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# Effects of hypoxic exercise on weight loss and lipid metabolism in overweight/obese adult women

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**Objective** To investigate the effectiveness of hypoxic exercise intervention on weight loss and weight control in overweight and obese people from the perspective of lipid metabolism through the exercise intervention in this experiment under normal pressure and low oxygen environment. Exercise is indispensable in the prevention and treatment of obesity. Scientific weight loss is firstly to change the original unhealthy daily life habits and to develop a good lifestyle and to control diet and to exercise regularly. Exercise in a hypoxic environment, the body should accept the dual stimulation of environmental what hypoxia and exercise hypoxia. Exercise in a hypoxic environment can deepen the impact on lipid metabolism. In a hypoxic environment, the oxygen saturation of the human arteries (the concentration of blood oxygen in the blood) is reduced; in altitude training or intermittent hypoxia training conditions, blood oxygen saturation can be reduced to 80-85%, and it is not in the normoxic environment. The result of hypoxia is that the muscles are forced to do anaerobic metabolism. In order to provide energy during exercise, and the body will store the stored fat to supply energy.

**Methods** The subjects in this study were adult overweight or obese women between the ages from 18 to 47 for a total of 40. Subjects with a BMI ≥ 24 were overweight and subjects with a BMI ≥ 28 were obese. Subjects who passed the physical examination screening were healthy and had normal motor function. All subjects used the weight index to pair the average into subgroups what hypoxic and normoxic groups. Exercise intervention, the training period is 6 weeks, the training the next day and 7 times in two weeks. The training content is divided into strength training and endurance training. The strength training is divided into each group of eight. To complete two cycles and the interval is 30s. The interval between each subgroup is 10s. Warm up and stretch before training. The time is 30 minutes. 12RM weight for strength training dumbbells, each group do 10-15 times. Eight actions include dead lift, upright row, squat, shoulder press, calf Jump, advance junge, biceps curl and triceps extension. Endurance training uses a running platform with a slope of 0°. The running speed is adjusted according to the target heart rate interval. The formula for calculating the target heart rate interval is (220-age) × 60%~(220-age) × 70%, running time is 30 minutes. In the hypoxic group, a suction-type atmospheric hypoxic device was used during exercise, and a mixed gas having an oxygen content of 16% was inhaled. The normoxic group is in a normal atmospheric environment during exercise. The ideological education of a reasonable nutritional diet for the subjects before and during the intervention is not mandatory to control the subject's daily diet. Height and weight and BMI were measured before and after exercise intervention. Fasting venous blood was taken to detect total cholesterol (TC), total triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-). C), leptin (LEP) and adiponectin (ADPN). All test results were expressed as mean ± standard deviation, non-parametric Mann-Whitney U test was used for comparison between groups, and non-parametric Wilcoxo was used for comparison within the group.The n-match was tested on the symbol level, with a significance level of $P < 0.05$ and a very significant level of $P < 0.01$.

**Results** After the intervention, the body weight of both groups decreased. The Δ body weight ($P<0.01$), body weight change rate ($P<0.01$) and BMI change rate ($P<0.01$) in the hypoxic group were significantly higher than the normal rate. Oxygen group. TG, TC and LDL-C decreased in hypoxia

group, and TG (P<0.05), TC (P<0.05) and LDL-C (P<0.01) were significantly different from those before intervention (P<0.01). The levels of TG and LDL-C increased after the intervention of normoxia group, and LDL-C was significantly different from that before intervention (P<0.05). The TC change rate (P<0.01) and LDL-C change rate (P<0.01) in the hypoxic group were significantly higher than those in the normoxic group, and the TG change rate was not different from the normoxic group (P>0.05). The HDL-C in hypoxia group and normoxia group increased after intervention. The hypoxia group had a statistically significant difference compared with the pre-intervention group (P<0.01), and the HDL-C rate in the hypoxic group was significantly higher than that in the hypoxic group. Oxygen group (P<0.05). LEP and ADPN in the hypoxic group increased after intervention, but there was no significant difference compared with before intervention (P>0.05). There was no significant difference between LEP and ADPN in the normoxic group before and after intervention (P>0.05). The change rate of LEP (P<0.05) and ADPN (P<0.01) were significantly higher in the group than in the normoxic group.
**Conclusions** (1) Under the same exercise intensity, After 6 weeks of hypoxic exercise intervention the hypoxic environment is more conducive to weight loss in overweight/obese women. (2) Compared with normotensive exercise, The six weeks of hypoxic exercise can effectively improve the lipid metabolism of overweight/obese women. (3) Hypoxic exercise failed to significantly increase serum LEP and ADPN levels in subjects, but the index change rate was better than that of oxygen group.