



Physiological Factors and Performance Gain Through High Altitude Training

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Abstract: Adaptation is the development of some unique characteristic features by the individuals to survive in a particular environmental condition. High altitude is any elevation above 1500 meters (5000ft) from the sea level. High altitude training is the practice by some endurance athletes of training for several meters at high altitude. Physiological adaptations that acclimatize the body of athletes by high altitude training involves increased erythropoietin (EPO) level, increased red blood cells (RBC) and hemoglobin, or alteration of muscle metabolism and higher VO₂ Max. A set of researchers claims that altitude training stimulates a more efficient use of oxygen by the muscles. This efficiency can arise from numerous other responses to altitude training including angiogenesis, glucose transport, glycolysis and PH regulation. Furthermore exercising at high altitude has been shown to cause to muscle adjustment of selected gene transcripts and improvement of mitochondrial properties in skeletal muscle. The effects of high altitude on human are highly conclusive. The percentage of oxygen saturation of hemoglobin determines the contents of oxygen in blood. After the athlete's body reaches 7000 ft above sea level, the oxy hemoglobin saturation begins to decrease constantly. Infected the human body has both short term and long term adaptation to altitude that allow it to partially compensate for the lack of oxygen. Athletes use their adaptations to help their performance.

Keywords: *Adaption, High Altitude and Hemoglobin.*

Introduction:

The study of altitude training and its impact on physiological adaptation by athletes was heavily delved into during and after the 1968 Olympics which took place in "Mexico City" Mexico elevation 2240 meters (7349ft). It was during these Olympics games that endurance events saw significant below record finishes while anaerobic sprint events broke all types of record. This was attributed not only to less resistance during moment due to less dense air but

also to the anaerobic nature of the sprint events. Ultimately, these games inspired investigation into altitude training from which unique training principles were developed with the aim of avoiding under performance. Athletes are individuals who wish to gain a competitive edge for endurance events can take advantage of exercising at high altitude. Some methods of altitude training principles are discussed below. Now a days, altitude training has become a standard training protocol in many aerobic sports to increase exercise capacity at sea level to acclimatize prior to competitions at altitude or before ascending to altitude. Sudden exposure of human body to a hypoxic environment or staying at altitude in dance numerous adaptations which can lead to improved athletes performance at sea level.

This training idea involves living at higher altitude in order to experience the physiological adaptation that occurs in the body of athletes. Good adaptation that occurs in the body of athletes. Good venues for live-high, train low at global level include Mammoth Lakes, California, Flagstall, Arizona and the Sieera Nevada near Granada in Spain. Altitude training can produce increases in speed, strength, endurance and recovery by maintaining altitude exposure for a significant period of time.

A study using simulated altitude exposure for 18 days, yet training closer to the sea level-showed performance gains were still evident 15 days later.

Live High Train High Principle in the live high train high regime an athlete lives and trains at a desired altitude. The stimulus in the body is constant because, the athlete is continuously in a hypoxia environment. Athlete will no longer be able to metabolize as much oxygen as they would at sea level. How after long period of training at altitude, high trained athletes returning to sea level do not exhibit increased red blood cells count or improved performance on 4000 mtr cycling test.

In repeated sprints in hypoxia (RSH) athlete run short sprint under 30 secs as fast as they can. The experience incomplete recoveries in hypoxia conditions. When comparing (RSH) and repeated sprint time to fatigue and power output. (RSH) and RSN group were tested before and after 4 week training period. Both groups initially completed 9-10 allout sprint before to tall exhaustion. After the 4 week training period, the RSH group was able to complete 13 allout sprints before exhaustion and the (RSN) group only completed (9) Nine.

Biggest issue facing those climbing to fram or live at altitude is that environment may cause you to feel acute altitude sickness. That cause you to feel acute altitude sickness. That

includes Nausea, Vomiting, headache, dizziness and difficult sleeping which can start from six hours following exposure.

However, the symptoms usual resolve with 24-72 hours upon returns to sea level.

Visible Physiological advantage from RSH includes compensatory vasodilation and regeneration phosphocreatine (PCR). The body tissue has the ability to sense hypoxic and include vasodilation. The higher blood flow helps the skeletal muscles maximize oxygen delivery. A greater level of PCR resynthesize augments the muscles power production during the initial stages of high intensity exercise.

Artificial Altitude:

In Finland, a scientist named HEIKKI RUSKO has designed a high-altitude house situated at sea level at normal pressure but modified to have low concentration of oxygen which is roughly equitant to the amount of oxygen available at high altitude often used for altitude training.

RUSKOS result show improvement of erythropoietin and red blood cells. Artificial altitude can also be used for hypoxic exercises, where athlete trains in an altitude simulator which judges the conditions of high altitude environment. Athletes are able to perform high intensity training at lower velocities and thus produce lessee stress on the muscular skeletal system.

At high altitudes, there is decrease in oxygen hemoglobin saturation. The hypoxic condition cause hypoxis-inducor factor (HIFZ) to become stable and to stimulate to production of erythropoietin EPO stimulates red blood cell production from bone marrow in order to increase hemoglobin saturation and O_2 deficiency. EPO has become frequently abused by Hypoxic condition is defined as an abnormally low content in any tissue or organ, or body as a whole Hypoxemia that refers to low oxygen in the blood, can cause hypoxia (hypoxemic hypoxia) but other mechanisms such as anemia can also leads to hypoxia. Competition athlete through blood doping and injections in order to gain advantages in endurance events. Abuse of EPO however increases RBC counts beyond normal level (Polycythemia) and increase in the viscosity of blood, possibly likelihood of hypertension blood clot, heart attack stroke.

Non Hematological Changes:

In addition to the changes in the blood cell volume, there are also a number of biological tissue alternations which help to turn one muscle into energy efficient machines.

There include:-

- Increased oxidative enzymes capacity.
- Increased mitochondrial volume and augmented muscle energy efficiency.
- Increased fatty acid substrate utilization.
- Greater lactic acid tolerance and muscle buffering.
- Improved muscle tissue PH regulation.
- Better glucose transport and glycolysis.
- Frontiers in physiology. <https://www.frontiersin.org>.

Conclusion:

For athletes, high altitude produces two contradictory effects on performance. For explosive events (Sprint upon 400 meters, long jump, triple jump, the reduction in atmospheric pressure means there is less resistance from the atmosphere and the athletes performance will generally be better at high altitude.

For endurance events (races of 800 meters or more predominant effect is the reduction in oxygen which is generally reduced the athlete performance at high altitude.

Sports organization acknowledges the effects of altitude on performance. The international association of athlete federations for example, has ruled that performance achieved at an altitude greater than 1000 meters will be approved for record purposes.

Despite the potential benefits arising from altitude training, its effectiveness in improving hematological variables is still debatable. Further research and better understanding of factors influencing the response to altitude, as well as factors effecting

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