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Environmental Factors and Sports Performance

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ABSTRACT

Every creature of this world is under the environment. The environment is the one and the most important factor to impact in every body's life beside heredity. Thus the environment plays an important role in the quality of an athlete's performance. There are many things the athlete can do or adaptations he can make to prepare him better for variations in the environment, either expected or unexpected. The athlete who trains at sea level is forced to make rather extensive physiological adjustments to compete successfully at higher altitudes. Training in cool climates does little to prepare the athlete to compete under conditions of extreme heat and humidity. Similarly, sudden exposure to cold can have a drastic influence on athlete's performances if they have not had an opportunity to acclimatize to the colder environment. Environmental factors include extremes of heat, cold, humidity and contests at high altitudes. In the Mexico City Olympic 1968 the altitude of 2240 meters, successful competitors exceeded the best world marks in running events, records were broken, and deterioration in the events which lasted longer than one minute. Altitude mainly affects endurance or aerobic activities rather than sprints on anaerobic events. Fit people will be able to perform better, just as they can at sea level, than the unfit.

Key Words : Environment, Sports performance, Altitude, Physiological changes

INTRODUCTION

Nobody can ignore the impact of an environment that may be internal as well as external. Sports are not an exception. Factors which keep impact on sports performance are variation of temperature, humidity, altitude etc. As the temperature of the surroundings increases, the gradient between the athlete and environment decreases *i.e.,* the temperature of the environment approaches the skin and deep body. The body produces a considerable amount of heat as it generates energy to perform various physical tasks. In a cold environment this metabolic heat production is necessary to assist in maintaining the body temperature. In a hot environment, however, it is a liability since it adds to the body's heat load. Body temperature is controlled by the hypothalamus unit in the brain. The body has a "set point" mechanism by which it copes with the environmental temperature. Similarly the ability of the athlete to successfully perform in the heat depends on the degree of the heat, humidity**,** the air movement, intensity and duration of effort, and the extent of his previous exposure to similar, environmental conditions. Four physical processes remove excess heat from the body are radiation conduction, evaporation and convention. Change the body temperature is usually higher than air temperature; the human body radiates heat rays to the environment. But during the warmer days of summer, heat is absorbed by the body through radiation. Physically fit people tolerate heat better than the unfit, because their cardiovascular systems are more stable and they dissipate heat more efficiently. They also become acclimatized more quickly. Simply losing weight will increase heat tolerance. Overweight individuals suffer more in heat and humidity because their heat insulates them and interferes with heat loss. Beside

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this the environmental factors like dehydration, acclimatization, humidity, altitude etc. play an important role as environmental factors for sports performance. Performance in cold also cannot be ignored. There are number of other factors within a particular environment that can contribute to the performance outcome of an athlete's effort. Weather is often an intractable and unpredictable variable in outdoor competitions. The event venue-such as World Championship or Olympic stages, as compared to local or regional event- can greatly affect both the mental and physical performances of the athlete, especially when comparing indoor to outdoor events. Wind resistance has a physical effect on running speed and metabolic cost as does the altitude of the venue. These factors, as well as timing method, were investigated by, Hollings *et al.* (2012) for their effect on elite male track athletic performance.

Aim and objectives of the study:

The main aim and objectives of the study is to discuss the influence of the environmental factors on sports performance.

Observation:

It has been seen that at altitudes of over 5000 feet the ability to perform physical work is effected-the higher the altitude more severe the effects. Longer an athlete remain at altitude, better becomes athlete's performance, but that is not equal to or reaches to that which obtained at sea level. This improved performance during stay at altitude is brought about through acclimatization. The number of weeks or days to acclimatization depends on the altitude e.g. for 10000 feet about 7 to 10 days, 12000 feet about 15-21 days, 15000 feet about 21 to 25 days. De-hydration is a serious threat to the human being. The deep body temperature rises from 0.3^0 F to 0.5^0 F for every one per cent loss in body weight. This rise is the result of the loss in blood volume *i.e.* a large per cent of the water lost in sweating comes from the blood volume. It also causes kidney failure. On hot days when humidity is high and there is little or no wind, evaporation is dangerously reduced. Acclimatization to cold does occur as a result of repeated exposures. It is relatively little value with regard to athletic performance. Humidity, air velocity, and the degree of cloud cover as well as temperature, all directly influence the degree of stress felt by the athlete. Physiological changes occur due to acclimatization increased pulmonary ventilation increased number of red blood cells and haemoglobin concentration. There are elimination of bicarbonate in the urine, changes of tissue level, increased muscle and tissue capillaries, increased myoglobin concentration, increased mitochondria density, changes of enzyme that enhance the oxidative capacity. The performance capacity effects due to high altitude are for decrease in total barometric pressure, decrease in partial pressure of oxygen, decrease in density of air, pulmonary ventilation is increased at high altitude, increased haemoglobin concentration in the blood, increases diffusing capacity of the lungs, increased vascularity of the tissues, increased myoglobin content of the muscle, increased ability of the cells to adjust to the low partial pressure of oxygen and make use of the available oxygen. In world class tournament including Olympic it has been seen that sports performance has been affected by the environmental factors mostly by the altitude.

Discussion:

Sports performances at Olympic level and other international and national levels have been highly influenced by environmental factors many times worldwide. Some where the sports performances have been increased and some where have been reduced. High heat and humidity lead to two problems in the exercising body: 1) increased core body temperature and 2) dehydration. Increased body temperature (hyperthermia) leads to decreased muscle endurance, which means the muscle's ability to contract repeatedly or in a sustained manner over long periods of time. High core temps also cause a shift in energy production from aerobic to anaerobic a mechanism, which means the body has to use up its muscle energy stores more rapidly. Unfortunately, during a longer athletic event, the rate of adding energy (sports drinks, energy bars, gels, etc.) can't keep up with the rate of losing energy when heat and humidity are high. Finally, high body temperature causes a decrease in blood flow to the heart as blood pools in the limbs. If the heart doesn't get as much blood, it can't pump as much oxygenated blood back to the muscles. Heat exchange between an athlete and their environment is directly impacted by the ambient temperature of the environment, as well as its moisture density, or humidity. Effective evaporation is limited in heavy humid conditions due to increased sweat vaporization, and thus reduces heat loss in the athlete (Hayes *et al.*, 2014). In dry heat conditions, the evaporative requirement of the athlete

cannot be matched by the environment's evaporation potential. In either case, the athlete is at risk for hyperthermia and significant physiological performance stress. There was a comparison made between hot, humid environments and hot, dry environments for their respective conditional effects on intermittent-sprint exercise performance (Hayes *et al*., 2014). The conditions were matched for heat stress to create the most controlled and accurate analysis of the two experimental groups, in relation to the temperate environment control group. The proposed hypothesis was that hot, humid conditions would produce greater physiological strain than hot, dry conditions and result in impaired sprint performance. The results of the study concluded that sprint performance was impaired, but not significantly more so in one condition over the other when heat stress was matched between the two. Ideally, an athlete should train for the environment in which the performance will take place. For example, training in dry heat would be optimal preparation for a championship event in Arizona. However, this is not always possible, so aiming to match the heat stress is a valid way to achieve similar gains in training. Preparing in Georgia heat and humidity for a dry heat Arizona competition may require training to be conducted in the early morning hours, when the humidity and temperatures are lower, to equilibrate the demands of GA and AZ running. As an example, training in 65 degrees and 40% humidity often feels equal to dry 80-degree training. Another study specifically investigated the effects of dry and humid heat stress on heat loss capacity in different age categories (Larose *et al.,* 2014). As age increases, sweat rate has been found to decrease, making it more difficult for older adults to effectively expend the heat retained during exercise. Heat loss capacity was measured by both direct (evaporative) and indirect (metabolic) calorimetric in 60 males, ages 20-70, in 35°C and both 20% and 60% relative humidity. The hot, humid conditions caused an attenuated heat loss capacity in all age categories. The relative core temperature, heart rate response, and perceived thermal discomfort level all increased with age. This corresponded with a decrease in heat-loss capacity in the middle-age and older populations. No age group differences were observed in dehydration status, per cent change in body weight, or local sweat rate and blood flow (Larose *et al.,* 2014). Participants aged 40-70 stored 60-85% [in dry heat] and 13-38% [in humid heat] more than the 20-30 year age group. It's important to consider the physiological effects of prolonged exercise in heat, especially for the lack of efficient thermal regulation in the older age populations. All in all, these findings are helpful for athletes to know and apply across multiple race performances, in order to gauge true comparisons in performance. Dehydration often occurs long before some athletes realize it or before cramps set in. Athletes can lose as much as 2 to 8 % of their body weight during high intensity exercise, and the rate of fluid absorption from the gut just can't keep up with that rate of loss. Dehydration causes a decrease in VO^2 max, which means the body can't utilize oxygen as efficiently to provide energy. Dehydration also contributes to the decrease of heart blood pumping mentioned above. So what can be done to combat or prevent the effects of high heat and humidity? If a person paid attention to news reports building up to the start of the World Cup, person heard about teams from all over the world flying to places with higher heat and humidity to train. Several teams trained in Miami, some in Latin America, and a few went right to Brazil. Acclimatization to higher temps and humidity can occur fairly quickly, as quickly as 7-10 days. Prevention for heat/humidity effects is conditioning. Better-conditioned athletes suffer less performance loss in high heat and humidity because they have a higher blood volume, better VO^2 max, sweat rate and more efficient use/replacement of energy stores. World Cup athletes have been training for several months (in addition to playing in their normal club/team roles) in preparation for this major event. Fluid replacement is critical for events in high heat and humidity. Fluid replacement starts before an event, continues during it, and doesn't stop until long afterwards. Drinking to thirst and keeping urine clear (not dark yellow) are good measures. Wearing light-weight, light-colored clothes of open-weave natural fibers (cotton, wool) or fluid-wicking fibers help increase evaporation and cool the body. Even here in Utah where the humidity is low, we're susceptible to heat-related performance drop or even heat illness if we're not careful. Be smart and enjoy the sun. Then, after a great, hot workout, find a cool drink and a TV positioned right below a soothing fan to enjoy some incredible World Cup matches! however, it is seen that in the Mexico City Olympic 1968 the altitude of 2240 meters, successful competitors exceeded the best world marks in running events, records were broken, and deterioration in the events which lasted longer than one minute. Altitude mainly affects endurance or aerobic activities rather than

sprints on anaerobic events. Fit people will be able to perform better, just as they can at sea level, than the unfit (Mathews and Fox Edward, 1985; (Marley William, 1982; Shephard, 1978 and Shaver Larry, 1982).

Conclusion:

It can be concluded that the causes of difference in sports performances in sports are many such as the impact of heat, cold, humidity, altitude, dehydration, acclimatization etc. Acclimatization to higher temps and humidity can occur fairly quickly, as quickly as 7-10 days. Better-conditioned athletes suffer less performance loss in high heat and humidity because they have a higher blood volume, better VO^2max, sweat rate and more efficient use/replacement of energy stores. World Cup athletes have been training for several months (in addition to playing in their normal club/team roles) in preparation for this major event. As we found in the Mexico City Olympic 1968 the altitude of 2240 meters, successful competitors exceeded the best world marks in running events, records were broken, and deterioration in the events which lasted longer than one minute. Altitude mainly affects endurance or aerobic activities rather than sprints on anaerobic events. Fit people will be able to perform better, just as they can at sea level, than the unfit. Arrangement of sports competitions should be in such places where there should be less effects of environmental influence. So that the genuine performance of an athlete can be recognized.

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