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Effects of 6-week Hypoxic Exercise on Glucose Metabolism in overweight/obese Males

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Objective Early studies have shown that exercise can have positive impacts on the body's glucose metabolism, but there has been no experiment revealing the different effects between normal and hypoxia, two different exercise conditions, on the glucose metabolism of adult males. The aim of this study is to expose the effects of hypoxic exercise intervention on glucose metabolism in 18-45 years old overweight/obese males. In this study, 40 males were given exercise intervention with different exercise condition. The research aims to discriminate the exercise environment that has a better influence on glucose metabolism by detecting and calculating the changes in glucose metabolism-related indicators during the different oxygen content environments exercise.

Methods A parallel group design was used to study 40 healthy 18-47 years old overweight/obese males. The overweight standard is $BMI \geq 24$ and the obesity standard is $BMI \geq 28$. All 40 males were randomly divided into the hypoxia group (HG) and normal group (NG) matched on BMI and age at the pretest. The HG was provided a hypoxic exercise environment by wearing a suction-type atmospheric hypoxic device, and the oxygen content of the inhaled mixed gas is 16%; the NG was provided a normal environment. Nutritional education was given to 40 males prior to the start of exercise intervention, but diet was not restricted during exercise intervention. Both groups involved a 6-week exercise intervention which three times per week and there will be a one-day recovery time after each exercise. The intervention consists of a strength training session and an endurance training session, each intervention was generally composed of a 5minutes warm-up, 30minutes strength training, 30minute endurance training, and 5minute cooldown. The strength training contains deadlift, upright row, squat, shoulder press, calf jump, bow step, biceps curl, triceps extension, all these training loading 12RM, repeating twice and there being 0.5mins rest between sets. The treadmill was used for the endurance training, adjusting running speed according to the target heart rate interval. The calculation method of the target heart rate interval is $(220 - \text{ages}) \times 60\% \sim (220 - \text{ages}) \times 70\%$, and the slope is 0° . Both groups were measured body weight and taken of fasting venous blood samples, measured fasting blood glucose (GLU), glycosylated hemoglobin (GHb) and insulin (INS), calculated insulin resistance index (HOMA-IR) before and after the exercise intervention.

Results After the intervention, the fasting blood GLU, INS and HOMA-IR level in the HG were significantly lower ($P \leq 0.05$). The fasting blood GLU, INS and HOMA-IR level in the NG were increased, but there was no statistically significant difference before and after the intervention ($P > 0.05$). There was a significant difference when compared the HG with NG in the fasting blood GLU, INS and HOMA-IR level ($P \leq 0.05$). After the intervention, the GHb levels in the HG and NG both increased, but there was no significant difference compared with the pre-intervention group ($P > 0.05$). There was no significant difference in the GHb change rate between the HG and the NG ($P > 0.05$), either.

Conclusions Through 6-week intervention, the exercise in the hypoxic environment can more effectively improve the indicators of glucose metabolism in adult obese men compared with the normal environment. The condition of hypoxic mode has more significant benign effects especially for fasting blood GLU, INS, and HOMA-IR. For the GHb results of this experiment, because this index reflects the overall glycemic control in the past 1-2 months, and this study only carried out six weeks of uncontrolled diet exercise intervention, there may be insufficient time for exercise intervention,

or the long, excessive glucose intake during the intervention, resulting in no significant differences in the comparison before and after the intervention.