CHAPTER V

SUMMARY, CONCLUSION, RECOMMENDATION
Drastic change has been happening to the norms and standards of athletics in the present decade. Now a day unimagined performance is stamped. Main factor is the demanding field of track and field and its social acceptance as well as strong inspiration has encouraged long, tough hours of work. Coaching has become more refined, to a degree, from the support of sport specialists and scientists. Most sophisticated equipments and research as well as knowledge about athletes now available everywhere which influenced much in training methods

The systematic information and research could be helpful to enhance the improvement of the area. Exercise has become the key to open the area of sports and games. Research reports from various allied areas provide the theoretical knowledge as well as method of training, which has become a key source of the development of sports and games. In order to appreciate the benefits of varying environmental temperatures and seasonal changes, it is all the more necessary to understand the mechanism of human acclimatization to the environment, the physics of low pressure environments, and the physiological changes brought about in the body by exposure to the hot and cold climatic conditions.

Different activities make different demands upon the organism with respect to the circulatory, respiratory, metabolic and neurologic process processes which are specific to the activity. Different environmental change, namely, height above sea level, weather, high temperature, humidity, and nutritional status etcetera has some close associations with the optional performance of an athlete.

Sportsmen became capable for producing outstanding performance because of the latest reports and information about the recent training methods such as techniques and tactics, facilities and finally environmental conditions.
Physical Education, now a day is considered as an important and integral part of general education which aims at the harmonious development of the man. But, in practice and from a functional view, no recognition has been received so far or status as an academic subject.

Scientists of physical education and sports created many programme to acquire good physical condition for better performance. Though research in physical education in India is in the stage of infancy and is a new venture, it has already reached a new height of using technical knowledge. 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.

Many investigators are of opinion that, along with several factors, the geographical as well as climatic conditions of the place where an athlete lives also play vital role in the level of performance ability. Since the geographical situation and climatic condition in India are different from other continents, it is assumed that the performance ability of Indian sportsmen may vary when they participate in the competition being organized in different continents in world sports. Supportive incidence is being evidenced in the case of Indian athletes participating in the Asian Games. Here, the performance of Indian athletes is comparatively superior since the geographical and environmental temperatures are approximately similar in the regions of Asia.

Although measurement of psycho-physiological functions and performance abilities in sports is a continuous process in bringing out a good sportsman, in India, research report on environmental temperature in relation to athletic performance is meager. Moreover, no investigation till-to-date is available in this direction, especially on the influence of climatic temperature on track and field athletic performance of College level athletes.

When we think about the environmental temperature, the physiological aspects also have to be taken into account. Exercise in agreeable temperate ambiance or environmental condition affects the athletes much in their performances. It may magnify the normal reaction to their physical effort. Further it may elevate the internal
Temperature, create increase in skin surface temperature, elevation in metabolic heat production, profuse sweating, elevated pulse count, and tend to becomes hypertension.

Women generally have ten to twelve percent greater surface area to mass ratio than men. Since they have more surface area, naturally the heat loss will be more in them. Even though it may harm their performance in hot humid areas, acts as a natural protection for them. Women with large subcutaneous fat deposits have greater resistance to heat loss in air or water. In general, women and men respond similarly to heat at rest. Heat tolerance capacity is highly related to the capability of acclimation with the environment. With repeated exposure to work in the heat, men as well as women develop low level of internal temperature gain and skin temperature, a diminished heat rate and an increase in the amount of time they can withstand the stress. Men usually have a higher sweat rate than women. There are several climatic and situational factors that may lead to heat stroke, even in relatively cool ambient conditions, under continuous and high heat production, such as that seen in Marathon or Ultra Marathon competitions. It would be unable to lose heat when the environmental temperature becomes higher than body temperature. In such conditions the body, in fact, gains heat from its surroundings by radiation, convection, and conduction. When the outside temperature rises or heat production activity of muscles increases, other internal mechanisms come into play.

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.

When the environmental air is warm and relative humidity is high, the vapour tension of air and water is high and thus thermal sweating is not effective. Information is available to indicate that workers who are exposed to severe heat and high relative humidity can sweat at rates as high as four liters per hour over short periods of time. Because of the reduced thermal and vapour pressure gradients brought on by climates
that are hot and humid, tremendous demands are asked of both the cardiovascular system and evaporate sweat mechanism. This is especially noticeable during work in hot, dry surroundings.

It is obvious that exercise in the environmental surroundings of high temperature and relative humidity can place severe strain upon the cardiovascular system that may deteriorate one’s level of sports performance.

Men and women respond differently to thermal stress. Male may have a slightly higher sweating threshold (2 to 3°F) than females. Evidence is available to indicate that the female sweats less than the male because she does not apparently start sweating until the environmental temperature is about 2°F above the male’s sweating threshold. It is an established fact that women have smaller capacity to transfer heat from inner body to outer body. Hence maintenance of heat in a balanced condition for women is not at all economic. So naturally there will be a downward movement in the physical, physiological performance. In hot weather the outer shell temperature will be little bit elevated for women when compared to men. That is why women will have greater acclimation than men. And also in cold region women feels more chilled than men. So heat loss is approximately 10% less for them. According to authorities studying heat and cold tolerance of different sexes, this may be partially due to a more effective vaso-constriction in women as well as to a greater amount of adipose tissue (about ten percent) in women.

It is particular that in the early morning body temperature will be low (about 36.1°C), and at its highest bout (37.4°C) in the late afternoon or early evening. Merely changing one’s daily living habits such as eating and sleeping can reverse these variations. Vasodilation is the major machine inside our body who works efficiently during hot sun. During this time the body will shed sweat towards the surface area to cool the surface and there by regulate the temperature of the whole body is regulated. This is done by the process of the hypothalamus. Vasodilation expands the blood vessel and naturally the blood flow will be more to this area and thus enhances the transfer of
metabolic heat from the deep core to skin surface. 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 people who live in cold region metabolism. Therefore, they consume more food and voluntarily increase the amount of fat in the diet”.

Man has adapted to cold climates by maintaining a comfortable micro-climate 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 reduced, especially due to the discomfort of hands and feet’s.

Considering the all these facts, atmospheric or environmental temperature, physical and physiological factors are very important for achieving the highest level of performance in standard competitions.

Even though, physical education is recognized as an integral part of educational systems. The findings of this investigation may be helpful in creative measures to educate the teachers and coaches to positive approach and accurate planning to implement the programs of physical education in the college/university for balanced development of the students’ character. During this study of students' attitudes toward physical education and sports, and the incidents which influence those attitudes, it is hoped that the secondary school physical education and sports will be better equipped to provide a meaningful physical education experience to the students by considering such information when making curricular, pedagogical, or other program decisions. The study will help in popularizing physical education programs to some extent.

Heat adaptation becomes stress for our body. In general, physical training in a cool-dry environment results in bio-chemical, hematologic, metabolic and cardiovascular adaptation. Heat adaptation via backbreaking exercise induces response recognized to
both passive heat contact and training in cool environments. Absolute heat adaptation need 14 days, but the body systems of the body to adapt heat exposure at varying rates. The early adaptations involve an enhanced power of heart function, with long-drawn-out plasma level, reduced heart rate, and autonomic nervous system habitation which redirect cardiac output to skin vessel beds and dynamic muscle. Plasma volume increase follow-on from amplified plasma proteins and increased sodium chloride retention, ranges from +3 to +27%, and is accompanied by a 15-25% decrease in heart rate. This cardiovascular strain reduces rates of apparent effort, which is comparative to central cardio-respiratory stress, again decreases all through the first five days of exercise-heat disclosure. Plasma volume increase is a provisional event, which decays at some stage in the 8th to 14th days of heat, and then is replaced by a long-lasting reduction in skin blood flow that serves to increase central blood volume. The regulation of body temperature throughout exercise in the heat is hazardous, because of the immense potential for lethal hyperthermia. Thermo-regulation (i.e., increased sweat rate, earlier onset of sweat production), joined with cardiovascular adjustment, results in a diminished body temperature. Yet, the adaptations of eccrine sweat glands are different during humid and dry heat exposures. Heat adaptation is done in a hot-humid condition; stimulate a better sweat rate than heat adaptation in a hot-dry atmosphere. Also, the absolute rate of sweating influences thermoregulation. If the hourly sweat rate is small a peripheral adaptation of whole body sweat rate may not occur.

An athlete should acclimatize to heat. The body can dissipate heat when the surface of the body is heated. 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. 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. Success in competitive sports and games can be attributed to many factors: training in different environment, attitudes, fitness, skills, etc. Among these, environmental condition is very much relevant to exhibiting one’s performance.
Athletic performance differs from laboratory studies of exercise in many ways. Perhaps one of the major differences is that the performer is influenced by a wide variety of environmental temperatures. The athlete, however, may find himself competing with extreme environmental conditions like heat or cold, and wind and rain to contend with, although he may come from a country with low temperature to one with high temperature and vice versa.

The regulation of body temperature is vitally important because the metabolic process involves chemical reactions, whose rates are affected by heat conditions. As a result, even slight shifts in body temperature can disrupt the physical performance of the athlete. So environmental temperature has a significant importance to achieve maximum performance of all sport and games. 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.

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. 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.

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 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.

Heart rate is the speed of the heart beat, particularly the amount of heart beats for each unit of time. The heart rate is characteristically spoken as beats per minute (bpm). The heart rate can vary according to the body's physical wants, 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.

The normal resting adult human heart rate ranges from 60–100 bpm. Bradycardiac 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. This abnormality of heart rate may occur some times, but not at all the times, show illness.

Heart rates shoot up with effort - to bring more oxygen and energy for the work out. Heart rate varies in accordance with our activity. We have a 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. Athletes who have done a lot of training may see their resting heart rate fall below 60 beats a minute, conceivably to as low as 40 beats a minute.

We should understand that one should not give concentration to the clock, but instead concentrate your thoughts on pulse waves. Breathing (which in organisms with lungs is called ventilation and includes inhalation and exhalation) is a part of respiration. Thus, in particular usage, the term inhalation and ventilation more or less same, of respiration; but this instruction is not every time follow, still by most health care providers, since the term respiratory rate (RR) is a well-established term in health care, even though it would need to be every time replaced with ventilation rate if the precise usage were to be followed.
Athletes who have done a lot of training may see their resting heart rate fall below 60 beats a minute, conceivably to as low as 40 beats a minute. The respiratory rate can be taken very easily. This is nothing but the number of breaths over a minute. The rate is usually numbered through a common observation as well as using an Expirograph also. 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 respiratory rate (RR), respiration frequency, pulmonary ventilation rate, or breathing frequency, is the rate (frequency) of ventilation, that is, the number of breaths (inhalation-exhalation cycles) taken within a set amount of time (typically 60 seconds). When the heart pumps blood into various parts of the body, we can feel the pulse in the form of waves. To feel the pulse there is a pressure exerted by the heart to the walls of the arteries. This is very close to the skin surface so that the pulse can feel firmly.

The normal body temperature of a person varies depends on sex, current activity, foodstuff and liquid using up, time, and, in women, the period of the menstrual cycle. Regular body temperature can varies from 97.8°F equivalent to 36.5°C to 99°F (37.2°C) for a healthy adult. When it gets cold, your body temperature may also go down. To remain the warmth, one must need to generate heat. Blood pressure can be measured with a Bp cuff and stethoscope. Bp is the force of the blood roughly alongside the walls of the artery.

The principal component of the hematologic system is the blood. Blood consists of three components: RBC, WBC, and Plasma. Among this the RBC and Erythrocytes, are the most common blood cells. White Blood Cells, or leukocytes, are the body's barricade to fight against diseases. Blood count determines the status of a number of different features of the blood. This include the quantity of haemoglobin in the blood, the number of red blood cells, the percentage of blood cells as a amount of the total blood volume, 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

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.

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 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 require your leg and core muscles to contract very quickly like other plyometric exercises, so that you can generate maximal force with each leap.

The coastal state of Kerala lying on the Southwestern tip of India has commonly been called the tropical paradise of India. Compared to other states of India, Kerala is very close to the equator. Still Kerala is blessed with a lovely and equable climate right through the year. This is because kand is very near to the sea and the presence of the fort like Western Ghats on the eastern side. Kerala would have been a waterless land because of the dry winds blowing from the northern part of India, but for the Western Ghats, which put off this wind from entering the land. Kerala receives copious rain every year.
The Kerala’s normal temperature ranges from 28° to 32°C (82° to 90°F) on the plains, but drops to about 20°C (68°F) in the highlands. 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 attraction for 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 by 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. Afternoon rains accompanied by thunder and lightning are the main characteristic of the season. Days are found to be the combination of both warmth and humid but there is not much variation in temperature. Winter in Kerala starts from the last lap of November to till the middle of February. During this season, even though 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, where winter temperatures often fall below 10°C. Winter season in Kerala witnesses the lowest amount of rainfall. Summer Season in Kerala starts from the end of February temperature starts climbing and this marks the beginning of summer in Kerala. Relatively high temperature, low rainfall and slightly humid weather are the characteristics of the summer season in Kerala. When compared to other states of India where the temperature soars to over 40°C, summers in Kerala are not so cool and pleasant. Starting from March, summer season continues until the end of May or the beginning of June and is concluded with the outset of monsoons.

Based on the prevailing scenario and the knowledge enriched from earlier studies, this piece research was professed to observe the influence of seasonal and environmental temperature on selected physiological, haematological and performance variables among college students. For this investigation 40 boys from the B.P.E course, Christ College,
Irinjalakkuda, Thrissur, Kerala were selected as the research subjects and they belong to eighteen and twenty one years of age.

The subjects belonged to different parts of Kerala state and were varied in their socioeconomic status. All the students had fairly well developed physique and all of them are regular in morning health conditioning programme.

In order to ensure full co-operation from the subjects, the scholar explained the requirements, the importance of this study. And the subjects voluntarily agreed to undergo the prescribed tests. Then the data were collected on the subject confined to this study.

The standardized equipments and testing procedures were used for the purpose of data collection, with the assistance of research scholars as testing personals. The data thus collected was subjected to the statistical analysis using simple descriptive statistics to process ANOVA followed by Scheffe’s post hoc test were utilized to evaluate the significant difference between the time of the day effect on variables considered in this study.
CONCLUSION

In order to achieve higher level performance standards in competitive sports, it is necessary to consider environmental factors such as temperature, humidity, altitude, etc. On the basis of the available literature, knowledge and techniques, this study has comprised with three different areas such as physiological, haematological and performance variables. To find out the outcome of the study, the investigator had used the seasonal and environmental temperature to collect the data.

For this study, 40 boys from Christ College, Irinjalakkuda, Kerala was selected and their age group belongs to eighteen (18) and twenty one (21) years. The data on selected physiological, hematological and performance variables were collected at three different temperatures in three days viz., the first day morning, second day noon and third day evening in all four seasons. To analyse the data, ANOVA statistical technique was adopted for this investigation. Scheffe’s test was administered to get the real result of this study. The statistical c level of this study was considered as 0.05.

1. There was significant difference in the 100 meter dash and long jump at the environmental temperature in the monsoon (July) season.
2. Putting the shot showed an insignificant difference in monsoon season.
3. The evening temperature of 27°C (81°F) is the suitable time for enhanced performance in100 meters and long jump during the monsoon (July) season.
4. There was no significant difference in the respiratory rate, heart rate, diastolic blood pressure and systolic blood pressure at the environmental temperature in monsoon season (July).
5. Body temperature had a significant difference in monsoon season (July).
6. The noon temperature of 27°C (81°F) is the best time for body temperature during the monsoon season (July).

7. There is no significant difference in haemoglobin (Hb) and red blood cells (RBC) in different environmental temperatures of monsoon season (July).

8. WBC had a significant difference in monsoon season (July).

9. The noon temperature of 23°C (73°F) is the most suitable time for white blood cells (WBC) in the monsoon season (July).

10. There was a significant difference in the 100 meter dash at the environmental temperature of the spring season (October).

11. There was an insignificant difference in long jump and putting the shot in the environmental temperature of the spring season (October).

12. Evening temperature is the most suitable time for performance in the 100 meter during the spring season (October).

13. There was a significant difference in respiratory rate (RR) in the environmental temperature of the spring season (October).

14. There was an insignificant difference in heart rate (HR), body temperature (BT), diastolic blood pressure (DBp) and systolic blood pressure (SBp) at the environmental temperature of the season (October).

15. Morning temperature is the suitable time for respiratory rate in the spring season (October).

16. There was an insignificant difference in hemoglobin, white blood cells (RBC) and white blood cells (WBC) at the environmental temperature of the season (October).

17. There was a significant difference in the 100 meters and long jump at the environmental temperature of the winter season (December).

18. Putting the shot showed an insignificant difference in winter season (December).
19. Evening temperature is the suitable time for performance in the 100 meters and long jump in the winter season (December).

20. There was an insignificant difference in physiological variables such as heart rate (HR), body temperature (BT), diastolic blood pressure and systolic blood pressure at the different environmental temperatures of the winter season (December).

21. There was an insignificant difference in haematological variables such as haemoglobin (Hb), RBC and WBC at different environmental temperatures of the winter season (December).

22. There was a significant difference in the long jump at the environmental temperature of the summer season (April).

23. There was an insignificant difference in the 100 meter dash and putting the shot at different environmental temperatures of the summer season (April).

24. Evening temperature is the best time to perform the long jump in the summer season (April).

25. There was an insignificant difference in respiratory rate, diastolic blood pressure and systolic blood pressure at the different environmental temperatures of the summer season (April).

26. Evening and noon temperatures are the best for heart rate and body temperature during the summer season (April).

27. There was an insignificant difference in haematological variables such as haemoglobin (Hb), RBC and WBC at the different environmental temperature of the summer season (April).

28. There was a significant difference in the 100 meter dash among the four seasons such as monsoon (April), spring (October), winter (December) and summer (April) seasons.
29. There was an insignificant difference in long jump and putting the shot among the four seasons.

30. Spring season (October) was the most suitable period to perform & practice 100 meter dash.

31. Among physiological variables, there would have much variation in heart rate, systolic blood pressure and body temperature among four seasons.

32. There was an insignificant difference in respiratory rate and diastolic blood pressure among the four seasons.

33. Summer season (April) was the suitable period for heart rate and body temperature.

34. Diastolic blood pressure seems to be normal in Monsoon season (July).

35. There was a significant difference in red blood cells (RBC) and white blood cells (WBC) among the four seasons such as monsoon, spring, winter and summer (July, October, December and April).

36. There was an insignificant difference in haemoglobin (Hb) among the four seasons.

37. Winter season (December) was the suitable period of red blood cell (RBC).

38. Monsoon season (July) was the best time for white blood cell (WBC).
RECOMMENDATIONS

This study added to the limited research on Influence of seasonal and environmental temperature on selected physiological, haematological and performance variables among college students. The insights gathered from this study, even though helpful, are in no way comprehensive, it is therefore necessary that future exploration in this area should continue. An obvious starting point would be to further investigate the role of environmental temperature in various other components. Based on the conclusions, the following recommendations were made.

The outcome of this study became an eye opener to the coaches, physical educationalists about the effects of different environmental temperature and seasonal influence on performance

1. Since most of the physiological, hematological and performance variables showed significant influence in atmospheric temperature variations, it is suggested that the coaches, trainers and physical education teachers take note of this and take steps to train the athletes to acclimatize with the environment.
2. A similar study shall be done with athletes of different category.
3. Same study shall be done with adolescent girls.
4. A study shall be done with other parameters.
5. Other performance variables may be used for a similar study.
6. Similar studies can be conducted with skin resistance as a variable.
7. Similar studies may be conducted by adding much number of psycho physiological variables.
8. Similar studies can be conducted with biochemical variables as criterion variables.
9. Similar study can be conducted with the games and sports which may be played or performed in both indoor outdoor play areas.

10. Similar studies can be conducted in different geographical positions such as high altitude & low altitudes.

11. Similar research is necessary to explore the effect of environmental temperature on other physiological and biochemical variables.