ANALYSIS OF ADVANTAGES AND DISADVANTAGES OF SUB-ALTITUDE ENVIRONMENT ON THE TRAINING OF MIDDLE DISTANCE RUNNERS

Ali Raza[1], Fathimath Rizna[2], Muhammad Iftikhar[3], Sumbal Shoukat[4], Wu Hao[5]
Capital University of Physical Education and Sports Beijing, CHINA[1,2,4,5],
Physical Education and Sports, University of Karachi, Pakistan[3].
Correspondence: [5]wuhao@cupes.edu.cn

***ABSTRACT*:** *Altitude training is one of the powerful means to improve athletes' performance. Since it was proposed in 1968, it has been highly valued by people in sports circles from all over the world, and altitude training has gradually been applied to many other sports. In various sports during the activity, scientific training of middle distance running in an altitude environment is extremely beneficial to improve the endurance and aerobic exercise capacity of the athletes. The altitude environment has both advantages and disadvantages for the influence of middle-distance running. Therefore, in this article, the author uses altitude training as the starting point to define the concept of sub-altitude and combines it with the training of middle-distance running characteristics, a detailed analysis of the pros and cons of the sub-altitude environment on training, and some suggestions are put forward, hoping to further improve the sub-altitude training.*

Keywords: Altitude training, Middle distance running, Athlete's performance

1. INTRODUCTION

The altitude environment has its unique environment, which is very effective for improving the physiological function and athletic ability of athletes. With the continuous development of sports science research, the athletes' sports level is also constantly improving, in order to continuously improve the sports performance of athletes, people regard the altitude environment as the focus of attention[1]. At present, altitude training is one of the main methods commonly used by people in the education sector to improve the training effect of athletes in middle distance running. However, the results of long-term sports training prove the influence of altitude training on middle distance running [2].

There are many disadvantages. Many athletes are not very effective in training in the altitude environment, but there are some signs of regression, it has also been questioned by people. Therefore, this article has conducted a comprehensive and objective understanding of the advantages and disadvantages of sub-altitude training and hopes that we can take advantage and avoid the disadvantages, and adopt scientific methods to improve the effect of altitude training [3].

2. Concept of sub-altitude

In view of the concept of sub-altitude, due to the different classification standards of altitude height, the height of sub-altitude also has different definitions. From the perspective of sports medicine, the height that can make the human body produce obvious biological effects is altitude [4]. This kind of height in general to reach more than 3000m. In addition to dividing from the perspective of sports medicine and geography, we mainly classify altitude from the perspective of altitude training[5].

However, the standards for the classification of altitude heights at home and abroad are very inconsistent.

For example, Russian long-distance running coach Suslov believes that altitude training should be divided as follows: 3000m or more is high altitude; 1200 to 2500m is medium altitude, and below 1200m is low altitude. In addition, many foreign researchers have also put forward their own opinions[6]. They think that the high altitude is above 3000m; the middle altitude is from 1500 to 3000m, and the low altitude is from 500 to 1500m. Two famous scholars in China have divided the altitude. One is Hu Yihai, in 2001 he classified altitude training into three basic types based on altitude, namely: sub-altitude (1800 to 2000m) training method; quasi-altitude (2000 to 2300m) training method, and ultra-altitude (2400 to 3000m) training method). The other is Qin Yufei, he believes that 1500m is a sub-altitude. At present, China calls 1500 to 1880m a sub-altitude. From the opinions of many scholars above on altitude training, we can see that 1500m is an altitude training threshold. If the altitude exceeds 1500m, the altitude environment will stimulate the human body to a greater degree. The main reason is that as the altitude increases, the human body's maximum oxygen uptake will decrease linearly. The maximum oxygen uptake will drop by 1%. According to relevant data, the altitude of most altitude training is between 1500 and 2500 meters. Therefore, based on a comprehensive consideration of the above opinions, the author in this article will take 500 to 1500 meters regional positioning of the sub-altitude [7].

3. Altitude training and middle distance running sports

3.1 *Middle Distance Running Sports*

From the perspective of exercise intensity, the middle and long-distance running sport is a sport of medium intensity to extreme pressure load. During exercise, it requires athletes to provide approximately 70%-95% of aerobic metabolism energy, that is, athletes must have superb aerobic metabolism, so the middle distance running exercise has better endurance and periodicity[8]. For training the athletic ability of middle and long-distance runners, the altitude environment is a very suitable choice. In the altitude environment, the athlete's blood transport function, hematopoietic function, and oxygen diffusion function to tissues will be significantly improved, which will help to improve the aerobic metabolism and endurance of middle and long-distance runners[9].

3.2 *Impact of Altitude Natural Environment on the human body*

Due to the high altitude of the altitude, its natural environment is very different from the environment on flat ground. On the altitude, its oxygen content is low, air pressure is low, windy sand is large, the sunshine time is long, day and night temperature difference is large, humidity is low and cold, ultraviolet radiation, solar radiation, and cosmic ray radiation are relatively high[10]. Among the

above characteristics, the hypoxic environment has the greatest impact on the human body. Due to the low atmospheric pressure on the altitude, athletes are in this hypoxic environment. Training under such an environment, athletes' physiological, and biochemical machinery will undergo a series of changes, and these changes mainly occur in the human body's red blood cells, maximum oxygen uptake, enzymes, lactic acid tolerance, hormones, etc. Finally, through these changes, athletes can be better. It is well adapted to the stimulation of hypoxia in the altitude environment and hypoxia in the exercise state, thereby continuously improving the athlete's performance in the competition[11].

3.3 *Impact of Altitude Training on AthletesBodies*

Altitude training is a kind of intensive training under special environmental conditions, because athletes need to adapt to two stimuli during the training process, namely, the stimulation of altitude hypoxia and the hypoxia stimulation caused by exercise[12]. The stimulation of double hypoxia will accelerate the body's physiological response to hypoxic stress and improve the athlete's athletic ability. However, training in an altitude environment will reduce the athlete's maximum aerobic training speed, especially when the altitude is above 2500 meters. Athletes staying at the altitude for too long will not only improve the athlete's high-intensity endurance ability, but will also increase it[13].

3.3.1Impact on the respiratory system

Middle distance running is an endurance event. The greater the oxygen uptake, the higher the athlete's relative exercise capacity. That is to say, one of the main indicators for judging the aerobic capacity of middle and long-distance runners is their maximum oxygen uptake. In the altitude environment, due to its low air pressure, the oxygen content is low[14]. During training, this will inevitably reduce the athlete's maximum oxygen uptake, and the higher the altitude, the lower the maximum oxygen uptake, thereby restricting mobilization of the athletic ability is restricted.

3.3.2 Impact cardiovascular

Altitude training has a significant impact on the cardiovascular system of athletes. Research on the electrocardiograms of athletes who have undergone altitude training shows that the electrocardiogram pressures of athletes' left and right ventricles are significantly increased compared to those athletes' before altitude training electrocardiograms.

The electrocardiogram generally shows the tendency of sinus bradycardia. The reason for this phenomenon may be that the training load under the altitude hypoxia environment makes the athlete's ventricular volume increase the load, which is also the result of the cardiac compensation adaptation[15].

3.3.3 Effect on Lactic Acid Metabolism

As an important intermediate product of body metabolism, lactic acid is not only the oxidation substrate of the aerobic metabolic energy supply system but also the final product of the glycolytic energy supply system. During altitude training, the athlete's body is exposed to high concentrations of lactic acid for a long time. In the environment, the body is constantly stimulated by high concentrations of lactic acid, and finally, the body produces a strong buffer system to adapt to the influence of the lactic acid metabolism system. As a result, the athlete's antioxidant capacity and lactic acid tolerance are significantly improved[16].

3.3.4 Effects on skeletal muscle

For the body, the main function of myoglobin is to transport and store oxygen. Once the amount of myoglobin in the body is high, it means that the body is in a severe hypoxia state and needs a lot of oxygen. For middle and long-distance runners, during exercise, the body is in a state of hypoxia, which requires a large amount of myoglobin in the body. Therefore, running training for middle distance running in an altitude environment can increase the concentration of myoglobin in the athlete's body by a small amount to adapt the body is quite severely hypoxic. However, exercise training in a hypoxic environment, even endurance training under hypoxia, will not fully stimulate the body's production of Mb[17].

3.4 Analysis of the Advantages and Disadvantages of Altitude Training to Middle Distance Running Training

3.4.1 Advantages

From the above analysis, we can see that altitude training has many advantages for middle and long-distance running training. Altitude training can improve the body's endurance to sports hypoxia, prompting capillaries to further shorten the distance from blood oxygen to cells; thereby increasing the body's oxygen supply capacity of cells. Altitude training can also cause a small increase in the concentration of myoglobin in the human body, adjust the functions of the body's respiratory and circulatory systems, accelerate the transport of oxygen, and make the body produce a hypoxia compensation mechanism, thereby improving the utilization of oxygen[18]. Finally, the effect of aerobic endurance training of middle-distance runners is continuously improved, and the aerobic capacity of athletes is quickly improving. Altitude training can increase the content of serum testosterone, promote protein synthesis, accelerate hemoglobin synthesis, and stimulate red blood cell production. Strengthening muscles and gaining weight can also promote the production of antibodies in the body, thereby strengthening the body's anti-infection ability and immune function. In addition, altitude training can also improve the metabolism of intracellular substances in the body and reduce the rate of biofilm renewal. It can also destroy cell membranes. The above part of the structure releases the proteolytic enzymes in the cell. These proteolytic enzymes can promote the regulation of DHA and RNA to synthesize some anaerobic metabolic enzymes, accelerate the anaerobic metabolic reaction in the body, and provide some energy for the body[19].

3.4.2Disadvantages

There are also many disadvantages in mid-and long-distance running training under hypoxic conditions. Under altitude hypoxia, the athlete's basal metabolic rate increases, and the body's lean body weight decrease; altitude training can reduce the body's maximum oxygen uptake. After a large amount of exercise for a long time, it is difficult for athletes to eliminate physical fatigue, which makes it difficult for athletes to perform long-term intensity training. In addition, high altitude hypoxia can also reduce muscle blood flow, coupled with an increase in red blood cells, resulting in blood viscosity As it rises, the resistance of blood circulation increases, which in turn puts a burden on heart function [20].

4. Influence of sub-altitude environment on the training of middle distance running

In decades of research on altitude training, there are basically no attempts to train sports in the sub-altitude environment, because many scholars believe that due to the low altitude in the sub- altitude, the degree of hypoxia cannot meet the requirements, which stimulates the body's EPO secretion. It is not strong enough to reach the hypoxia threshold of the body, so sub-altitude is basically rejected in altitude training. However, combined with years of altitude training practice, sub-altitude can rely on its own characteristics to provide training with sufficient hypoxia stimulation can also avoid the adverse effects of altitude training on the body to a certain extent[21].

4.1Comparison of Hypoxia in Sub-Altitude Areas

In sub-altitude areas, due to the relatively small drop in atmospheric pressure and oxygen partial pressure, the hypoxia stimulation to the athlete's body is small, and the exercise load is close to the plain state. When the athlete enters the altitude for the first time, it does not need to undergo the first week of adaptation. It can directly enter the normal training state. In the sub-altitude environment, it has little effect on the body's skeletal muscle protein synthesis, and the degree of muscle atrophy is very small. It will basically not affect the body's strength and speed quality[22].

4.2Obvious Low Temperature in theSub-Altitude

In addition to the obvious impact of hypoxia on the human body, as the altitude increases, the temperature will gradually decrease. In a low-temperature environment, athletes are easily infected with diseases. However, in sub-altitude areas, low temperature is not obvious. It is helpful for athletes to train better[23].

Sub-altitude training is less risky and easy to operate in altitude training, if the training plan cannot be scientifically and reasonably arranged or the training load is not properly grasped, not only will it not improve the athlete's performance, but it will cause the athlete to consume too much physical strength, which is not good for the body, and the altitude training will be lost. It should have the effect. At present, we can see many examples of this at home and abroad. The effect of altitude training due to improper training plans or excessive training load has been questioned by people.

However, it is carried out in a sub-altitude environment. In training, there is little difference between athletes' physical exertion and plain training, and various disadvantages are also relatively small. Therefore, athletes are less risky and easy to operate during training, and they can be used for longer exercise training[24].

5. CONCLUSIONS

In summary, altitude training, as an effective means for athletes to continuously improve the athletes' athletic ability and endurance, has received widespread attention since it was practiced. However, while seeing the good effects of altitude training, we also need to face its existing shortcomings. The unique environment of the sub-altitude can appropriately compensate for the many shortcomings brought by the altitude environment to the training of middle and long-distance running. Therefore, we must further understand the characteristics of the sub-altitude environment, make full use of its advantages, and combine the characteristics of long-distance running sports to continue to work hard to continuously improve the comprehensive quality of athletes.

Acknowledgement

The research by the author reported herein was supported by the Capital University of Physical Education and Sports, Beijing, China 100191。

State Key R&D Program (No. 2018YFF0300603) Characteristics of Winter Sports Athletes' Special ability and Key techniques for Scientific Selection, Key Technology Research of Special International Training Platform for Winter Skill Sports Research and Applications (No. 2018YFF0300902 The authors declare no competing financial interest.

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