CHAPTER-I
INTRODUCTION

There has been a progressive and continuous development through the conclusive sphere of homo-sapience, till today. Contemporary to early human civilization, sports was not more than a recreational phenomenon. With the progress of modern civilization to the computer era, the field of sports also got sophisticated beyond the recreational approach. The interest in games and sports has motivated the researchers towards a number of scientific researches and observations. An attempt has been made to observe the performance of sportsperson in different fields with a view to find out various factors which affects the performance. The performance of sportmen has become a matter of national importance, prestige and prosperity.

The field of physical education and sports is affected by the development in science and technology because it is becoming more competitive and innovative day by day. The physical educationists and sports scientists are working hard to develop suitable methods to enhance existing level of performance. There are many reasons for the continuous improvement in performance. The large numbers of young people are coming in contact with systematic coaching for greater and better selection. Modern coaching methods are improved by the application of the results of research in all the related sciences. As a matter of fact, this breaking and re-establishing of records is not only the product of one field, but also of many fields such as Anthropometry, Biomechanics, Physiology, Sports Medicine, Sports Training and Psychology. These sciences are more and more involved in the selection and better performance of the players. Therefore, high-level performance can be achieved with the combined efforts of sports persons, coaches, scientists, doctors and psychologists etc. Desired results can only be achieved through integrated efforts of leading people of various fields who can give valuable inputs for desired performances.

Performance in sports competitions at various levels have become a sign of prosperity, development and innovations of new techniques in the field of sports. It is gaining momentum day by day and high level research in the field is going on to explore the possibilities of investigating the ingredients responsible for the enhancement of sports performance and facilitating the talent selection for competitions. New incentive, sufficient infrastructure and standardized sports
equipments are being provided by the agencies interested in the development of sports to see their nations at the top of medal winning country in world competitions. A lot of research is being done on various aspects of sports performance. Numerous physical educationists and sports scientists are engaged in finding new dimensions for talent selection for better performance. It is due to their sincere efforts, the records of the performance in any games and sports are being broken and new records are being established.

Generally, it is considered that success in team game is more related to knowledge of the game strategies, technical efficiency, tactical skills and performance capabilities. Therefore, it becomes difficult to predict potentially talented players. There are number of factors which affect the performance of sportspersons, such as age, sex, physical growth, physiological, biochemical, biomechanical, genetically, anthropological and psychological factors. Among these factors, the size, shape, physique, proportions, physical fitness, skill efficiency level also play significant role in enhancing performance.

The origin of scientific approach in physical education and sports could be traced back to Hitchcock, E. (1971), who first applied a science of anthropometry to physical education. He thus, laid the foundation for scientific approach of investigation by physical educators of that early era and by doing so, he contributed substantially to the establishment of physical education as a science. The use of scientific method has become an important aspect and now being wide spread in sports. It is a well-established fact that practice alone cannot ensure improvement in performance. So specificity in physique is required because the sports movements are highly specific. The staggering number of conditional components such as reaction that might be involved in various combinations in a single sports movement makes specificity quite logical.

Since the advent of competitive sports, scientists have been working hard in search of such ingredients that would produce a super athlete. The sports and games have expanded rapidly with the association of skills, techniques and styles. The scientific evidence reveals that requirements of any sport or game are specific to that activity. In each sport, the activity places certain specific demands on the individual depending upon the type of the game, its duration, intensity and degree of skill execution.
It may be referred that every male and female begins life with morphological and functional potential which sets limits for the health and physical fitness, the body shape and composition, the bone structure, the size and conditioning of the heart, lungs and other organs. Evidently, all the persons cannot confirm to these attributes. It seems that some persons possess high potential for physical fitness and work performance, while others are not. Thus it is not possible to control all these constitutional variables (Bawa, 1981) as such; there would inevitably be difference in the performance of each individual. It can be inferred that the body size and the type of physique are important factors to describe the ultimate limit of achievement of a sportsman. It follows that certain body specifications may be conducive to efficiency in some apparatuses, while the same may be impediment in smooth and easy performance on others.

Anthropometry is the oldest type of body measurement used, dating back to the beginning of recorded history. The concepts of the ideal proportion varied over periods of time. For example, Polycletus fashioned Doryphorus, the spear thrower, as a fighter and an athlete, broad shouldered, thick set and square chest as the ‘perfect man’ (Clarke and Clarke, 1987).

Anthropometric measurements were central concerns of the first phase of the scientific era of measurements which began in 1860. Current interest in anthropometric measurements focuses on three areas; growth measures, body type and body composition. The use of such measures included classification, prediction of growth pattern and prediction of success in motor activities as well as assessment of obesity.

Measurements of body size includes such descriptive information as height, weight and surface area, while measures of body proportion describe the relationship between height and weight among lengths, widths and circumferences of various body segments. It has been found that top athletes in some sports tend to have those proportions that biomechanically aid the particular performance required (Zeigler, 1982). An evidence of this we observe the well-proportionate physique of boxers and gymnasts, the super-structure of great basketball competitors, the solidness of top-flight football players, the wiriness of champion distance runners and massive builds of great shot-putters and discus throwers (Clarke and Clarke, 1987).
Anthropometry is the systematic collection and correlation of measurements of the human body. Anthropometry has been used to assess gross structure and function, including body size, shape and proportion and body composition. Assessment of the human body is important to determine its relationship with risk of health problems such as overweight, growth failure and eating disorders. Anthropometry is an important aspect and technique in the field of public health and nutrition.

Assessment of the human body to solve the problems in relation to the human growth, body performance and all other issues associated with nutrition is important. Therefore, Kinanthropometry may be considered as a fundamental discipline in human research.

The greater propagation of interest regarding a particular type of inherent physique that produces an athlete with greater performance for a particular event came up around the middle of the twentieth century. It is important to note that research in India, in this particular field started during the past few years. In other countries, however, research in the disciplines concerning sports has been on since long (Hirata 1979).

Due to the high correlations between anthropometric measurements like linear measurements, circumferences, diameters, body composition variables etc. and physical performance, the recent trend is to include these variables in the areas related to the strength of the athletes. Sundarajan (1986) has stated in his Sports Medical lectures that Sports Anthropometry has developed as a special branch, not only as a parameter of selective diagnostic procedure but also as a performance prediction tool. Anthropometric measurements have revealed correlation between body structure, physical characteristics and sports capabilities. This knowledge of mathematical correlation permits sports physicians to evaluate and to predict performance-potentialities on the basis of physical characteristics and specific requirements of the game.

Parnell (1951) in an anthropometric study of athletes concluded that an individual’s choice of athletic event might be due to the characteristics probably inborn.
De Garay et al. (1974) after an intensive study of anthropometric measurements of Olympic Athletes concluded that top level performance in particular event demands particular size of the body and shape, other aspects being similar. They established strong relationship between the structure of an athlete and specific task (event in which he excelled) clear physical proto type-exist for optimal performance at Olympic level.

Performance in sports depends upon certain factors-physique and body composition being one of the most important factor. Athletes for certain games are selected naturally on the basis of their bodily characteristics. Hirata (1979) has suggested that the selection of Olympic athletes based on their morphological measures (weight, height, ponderal index and age) should be done two years prior to the Olympic games and probable’s thus selected may be put to best training for winning their respective event. Thus the best available training efforts of a country if coupled with proper selection of athletes may be undoubtedly expected to improve its national athletic performance levels.

Anthropometry is used to assess and predict performance; health and survival of individuals reflect the sports and social well being of populations. Anthropometry is a widely used, inexpensive and non-invasive measure of the general nutritional status of an individual or a population group. Recent studies have demonstrated the applications of anthropometry to include the prediction of who will benefit from interventions, identifying social and economic inequity and evaluating responses to interventions. For more information on the application of anthropometric data, anthropometry can be used for various purposes, depending on the anthropometric indicators selected. For example, weight-for-height is useful for screening children at risk and for measuring short-term changes in nutritional status. However, weight-for-height is not appropriate for evaluating changes in a population over longer time periods. A clear understanding of the different uses and interpretations of each anthropometric indicator is a help to determine the most appropriate indicator for evaluation.

Man’s interest in the body structure of his own species can be traced back to ancient civilization. History reveals how in ancient Greece, a new born was produced before a council of elders who decided whether a child may be allowed to be brought up or not. After examining the physical feature and prospects of physical
development, Greek sculptors, painters and poets visited the pales trace and athletic contest arena to observe the beauty of human form in action and response, in order to express their impressions in their artifacts (Van Dalam et al. 1971).

The sports structure in India is changing very fast because of the availability of increased facilities and sports environment. Awareness among the coaches and physical educationists towards the recent development in sports sciences is growing rapidly. The role of an emerging scientific discipline known as sports anthropometry is of great significance. It is the science that deals with the body measurements of athletes. This science is also known as kinanthropometry. The knowledge of this science is increasingly being appreciated by the sports administrators. Assessment of human physical performance through kinanthropometry helps to evaluate the physical structure and functions of individuals. The knowledge of this science equips us with the techniques of various body measurements like height, body weight, diameters, circumferences and skinfold thickness which ultimately deal with the assessment of human physique, body composition, physical growth, maturation and gross functions of the human body. The inter-relationship between each of these above mentioned variables with the success in sports can be regarded as a proven fact today (Cureton, 1951; Sargent, 1887; Tanner, 1964; Sidhu and Anand, 1971; and Stepnicka, 1986).

The athletes are recognized and selected naturally on the basis of their bodily characteristics for a particular sport or event. It is presumably true that every male and female begins life with a morphological and functional potential, which sets limits for health and physical fitness, body shapes and composition, bone structure, size and condition of heart, lung and visceral organs. The total number of muscles and nerve cells within the body are fixed at birth. Therefore, it indicates that some persons are born with a high potential for physical fitness and work performance while others are not. It indicates that the morphological or physical characteristics are determined by heredity, though it is difficult to assess the role of heredity and environmental factors affecting physical variations. The physical exercise and other training can improve the performance of an athlete only up to certain limit that is set by his genotypes (Klissouras, 1971).

According to Tanner (1964) the athletes are both, born and made. The basic structure must be present for the possibility of athlete to arise. He also pointed out that lack of proper physique may not help athletes to achieve a desired level of
performance. This basic structure or physique of an athlete is likely to depend on one's heredity or family line trends. Garn (1952) and Parnell (1958) pointed out that tall parents tend to have tall children and short parents are likely to have short children. So the choice of a sportsman for particular event is largely determined by his inborn characteristics. Naturally, therefore, heredity can play a significant role in selecting the talent in sports. No two athletes are exactly alike in their physique, therefore, they are neither equally physically fit nor can participate in the same activity to get the equal achievements and satisfaction due to certain limitations imposed on one and advantages extended to the group may not be possibly taken on equal terms. Hence the individual differences in sports and games can not be ignored. Through the study of variations in physical characteristics of athletes we come to know as to how close pre distant they are functionally as closer they are structurally and closer they would be functionally (Stepnicka, 1986).

With the advent of new physical fitness test (American Association of Health, Physical Education and Recreation) the physical education teachers and coaches are more interested to find out the role of body composition of the athletes and its effect on the performance and various physical activities. It is therefore, important to know the norms of body composition for participants of various athletic events so that a suitable training schedule may be constructed to improve the performance and also help to select the best body types for various physical activities and sports.

The physique of an athlete may influence the technical and tactical aspects of the game. The training, physical activities, environment and nutrition etc. can not change the segmental lengths of an athlete. So for efficient execution, suitable change in the technique and tactics in accordance to ones segmental size and structure may be beneficial at times during the game. It is this aspect of thought that may be used tactically by the coaches and sportsmen from time to time.

In the recent years the selection and development of talent in sports has been gaining greater emphasis. It involves integral approach of different sports, science specialties to pay attention to the sports in childhood and adolescences, since it has been realized that top performance in many sports is reached only if appropriate training is started at very early age. Every game requires a particular type of body; unspecific body type will pose hindrance in the improvement or in achievements of athlete’s performance. Various researches suggest that suitable physique plays a

These studies practically, play a significant role with regard to the selection of sportsmen as well as talent hunt for a particular game or sport. No doubt, physique plays a predominant role but it is not the only factor responsible in acquiring the best performance. Parnell (1951) and Hebbelinck (1985) advised that good result in sports can not be achieved if the biological features, mainly the somatic ones are unsatisfactory. With the process of growth and development the characteristics of physique undergo a marked transformation in physical characteristics such as height, weight, shape and proportions. The modifications in the morphological parameters are not possible beyond narrow limits. Alternations are possible in the physique of adult athletes in their body composition and somatotypes through training and specific physical activities but within specific limits.

By nature human beings are competitive and ambitious for the excellence in all athletic performance. Not only everyman but also every nation wants to show his supremacy by challenging the other nation. This can only be possible through scientific, systematic and planned sports as well as by finding out their potentialities. The success and failure of an individual athlete depends upon the blending of physical ability, conditioning, training, mental preparation and the ability to perform well under pressure.

International sports performance in physically competitive sports and games is influenced by the technical, tactical and physical abilities of the players. However, the top level performance is not ensured, if the anthropometric body dimensions of sportsmen do not correspond to the mechanical aspects of the game concerned. Studies have shown that champions in different sports differ in their anthropometric and physiological characteristics that correspond to some extent, with particular requirements of their respective events (Tanner, 1964; De Garay et al., 1974; Hirata, 1979; Carter et al., 1982; Borms and Hebbelinck, 1984; Sidhu et al., 1990; Sharma and Shukla, 1990). Therefore, it has been observed that apart from other factors the performance of a sportsman in any sport and game is influenced by various specific characteristics of physique, body composition, psychological traits and physiological
functions which help him to attain better performance (Astrand, 1956; Cureton, 1951; Tanner, 1964; Bhatnagar, 1980; Bouchard and Lortie, 1984; and Stepnicka, 1986).

There are various factors which affect performance in sports and games viz. physique, training, skill, age, motivation etc. physique is the most fundamental of all the factors. According to Eiben (1972), it is the morphological constitution of an individual and is formed by the manifestation of genetic endowment and as a result of adaptation processes to environmental effects. The physique of an individual can be evaluated from body dimensions, proportions, components and by somatotyping.

Hirata (1966) suggested that a country with people whose general physique, body build and body composition was limited to the characteristics of champions in certain events should better concentrate on these events. For instance, Japanese who have short stature should concentrate on exercise which is the best for small build such as gymnastics, long distance running, the light class in boxing, weight-lifting, judo and long distance cycling. Thus it becomes a very important task for future researches to work out the relationship of physique, body composition, body build and body fat with different types of athletic and sportive events.

One may not take it for granted that every child can be trained to be an Olympian, for there are a few persons who have a combination of the development of each requisite factor developed to the highest degree. The idea is to put the interested individual in a game or event in such a way so that one gives out the best of one's abilities. There seem to be various unchangeable characteristics in the human body. For example, if the game of Basketball needs the players to be tall, then those who are shorter cannot be made taller under normal conditions. Further if the sport of Gymnastics needs the players to be short, then those growing taller cannot be made shorter. Similarly the length of arms, legs etc. cannot be changed. To excel in a physically competitive sport, the player must possess such dimensions of body characteristics, which suit in his/her sport. It is therefore, because of this reason, the kinanthropometric or physical characteristics are known to be of fundamental importance for individual development to achieve Olympic level performance in sports.

The body composition studies have been conducted very extensively on the athletes. The examination of fat and skinfold at selected sites is most important in
them. It has been found that the athletes who were lean or less fatty but heavy because of a well-developed musculature were superior in performance in certain competitive sports. On the other hand the athletes who had substantial amount of adipose tissue have permanently increased energy demands owing to the inert weight of fat, this making the work more difficult to perform in such activities where the body has to be projected as in jumping movements or propelled against gravity over long distance as in distance running contrarily. The long distance swimming, water polo and synchronized swimming are sports where in moderate levels of fat may actually aid performance by providing additional buoyancy (Carter & Yuhasz, 1984) and insulation provided by the fact to be a reduced heat loss.

In the present study, the investigator being an outstanding hockey player and having participated in many All India University Competitions is well acquainted with the knowledge of ball games players, who performs at different level of competitions. It is a common observation that body structure and body proportions play an important role in mastering and achieving the various skills in competitive arena of ball games. The investigator in the underline study would like to compare the anthropometric variables and body composition between high level performers and low level performers of ball game athletes.

1.1 STATEMENT OF THE PROBLEM

“A study of anthropometric measurements, body composition in relation to competitive performance of ball games athletes”.

1.2 SIGNIFICANCE OF THE STUDY

- The present study might be helpful in understanding the relationship of anthropometric measurements with performance.

- The coaches and trainers might develop an insight for the objective selection of athletes of ball games, for their participation in different levels.

- The present study might be useful in sports where the counselling to children can be provided to which games and sports they are well suited by comparing their physique and body composition.
Improvement in terms of physique and body composition would help in improving performance standard of male athletes of Himachal Pradesh University and India in the above mentioned ball games.

The present study will help to evaluate and see the differences in anthropometric measurements and body composition of ball game athletes and make recommendations in their development.

The result of the study would add further knowledge to existing literature of kinanthropometry.

1.3 OBJECTIVE OF THE STUDY
1. To find out the difference in selected anthropometric measurements between high level and low level performers in ball games.
2. To find out the difference in body composition between high level and low level performers in ball games.
3. To find out the difference in selected anthropometric measurements among ball games athletes.
4. To find out the difference in body composition among ball games athletes.

1.4 HYPOTHESES OF THE STUDY
1. There would be significant difference in anthropometric measurements between high level and low level performers in ball games.
2. There would be significant difference in body composition between high level and low level performers in ball games.
3. There would be no significant difference in anthropometric measurements among ball games athletes.
4. There would be no significant difference in body composition among ball games athletes.

1.5 LIMITATIONS OF THE STUDY
1. Testing timings might be differing on the basis of availability of participants at specific schedules.
2. The investigator could not control other personal characteristics and habits etc.
3. The investigator tried to use the standard equipments for collecting the data on the basis of availability in the department.

1.6 DELIMITATIONS OF THE STUDY

1. The present study has been delimited to five ball games namely:-
   i) Basketball
   ii) Football
   iii) Handball
   iv) Hockey
   v) Volleyball

2. The present study has been delimited to the following selected anthropometric variables:-
   A) Linear measurements:- height, weight, sitting height, total arm length, bi-acromial breadth, bi-cristal breadth, hand length, hand width, leg length, upper leg length, lower leg length, foot length and foot width.
   B) Diameters:- humerus bicondylar diameter, wrist diameter, femur bicondylar diameter and ankle diameter.
   C) Circumferences:- chest circumference, upper arm circumference, forearm circumference, hip circumference, thigh circumference and calf circumference.
   D) Skinfolds:- biceps skinfold, triceps skinfold, forearm skinfold, sub scapular skinfold, supra iliac skinfold, supra spinal skinfold, thigh skinfold and calf skinfold.

3. The present study has been delimited to the male ball games athletes only.

4. The present study has been delimited to the Himachal Pradesh University ball games athletes.

1.7 DEFINITIONS OF THE IMPORTANT TERMS

(A) ANTHROPOMETRIC MEASUREMENTS: Anthropometric measurements are dimensions of the structure of human body taken at specific sites to give measures of length, girth and width.

(B) BODY COMPOSITION: Body composition is the proportion of the lean body mass and fat mass. It is one of the most important morphological features characterizing human organism.
(C) **COMPETITION PERFORMANCE**: The results achieved by players of ball games in Himachal Pradesh University inter college competitions will be considered as their competition performance.

(D) **HIGH LEVEL PERFORMERS**: First three positions in Himachal Pradesh University inter college competitions of ball games will considered as high level performers.

(E) **LOW LEVEL PERFORMERS**: All the players who could not come among the best three in Himachal Pradesh University inter college competitions will considered as low performers.

(F) **BALL GAMES**: Those sports where players play with ball either through hand or legs or with any equipment.

(G) **ATHLETES**: A sports person competing in an organized sport (team/individual). The word “Athlete” has been used throughout the present study in a broader sense for the individual who involves himself in any competitive sport.