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# Running Science

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## Altitude Training - Part One

Written by Philo Saunders

Dick Telford's squad, training at altitude in Switzerland.



*Altitude training is used by many elite athletes around the world in preparation for major events. But how through what mechanisms does it produce its benefits, exactly what benefits are provided, and what is the best method to achieve success after altitude training? These are just a few of the questions that will be addressed over coming issues.*

Altitude training has been found to be only really beneficial for elite endurance athletes who have already reached a very high level of fitness through years of consistent and hard training, and who are looking for extra improvements that can be gained in addition to running training. The improvements that can be obtained simply by increasing training volume and intensity for recreational runners far out way any small improvements that can be gained from using altitude training. The effect of altitude training on endurance performance has been researched extensively and there is a widespread belief in the athletic community that altitude training can enhance sea level athletic performance, with increases in maximal oxygen uptake (VO<sub>2max</sub>) and running performance being observed after periods of altitude training. At high altitudes the amount of oxygen in the air is reduced and the body adapts to

this. The exact adaptations are still not totally clear, but have been proposed to include an increase in red blood cells (carries oxygen to the muscles to produce energy), muscular adaptations (such as improved ability to buffer lactic acid), improved running economy (reduced oxygen consumption required to run at a given running speed), or a combination of these factors.

The traditional approach to altitude training is for athletes to live and train at natural high altitude venues (1500-3000 m). A recent approach has been for athletes to live/sleep at high altitude and train at or near sea level, the so-called live high – train low (LHTL) method. Because the geography of many countries does not readily permit LHTL a further refinement has been for athletes to live at simulated high altitudes using altitude chambers and altitude tents and training at, or close to, sea level. The philosophy behind LHTL altitude training is to expose the body to hypoxic (low oxygen) conditions but not compromise training intensity and avoid fatigue, both of which can occur when living and training at high altitude. Simulated altitude can be obtained by two methods. Nitrogen Dilution – this method uses an enclosed room or tent with air being pumped in with differing concentrations of

Nitrogen. Increasing the percentage of nitrogen in the air displaces the percentage of oxygen creating hypoxic conditions. Oxygen filtration – this method requires a generator that draws in room air and with a special filtration system absorbs oxygen to varying amounts and then pumps air that is lower in oxygen into a sealed room or tent. In continuation on the previous two issues of R4YL, which focused on running economy and the use of plyometric training to improve running economy, altitude training can also be used to improve running economy in highly trained distance runners. Research undertaken out our laboratory at the AIS and at other research centres around the world have demonstrated that various forms of altitude training can reduce the oxygen cost of submaximal running and cycling. Subsequent issues will focus on various methods of altitude training to improve running economy and other factors that lead to better running performance.



An altitude tent.

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