

The effects of HiLo Training on Rats Muscle CCO

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Abstract. HiLo training sport mode, the rats in a quiet state, immediately after exercise, after exercise to study changes in skeletal muscle cytochrome oxidase three states under three hours, and then observed in rats HiLo training changes in mode of aerobic exercise capacity. The results show that: in a quiet state, high-living group relative to the quiet group there was a significant difference, three hours immediately after exercise and after exercise did not change significantly.

Introduction

The aim is to use altitude training plateau high altitude, low-oxygen environment to stimulate the compensation mechanism to stimulate the body's athletes by increasing the difficulty of training and load, physical, and fully mobilize the greatest athletes on the physiological process of athletic ability, and stimulate the body to produce a series of anti-hypoxia training methods reactions. These incentives will make the athletes have a strong stress response, thereby mobilizing the body's performance potential, leading to a series of favorable endurance athletes to improve athletic ability of anti-anoxia physiological adaptation [1]. Although the altitude training method has been widely used practice of training and is generally considered a good training methods to improve endurance. But through something a little research and found that the effect of altitude training is not as high people expect. Advantages and disadvantages inherent in altitude training, making it - the "double-edged sword." [2]. So people began to explore an effective alternative method of altitude training, "HiLo training" is to simulate altitude training in one of these modes. HiLo training method is HiLo training (Living high and training low) for short, is developed in a traditional altitude training on the basis of valid scientific methods to improve exercise tolerance. Let the athletes were treated at different times of hypoxia and exercise stress load, that is, under normal oxygen partial pressure in the training, in the resting state to accept the load hypoxic hypoxia, anoxia load so that the load can be coordinated and athletic, mobilize the body's ability to improve athletic ability. In this study, HiLo training mode, change CCO of rat skeletal muscle were studied, observed in a quiet state, immediately, changes three hours after exercise after exercise under three states, and thus presumably at HiLo training mode changes in rat skeletal muscle aerobic capacity, and provide a reference for sports training.

Content and Methods study

SD male rats were 72, 8 weeks old, according to the experimental animals fed standard score cages, habilitation one week after the experimental animals were randomly divided into four groups, formal training in three weeks, a total of four weeks.

Methods Grouping. The rats were randomly divided into four groups habilitation week: normoxic control group (C), normoxic exercise group (S), living high in the control group (H) and HiLo training group (HS), each group of 18.

Each group training arrangements

- ① normoxic control group (C): normal eating, drinking freely without any training activities.
- ② normoxic exercise group (S): rats only aerobic endurance training every day.
- ③ living high in the control group (H): hypoxic rats night 8:00 into the house, Sleeps 8 o'clock the next morning , the hypoxia house. 12 hours a day hypoxia . 3 times a week . Hypoxia instrument before each use are normal zero, and set the oxygen concentration of 20.9% in the normal monitoring , the oxygen concentration is controlled hypoxic tent of 15.3% , so that a hypoxic environment is formed inside the tent , the simulation altitude is equivalent to 2500m.
- ④ HiLo training group (HS): hypoxic rats night 8:00 into the house, Sleeps 8 the next morning when , out of the house hypoxia . 12 hours a day hypoxia . 3 times a week . Hypoxia instrument before each use are normal zero, and set the oxygen concentration of 20.9% in the normal monitoring , the oxygen concentration is controlled hypoxic tent of 15.3% , so that a hypoxic environment is formed inside the tent , the simulation altitude is equivalent to 2500m, a day immediately after the hypoxic training aerobic endurance training.

Sport mode : exercise group ran an electric station with domestic rodents trained to adapt to the peripheral speed of 15m / min, 30min a day, the animals were familiar with treadmill exercise , one week after the start of incremental load by week , the weekly increase speed 5m / min, increase the time 10min; the last week of speeds up .

Experimental drawn. After the end of the training program , with 0.4% sodium pentobarbital 1ml / 100g of body weight rats were anesthetized , quickly removed the gastrocnemius and heart , the heart was weighed on Libra , the gastrocnemius muscle and cardiac muscle into the stand at -70 °C .

Testing Index. Cytochrome oxidase (CCO): measured by a spectrophotometer

Test Indexes. Weigh accurately myocardium , right after the gastrocnemius each 200mg, were placed in a small beaker 5ml ; previously taken with a pipette in a refrigerator (4 °C) 9% saline 1ml pre-chilled beaker , ophthalmology small scissors cut it into pieces as soon as possible organization blocks (small beaker in ice water) . Shredded tissue homogenates will be poured into a glass tube, then take 0.8ml cold saline flush left in the beaker tissue fragments together into homogenized tube homogenized , enabling organizations to fully homogenized , made 10 % homogenates . The homogenates prepared using a refrigerated centrifuge 3000r / min centrifugal 10min, the supernatant was measured according to cytochrome oxidase measured after centrifugation conventional cytochrome oxidase activity.

Data Processing. The results are used all the data mean and standard deviation ($X \pm SD$) to represent the statistical processing and analysis using ANOVA method, all figures are calculated on a computer using the statistical software SPSS, a significant difference was $P < 0.05$.

Results and Analysis

HiLo training on muscle cytochrome oxidase in rats. You can see the changes in skeletal muscle tissue cytochrome oxidase from Table 1 :

Under HiLo training mode: living high in the control group and HiLo training group in a quiet state with normoxic control group there was a significant difference ($P < 0.01$), in the state immediately after exercise , and three hours after exercise state By then there was no significant difference.

Table 1: HiLo training on skeletal muscle cytochrome oxidase in rats

groups	Unit : Kmin-1 / mg		
	quiet state	immediatly after exercise	3 hours later
C group	4.35+0.49	5.08+1.22	5.56+0.85
S group	5.06+0.28##	5.45+0.72	5.27+0.59
H group	5.067+0.23##	5.23+0.93	4.93+0.42
HS group	5.56+0.46##	5.37+0.59	5.17+0.43

Note: with normoxic control group # shows $P < 0.05$, ## shows $P < 0.01$;

HiLo training on muscle cytochrome oxidase in rats

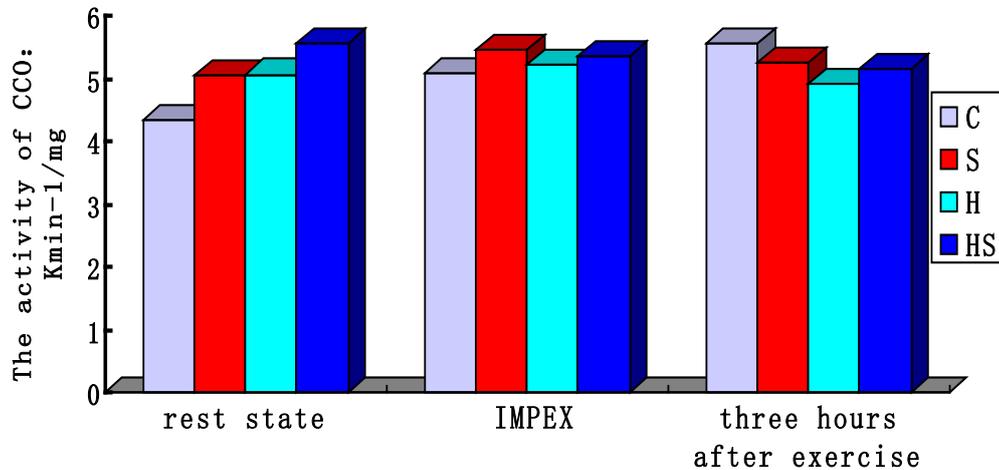


Fig. 1: the effect of HiLo training on skeletal muscle of rat cytochrome oxidase activity

Mitochondria are cellular respiration and ATP to produce parts, the mitochondrial inner membrane contains all the enzymes of the respiratory chain and oxidative phosphorylation system, comprising NADH dehydrogenase, CCO, and other enzymes, the electrons pass through the respiratory chain of these enzymes, and ultimately by the CCO passed to molecular oxygen (various components of the electron transport chain by a redox reaction of the NADH supplied sequentially passed down electrons eventually oxygen molecules accept electrons, is reduced to water, while releasing energy needed for the body). Among these enzymes, cytochrome oxidase (CCO) is marked by an enzyme, it is the end of the cytochrome system, the last carrier of the electron transport chain, including cytochrome a, and a₃ [3,4], the enzyme substrates electronic respiratory system through the cytochrome passed directly to molecular oxygen (i.e., an automatic oxidation), an electron transport and ATP formed in the phase of normal tissues is always coupled, ATP must be generated electronic transfer as a precondition, but only generate ATP respiratory chain in order to promote electron transfer. The results of this experiment indicated that quiet state, normoxic control group and the control group of high living, HiLo training group, ($P < 0.01$), high-living increase 16% in the control group, HiLo training group, 28%; sports immediately after exercise and after three hours under the state, there was no significant difference. Description CCO skeletal muscle cells in a quiet state of change more obvious, but under stress but no significant change, it may take a longer recovery period in order to have significant differences, due to the limitation of experimental conditions, the experiment failed more depth.

Conclusion

HiLo training mode, through the quiet state, immediately after exercise in rat skeletal muscle CCO three states three hours after the movement, research, and only in a quiet state have a more significant change, while the other two states although the change, but not particularly obvious, indicating changes in rat skeletal muscle CCO in HiLo training after resting state is more obvious.

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