued to feed with high fat diet. Secondly, establish a hypoxic and/or endurance exercise model, and the experimental experiment is expected. The rat training program is as follows: the normoxia quiet group does not perform any endurance exercise and other interventions under normoxia; the normoxic exercise group is large. The rats underwent a medium-intensity endurance exercise with a running speed of 20 m/min in a normal oxygen environment for 40 min. Similarly, rats in the hypoxic quiet group underwent continuous hypoxia intervention for 12h in the corresponding hypoxic environment; the hypoxic-binding endurance exercise group was based on the intervention of the hypoxic-quiet group, with a time of 40 min and a running speed of 20 m/ Min's medium-intensity endurance exercise. The frequency of exercise is 5 times a week (every Monday to Friday) for 8 weeks. After the last training, fasting for 24 hours, the rats were sacrificed and sampled. Biochemical indicators were used to measure blood lipids and blood glucose concentration; real-time quantitative PCR was used to detect the expression of autophagy regulators Sestrin2, AMPKα2 and autophagy Beclin1 and LC3II mRNA.
Results 1. Nutritional obesity rat model: After 8 weeks of high-fat feeding, the body weight, Lee's index, BG, TC, TG and LDL-c concentrations in the high-fat group were significantly increased ($P<0.05$).
2. Changes in morphology and blood lipids of rats: Compared with group A, the body weight, BG, TC, TG, LDL-c concentrations in the AE group were significantly decreased ($P<0.05$), and the HDL-c concentration was significantly increased ($P<0.05$). LDL-c in group D, TG and BD concentrations in group B, group C and group D were significantly decreased ($P<0.05$), and HDL-c concentrations in groups C and D were significantly increased ($P<0.05$); Compared with the group, the LDL-c and TG concentrations in the DE group were significantly lower ($P<0.05$), the BG concentrations in the CE group and the DE group were significantly lower ($P<0.05$), and the HDL-c concentration in the DE group was significantly increased ($P<0.05$).).
3. Real-time quantitative PCR showed that compared with group A, the expression of Sestrin2, Beclin1 and LC3II mRNA in skeletal muscle cells of AE group, C group and D group was significantly increased ($P<0.05$), and the expression of AMPKα2 mRNA in group D was significantly increased.

Compared with AE group, the expressions of Beclin1, LC3II and AMPKα2 mRNA in CE group and DE group were significantly increased ($P<0.05$), and the expression of Sestrin2 mRNA in DE group was significantly increased ($P<0.05$).

Conclusions 1. Three different concentrations of hypoxia and / or combined endurance exercise can reduce the body weight of obese rats, improve the blood sugar, blood lipids, hypoxia and exercise in obese rats, the effect of weight loss, blood sugar and blood lipids is more obvious.

2.Endurance exercise, hypoxic exposure, hypoxia combined with endurance exercise can induce autophagy in skeletal muscle cells; and the cumulative stimulation effect of exercise and hypoxia is more prominent than simple endurance exercise and hypoxia exposure.

3. Three different concentrations of hypoxia and/or combined endurance exercise can up-regulate the expression of Sestrin2, AMPKα2, Beclin1, and LC3II mRNA, thereby effectively activating and enhancing the autophagy level of skeletal muscle cells in obese rats, especially 11.3% hypoxia. The endurance exercise group has a more pronounced effect.