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RECENT TRENDS IN ALTITUDE TRAINING

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ABSTRACT

The purpose of this research is to examine recent changes in altitude training. Athletes typically use altitude training to increase their endurance. Athletes competing at lower altitudes will have a larger concentration of red blood cells for 10-14 days after the competition, which gives them a competitive advantage. The athlete's adaptation is an increase in the amount of red blood cells produced in response to increased kidney production of the hormone erythropoietin, which will provide maximum endurance.

INTRODUCTION

Some endurance athletes use altitude training to train for several weeks at a high altitude. The air still contains around 20.9 percent oxygen at this height, but the barometric pressure, and hence the partial pressure of oxygen, is lower. The body may adapt to the relative absence of oxygen hypoxia depending on the methods utilised. Athletes will have a larger concentration of red blood cells for 10-14 days when they travel to events at lower altitudes, giving them a competitive advantage. The air becomes thinner as you go higher in the atmosphere.

Thinner air means less air resistance, but also means less oxygen, so the pace of hard endurance training and competition--which depends on high rates of oxygen consumption--gets slower at altitude. The most important adaptation for the endurance athlete is an increase in the number of red blood cells, which are produced in response to greater release of the hormone erythropoietin (EPO) by the kidneys.

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Increases in red blood cell mass and hemoglobin (it is inside red blood cells), in conjunction with the production of new capillaries have been shown to enhance an athlete's oxygen carrying capacity. The increase in red blood cells can mean 3% - 7% more speed, endurance, and power.Altitude simulation systems have enabled protocols that do not suffer from such compromises, and can be utilized closer to competition if it is necessary. Some devices would be considered portable.Numerous other responses to altitude training have also been identified, including angiogenesis, glucose transport, glycolysis, and pH regulation, each of which may partially explain improved endurance performance independent of a larger number of red blood cells. Furthermore, exercising at altitude has been shown to cause muscular adjustments of selected gene transcripts, and improvement of mitochondrial properties in skeletal muscle.

Altitude simulation technologies have made it possible to develop protocols that are free of such compromises and can be used closer to competition if necessary. Some gadgets are considered portable. Angiogenesis, glucose transport, glycolysis, and pH regulation are just a few of the other reactions to altitude training that may help explain enhanced endurance performance without requiring a bigger number of red blood cells. Furthermore, it has been demonstrated that exercising at altitude causes muscular changes in specific gene transcripts as well as an enhancement in mitochondrial characteristics in skeletal muscle.

Methods used for training in hypoxia

- 1. Supplemental Oxygen
- 2. Hypoxic Sleeping Devices
- 2.1 CAT Hatch
- 2.2 Hypoxic Tent System
- 3. Intermittent Hypoxic Exposure (IHE)
- 3.1 IHE at Rest
- 3.2 IHE During Exercise

1.Supplemental Oxygen

- It is a modification of the 'live high – train low'.
- Is used byathletesthat live in a natural terrestrial altitude environment but train at 'sea level' with the aid of supplemental oxygen.
- Is used at the US Olympic Training Center in Colorado Springs.
- Scientific data regarding the efficacy of hyperoxic training suggest that high-intensity workouts at moderate altitude (1860m/6100ft) and endurance performance at sea level, may be enhanced through the use of supplemental oxygen.

2. Hypoxic Sleeping Devices

- Thissystems are designed to allow athletes to sleep high and train low.

2.1 CAT Hatch

- It is a cylindrical hypobaric chamber
- Can simulate altitudes up to approximately 4575m
- Cost of approximately 14 000 $.

2.2 Hypoxico Tent System

- This modality can be installed over a standard double or queen-sized bed.
- simulates elevations up to approximately 4270m
- Cost of approximately 7000 $.

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- **3. Intermittent Hypoxic Exposure (IHE)**
- Is based on the fact that brief exposures to hypoxia (1.5 to 2.0 hours) stimulate the release of EPO.
- Athletes typically use IHE while at rest or in conjunction with a training session.
- The IHE allows the athlete to 'live low-train high'.
- **3.1 IHE at Rest**
- Is to expose an individual to intermittent hypoxic conditions during the recovery period

3.2 IHE during Exercise

- Is to expose an individual to intermittent hypoxic conditions during the exercise.

Doping

- Synthetic EPO also exists. Injections of synthetic EPO and blood doping are illegal in athletic competition because they cause an increase in red blood cells beyond the individual athlete's natural limits.
- This increase, unlike the increase caused by altitude training, can be dangerous to an athlete's health as the blood may become too thick and cause heart failure.
- The natural secretion of EPO by the human kidneys can be increased by altitude training, but the body has limits on the amount of natural EPO that it will secrete, thus avoiding the harmful side effects of the illegal doping procedures.

Negative aspects of training at altitude

- Athlete's red blood cell concentration returns to normal levels within days of returning to sea level and that it is impossible to train at the same intensity that one could at sea level, reducing the training effect and wasting training time due to altitude sickness.

- Acute mountain sickness (AMS) is a pathological condition that is caused by acute exposure to low air pressure (usually outdoors at high altitudes). It commonly occurs above 2,400 meters. Acute mountain sickness can progress to high altitude pulmonary edema or high altitude cerebral edema.
- It occurs in low atmospheric pressure conditions but not necessarily in low oxygen conditions at sea level pressure. Although treatable to some extent by the administration of oxygen, most of the symptoms do not appear to be caused by low oxygen, but rather by the low CO_2 levels causing a rise in blood pH, alkalosis.
- Other sickness often confused with altitude sickness, is dehydration, due to the higher rate of water vapor lost from the lungs at higher altitudes.

CONCLUSION

High altitude training aids in the improvement of a competitive athlete's endurance. Increased red blood cell mass and hemoglobin, as well as the formation of new capillaries, have been found to improve an athlete's oxygen carrying capacity and performance. As a result, altitude training is one of the most effective ways for athletes to increase their performance, particularly in long-duration exercises.

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