CHAPTER I

INTRODUCTION
CHAPTER I

INTRODUCTION

It is established that the role of physical education scientists is essential for the smooth conduct of research in modern physical education programme. This field could develop new ideas and training methods to reach the zenith of performance in the field of sports and performance. In this context, it is proper to examine the innovative strategies being employed in the sporting arena. The most recent trends like, dividing the training calendar broadly into in-season and off-season phases and organizing training cum skill development programme have come in for rave reviews. In the larger interests of sports persons, the introduction of a calendar of events seems to be a very positive initiative (Singh, 2004).

The cyclic change of seasons is a natural phenomenon and therefore irreversible. The earth has an elliptical orbit around the sun and the axis on which it rotates is inclined at 23.5° from the vertical. These in turn combine to produce variation in the duration of daylight and also the angle at which the rays of the sun fall on the surface of the earth. There are other factors contributing to variations in atmospheric conditions. There are wild fluctuations in weather that occur within the annual cycle of seasons. The severity of these changes depends on the latitude of a place and lie of the land. Luckily, all living creatures have evolved effective ways of coping with seasonal extremes (Persinger, 1980).

Over the past several years, a large number of exercise physiology laboratories have come up. Consequently, much new knowledge dealing with how to develop a new fitness regimen, how to train athletic teams for improved performance and also how to sustain the level of performance have begun to appear in scientific journals. It is a time honored fact that, along with several other factors, the geographical as well as climatic conditions of the place where an athlete lives also play a vital role in performance ability (Drust, 2005). In a vast country like India, it is assumed that the performance ability of sportsmen may vary when they participate in the competitions being organized in
different parts of the world. Indian athletes participating in Asian games at various venues provide us with ample evidence in support of the premise.

As a result of recent researches in exercise physiology, there has been a sudden upsurge of interest in physical fitness and wellness; today’s young professionals are faced with increased learning challenges vis-à-vis new career opportunities. Exercise physiology in a branch of sports medicine that involves the study of how the body, from a functional standpoint reacts, adjusts and adapts to exercise. Various experiments conducted in recent years have conclusively proved that the performance in any sports activity depends upon the psycho-physiological homeostasis and physical fitness as well as related skills of the athletes (Sinning, 1973).

Maximum daily temperature in the tropics generally averages 30°C all the year-round. During the wet season, humidity is quite high. Strategies that reduce resting body temperature or enhance the dissipation of heat can therefore enhance performance. Fluid ingestion can attenuate the loss of plasma volume that would otherwise reduce blood flow to the skin and thereby compromise dissipation of heat.

**Impact of Environmental Temperature on Athletic Performance**

When we think about environmental temperature, the physiological aspects also have to be taken into consideration. Exercise in exposure to warm weather condition will elevate the deep decline of physical performance. If the inside temperature of our body raised critically, the heat produced during metabolism as well as the rate of sweat production, blood pressure and pulse count will also elevate simultaneously (Greger et al., 1996). This will help our body to eject out the surplus heat through radiation and thereby cool the surface area and as a result helps to lower the temperature.

The athletic performance is influenced quite violently due to the environment around him. There are many things athletes can do or adaptations they can make to prepare better for variations in the environment, either expected or unexpected. Training in cool climate does little to prepare the athlete to compete under conditions of extreme heat and humidity (Arnheim & Prentice, 1997). Similarly, sudden exposure to cold can
have a negative influence on athletes’ performances if they have not had an opportunity to acclimatize to the cold environment. Environmental factors include exposure to extremes of heat, cold, humidity and high altitudes.

It is categorically found out that exercise on exposure to sun can put to severe injury and strain to our cardiovascular system which is finally the cause of declined sports performance.

Usually our body temperature will show very less in early morning and also will be high in the late afternoon hours. Merely changing one’s living habits such as eating and sleeping can reverse these variations. The body used to regulate its temperature in warm weather condition while doing exercise through vasodilatation. During vasodilatation, the blood flow will be more of the skin surface and thereby improves convey of heat production from inside to the outside surface of our body. Secretion of sweat, on the other hand, provides water or evaporative cooling.

The problem of cold is much simpler than that of heat, because, usually it can be solved by wearing heavier clothes while a nude man working in a tropical climate is at the mercy of his own physiological adaptation; a man in the Arctic puts on a “Parka”, extra-heavy boots, gloves and other warm clothing. Therefore, they consume more food and voluntarily increase the amount of fat in the diet.

Man adapts to cold climates by maintaining a comfortable microclimate about his skin. This is accomplished through the wearing of clothing, which assures a protective, comfortable insulating layer of air. Often, work productivity in cold climates is reduced, especially due to the discomfort of hands and feet (Frisancho, 1979).

It is through the release of energy that a muscle is able to contract. The way in which energy stores are depleted depends essentially on the fitness of the person and on the kind of physical activity being performed. The heat gained inside the body should be balanced. Heat is gained by the body mainly through metabolism, but it may also be gained from the environment through radiation, convection and conduction (Fox, 1999). Sports performance may influence the atmospheric temperature and studies proved that
the climatically conditions very much influenced for physical and physiological efficiency.

**Environmental Parameters**

It is quite clear that the environment of high humidity and high solar heat can experience heavy thermal stress during sports practice and leads to the risk of severe allied heat injuries. The athlete should be aware about the abnormal atmospheric temperature. If it goes into a high range abnormally the performance, watch the sign carefully of the distress. Still another thing, if the humidity is more with the same normal temperature, it may not harm anything for at least half an hour. If the temperature is more with high humidity, the condition is more or less dangerous for the athletes. If the parameters viz, inside temperature, rate of sweat production, pulse count is increased abnormally, we can control the stress due to the bad weather by using clothing (Frisancho, 1979).

If the atmospheric temperature in more than the body temperature the body will produce more sweat. And if the environmental temperature is more than 35°C and at the same time humidity is more, the body will maintain normal temperature through sweat evaporation. This will consume most amount of energy expenditure due to cardiac work. Hot environmental conditions certainly lead to strain in athletes and will reach to a collapsed condition of heat injuries as well as the declined performance.

**Impact of global warming on atmospheric temperature**

Global warming is the increase in the average measured temperature of the Earth's near-surface, air and oceans. It reached alarming proportions in the mid-twentieth century, and is projected to continue. Natural phenomena such as solar radiation, combined with volcanic eruptions probably had a marginal warming effect from pre-industrial times to 1950 and a slightly cooling effect from 1950 onward.

Human body temperature varies depending upon the various factors like the time of the day when it is measured, the kind of activity a person is engaged in and the part of
the body where the instrument is placed. The normal internal body temperature is \(37^0\) C (Drust, 2005).

The temperature will vary all around the day due to this physiological process. The body will show at its lowest temperature during his end spurt of his sleep. Besides, the temperature may vary depending upon the person’s nature of work, and other external factors (Frisancho, 1979).

Usually the body temperature will show variety of readings depending upon the person, time and the place. Hence, each measurement is typical. The oral body temperature usually shown in a range of 36.3 to \(37.3^0\) C and found to be normal. The temperature of the body also depends on the atmospheric differences.

The effect of body temperature variation will have a tendency to decrease due to the age factor. Old people have a low capacity to generate body heat due to their geriatric condition. When the physical fitness level goes up, the temperature variation effects will also go up hand in hand (Drust, 2005).

**Variations**

These are the various temperatures,

- \(37.5^0\) C is considered to be the temperature in anus, vagina and the ear.
- The oral temperature is around about 36.8 °C.
- Temperature in the armpit is nearly about 36.5 °C.

The oral temperature can be controlled through the activities such as drinking, breathing through the mouth. There showed poor correlation between inside body temperature and the temperature in the armpit, ear and other like skin temperature. The surface temperature is widely shocked by other outside parameters like clothing, environmental temperature and seasons.
Changes due to external factors

Other allied outside factors are also found in effects the body temperature. The body temperature remains changed even if one sleeps in a normal room temperature. The body will take time to acclimatize with the room temperature even after arise from the sleep.

The body responds to its temperature and found to be elevated even after eating and drinking (Persinger, 1980).

Excess conception of alcohol will tends to change the body temperature greatly lowered in the day time and significantly raised at night time.

And also physical exertion will elevate the body temperature noticeably in adults in during strenuous exercises prolonged for a long time while children will attain a higher body temperature through jumping and running (Frisancho, 1979).

A cool temperament, exited person and like psychological factors has got a greater impact on body temperature.

Sleep disorders also affect body temperature. The temperate will go down normally during bed time and maintains steady at the nigh time. Insomnia and the quality of sleep are widely related with the decline of body temperature. As in the case of unusually rose from the bed and sleeping in later in the day also known to affect the body temperature.

Effects of body temperature variation

Abnormal body temperatures

Heat stroke not at all related to the fever. The person having fever will feel cold at high body temperature. The most recent hypothesis is that fever is not a disease, but it is only a response to illness (Frisancho, 1979).

- The person will die if the temperature is more than the 44°C
- 43°C - Naturally dies or chronic damage to brain cells
• The person will have fainting, dizziness and other like illness may occur when the body temperature reaches to 40°C

• When it is at 39°C the persons heart rate will be elevated, breathlessness, severe sweating etc. can happen

• On 38°C the body will start and feels discomfort and finally slight hunger

Below normal body temperatures

• When the body temperature goes down to 36°C slight shivering can happen

• Serious change in heart rhythm, shallow breathing etc. can occur if the body temperature declaims to 31°C

During the day, numerous processes in our body fluctuate in a normal stream. Internal clocks regulate many of our internal mechanism, such as body temperature, secretion of hormones and heart beat pace.

As far a human body is concerned, it maintains a normal temperature and it usually rest that point (Greger et al, 1996). Obviously we understood that we feel chilled when the body temperature dropped down, and it is an involuntary action from the brain, the hypothalamus know how to keep the temperature steady. But occasionally the body temperature regulation mechanism will deviate from the normal set point due to the surrounding effects like cold exposure or fever and finally exercises.

Usually human beings are able to maintain a stable internal temperature. Apart from this we are inclined to heat stroke when the internal temperature is higher than the atmospheric temperature which could be dangerous unless treated on time.

While core temperature is regulated, the skin temperature changes widely with respect to metabolism and the environment.

Vasodilation

Vasodilation refers to the expansion of blood cells. It is the product of smooth muscles, capillaries and blood vessels. The body temperature is keeping up
homeostatically so that it is always maintained at a constant temperature of about 37°C despite the changes in the environmental temperature.

Vasodilation happens when the atmosphere is warm. Then the Blood capillaries dilate and widen their diameter. And thereby, more amount of blood flows to the body parts. The excess amount of heat in the body is vaporized through the conduction and radiation (Frisancho, 1979).

In a cold environment, a decrease in the diameter of blood cells occurs. Blood capillaries will have a narrow compression and their diameter reduced. Thus, blood flow to the body will be reduced. Blood is divided again from the surface the body. Hence, heat loss through conduction and radiation is reduced (Singh, 2004).

The blood flow increases when the blood vessel expands. Thus the blood pressure will decrease due to the expansion of arteries. This response is due to the process in the surrounding tissue as well as hormone production.

Vasodilation is a mechanism occurs due to the amazing performance of sympathetic nervous system. It is understood that the process of vasodilation has a great influence on an athlete’s performance (Fox, 1999).

Vasodilation happens as a result of release in the smooth muscles around the blood vessels. This response happens from the neurons, which originated from the hypothalamus. This is accomplished through re-uptake of ions into the sarcoplasmic reticulum via exchanges and expulsion across the plasma membrane. There are three main intracellular stimuli that can result in the vasodilation of blood vessels. The particular mechanism to carry out these effects varies from vasodilator to vasodilator.

**Temperature management mechanism**

Our normal body temperature is 37°C whatever be the atmospheric temperature. The temperature will be regulated by our natural cooling system of the body controlled by the brain. The brain sends instantly reflex to various parts of the body, together with the skin, to preserve the heat or to drop excess heat. Other temperature systems are used in regulating the glucose level and water in the blood. Maintaining temperature, glucose
and water in balanced levels is known as homeostasis and is important for the chemical processes of the body to work properly.

**If the body is too cold...**

When the hairs throughout the body becomes rigid by muscle trap, a air layer will be produced and seem to be goose. The then formed air will act as a protective covering to preserve more heat and, and during shivering, there is an increase in the rate of breathing also helps to keep the warmth of the neighboring tissues (Drust, 2005).

The number of heart beats depends up on the amount of blood flows to the arteries and veins. The blood will keep aloof from the surface area when the body temperature is low. Only a small amount of blood will flow at this time and further will reduce skin heat loss. (Frisancho, 1979).

Vasodilation can be occurring during cold weather also. This will helps to reduce the injury rate. This will happen in colder climatic regions. Cold induced vasodilation commonly found in the most exposed parts like fingers since it is open to cold. This is caused by an immediate fall in the process of release of response from sympatric nerves to muscles.

**If the body is too hot...**

The major symptom and effect of exercises is undoubtedly the sweating. The blood vessels leading to the skin capillaries dilate, causing vasodilation. This enhances lots of blood to flow near the surface area of the skin and heat is released through the skin by convection and radiation.

Sweating will reduce the body temperature. This is our natural cooling system. When the sweat is produced the surface area will be cooled and there by the whole body temperature will be maintained to normal. Most part of sweat consists of water and body salts. This process is formed by the sweat glands and pushed out on to the surface area of the skin.
Here the water evaporates, and the heat from the skin escapes leading to the cooling down of the skin. Salt is remained on the skin and the skin can taste a bit salty after the sweat. If there is profuse sweating, more amount of salt is likely to be lost from the body, and can occur upsetting the ion balance in the blood, which in turn can lead to cramps (Drust, 2005).

In very hot environments, excessive sweating can also lead severe to dehydration. The most dangerous part of dehydration is the reduction in the amount of sweating and the body temperature remains high. If it persists like this, the natural cooling system will be failed to function properly. Hence intake of enough water is more important to ward off such a precarious situation.

Usually the shrinkage of blood vessels happens followed by expansion of blood vessels. It repeats itself continuously. This is commonly known as hunting reaction.

Exercising in hot weather puts extra stress on the human body. If proper care is not taken when exercising in the heat, there is always the risk of a serious illness. Both the exercise and the air temperature increase core body temperature.

The body sends more blood to circulate through the skin so as to keep it cool. This leaves less blood for the muscles, which in turn increases the heart rate. If the humidity also is high, the body faces added stress because sweat doesn't readily evaporate from the skin. That pushes body temperature even higher.

Under normal conditions, the skin, blood vessels and perspiration level change to the heat. This normal cooling system may be unsuccessful if one is exposed to high temperatures and humidity for too long. This results in heat-related sickness. This occurs along a range, starting out as a mild ailment, worsening if left untreated (Frisancho, 1979).

**Sweating-the Cooling System of the body**

Most people know that they sweat more when they exercise and that in order to stay healthy, they need to drink plenty of water. However, many people aren't aware of how much water they need to drink and why it's important to do so.
When engaged in physical activity, body temperature rises as much as $3^\circ$ Celsius. The body's natural cooling system—sweating—kicks in to reduce the body temperature. During severe activity and heat stress, there may be water lose up to $\frac{1}{2}$ liter in an hour (Fox, 1999).

Unless you replace the water loss, you will be in trouble of becoming dehydrated. When a person is dehydrated by more than 4% or 5% of body weight, exercise performance declines by 20% to 30%. Not only that, the impact of dehydration on the cardiovascular system can produce cardiac problems in people with coronary heart problems and allied diabetes. Dehydration is furthermore tough on the kidneys (Fox, 1999).

**Exercise in heat**

The ability of athlete to successfully perform in the heat depends on the degree of heat, the humidity, the air movement, intensity and duration of effort, and the extent of his previous exposure to similar environmental conditions. An athlete should acclimatize to heat.

Since the body temperature is usually higher than air temperature, the human body radiates heat rays to the environment. However, during the warmer days of summer, heat is absorbed by the body through radiation.

There are two kinds of heat loss through conduction to the air and to objects. When swimmers lose body heat to the water, very little heat is lost through conduction during exercise (Frisancho, 1979).

Convection is the term applied to air movement-wind. It plays a major role in heat loss by both conduction and evaporation. During exercise, sweats conduct an enormous amount of heat from within the body to the skin surface. The heat dissipates when the convection currents (wind) evaporate the sweat.
In the presence of high environmental temperatures, evaporation and convection provide the only relief from heat stress. On hot days when humidity is high and there is little or no wind, evaporation is dangerously reduced (Drust, 2005).

Clothing is an important consideration of the problem of heat stress. It is recommended by the exercise scientists and sports physicians that the athletic wear loose, light-coloured cotton or nylon mesh clothing to allow the skin beneath to breathe. Light colours reflect heat; dark colours absorb it. This physical principle also applies to skin absorbs more heat

Physically fit people tolerate heat better than the unfit, because their cardiovascular systems are more stable and they dissipate heat more efficiently (Greger et al, 1996). They also become acclimatized more quickly. Simply losing weight will increase heat tolerance. Overweight individuals suffer more in heat and humidity because their fat insulates them and interferes with heat loss.

Environmental heat reduces the thermal gradient between the environment and the skin surface, and between the skin surface and body core, this imposing an added resistance to body heat loss. It is already established that the body will attain heat when the atmospheric temperature is more than our skin temperature. Increased humidity imposes a heat loss barrier to the evaporative mechanism by decreasing the vapor pressure gradient between the moisture in the air and the sweat on our skin. Such a heat loss barrier causes an excessive increase in rectal temperature and severely limits the capacity for work (Frisancho, 1979).

**Exercising in cold**

Whatever exercise do in cold climate, the safety precautions should take. Without proper safety measures, serious illness such as hypothermia, frostbite, and dehydration may occur. If the body’s core temperature drops lower than normal, its capacity to adjust the temperature can become impaired. This condition is called hypothermia. It develops because the body cannot produce heat as fast as it is losing it.
Movement of a person through the air makes an effect similar to that cause of wind. Riding a bicycle at 15 mph is as equivalent standing in a 15mph wind. If, there is a 5mph headwind, the overall effect is equivalent to a 20mph wind. Many long distance athletes are used to practice in cold climate and high altitude, due to this atmospheric temperature will help to improve the physiological efficiency particularly lungs capacity.

**Acclimation to hot, humid environments**

Adjusting to differing environmental situations is acclimatization. Military personnel’s are newly introduced to a hot, humid climate and are quite active in it can acclimatize in 8 to 14 days. Army persons are inactive, consume much longer. There may have more chance for the soldiers to get heat injuries, till they are acclimatized.

A soldier’s ability to perform successfully in warm, moist conditions depends on his acclimatization and level of physical fitness. The amount of heat stress depends on the absolute workload. Whenever two soldiers do the same work, there will be less heat stress for the soldier who is in a robust physical condition, and his performance will be better. So, one should need to maintain high physical fitness (Frisancho, 1979).

Athletic competition often takes place during the summer months in hot environments. It is established that the elevated ambient temperature is detrimental to endurance performance, such as distance running (Frisancho, 1979). A rise in core temperature (Tc) during exercise and heat stress to a critical level of 40°C causes fatigue. Hyperthermia during moderately prolonged, strenuous exercise increases cardiovascular strain, reduces maximal oxygen (VO₂ max), and increases relative metabolic strain and it detrimentally affects the functioning of the central nervous system (Fox, 1999).

Tolerance of the human organism to high heat load has been studied in a range of situations, both while at rest and during exercise and with a range of strategies designed to either reduce the heat load or enable the participant to cope with the debilitating effects of heat stress. It is categorically established that exercise in advance finished in the heat. To deal with this problem, several specific approaches have been used either experimentally or in the field to manage or offset this reduction in performance during
exercise heat stress. The approach most used in experimental settings and in the field is acclimation and fluid ingestion. In contrast, whole body pre-cooling, a method used to reduce body temperature prior to exercise, has been mostly used in tentative settings.

“It is well recognized that exercise is too soon seized in the heat.”

**Thermoregulation**

The thermoregulatory system is the control unit that regulates the body temperature. The maintenance of internal body temperature while at rest and during exercise is the prime concern of the thermoregulatory system.

These are the fundamental components of the thermoregulatory system.

1. Adjusting to hot and cold
2. To sense the surrounding and regulate and changes
3. To co-ordinate the incoming and outgoing information

**Thermal receptors**

The brain and skin are the two predominant thermal receptors of our body. The skin is the peripheral receptor and the hypothalamus is the central receptor. Both the receptors have unique functions. One is related to heat and the other one is cold. The brain receptor is quite capable to respond small temperature variations while the skin is capable to catch the variation in and around environment.

**Thermal effectors**

The skeletal muscles are the direct organ connected to thermal effectors. The smooth muscles around the arteries provide sufficient amount of oxygenated blood to the skin, sweat glands and other endocrine glands. In hot climate during vasodialation the artery will supply the blood to the skin surface. During this time the internal heat is transported to the surface of the body along with the oxygenated blood and evaporated out through sweat glands. Hence the temperature in regulated. This is very useful for athletes and
physical trainees, they need oxygenated blood to all part of the body to perform maximum and use maximum energy.

The thermal regulatory center

The above explained responses are coordinated in the brain. The internal temperature is maintained by the receptor to $37^\circ$C. If it goes up or down the brain atones passes information to the systems of cooling or heating. This will regulate the temperature of $37^\circ$C. This is done by the skin. When the surface of the skin is warms the body temperature will be reduced through vasodialation by the natural cooling system of our body.

When the athlete is practicing the total blood volume will flow to the lower body. This will lead to an increase is to an internal body temperature and thereby reduction in the cardiac cycle. During the time of elevated internal temperature the heat will be exchanged in between arteries to the limbs. The rest of the blood from through the vain passes through the skin surface and cools the surface area for heat loss (Frisancho, 1979).

The stroke volume of the heart reduces even if the heart rate increased due to exercise. The blood flow to the skin surface will be less due to the reduction in the stroke volume. This is a major cause of dehydration. When the stroke volume of the heart is less, the body will increase the heart rate and finally decline in the performance level, reduction in the exercise tolerance and will reach in to fatigue condition.

Adjustments in Thermoregulation

Our body will regulate the temperature includes skin and internal temperature regulation. Skin will regulate the surface temperature and the brain will regulate the internal temperature. The body temperature found to be varied from day to night. This is a unique process happened in our body. Positive and negative heat exchanges happen when heat is conveyed from our body to the surroundings and from the surroundings to the body respectively. The process of heat production and heat loss should be maintained in a balanced condition for the normal functioning of our body with physical exercise.
The athlete should be aware and try to bring down the body temperature if it rose to a life threatening condition. The surrounding temperature and the hot, humid condition are the two major factors. The athlete should bring down body temperature through heat loss by evaporation.

**Dissipation**

The body can dissipate heat when the surface of the body is heated. The air flow will dissipate out the temperature came to the surface of the body. We can dissipate the body temperature with another low temperature surface. Such as water or sitting under fan etc. We can dissipate through the skin surface by evaporation. While breathing the water content will be evaporated out through respiration and profuse sweating.

**Circulatory system and Sweating Mechanism**

The reduced thermal and vapor pressure gradients of hot, humid environments greatly increase the demands placed upon the circulatory system and sweating mechanism. This is evidenced by greater increases in heart rate and sweating during exercise in hot, more blood must be circulated and more sweat secreted by the sweat glands in order to lose any given quality of heat. The major circulatory demands while working in the heat are (1) a large blood flow through the working muscles is necessary to provide for the increased respiratory exchange of O2 and CO2, and to carry away the increased heat produced there, and (2) as previously indicated, a large skin blood flow is also necessary to cool the blood and supply the sweat glands with water.

During exercise the body regulates the temperature through evaporation and thus cools the surface area. The sweat glands present in the armpit produces sweat, which contains sodium, glucose and other like body salts. This will lead to weight loss. Hence a high humidity and dehydration stands a cause for weight loses. Another most important factor is that the sweat rate will regulate the blood pressure. Even though the internal temperature is more sweat rate will reach to the maximum within an hour of stress (Frisancho, 1979).
When there is a reduction in blood flow with maximum intensity of exercise leads to decrease the blood volume further became a cause sweat and fluid depletion. This may happen during hot environment. In the cooler climatic condition, the body helps to retain its fluids.

**Water and salt requirements:**

The high sweat rates required for adequate evaporative cooling during exposure to heat (0.5 – 2.0 liters per hour) can lead to excessive losses of water (dehydration) and of salt and other electrolytes. When this occurs, work performance and tolerance to heat are greatly reduced; hyperthermia (excessive internal body temperature) with a predisposition to serious heat disorders is eminent (Fox, 1999).

The most serious consequence of profuse sweating is loss of body water. This leads to a decrease in blood volume. The decrease in blood volume and evaporative cooling, in turn, causes added circulatory strain with eventually circulatory collapse and an excessive rise in rectal temperature.

**Endocrine system**

During exercise blood as well as hormones is re distributed all around the body. Among other hormone adrenal glands ejects a number of hormones to regulate the fluids and electrolytes. In additions to that the pituitary gland is also ejected hormone for fluid regulation. All these hormones inspire the synthetic nerve to control our body from being collapsed. (Sinning, 1973).

When dehydration happens in our body the plasma absorption will be increased and thereby increase the intake of the sodium as well as water. This will lead to trigger of the thirst mechanism resulting more amount of water intake. A reduction in the amount of urine output may lead to the enhancement of blood volume and weakens the sodium found in plasma (Frisancho, 1979).
**Immune system**

The heat can hold performance of our immune system negatively. Decrease in the growth hormones, bio-chemical parameters like haematological parameters happened to our body due to the extreme hot condition.

**Heat disorders in athletes**

The seriousness of overexposure to heat while exercising is exemplified not only by a decrease in work performance, but also by a predisposition to heat illness. These disorders are categorized in ascending severity as

1. Heat cramps
2. Heat syncope
3. Hyponatremia
4. Heat exhaustion
5. Sun stroke

Another condition named hyperthermia has also started researching. This happens when the body’s heat production exceeds the heat dissipation. Other factors of athlete’s heat tolerance and illness are viz environment, food intake, fluid intake and clothing (Greger *et al*, 1996). If the intensity of the exercise is high heat dissipation will be more, finally reaches to hyperthermia. One should know how to diagnose the signs and symptoms orals can easily catch holed by the condition of hyperthermia. This is one of the major problem faced by most athletes. This happens due to lack of their knowledge regarding this injury. Hence knowledge of heat allied injuries is considered to be the prime thing as far as a coach is concerned.

**Muscle cramps**
Muscle cramps are involuntary forceful contraction of the large group of muscle due to the lack of sufficient amount of fluids. This may occur during exercise in a hot environment. As a result of this severe pain and muscle fatigue also happens. But the blood pressure and temperature may be normal. We understood that heavy sodium chloride debt and unbalanced fluid condition can cause reduction in the amount of the plasma. These changes can cause muscle contraction uncontrolled

**Syncope**

Syncope is nothing but or complete loss of consciousness. This happens during continues exercise. The athlete may feel tired and even faint down. This sort of injuries occur along with dehydration too. This happens due to lack of their knowledge regarding this injury. Hence knowledge of heat allied injuries is considered to be the prime thing as far as an athlete is concerned.

**Hyponatremia**

It is a very chronic condition of the body where there is heavy sodium loses with excessive fluid intake. This finally reaches to electrolyte in balance. Athletes feel this condition exercise during late afternoon hours. This is a very acute and chronic condition this occurs due to the certain exclusive conditions of sodium loses while doing exercise for a long time. Even though those found to be normal, during this time plasma sodium reduces when there is excessive fluid intake. And furthermore the more fluid intake the more electrolyte imbalance happens. Very familiar symptoms of this injury are omitting, headache, nausea, weakness, cramps etc. Moreover, this can have many systems of our body like cardiac arrest and edema.

**Exhaustion**

In this condition, the body is not in a position to carry on an activity in the heat. This is found to be a very common heat illness on athlete. There could found two types of exhaustion are

1. Exhaustion due to the depletion of water in the body
2. Depletion of body salts due to the high exhaustion to hot and humid condition

In this illness the cardiovascular system cannot perform sufficiently during exercise and reaches to the condition of dehydration too rapidly. Therefore the need of muscle and skin blood flow cannot meet completely and finally collapsed exercise is seized. When the body temperature reaches to the 38\(^0\)C can easily fall into this condition.

Very common symptoms of this illness are vertigo, headache, dizziness and cramp etc. this may happen when the body faced to acclimatize with the surrounding heat.

When the body temperature reaches to the excessive level may damage the tissues and related organs in the body. When the athlete tries to continue exercising for a long period of time he may collapse very quickly with the negative effect of higher temperature. When it reaches to 43\(^0\)C, he may fall to the unconscious conditions (Persinger, 1980).

Heat stroke can happen soon after fifteen minutes when the heat production reaches to 1033 Kcal. An active person’s metabolic energy level may be ten times were as in a trained person it is twenty times. The overall requirement for body metabolism is controlled by humidity, temperature and the atmospheric conditions (Frisancho, 1979).

When the blood flow is reduced deformities like dehydration can affect adversely on the performance of kidney function and finally the renal failure occurs commonly. When the sweating is seized body has a potential to maintain the body temperature up to 41\(^0\)C within 20 minutes. If the body temperature exceeds 41\(^0\)C can harm the body and damage of liver, kidney, brain cells and other like injuries may happen. Some of the athletes are unable to diagnose this can further reach to more complications.

It is also important to point out that inattention to the stroke and finally to death because of irreversible damage to the central nervous system. Even in those who do recover from heat stroke there often is some permanent damage to the thermo regulatory center in the hypothalamus. As a result of this damage, the hypothalamus loses some of its integrity or ability to regulate body temperature. This leads to decreased heat
conductance from the body core to the periphery and explains why many who have survived heat stroke are more prone to future heat disorders. Normally, a person will voluntarily stop working and seek shelter from the heat when heat cramps, heat exhaustion or syncope, sets in. However, highly competitive athletes are more vulnerable to heat disorders in general and heat stroke in particular for several reasons:

1. They are highly competitive (motivated) and therefore more likely to overextend themselves.

2. They have a sense of immortality.

3. They sometimes are required to wear heavy protective equipment which adds resistance to heat dissipation.

4. Incomprehensible as it may seem, the coach may deny them water during prolonged contests or practice sessions, which lowers their resistance to heat tolerance.

People who are not able to tolerate the heat whose body temperature will be elevated uncontrollably leads to heat illness very quickly. This is due to certain reason like sedentary lifestyle and physically unfit being obese etc. The sedentary lifestyle leads to many diseases particularly hypokinetic diseases like hypo tension, hyper tension, diabetic etc. (Persinger, 1980).

Women and men have better capacity to deal with humidity and hot dry conditions respectively. A red rash on the body is a perfect sign of intolerance. This is caused by sweat gland obstruction and can be rectified through the few days frequent exposure to heat. There for the higher the work efficiency, the lower the heat production and the metabolic rate, which helps the athletes’ better heat tolerance (Frisancho, 1979)?

Dehydration is a major hindrance affecting for heat tolerance. Decreased sweating efficiency, circulation and transference of internal heat to the skin are the major problems faced when dehydration happens. Obese people will have low levels of heat tolerance
because they have higher heat production during exercise since they have high body weight and a high heart rate.

Abuse of psychoactive drugs can affect heat tolerance. Relapses can occur in a person who is caught by the heat intolerance. This happens due to lack of their knowledge regarding this injury. Hence knowledge of heat allied injuries is considered to be the prime thing as far as a coach is concerned.

**Physiological thermoregulation in the cold**

The body regulates itself either by heat conservation or heat production. In the first case, the body conserves heat by vasoconstriction of the surface vessels and by shutting down the sweating mechanism. Heat production, increasing metabolite rate, is accomplished by shivering of skeletal muscles or stimulating increased tissue oxidation by the intervention of various hormones. Cold receptors are located in the skin, but they are far fewer than heat receptors. When skin temperature falls below normal, signals from the cold receptors increase in frequency. Receptors are sensitive to both absolute temperature and the rate of change in temperature (Webster, 1974)

Cold receptors are located in the spinal cord and abdominal viscera. Signals received by the hypothalamus are integrated and directed by the motor nerves to stimulate muscles to shiver, the sympathetic nerves to cutaneous blood vessels which vasoconstrict and adrenal cortex to release glucocorticoid (cortisol and corticosterone).

**Mechanism of heat conservation and production**

**Vasoconstriction:** The major mechanism of heat conservation is vasoconstriction of cutaneous vessels resulting in the flow of heat from the core to shell to be limited. This results in decreased skin temperature, which decreases the temperature gradient with the environment and thus reduces heat loss. The blood pressure increases and heart rate decrease most likely a parasympathetic (vagus nerve) influence on the heart.

**Muscular shivering:** Shivering (involuntary muscle contraction) increases metabolic heat production to help us maintain or increase our temperature, thus reducing muscular heat loss.
**Hormonal response:** During cold stress the catecholamine are known to increase the release of free fatty acids that increase oxidative phosphorylation, which results in increasing the metabolic rate. Catecholamine also stimulates hyperglycemia; again, producing a condition favorable in tissue oxidation. Thyroxine has also been implicated in the increase of metabolic rate in cold acclimatization. Glucocorticoid – Cortisol and cortisone produced by the adrenal cortex stimulate the formation of glucose, which increase oxidative metabolism for cold adaptation.

**Physiological response to cold stress**

**Extremities:** Since the ear, feet, and figure have very little metabolically active tissue, they depend heavily on the blood supply of heat. Therefore, when skin vessels constrict, shell temperature decreases to appoint close to the environmental temperature. A hunter’s response has been observed in which a cold induced vasodilatation occurs, possibly protecting the skin from injury. Cross-country skiers may have noticed that sensation of periodic warming and cooling of the extremities.

**Oxygen consumption:** VO$_2$max is independent of the environmental temperature. This condition causes a decrease in muscle temperature < 38°C (100.4°F) in which case aerobic power is decreased.

**Blood lactate and muscle glycogen:** Blood lactate levels were elevated in the heat compared to cold and glycogen appears to be spared in the cold that is exercise is, more aerobic in the cold with more reliance on fat as a fuel.

**Strength and endurance during cold stress:** Maximal isometric strength does not seem to be affected by the lowering of muscle temperature. Peak torque achieved during dynamic muscular contractions, at selected angular velocities, decreases with reduced muscular temperature. Eccentric strength is increased as muscle temperature is lowered. Thus; the effect of lowered muscle temperature on the development of force seems to be dependent on the type of exercise. When temperature does not have an effect, it is a result of its influence on the myosin cross-bridges, that is, the rate of breaking and forming actomyosin. Muscular endurance has also been studied at various environmental
temperatures: 10°C, 13°C, 18°C (50°F, 55.4°F, 64.4°F, 75.2°F) and 24°C. Muscular endurance was improved by 30% in the 10°C (50°F) condition compared to 24°C (75.2°F). The muscular strength and endurance may influenced by cold stress. The eccentric and concentric contraction also influenced for explosive strength and that is influenced by situations.

**Training during cold conditions**

Many people worry about possible damage to lung tissue while exercising in the cold. Environmental air at a temperature of -32°C (89.6°F) is known to be heated to 24°C (75.2°F) before it reaches to bronchi. The respiratory discomfort sometimes associated with breathing cold is most likely related to the fact that cold is usually very dry. When subjects exercise at sub maximal exercise intensities while breathing air cooled to -35°C (95°F), there is not only an absence of harmful tissue effects, but VO2 respiratory rate and rectal temperature are unaffected as well (Greger et al, 1996). Since air is such good insulator, the athletes require only a tight weight clothing material that is porous so that sweat can wick to the surface where it can be removed.

**Acclimation to cold stress**

Various physiological adjustments have taken place that would offer an advantage to cold exposed players. It has been suggested one or more of the following criteria must be met to prove that man has acclimatized.

a) Evidence of an increased metabolic rate in a thermo neutral environment, that is, neither hot nor cold,

b) Evidence of increased tissue, insulation, that is, tissue characteristics that reduce heat loss such as fat,

c) A decreased susceptibility to pain, numbness, or cold injury in the extremities,

d) A decreased cutaneous threshold for cold thermogenesis.
Subjects placed in a cold chamber begin to show acclimation effect after one week, a decrease in shivering response, an increase in non-shivering thermogenesis and a decrease in skin thickness (Frisancho, 1979). These changes are related to increased fat mobilization in the cold that reduces skin folds fat thickness. Acclimation is very important for all the elite athletes to get good performance and use maximum potential particularly for competitions.

**Cold and Performances**

Performance of short term events is adversely affected by what is, in essence, the absence of a warm-up. Muscle tone and viscosity are increased and the speed of contraction is lowered, leading to delayed relaxation of the antagonist muscles. Speed and power events are thus performed poorly and there is an increased risk of injuries due to failure of relaxation, impaired proprioceptive function and hypothermia or hypoglycemic confusion. There may be a small increase in maximum oxygen uptake due to peripheral vascular constriction and an increased physical solution of oxygen in the blood, but any benefit from these changes is offset by the added cost of increased muscle viscosity, shivering, heavy clothing and the need to move over snow or wet terrain. With more prolonged exposure, blood volume is depressed by a cold diuresis and inadequate fluid intake.

During maximal exercise, if core and muscle temperature fall below normal, endurance, VO\textsubscript{2} max and heart rate all decreased linearly with decreasing body temperature. In well-trained male subjects, it was shown that the VO\textsubscript{2} max decline by 5-6% per degree centigrade decline in core temperature. Time to exhaustion on a cycle ergometer declined by 20% per degree centigrade and heart rate decline 8 bpm per degree centigrade. Cold tolerance is modified by age, physical fitness; body surface area and a small amount of body fat are the factors that decrease cold tolerance (Frisancho, 1979).

**Physiological response of exercise on various Environmental Temperatures**
The physiological response to exercise is dependent on the amount, time and frequency of the work out as well as the surroundings conditions. All through exercise, necessities for oxygen and substrate in skeletal muscle are improved (Greger et al., 1996). Manage of core warmth depends on sufficient sweat production and the ability of the surroundings to disperse the sweat. The character of the workout warmth strain is confirmed by coherent examination of the physical heat exchanges among the body and the background.

Athletes should learn about the atmospheric temperature variations and how to cope-up with the surroundings. They are practicing with their team mates daily, even in summer days ignoring the negative responses of the environments. This could be one of the major reasons to intensify the heat disorders. This may decrease the internal temperature, reduction in heart rate etc. can occur which harms the body violently further leads to the collapse of our body as well as the performances. Negative body chemistry happens, especially in the early morning due to the lack of acclimation, physical fitness etc. The body should attain the potential to cope-up with these dangerous situations through developing a good physical fitness (Persinger, 1980).

To improve positive response to cope up with heat disorders and other negative responses, methods like cooling the surface area are used very recently. This is to prevent the body from going into the heat disorders. Keen observation and identify the problem is the main hurdle before the coach and athletes.

A proper treatment to manage this situation is the most important task too. It is all the more necessary that a good cooling method should be adopted by the athletes’ during field practice. All the coaches and sports professional are able to manage with these techniques very easily to manage the heat illness during the causalities occur.

**Exercise physiology**

Exercise Physiology is an important sub-discipline. Exercise Physiology is the identification of physiological mechanisms underlying work out, the widespread treatment services concerned with the study, progress, and preservation of health and
physical fitness, treatment of cardiac illness and further diseases and disabilities, and the 
expert supervision and guidance of athletes and others interested in games, sports 
instruction, and human adjustments to acute and chronic exercise (Singh, 2004).

Many researchers are using physiological variables to solve many problems 
related to physiological conditions and improve the physical and physiological efficiency 
for sports performance. Without this variable an investigator could not conclude the 
investigation with clear result, whatever the study related to physical education field. The 
exercise represents one the highest levels of extreme stresses to which the body can be 
exposed (Greger et al, 1996).

**Physiological variables**

Heart rate is the speed of the heart beat, particularly the amount of heart beats for 
a unit of time. Normally the beats are considered for one minute (60 sec) as well as the 
need to sop up oxygen and excrete carbon dioxide. Actions that can irritate alter contain 
physical exercise, sleep, anxiety, nervous tension, disease, ingesting, and drugs (Greger et 
al, 1996).

The normal resting adult human heart rate ranges from 60–100 bpm. Brady 
cardiac is a slow heart rate, distinct as below 60 bpm. Tachycardia is nothing but heart 
rate moves in a considerable pace, distinct as above 100 bpm at rest. When the heart is 
not beating in a normal mode, this is referred to because of an arrhythmia. These 
abnormalities of heart rate occasionally, but not at all times, show illness.

Heart rate varies - we have an inactive heart rate that does precisely what it says 
on the tin: it is the rate at which our heart beats when we are relaxed. Heart rate shoots up 
with effort - to bring more oxygen and energy for the workout. Remember that one 
should not give concentration to the clock, but instead concentrate your thoughts on pulse 
waves.

The respiratory rate is one of the important variable of this investigation and it is 
measures normally by using an expirograph. Observe the person when he is at rest and 
watch the number times the upper body rises. Usually if one is having fever or other
diseases, we can observe an elevated respiratory rate. And also if one is having any respiratory difficulty during the time of data collection (Sinning, 1973).

The normal reading of the respiratory rate when one is at rest is considered to be between 12 and 16 respirations over a minute. The respiratory rate (RR), normally taken by using one minute time (60 sec) and count the inhale and exhale cycles. When the heart pumps the blood and the blood passes through the arteries like waves where there will be a pressure on the walls of the arteries. When we exert pressure on that artery with our fingers, we will be able to feel the number of beats gently on the surface of the skin (Singh, 2004).

Blood pressure can be measured with a Bp cuff and stethoscope. An individual cannot take his or her own Bp, but if one can monitor his Bp if he possess an electronic Bp monitor machine is used (Sinning, 1973).

When we measure the BP, we will get two readings. The superior number is known as systolic pressure, refers to the pressure within the artery when the heart contract and pumps blood through the body. The inferior number is called diastolic pressure, means the pressure in the artery when the heart is at rest (Greger et al., 1996).

Hypertension has got a direct a link in the risk of heart attack and brain stroke. With high blood pressure, the arteries may have an increased resistance against the blood flow, becomes the reason for the heart to pump more strenuously for further circulation.

Normal blood pressure is less than 120 mm Hg systolic pressure, less than 80 mm Hg diastolic pressure and 140/90 found to be high Bp as far as an adult is concerned. A person who normally runs a lower-than-usual blood pressure may be considered hypertensive with lower blood pressure measurements than 140/90.

The human body's cardiovascular system keeps it functioning at peak efficiency by maintaining homeostasis through proper Bp. The blood vessels will either expand or contract depends on the temperature of the body. When a blood vessel contract, blood pressure will increase if the body maintains the same heart rate because of the amount of blood going through the circulatory system (Singh, 2004).
Smoking, obesity, lack of physical work, usage of too much salt in daily food, kidney mal functioning, disorders in thyroid functioning and finally the hereditary factors are the common reasons for elevated Bp. Obviously over stress can lead to the dangerous condition of hypertension. And low Bp is also a dangerous condition in men than women. The Bp has a direct link with the intake food especially salt.

High Bp has become a major health problem among people. Hence we must regulate our Bp through regular exercises. Bp will be lower in people who are physically fit. Our systolic Bp will rise during rigorous exercise since our heart needs to pump more blood with every contraction. If the exercise is more strenuous, the systolic Bp will be higher. Hence this has become one of the major lifestyle diseases in human beings.

**Haematological variables**

The principal component of the hematologic system is the blood. Blood consists of three components: RBC, WBC, and Plasma (Leukocytosis et al., 2011). Among this the RBC and Erythrocytes, are the most common blood cells. White Blood Cells, or leukocytes, are one of the body's defenses. The amount of RBC is the average amount of haemoglobin in the RBC, the number of white blood cells (white cell count), the percentages of the different types of white blood cells (leukocyte differential count) and the number of platelets.

A WBC count is a test to measure the number of white blood cells (WBCs) in blood. WBCs help to fight against infections. The normal number of WBCs in the blood is 4,500 to 10,000 white blood cells for each microliter (µL). A low number of WBCs is called leukopenia. If the WBC count below 4500 is less than the normal (Greger et al, 1996).

An RBC count is a blood test that tells how many red blood cells (RBCs) you have. RBCs enclose hemoglobin, which carry oxygen. The amount of oxygen depends upon the amount of RBCs hold and how well it works. The RBC count is almost always part of the CBC (complete blood count) test. The test can help identify anemia and further situation upsetting red blood cells. The general the range is as follows: Male: 4.7
to 6.1 million cells per microliter (cells/ µL), Female: 4.2 to 5.4 million cells/mcL. Your RBC count will increase for several weeks when you move to a higher altitude. A high red blood cell count is generally meant more than 5.72 million red blood cells for every microliter (mcL) of blood for men and 5.03 million for every mcL for women. The threshold for high red blood cell count varies with age and gender among children (Singh, 2004).

**Performance variables**

The 100 meter dash is a sprint race in track and field competitions. This is considered to be the shortest common outdoor running distance. It is one of the most trendy and high-status events in the sport of athletics. 100 meter dash measures one’s sprinting ability, explosive strength. It is important to remember that the improvement of running speed is a complex process that is controlled by the brain and nervous system. Speed is influenced by the mobility, particular strength, strength endurance and technique (Clarke & Clarke, 1976).

This speed component of anaerobic metabolism lasts for approximately eight seconds and should be trained when no muscle fatigue is present (usually after 24 to 36 hours of rest). Downhill sprinting, speed, reaction drills is the common method of developing sprinting speed following the acceleration phase (Clarke & Clarke, 1976).

The long jump otherwise known as the broad jump is one of the major items among track and field events in which athletes possess multifarious dimensional skill related physical fitness components. It needs a lot of effort to take the jump as well as take-off and landing. So the athletes have to attain ample level of physical fitness for the best performance. It has got three phases such as run-up, take-off, and landing. All these three phases needs speed to perform better. Speed became an essential component for performing long jump; it is very common that most of the long jumpers are also used to compete in sprint events also (Arnheim & Prentice, 1997).

The horizontal jump (Long Jump) move toward run, some places flanked by the 4-6 total steps (2 or 3 rights/ lefts) are used to accelerate to utmost speed. The slower your
athletes are, the faster they will get to peak speed. The faster athletes will have longer achieved with their maximum speed. The remaining number of steps is done at maximum convenient speed. Upholding of this speed and the erect posture at the end of the approach is crucial to success. Long jump measures leg strength and explosive strength. One or two plyometric training sessions per week can have a significant affect on your explosive strength and in turn, the sprinting and jumping performance (Clarke & Clarke, 1976).

The shot put is a track and field event involving "throwing" (throwing in a pushing motion) a heavy spherical object the shot as far as possible. The distance achieved in the shot is dependent on the height of release of the shot, the angle of release of the shot, speed of release of the shot. The shot-put is a sport in which upper body strength is a critical factor. The parameter that has the greatest effect on the potential distance is the speed of release of the shot. The shot put athlete (or shot-putter) needs power, but must also be fast and synchronized in order to create momentum and maximum force during the throwing motion. The biggest benefit of broad jump training for athletes is that it improves the reaction of fast-twitch muscle fibers all through the body. Effective, broad jumps requires your leg and core muscles to contract very quickly like other plyometric exercises, so that you can generate maximal force with each leap.

**Climate in Kerala: The independent variable**

The coastal state of Kerala lying on the Southwestern tip of India has commonly been called the tropical paradise of India. This state receives very much rain in season and blessed with back water. This coastal state has a hot and humid climate during April-May and pleasant, cold climate in December-January. The Highlands of Kerala, which is an area of major attractions, tourism, enjoys a cool and bracing climate the year-round. Owing to its diversity in environmental features, the climatic condition in Kerala is unique. It can be divided into 4 seasons – Monsoon, spring, winter, summer.

Monsoon is the main rainy period of Kerala. This period begins in the last part of May or early June with the onset of the southwest monsoon winds. Spring season begins in the month of September and sometimes lasts until November. This found to be the
combination of both warm and humid but there is not much variation in temperature. Winter in Kerala is from the end of November until the middle of February. During this season, even though the temperature is found to be comparatively low, but still it does not vary much from other seasons. The climate is cool throughout the year in the highlands of Kerala. In this state during winter season the temperature come below $20^0$ and summer above $40^0$C. Starting from March, summer season continues until the end of May or the beginning of June and is concluded with the outset of monsoons.

More over Kerala state produced many national and international athletes with good performance. The physical condition and the climate may be one of the reasons for this achievement. Particularly many national level sprinters and jumpers both men and women belong to Kerala state. This state has mainly four seasons ie; monsoon, spring, winter and summer, these seasons also influenced by the performance of an athletes. Many national and international football players, hockey players and cricket players are also produced by Kerala, so the atmospheric condition and the temperature of this state may influence to improve the physical efficiency.

Hence, considering the facts we can reach to a strong conclusion that environmental temperature, physical and physiological factors are very important for achieving the highest level of performance in standard competitions (Singh, 2004).

So, the investigator made an attempt to determine the influence of various environmental temperatures on athletic performance.

**STATEMENT OF THE PROBLEM**

Success in competitive sports and games can be attributed to many factors: training in different environments, attitudes, fitness, skills, etc. Among these, environmental condition is very much relevant to exhibiting one’s performance.

In India, consideration of such environmental temperature in relation to athletic performance, during sports training as a part of acclimatization is generally neglected not only by the athletes but also by the coaches. Although the concept of acclimatization of environmental temperature is theoretically accepted, research evidence on Indian athletes
is available in this direction is meager. Moreover, no report on environmental temperature in relation to selected track and field performance of College level athletes is found in Indian literature of sports.

Therefore, it was desirable to investigate the influence of various environmental temperatures on performance in certain selected track and field events. Thus, the topic entitled, “Influence of Seasonal and Environmental Temperature on physiological and hematological Functions and Performance in Athletics has been proposed for the research.

DELIMITATION OF THE STUDY

1. This study is delimited to the selected track and field events such as 100m dash, long jump and putting the shot.

2. Only forty boys were able to select as the subjects for this study.

3. Data collected from college level students of the population of Kerala state.

4. This study is delimited to the selected physiological components.

5. Only haemoglobin, red blood cells and white blood cells were selected as haematological variables for this study.

6. This study is also delimited to the environmental conditions of Kerala.

LIMITATIONS

The under mentioned limitations of this study are needed to be recognized while interpreting and generalizing the results.

1. Variation in temperature and humidity levels was not taken into consideration.

2. Factors like diet, personal habits, daily routine activities and lifestyle of the subjects were not taken into consideration for this study.
3. The economic conditions and financial background of the subjects were not considered.

4. Previous sports experience of the subjects was not taken into consideration.

5. The psychological models of the subjects at the time of collecting data were not taken into consideration.

OBJECTIVES OF THE STUDY

1. To evaluate seasonal temperature and to establish its relationship with athletic performance.

2. To analyze and compare the season-wise and day-wise (morning, noon and evening) athletic performance.

3. To evaluate how athletic events are influenced by varying environmental temperatures.

4. To suggest the best time in a day and to identify an appropriate season for improving performance in selected athletic events.

HYPOTHESIS

It has been hypothesized that the different environmental temperatures of Kerala may affect the performance of selected physiological, haematological and track and field events of college students.
MEANING OF THE KEY TERMS

Heart rate

The heart rate is the numerical of contractions of the ventricles (the lower chambers of the heart) (Singh, 2004).

Respiratory rate

The number of breaths per minute or cycle of inspiration and expiration per unit time.

Diastolic blood pressure

The pressure exerted in the blood stream when the heart relaxes and dilates, filling with blood.

Systolic blood pressure

The pressure exerted in the bloodstream of the heart when it contracts, forcing blood from the ventricles of the heart into the pulmonary artery and the aorta (Sinning, 1973).

RBC

Erythrocytes the red blood cells, the main component of the microscopic ‘formed elements’ in the circulating blood.

WBC

Leukocytes the white blood cells, one of the ‘formed elements ‘of the circulating blood systems that comprise the cells of immunity and inflammation.

Haemoglobin (Hb)

The iron contained oxygen transport-protein of red blood cells that transports oxygen as oxyhaemoglobin from the lungs to various cells, everywhere the oxygen is
willingly free and the oxyhaemoglobine becomes Haemoglobin (Leukocytosis et al, 2011)

**Body Temperature**

The level of heat produced by the body process. During aerobic activity, the body temperature would increase and while in rest period the temperature would normal.

**Acclimatization**

The process of adjusting the body with the new environment. An athlete is need to acclimatize the condition, then only use maximum potential and prevent the physical condition from all the diseases. Normally all the elite sports persons to reach the competition venue as earlier to acclimatize the physical condition.

**Dehydration**

Excess loss of body water with an accompanying disruption of metabolic process. In hot temperature

**Hyperthermia**

High body temperature due to failed thermoregulation that occurs when a body produces or absorbs more heat than it dissipates

**Hypo hydrated**

Decline in body water content.

**Maximal Oxygen Uptake (VO₂ Max)**

The ability for oxygen utilisation by the body for the duration of maximal exertion (sinning, 1973).

The maximum quantity of oxygen utilize while doing strenuous physical activity, particularly aerobic and some anaerobic programme.
Thermoregulation

Thermoregulation is the process of the body to maintain its core internal temperature. Body is capable to regulate the core internal temperature for any circumstances and any situations.

SIGNIFICANCE OF THE STUDY

On the following grounds, this study is significant:

1. The purpose of this investigation to direct the coaches and physical education experts to provide the right training to the players on the basis of the latest findings to reach the zenith of performance.

2. No research, till date, could establish the relationship between varying environmental temperature and athletic performance of college students in Kerala State.

3. This investigation, therefore, may be of immense use in developing a strategy for improving athletic performance.

4. Even though, athletes have an excellent level of physical fitness and skills with a strong physique, implication of environmental temperature as an acclimatization process may facilitate improved performance. The same strategy may be useful for sports persons in that state and national level.

5. The investigation will be an eye opening to the researchers and scientists to new field of research and training methods to improve performance.