



## Exercise Biochemistry Review

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### Effects of 6-week hypoxic exercise on aerobic capacity-related proteins in overweight/obese women

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**Objective** To explore the effects of hypoxic and normoxic exercise on hemoglobin (Hb), erythropoietin (EPO), hypoxia-inducible factor 1 $\alpha$  (HIF1 $\alpha$ ) and vascular endothelial growth factor (VEGF) in overweight women.

**Methods** This study enrolled 40 female overweight/obese subjects, age is among 18-47 years old, with no abnormal physical examination. The overweight standard is BMI  $\geq$  24, and the obesity standard is BMI  $\geq$  28. All subjects were paired according to body weight, divided into hypoxia group and normoxia group, doing 6 weeks of exercise intervention, 3 times a week, every next day one time. The exercise intervention includes 30 minutes of strength training and 30 minutes of endurance training. There are 5 minutes of warm up before training and 5 minutes cool down after the training. Strength training uses the device as a dumbbell. The training content consists of 8 movements, there are dead lift, upright row, squat, shoulder press, calf jump, advance lunge, biceps curl and triceps extension, and the weight is 12RM. 2 sets for each action, rest between sets is 30s. Endurance training uses a treadmill with a slope of 0 $^\circ$ , and the speed is adjusted according to the target heart rate interval. The calculation method of the target heart rate interval is  $(220 - \text{age}) \times 60\% \sim (220 - \text{age}) \times 70\%$ . Among them, the hypoxic group is equipped with a suction-type atmospheric hypoxic device, which moves with low-oxygen environment, and the oxygen content of the inhaled mixed gas is 16%; the normoxic group moves with normal oxygen environment. Nutritional education was given to all subjects prior before the start of exercise intervention, but diet was not restricted during the intervention. Fasting venous blood was taken before and after exercise intervention, and Hb, EPO, HIF1 $\alpha$ , and VEGF were detected. All the test results were expressed by mean  $\pm$  standard deviation ( $\bar{x} \pm \text{SD}$ ). The data between two groups were compared by non-parametric Mann-Whitney U test. The intra-group data were compared using a nonparametric Wilcoxon match for the symbol level test, with a significance level of  $P < 0.05$  and a very significant level of  $P < 0.01$ .

**Results** After the intervention, the Hb level in the hypoxic group was increased, but there was no significant difference compared with the pre-intervention group ( $P > 0.05$ ). There was no significant difference in the Hb change rate between the hypoxic group and the normoxic group ( $P > 0.05$ ). The EPO level in the hypoxic group was significantly increased, and there was a statistically significant difference compared with the pre-intervention group ( $P < 0.01$ ). There was no significant change in the EPO level in the normoxic group ( $P > 0.05$ ). The EPO change rate in the hypoxic group was compared with the normoxic group. There was no statistical difference ( $P > 0.05$ ). The level of HIF1 $\alpha$  in the hypoxic group was significantly higher than that before the intervention ( $P < 0.01$ ). The level of HIF1 $\alpha$  in the normoxic group was significantly lower than that before the intervention ( $P < 0.01$ ). The rate of change of HIF1 $\alpha$  in the oxygen group was statistically different from that in the normox group ( $P < 0.01$ ). The level of VEGF in the hypoxic group was increased, but the level of VEGF in the normoxic group was decreased, but there was no significant difference compared with the pre-intervention group ( $P > 0.05$ ). There was no significant difference in the rate of VEGF in the hypoxic group compared with the normoxic group ( $P > 0.05$ ).

**Conclusions** Compared with normotensive exercise, 6-week exercise increased the levels of Hb and EPO in overweight women, but the difference between hypoxia and normoxia was not significant.

The level of HIF1 $\alpha$  in the hypoxic group was increased, and the level of HIF1 $\alpha$  in the normoxic group was decreased. This index was significantly affected by hypoxia. The level of VEGF in the hypoxic group was increased, and the level of VEGF in the normoxic group was decreased, but the effects of hypoxia and exercise were not obvious.