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E-Journal of Research

ISSN NO: 2395-339X

Environmental Effects on an Athlete

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During an athlete's career numerous things happen which bring changes in his environment. In the early stages, the most common changes involve long, tiring journeys, sometimes combined with a stay for a number of days in an unfamiliar place. Later in the athlete's career, there are more serious changes to take note of, and to prepare for. There are three environmental conditions which an athlete will have to learn how to acclimatize to, these are altitude, temperature and time change.

Altitude

At altitude, there is reduced air resistance, suggesting an advantage in activities involving speed, i.e. sprints. The force of gravity is reduced, suggesting an advantage where relative and maximum strength is critical.

Some of the **immediate effects** of exposure to altitude are increased breathing rate, increased heart rate, giddiness, nausea, headache, sleeplessness and decrease in VO_2 max. For every 300 meters above 1000 meters VO_2 max decreases by approximately 2.6%. The total effect of these adjustments is a reduction of work capacity.

The **long term effects** of continued exposure to altitude include are increased erythrocyte volume, increased hemoglobin volume and concentration, increased blood viscosity, increased capillarisation, continued lower $VO_{2\max}$, decreased lactic acid tolerance and reduced stroke volume.

For **short term training at altitude**, the various benefits associated with it can be offset by other fundamental drawbacks such as are poor facilities, strange diet, different surroundings and homesickness. Benefits must be weighed against these limitations, plus those created by time change and problems in travelling to the training venue.

On return from altitude training performances at sea level appear to peak between the 19th and 21st day and then again between 36 days and 48 days performance improves.

Data collected from a variety of elite endurance athletes from a variety of sports have shown that training at altitudes between 1.8 km and 3 km promotes improvement in endurance based activities made at sea level. At these altitudes, it can take an athlete up to three weeks to acclimatize.

High altitude may result in a drop of your VO_2 max. The magnitude of this decline is approx. 5 to 7% per 1000 meters (Bernhard 1978)^[1]. To overcome this effect a "live high train low" model was developed where athletes slept at an altitude of 2500 meters but trained at sea level (Levine 1991)^[2].

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Hazards of altitude training

Due to the reduced oxygen pressure at altitude, athletes are unable to maintain high intensity training and subsequently their aerobic fitness may slowly decrease. This reduction in fitness may offset any positive physiological adaptations from altitude exposure (Levine 2002)^[3]. Athletes can become 'over trained' as it is a common mistake to adopt the same training zone based on heart rates or times, time to perform a certain distance and/or lactate concentration.

Heart rate at rest and during sub maximal exercise will increase proportionately to the level of altitude compared to sea level. With acclimatization, the resting and sub maximal heart rate will decrease, but will still remain higher than sea-level values. In contrast a decrease or a similar heart rate during maximal exercise in hypoxic conditions is observed. Training at altitude will result in higher levels of lactate concentration; at a specific intensity of exercise, an altitude-induced performance impairment of about 3% has been observed in 1,500m running and of about 8% in 5,000 and 10,000m running compared to sea level. Similarly, impairments of 2-3% for 100m and 6-8% for 400m swimming or longer have been recorded (Can Med Assoc J. 1973)^[4]. What this means is that an athlete's sea level training standards cannot be used at altitude.

The dryness and the altitude-induced hyperventilation cause an increase in water loss via breathing (up to 1,900ml/day for a man and 850ml/for a woman). In addition, altitude-induced hormonal changes and the release of metabolites during the acclimatization phase can increase the urine production by up to 500ml/day. It is important to drink sufficient fluid while at altitude (up to 5 liters per day) and reduce the use of caffeinated drinks, which can act as a mild diuretic.

Recovery from training is longer and since sleep can also be disturbed, a good way to avoid overtraining is to take an afternoon nap. Nutrition is important as lower oxygen levels mean that the demand for carbohydrate is proportionately higher and a healthy iron status is also desirable for the production of red blood cells. A nutrient-rich diet is also recommended to help counter the possibility of illness and infections due to the suppression of the immune system at altitude.

Symptoms such as headache, vomiting, dizziness, physical and mental fatigue, sleep disturbance and digestive disorders can also occur at altitude and may require the reduction and modification of training, or even a complete cessation of training.

Ultraviolet radiation is significantly higher at altitude and can cause sunburn or snow blindness. Athletes should protect themselves by using ultraviolet sunscreen and sunglasses.

Preparing for major competition

The top endurance athletes prepare for major championships with altitude training. The general advice is:

- plan two sessions of altitude training
- 1st at 9 weeks prior to the competition and lasting 3 weeks
- 2nd lasting 2 weeks and ending 3-4 days prior to the competition
- supplement your diet with vitamin C and Iron

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Hypoxic Tents

Regardless of the altitude, the air we breathe contains 20.9% oxygen, 78% nitrogen and 1% trace gases. At altitude the atmospheric pressure is decreased, and while the content of oxygen in the air remains the same, its pressure and concentration is decreased. In a hypoxic tent the air pressure is not changed but the oxygen content is and at approx. 15% oxygen it is similar to an altitude of 2500m. Using a hypoxic tent an athlete can take advantage of the benefits associated with altitude training while at home.

Malloy et al. (2007)^[5] discusses the influence of a hypoxic environment on human physiology and altitude training's influence on athletic performance.

Temperature

The ability to perform vigorous exercise for long periods is limited by hyperthermia (over heating) and loss of water and salt in sweating. Athletes should know the hazards of vigorous exercise in hot, humid conditions and should be able to recognise the early warning symptoms that precede heat injury.

The circulatory system functions first to deliver nutrients to the working tissues and remove the waste products; and secondly to regulate the transfer of heat from active muscles to the body surface.

It is because of this added demand on blood flow that body temperature regulation, and circulatory capacity, are significantly influenced by the environmental temperature and humidity. When performing in warm, humid conditions the circulation cannot both supply nutrients to muscle and regulate body temperature to the complete satisfaction of the body. As a result, the athlete's performance is impaired, and overheating becomes a serious problem.

Low levels of dehydration can influence performance and it is reported by Cheugn (2004)^[7] that a loss of 2% body weight (1kg for a 50k athlete) can reduce performance by 10 to 20% (a 120 seconds 800 metres reduced to 132 to 144 seconds).

Two factors influencing early fatigue and impaired performance in all types of sports are the depletion of the body's levels of carbohydrate and fluids. Athletes should consider the use of sports drinks to replace these.

HEAT STROKE is one of the few potentially lethal complications of sport in a healthy individual.

Time

When we travel in an easterly or westerly direction, for every 15 degrees of longitude a time change of one hour occurs. The general effect of this time change is an upset to those body functions that are time-linked, e.g. sleeping, waking, eating, bowel and bladder functions. The body will gradually adjust and a minimum of one days stay for a one

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hours time change is regarded as a necessity. Air travel has an effect on the body. e.g. digestion upset, swelling feet and dehydration.

Research by Youngstedt (1999)^[6] concluded that studies that have assessed athletic performance have produced mixed results and further research is required to establish if athletic performance is influenced by air travel.

References

1. BERNHARD, W.N. (1998) Acetazolamide plus low-dose dexamethasone is better than acetazolamide alone to ameliorate symptoms of acute mountain sickness. *Aviate Space Environ Med*, 69, p. 793-801
 2. LEVINE, B.D. (1991) Living high-training low: The effect of altitude acclimatization/normoxic training in trained runners. *Med Sci. Sport Exec*, 23 (S25)
 3. LEVINE, B.D. (2002) Intermittent hypoxic training: fact and fancy. *High Alt Med Biol*, 3, p. 177-193
 4. Can Med Assoc J., 1973, 109 (3), p. 207-209
 5. MALLOY, D.C. et al. (2007) The spirit of sport, morality, and hypoxic tents: logic and authenticity. *Applied Physiology, Nutrition, and Metabolism*, 32, 2, p. 289-296
 6. YOUNGSTEDT, S. D. and O'CONNOR, P. J. (1999) The influence of air travel on athletic performance. *Sports Medicine*, 28 (3), p. 197-207
- CHEUNG, S. and LEIVERT, G. (2004) Multiple triggers for hyperthermic fatigue and exhaustion. *Exerc. Sport Sci*, Rev32, p. 100–106