ATLANTIS PRESS
Advances in Social Science, Education and Humanities Research, volume 105
International Conference on Sports, Arts, Education and Management Engineering (SAEME 2017)

Research Status and Progress of Altitude Training

Shao Bo
Changchun University of Science and Technology 30000, China.

Keywords: altitude training, origin, status quo, development.

Abstract. At present, altitude training has been the focus of attention of athletes, coaches and sports researchers, and has attracted worldwide attention. Most elite endurance athletes in the world use altitude training when preparing for major international competitions, and many effective methods have been put forward for altitude training. Altitude training has produced two global training climaxes. This paper reviews the achievements and the development process from the aspects of the origin and development of altitude training, and the prospect of altitude training for more than 50 years, in effect of altitude training in modern exercise training.

1. Introduction

In recent decades, countries around the world have made many researches and practices on altitude training, especially in some western countries, it has become a system for athletic athletes to perform altitude training before major competitions. Many excellent athletes, such as the United States, former Democratic Germany and the former Soviet Union, also carried out "imitative altitude" training or "simulated altitude" training, as well as by decreasing the volume percentage of oxygen in the air to provide the rated low oxygen partial pressure mixed gas, that is, " Low-pressure Cabin" training. Salazar, a famous American marathon runner, used the " Partial Pressure of Oxygen Aerobic Trainer" to imitate altitude training, he has created the best results of world's marathon for twice and won the major international marathon race champion many times. In recent years, Chinese athletes have to undergo altitude training before the big game, Ma Jiajun created the resplendence of long-distance running by altitude training. The effect of altitude training is positive. Now the research and practice of altitude training is also more perfect. Currently, the altitude of altitude training, the duration of the training, the timing of the competition, the adaptation to high training, individual differences, training effectiveness, training equipment and so on are still in depth study.

2. The Origin and Development of Altitude Training

Altitude training began in the mid-1950s, at that time, mainly for individual competitions, the venue was above 1500 M, a kind of altitude adaptive training was specially organized by some sports teams for the purpose of successfully participating in the competition, and the athlete's performance in the altitude adaptive training has been improved obviously in the game than that of the athletes who haven't participated in the altitude adaptive training, which caused a lot of sensation in the field of sports training. Altitude training's specialized research has not formed the theory in the middle of 1950s, but the specialized altitude training has been started, and the purpose is very clear, that is to say, an altitude acclimatization training was organized in order to successfully compete in the plateau region. Altitude training has been published as a method of improving aerobic ability of athletes for more than 50 years. During this period, there were two global upsurge of altitude training. The first was in the late 1960s, that is, 1968, this is because Mexico City was the host of the Mexico Olympic Games in 1968, which is 2240 m above sea level, many participating countries take into account the competition from the plains to the plateau, the physical function of the condition will be restrained by altitude hypoxia, so as to restrict the normal exertion of sports ability, as a result, many participating countries have been looking for training in the altitude, in order to obtain adaptive preparation for the plateau competition. From the Track and Field Competition results of Mexico Olympic Games, it also

proved that the effect of competitive ability did improve after altitude training, and in the previous Olympic Games, the African athletes who won victory mostly from plateau mountain or plateau in perennial training, such as Kenya's elite long-distance race, world-class athletes, mostly in the altitude of plateau that is between 1500 m and 2000 m. People in the middle-distance race training circles from all counties began to consider the importance of altitude training, and started the research and practice of training. Thus appeared the first global altitude training upsurge from the late 11960s to the late 80s, there arose a climax of further research on the physiological mechanism of altitude training around the world. This systematic study is still in the initial stage, so the research methods are not required to set up the control group, relying on the research theory in single science, in the object of study or limited to a few items, or limited to a certain part of the body function, resulting in the theory of many altitude natural, human body and medical phenomena cannot be justified, and the debate is very intense. With the deepening of altitude training awareness, it is increasingly recognized that altitude training is a more systematic research field than the plain training involving more discipline, training and research. Thus, in the subject areas involved by the study which included not only the backbone discipline such as altitude medicine, plateau physiology, altitude biochemistry, altitude mechanics, plateau psychology, altitude training and so on, but also contained the interdisciplinary subject like plateau meteorology, altitude geography, plateau atmosphere physics and plateau biology, routine automatic monitoring instruments such as blood lactic acid, blood gas, blood cell, biochemistry, telemetry heart rate and urine distribution were used in the research methods, and the use of high, fine, sharp instruments and equipment including exercise cardiopulmonary function test system, color Doppler, color Doppler, HPLC, electron microscope, muscle strength test system, stereoscopic motion analysis system, three-dimensional ultrasound cardiogram, multichannel telemetry my electricity, EGG and mechanical test system as well, in the research type, both applied research and supplemented with basic research and development research, in the research area, there are not only the leading research which has guiding significance to altitude training practice, but also summarizes the research with regularity to guide the summary experience of practice. In the research subject, there are not only the pattern of gradually increasing of altitude training intensity, the corresponding medical supervision and recovery measures, and different altitude has alternately training research, besides, there are also many subject studies such as the adaptation mechanism of athletes under the high altitude hypoxia environment and so on. In the object of study, there are athletes living on the plateau, immigrants, and plain athletes, as well as plain athletes with acute and chronic altitude sickness and altitude athletes with downhill depression. Undoubtedly, it has played an active role in accelerating the development of theoretical research and practical application of altitude training.

3. The Present Situation of Altitude Training

In recent years, especially endurance athletes use some innovative methods of altitude training through long-term practice, training methods are commonly used: 1, under normal pressure by hypoxia training method training method of nitrogen dilution, 2 supplemental oxygen sleep instrument training method 3, 4, intermittent hypoxia training method. Simulated 2000 meters to 3000 meters altitude environment at normal atmospheric pressure, athletes stay in the hypoxic cabin for 8 hours - 18 hours to simulate the “living and sleeping in the plateau environment". But the training at sea level, or highly trained close to sea level, some researchers believe that using low-pressure cabin method will lead plasma EPO levels, the number of reticular cells and red blood cells to produce beneficial changes, thereby improving the endurance performance after altitude training. However, the other in the test of low oxygen cabin is not found on the changes of blood. This difference may be due to the stimulation of hypoxia or the difference in athletes' training. Supplemental oxygen is often used to simulate high intensity training on the plateau in oxygenated, normal sea level or oxygenated environments. This method is used to improve the "Plateau" to the "Plains" strategy, that is, athletes live on the plateau, but training at "sea level". Practice has shown

that after a few weeks of training, at a height of 1860 meters at medium altitude, high-intensity training will greatly improve endurance performance.

In addition, the design of an anoxic sleep apparatus allows athletes to keep living high-training low, including altitude training modules and hypoxic tent systems in Colorado. At present, there are not research's report whether the use of instruments is effective to athletes' red blood cell count, maximum oxygen uptake and exercise performance or not. In addition, intermittent hypoxia assumes that after a short period of 1.5 h --2 hours of hypoxia, there is sufficient stimulation to release plasma EPO, which eventually leads to elevated RBC levels. Athletes use intermittent hypoxia during rest, or use it with exercise week, which is more effective.

4. The methods of altitude training

4.1 The Common Methods of Altitude Training.

(1) Intermittent hypoxia training in the late 1980s, Professor Erbosi Strilakos, a former Soviet scientist, created intermittent hypoxia training. This method relies on a specific instrument, by reducing the percentage of oxygen in the air volume with rated low oxygen pressure mixed gas, which enables the trainees to inhale hypoxia gas, because the total amount of anoxia load in practice will be divided into several independent groups, each group consists of several times, the free breathing at normal atmospheric pressure is resumed at intervals of two reductions in oxygen stimulation, making the hypoxia load training shows the intermittent characteristics of impulse type or Intermittent hypoxia stimulation, so it is called intermittent hypoxia training. Intermittent hypoxia training refers to the alternate routine exercise training of athletes in improving their physical quality, technical and tactical abilities, this training is usually arranged after the training is over.

(2) Living high-training low Living high-training low lets athletes live in altitude or artificial hypoxia environment, training in plain or low altitude areas. The training method was first proposed by American scholars. At that time, it was attracted by the attention of experts and scholars immediately, some developed countries in Europe and America quickly put a lot of practical investments in this field, and made a lot of basic research and threw into practical application. Among them Finland Olympic Institute was the earliest place that make Living high-training low input the exercise training. After the Finland, some developed countries in Europe and America have also quickly set up high living and low training laboratory and training center, and put into use.

(3) The effect of altitude training the results showed that intermittent hypoxia training can make the organism produce an overall tolerance to hypoxia, through improving the oxygen metabolism enzyme activity and respiration, adaptation of the circulatory system and Enhancement of anti-lipid peroxidation, which improves the organism's oxygen metabolism ability. The emergence of short time response or long time of intermittent hypoxic adaptation training and the decline of heart rate at the same level of load can prolong the cardiac cycle, especially the diastolic period, so as to improve the working ability of myocardium, and prevent the damage and hemolysis of erythrocytes caused by hypoxia after intermittent hypoxic training. At the same time, intermittent hypoxia training can increase the lactate threshold and increase the aerobic capacity of the athletes to increase the cardiac reserve, and it also can increase the myocardial working ability and improve the oxygen utilization capacity of the body, thereby increasing the body's potential and ability. In addition, intermittent hypoxia training can effectively improve the myocardial index and skeletal muscle index, thus enhancing the antioxidant capacity of the myocardium and skeletal muscle. It is beneficial to maintain the normal blood supply function of the heart during the long time movement, effectively improve the antioxidant ability of skeletal muscle and delay the occurrence of central disease and fatigue in the movement. The effect of living high-training low, research results show that the method of living-high and training-low can make the maximum oxygen intake of athletes to improve. Using this method of training until fifth days, EPO in the blood increased markedly, reticulocytes also doubled. With the extension of training time, the lactic acid value in the exercise under certain load is gradually reduced, and the average speed of trainees is obviously improved. The plateau training symposium

which was organized by the United States Olympic Committee and Northern Arizona University provides a platform for academic communication for altitude training theory and practical application. The main conclusions of this workshop are as follows: 1. Obviously " living-high and training-low" is an effective method in improving the competition performance in the plains; 2. For most athletes, in order to increase the number of red blood cells, it is necessary to live at a natural altitude of 2100 to 2500m; 3. In order to avoid the negative effects of altitude training, the oxygen can be effectively supplemented during high-intensity training, so let athletes to live high and train low; 4. According to current studies, it is not clear whether altitude tents can produce beneficial physiological responses (e.g. an increase in red blood cell count) or increase exercise capacity; 5. According to current studies, intermittent hypoxia exposure and intermittent hypoxia training showed no increase in red blood cell count or increased endurance in plains. However, intermittent hypoxia exposure is clearly helpful in preparing for competition in the highlands.

5. The Direction of Altitude Training Development

5.1 Continue to extend to non-endurance item.

Altitude training is often used in endurance programs because of its improved oxygen capacity. In recent years, altitude training programs have been expanded to more than 20 Olympic events.

5.2 The development of simulated altitude training.

In the plains areas, a similar plateau condition is created for athletes to train, which is called "simulated altitude training". From the required facilities, simulated altitude training can be divided into two major categories: first pressure cabin type; two is mask type. The characteristics of simulated altitude training are that it can be carried out in plain conditions, and it is more economical to avoid the transfer from the plateau to the plateau. In terms of effectiveness, it also has a role, but some people think that it is not as effective as the field altitude training.

5.3 Rejuvenation of athletes.

In the past, altitude training is only suitable for adult athletes. Young athletes' heart and lung function is not very mature, so it is difficult for them to tolerate the altitude training. But now, participate in the training of athletes plateau age is smaller than in the past. For example, the middle-distance runners of Schoen who is a coach of the German national team are 16 years old. The throwers of Lage Manna Lief who is a Bulgarian coach are 17 years old. And the excellent swimmers in China and the United States are 14~15 years old.

5.4 Pay more attention to the support of scientific research.

In view of the fact that altitude training is heavy on the body and involves a variety of influencing factors, in order to improve its success rate, many countries have given greater support in scientific research. For example, Japanese foot race athletes trained at the base of Qinghai's DOPA, and sent a group of experts made by the famous sports physiology professor of the Tokyo University, the Waseda University and Heaven University to escort them. 1994~1995 years, the Australian Institute of Physical Education issued a plateau training research program "A study on the effect of middle altitude training on improving the athletic ability of middle and long distance runners in plain", and 30 scholars who are from Australia training and Research Center, Queensland sports center and the University of Sydney in three units conduct a comprehensive study of nutrition, psychology and other disciplines from the physiological (blood, biochemical, endocrine, immune, and hemodynamic). At present, among the international plateau training bases, Spain's Serra Nevada base in scientific research facilities is perfect and it use advanced test means that contain Biomechanics (with 3D mechanical analyzer motion analysis of displacement, angle and speed, position of center of gravity analysis, quantitative analysis of technical movements, swimming, jumping, throwing throw line trajectory analysis), evaluation of physical fitness (measured leg strength, flexibility, determination of motion displacement electronic timing and when the neural response), body measurement, medical physiology assessment (biochemical, blood, urine, exercise test), with a set of laboratory instruments and equipment which a high level of sports scientific research units possess.

In a word, altitude training as a special training method has played a great role in promoting the development of competitive sports, but there are still many problems worthy of further study. Therefore, we should not blindly follow the altitude training, but should combine scientific analysis of the characteristics of sports events. Only in this way can we achieve better results. Therefore, we should not blindly follow the altitude training, but should combine scientific analysis of the characteristics of sports events. Only in this way can we achieve better results.

References

[1]. Zhao Ou, Zhang Yan, The origin and historical review of altitude training [J]. Huaihua University Newspaper (2014.10).

[2]. Ma Yajun, Research status and progress of altitude training [J]. Neijiang science and technology (2016.1).

[3]. Tian Maijiu, Wu Fuquan, Scientific exploration of sports training [M]. Being People’s Physical Culture Publishing House (2013.55).

[4]. Weng Qing zhang, Altitude training [J]. Qinghai sports science and technology (2012),[1]56—74.

[5]. Yin Weina, Zhang Chuanxin, Research progress of altitude training [J]. Journal of Capital Institute of Physical Education. (2015.5) 17-3.

[6]. Lei Zhiping, Discussion on development trend of altitude training [J]. Journal of Xi'an Physical Education University. (2014) 14 (2).