

especially those with adjust physiology function, targeted to improve the body under hypoxic conditions the sports ability of the substance. However, the exercise supplements with improving the body anti-fatigue capability and safe and effective exercise supplements is still rare. Pine pollen which is a medicinal plant plays a very important role in our country, since the ancient times, people have been put it for food and drug on the market for it can adjust the function of human physiology body physiology. This experiment chooses pine pollen to observe the mice hypoxia and resist fatigue related metabolic indices of changes after the short-term continuous treatment, in order to provide the theory basis of taking pine pollen for coaches and athletes.

Methods In the experiment, 40 healthy kunming mice are divided into two groups, which are hypoxia group and anti-fatigue experimental group, each group 20 mice. Every large groups is divided into the treatment group and control group, each group take 10 mice. Give medicine mice pine pollen 4 g/kg/day for three consecutive weeks by irrigating stomach; The control group give normal saline into stomach. We put weight on mice tails of both the control of fatigue group and dosage group, then let them swim to exhaustion for once time. At last we observe the influence of the ability of resisting lack of oxygen in mice, exhaustion of sexual swimming and related blood biochemical index stamina when given drug.

Results In the hypoxia experiment, compared with control group, the mice's survival time was significantly extended ($p < 0.01$), average extend rate was 36.58%, the longest time to live is improved by 10.11 min. In the anti-fatigue experiment, compared with the control group, the mice of treatment group's exhaustion swimming time was significantly extended ($p < 0.01$). The treatment group is 30.42% longer than the control group, exhaustion swimming maximum time improve 6.95 min than the control group. Mice in the long time exhaustion after swimming, haemoglobin content, blood sugar levels and lactate dehydrogenase activity than control group ($p < 0.05$), And the two groups of mice's weight gain no significant difference ($p > 0.05$).

Conclusions In the hypoxia experiment, compared with control group, the mice's survival time was significantly extended ($p < 0.01$), average extend rate was 36.58% indicates that the extended pine pollen has hypoxia role, indicates the pine pollen delay fatigue condition by the increasing hypoxia tolerance.

In resist fatigue experiment, give medicine mice compared with the control group, there are significant differences in the time of swimming and exhaustion of HB, blood sugar, CK which indicates the pine pollen has certain anti-fatigue effect, it also indicates the pine pollen may have the function of nutritional therapy anaemia. This study found that pine pollen can significantly improve the content of the haemoglobin in mice ($p < 0.05$), this may be because pine pollen is rich in protein and iron, and ensure that the red and haemoglobin can be increased, which can improve the body's aerobic oxidation ability and the ability to clear lactic acid and myocardial and Ge muscle produce protection. Also this study found that pine pollen in mice can significantly improve the blood sugar concentration ($p < 0.05$), this may because pine pollen is rich in simple sugars and polysaccharide. The experimental results show that the pine pollen can significantly enhance mice immediately after exercise the activity of LDH ($p < 0.05$), this may be its important mechanism of fatigue.

In hypoxia and resist fatigue experiments, give medicine group and control group mice's weight all have growth, but the growth is within the normal scope gr. Treatment group compared with the control group, the weight growth has not seen the obvious difference ($p > 0.05$), which shows that pine pollen has no effect to weight. Also it indicates the pine pollen may reduce weight.

GW23-e2369

THE EFFECTS ON PINE POLLEN TO EXHAUSTIVE MICE'S ANTI-FATIGUE CAPABILITY

doi:10.1136/heartjnl-2012-302920b.39

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Objectives In recent years, with the rapid development of competitive sports, people pay more attention on the athletes' nutrition,