

# Chronic intermittent hypoxia training on rat myocardial mitochondria atpase impact study Opportunities

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**Keywords:** Hypoxic training; Mitochondria; Cardiac muscle; Na<sup>+</sup>, K<sup>+</sup>-ATPase; Ca<sup>2+</sup>, magnesium 2 + ATPase

**Abstract:** Objective: To study the chronic intermittent hypoxia training on rat myocardial line grain of ATP content and Na<sup>+</sup>, K<sup>+</sup> ATPase and the influence of Ca<sup>2+</sup>, magnesium 2+ATPase. Methods: 32 male Wistar rats as the research object, according to the low oxygen training program can be divided into intermittent group, acute group and the control group, among which chronic intermittent hypoxia training, intermittent simulated altitude 3 km, 2 w, then simulated altitude training 5 km, 2 w training, daily training 4 h, finally simulated altitude 8 km, placed 4 h. Acute group immediately under simulated conditions of 8 km altitude 4 h; The control group are not hypoxic training. After the expiry of the low oxygen, beheaded executed after, separation of myocardial mitochondria, determination of ATP enzyme activity. Results: (1) atpase chronic group content (9.04±4.71 mg/100 mg of BW, (4.96-1.17) in the acute group mg/100mg of BW and the control group (4.38±0.95 mg/100 mg of BW were significantly higher, significant difference, statistically significant (P<0.05). (2) chronic group of Na<sup>+</sup>, K<sup>+</sup> ATPase activity (2.55±1.41) mu mol, pro-1mg/h, (2.66±1.07) in the acute group mu mol, pro - 1 mg/h and the control group (3.08±1.37) mu mol, pro-1mg/h had no significant difference.(3) chronic group of Ca<sup>2+</sup>, magnesium 2 + ATPase activity (1.17±0.34) mu mol, pro-1mg/h, the control group (1.28±0.42) mu mol, pro-1mg/h no significant difference, but the acute group (0.58±0.14) mu mol, mg/h significantly higher pro -1, the difference has statistical significance (P<0.05). Conclusion: chronic intermittent hypoxia training to ensure the Ca<sup>2+</sup>, magnesium 2+ ATPase activity has a positive meaning, at the same time can significantly increase the content of ATPase, help to improve myocardial motion function, adapt the rat hypoxic environment.

## Introduction

Mitochondria are important organelles, mainly involved in cellular respiration and ATP production in hypoxic acclimatization process plays a key role in providing energy for physical activity<sup>[1]</sup>. Previous studies have shown that acute hypoxia can cause changes in myocardial activity of mitochondrial ATP, but different studies showed large differences in the levels<sup>[2-3]</sup>, and less domestic research on this project, in order to further the research system effectively compensate for gaps in the domestic technology and research, the author of 32 male Wistar rats for the study, conducted on a different hypoxic training, myocardial mitochondrial ATP enzyme activity in the specific report as follows.

## 1 Materials and Methods

1.1 Animal Model : The subjects were obtained from 32 male Wistar rats, Huazhong University of Science and Laboratory Animal Center, rat age are 8w, according to random number table can be divided into three groups. Wherein the chronic group 11 patients underwent chronic intermittent hypoxic training, first placed in a hypobaric chamber to simulate 3Km altitude, duration 4h daily, lasted 2w; then adjust the chamber, 5Km altitude simulation, continued 4h daily, lasted 2wafter

training is completed, adjust the chamber, 8Km altitude simulation, continued 4h. 12 cases of acute breathing room air, after regular feeding 4w, immediately placed in chamber, 8Km altitude simulation, continued 4h. 9 cases in the control group, only routine feeding.

## 1.2 Myocardial mitochondrial ATP enzyme assays

1.2.1 sample preparation : After the group and chronic and acute hypoxia exposed rats to complete 4h, all rats were decapitated, heart was taken out, washed with cold saline to clean, remove large blood vessels, and other atrial tissue. Preparation of homogenization buffer, as main components, sucrose 250mmol/L, EDTA 5mmol/L, Tris-HCl 10mmol/L. Shredded in homogenization buffer rat heart, heart homogenates is formed, into centrifuge 10min, the supernatant was centrifuged again to collect the upper 15min, the precipitate was collected, placed in homogenization buffer, centrifugation was repeated 2 times, both continuous 15min. Centrifugal environment are controlled within the (0~4)°C range<sup>[4-5]</sup>.

1.2.2 ATP enzyme activity assay: Line Lowry assay ATP enzyme content, and use Reinila, who designed the determination of ammonium molybdate ATP hydrolysis release of trace inorganic phosphorus measurement to determine the Na<sup>+</sup>, K<sup>+</sup>-ATPase and Ca<sup>2+</sup>, Mg<sup>2+</sup>-ATPase activity, and its per unit hour activity represents (μmol • mg pro-1/h).

1.3 Statistical Methods : Application SPSS19.0 statistical software to process data, press (  $\bar{x}\pm s$ ) expressed in the form of data, t-test, depending on the P<0.05 for the difference was significant, with statistical significance.

## 2 Result

### 2.1 Changes ATP enzyme protein content

Statistics show that chronic group ATP enzyme protein content was the highest (9.04±4.71) mg/100mg BW, followed by acute group, less is 4.96±1.17) mg/100mg BW, the control group was (4.38±0.95) mg/100mg BW. Chronic group than in acute group and control group were significantly higher, the difference was statistically significant (P<0.05).

Table 1 ATP enzyme protein content changes (  $\bar{x}\pm s$ )

Group(n)	ATP enzyme protein content (mg/100mg BW)	*t,P	&t,P
Chronic group (11)	9.04±4.71		
Acute group(12)	4.96±1.17	2.9101,<0.05	
Group(9)	4.38±0.95		2.9064,<0.05

Note: \* indicates a group of chronic and acute comparison group; & showing chronic contrast with the control group.

### 2.2 Changes in activity of APT

Three sets of Na<sup>+</sup>, K<sup>+</sup>-ATPase activity of the active twenty-two contrast no significant difference (P>0.05), but the chronic group Ca<sup>2+</sup>, Mg<sup>2+</sup>-ATPase activity was significantly higher than the acute group, the difference has statistical significance (P<0.05).Data are shown in Table 2.

Table 2 ATP activity changes (  $\bar{x}\pm s$ )

Group	Number of cases	Na <sup>+</sup> , K <sup>+</sup> -ATPase (μmol·mg pro <sup>-1</sup> /h)	Ca <sup>2+</sup> , Mg <sup>2+</sup> -ATPase (μmol·mg pro <sup>-1</sup> /h)
Chronic group	11	2.55±1.41	1.17±0.34
Acute group	12	2.66±1.07	0.58±0.14

Group	9	3.08±1.37	1.28±0.42
*t,P	-	-0.2119,>0.05	5.5306,<0.05
&t,P	-	-0.8469,>0.05	-0.6480,>0.05

Note: \* indicates a group of chronic and acute comparison group; & showing chronic contrast with the control group.

### 3 Conclusions

Mitochondria are organelles in eukaryotic cells main energy supply, and myocardial mitochondria compared with normal motor function of the heart provides the energy basis, and its main role is involved in cell respiration, and store energy to generate ATP<sup>[6-7]</sup>. Mitochondrial functions primarily through the cell membrane Na<sup>+</sup>, K<sup>+</sup>-ATPase and Ca<sup>2+</sup>, Mg<sup>2+</sup>-ATPase achieved<sup>[8-9]</sup>, so by studying the mitochondrial ATP enzyme activity, can effectively analyze the properties of cell acclimatization.

This study shows that chronic group ATP enzyme content (9.04±4.71) mg/100mg BW, compared with the acute group (4.96±1.17) mg/100mg BW, the control group (4.38±0.95) mg/100mg BW were significantly higher, the difference was significant statistical significance (P<0.05). Chronic group, Na<sup>+</sup>, K<sup>+</sup>-ATPase activity (2.55±1.41) μmol • mg pro-1 /h, compared with the acute group (2.66±1.07) μmol•mg pro-1/h and the control group (3.08±1.37) μmol•mg pro-1/h were not significantly different. Chronic group, Ca<sup>2+</sup>, Mg<sup>2+</sup>-ATPase activity (1.17±0.34) μmol•mg pro-1/h, compared with control group (1.28± 0.42) μmol•mg pro-1/h no significant difference, but more acute group (0.58±0.14 ) μmol •mg pro-1/h is significantly higher, with statistically significant difference (P<0.05). Through this study, it can be seen in chronic intermittent hypoxia training can effectively improve myocardial mitochondrial protein content, and to ensure that Ca<sup>2+</sup>, Mg<sup>2+</sup>-ATPase activity tends to normal levels, which may be due to chronic intermittent hypoxia rats trained on cell It produces adaptive changes, mitochondrial proliferation, the number and volume have increased, and thus the protein content increased. And Na<sup>+</sup>, K<sup>+</sup>-ATPase activity was not significantly changed, the but also suggested that hypoxia injury and Na<sup>+</sup>, K<sup>+</sup>-ATPase has nothing to do, only to provide a theoretical basis and Ca<sup>2+</sup>, Mg<sup>2+</sup>-ATPase activity, which can solve acclimatization problems for us<sup>[10]</sup>.

In short, from this case study can be seen by chronic intermittent hypoxic training, enabling myocardial produce adaptive changes its protein content increased ATP enzyme and Ca<sup>2+</sup>, Mg<sup>2+</sup>-ATPase activity tends to normal levels, it can be gradually adapt to hypoxia.

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