CHAPTER 1

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The level of sports performance at top competition is increasing day by day and it is very true that only a trifling margin makes the differences for the top positions. Intensity of competitions in each and every field of sports goes on increasing as we move from the lowest level of domestic competition to the highest level of Olympics. Only selected players take part in a game at the highest level.

Remarkable competition in the sports at the highest level has gained splendid spectators. Fantastic records and athletic prowess are fascinating the common man. High esteem of sportsmen and their high incomes have also attracted people. The enthusiasm of common man and hard competition in sports resulted in the emergency of scientific techniques and research in sports. It constantly highlights and asserts the idea of sports science as an instrument of goal oriented service: clinching the top performance and top positions.

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 day to day 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 equipment 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 all aspects of sports performance. Numerous physical educationist and sports scientist 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 day by day and new records are being established.

Thus, 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).

The sports structure in India is fast changing because of the availability of increased facilities and sports environment. Awareness among the coaches and physical educationists towards the recent advances 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 upto 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 all parents tend to 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 physiques, therefore, they are neither equally physically fit nor 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 attention has been paid 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 predominant role for success in sports Cureton, 1951; Correntli and Zauli, 1964; Hirata,

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 narrow limits.

Currently, Excellency in sports performance has created the development of advance scientific training techniques designed to improve the standard of performance. Medalist performance no longer occurs at random or as a result of chance alone. International level sports performance in various games and sports is influenced by many factors such as level of physical, physiological and psychological abilities, nutrition, techniques, tactics, physique, body type and body composition.

Hirata (1966) suggested that a country with people whose general physique, body builds 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.

Recently researches in the field of physical exercise have revealed that athletes and the sportsmen of different athletic events and sports differ greatly in their body size, shape, composition, build and density in accordance with the demands of their athletic or sportive activities (Behnke and Royce, 1960; Cotes and Davis, 1969; Kane, 1961; and Malhotra et al. 1972). So it becomes very essential to identify potential performance capacity of a particular body type in a specific sportive or athletic activity. It is now an established fact that champion of different athletic and sportive events differ significantly
in their physical, physiological, body composition and body building characteristics that correspond, to some extent, with the particular requirements of their respective events (Sodhi and Sidhu, 1984).

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.

The limits of certain types of performances and the manner in which body structure plays a role in setting these limits are of fundamental importance to the sports scientist. If any relation between physique and success is one event rather than another exists. It will show up most clearly in groups where the extreme of competition has asked to equalize all other influences, such as motivation and training. In reaching the Olympic standard every little thing counts and it is when two men are equally pushing themselves to their maximum capacity that a difference in physical structure may be decisive. We believe, therefore, that physique is a factor in the sort of success that may lead to inclusion in an Olympic team or more negatively, that lack of the proper physique may make it almost impossible for an athlete to reach that degree of success. But we do not suppose that winning the Olympic event has much to do with physique, except perhaps in some rare cases where one single man is almost outstanding. By the time when the final is reached even the physique is becoming matched one with another as we shall see; then the importance passes to the will to win, the utter refusal of the great athlete to contemplate defeat or to give an inch of chance to his adversary (Tanner, 1964).

According to Hirata (1979) the best training method is superior to suitable physical fitness in domestic or low level competition, for instance even a short person can win in the shot put, at lower level competitions, if he is trained by the best method. But when the training method will be equivalent for every individual for higher levels competition like Olympics, suitable physical fitness and age will be the most important factor to succeed.

The scientific study of performance as a function of one's physique and physiology is not very old. Matiegka (1921) was perhaps the first biologist to initiate to studies the physique, body build and body composition as a measure of one's physical efficiency. But this work did not receive proper impetus, may be due to methodological
difficulties including large computational work. In 1940 Sheldon gave much simpler visual technique of characterizing one’s somatotype. Consequently his somatotyping method was extensively used by various investigators to study the physique of different categories of players and athletes (Cureton, 1951; Tanner, 1964; Carter, 1970; and Westlake, 1967).

With all round advancement in the science of sports the new disciplines are emerging with super specializations. The element of scientific basis of selection is being inducted in the procedures of selection of athletes at various levels in some advanced countries. The knowledge from many scientific disciplines is being used for improving the criteria for selection of talent. The performance structure for different games and events is being worked out. The general physical fitness of top ranking athletes has been evaluated. Proposals are coming up for the selection of potential athletes with the design of tests and the body size predictions. Human physique, growth and performance are also an important field in this regard.

One may not take it guaranteed 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 etcetera 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.

Studies on physique may be useful in choosing a suitable physical activity for an individual whose main objective is competition. The hurdlers, for example, have been found to have long legs and short trunk. Hildreth (1958) observed that all high hurdlers, who recorded times less than 14 seconds, were over six feet tall, with the notable exception of one who though only 179.1 cm, has the typically long legs of the Negro hurdlers. Longer legs are helpful to take the necessary long strides over the hurdles without the loss of time that jumping entails.
According to Carter and his associates (1982) the athletes who wish to achieve success in sports at high level, can compare their physique with those of Olympic athletes. If the athlete is within the limits of the Olympians', then the appropriate structure for high performance is achieved. Consideration can then be given, whether changes in physique, such as lower body fat or increased muscle mass, would help or hinder his performance. This problem is of special significance in games like weight lifting, boxing, judo and wrestling which are competed on the basis of body weight. In these games, the competitors are required to compete within their respective weight categories.

The component of physique such as size, body composition and structure has been shown to affect physical performance capacity (Slaughter et al. 1980). The study of body composition may also be used as the basis to differentiate between different physiques (Matiegka, 1921; Tanner, 1964). The study of body composition deals with the classification of the human body into its components. One way to obtain different components is through the techniques of surface anthropometry (Matiegka, 1921; Keys and Brozek, 1953; Garn, 1955; Durnin and Rahaman, 1967; Durin and Womersley, 1974).

The characteristics of world champions or Olympians are surely typical in nature for the particular sport in which they are specialists. We have to therefore look for more superior, typical or classical types of athletes in our young growing athletes (Sodhi, 1991). Individuals who are gifted with specific physique required for particular game generally excel. (Singh et al. 1998).

The morphological characteristics of athletes are of interest to the sports scientists and coaches, as competitive sport demands the utmost from the body. One method of describing human morphology is through somatotyping, which is a classification of total body form and shape expressed as a simple rating on continuous scales. In making evaluation of individual’s physique the anthropometrist measures height, weight, lengths, width, circumferences of all body segments and size of fat stores. These measures are reduced to an accurate index that conveys the athlete’s potential of a given physique. The specific index comprising an individual’s degree of fatness and muscularity is known as ‘somatotype’.

The Concept of human physique and its quantification was critically studied by Sheldon et al. (1940). They devised for the first time a workable method of analyzing human physique which highlighted the continuity of human physique. This method is popularly known as somatotype method (Sheldon et al. 1940). It emphasizes that human
physique does not change throughout life, which remains static even under the influence of environment factors. It serves the purpose of a morphological tag to a person. Heath and Carter (1967) basically objected to the concept of constancy of somatotype and devised a new method based on body measurements, which has found wide applications throughout the world.

Unique performance capacities during exercise have been shown by humans with different somatotypes. Thus individuals competing in the same athletic event have similar somatotype and individuals participating in different athletic activities have different somatotype whether their geographical, cultural or economic background are different or same (Cozenes, 1930; Cureton, 1941; Sills, 1950; Sills and Michein, 1957). Further more, significantly different somatotypes have been associated with elite performance in different athletic events (Carter, 1970 and de Garay et al., 1974).

Most of the studies in the past have, however, been conducted on adult sports persons belonging to heterogeneous population groups. Yan-Shu Liu et al. (1989) have pointed out more needs to study about the somatotypes of young athletes in order to help them to know, for which sport they are reasonably fit.

There is no doubt that at the highest level of sports there are apparent somatotypic differences between sports. It is well established fact that physique is sports specific. In other words, we can say that to excel in certain sports, players should have specific physique. There is evidence that in several sports the most successful somatotype have changed over the time. (Carter, 1984; Meszaros and Mohacsi, 1982b; and Stepnica, 1986).

Somatotyping has been used fairly and extensively as a research tool for describing and understanding variations in human physique (Carter and Heath, 1990). It also serves well as a measure of nutritional status (Lasker, 1947). Numerous studies show that somatotypes of individual children are subjected to significant changes during childhood and adolescence and these ratings continue to change till adult ages (Barton & Hunt, 1962; Heath and Carter, 1971; Carter & Parizkova, 1978; and Handa et al., 1995).

All individuals have different physical characteristics because of different biological, sociological, geographical, cultural & racial background. Hence human beings come in many shapes and sizes. In biological attributes they look alike but in individual traits and characteristics they actually differ from one another. Scientists believe that there must be selective factors (e.g. genetic endowment) that keep people about size and shape they are. Individual differences in body shape, structure, classification and other
anthropometrical measurement are genetically determined. There is perhaps an advantage to the society for various body forms to exist. At the same time, these differences possess numerous problems to educationists.

Constitutionally, some human beings are tall, other short, some are lean, other stocky and fleshy, and some are weaklings, others generally healthy. "The constitution, says Kmessmann, is relatively constant and uniform structure of fundamental somatic and psychic properties of the individual".

Physique refers to the shape, size and form of an individual. Of course, the three factors are intimately linked with each other and are manifestation of the internal structure and tissue components, which in turn are influenced by the environmental and genetic factor (Sodhi & Sidhu, 1984). The methods of Viola, Kretschmer, Sheldon, and Heath & Carter have historical lineages so far, as development of this science is concerned.

There are several methods of describing the characteristics of human physique. One is through the classification of body type, according to its appearance. Somatotype is one such method. It is a rating of body form and is a general description of what the body as a whole looks like. The word somatotype was first used by Sheldon, Steven and Tucker (1940). The term "somatotype" from Greek, soma, gen, somatos, "body" was used to designate the 79 varieties of the human physique.

The methods of evaluating physique have been in use since long, though a standard methodology, well in use, has been authenticated very recently. The modern scientists are looking for a method of studying physique which could be less time consuming and least expensive.

In man, the scientist has sought to look for similarities in diversity and classify people in “types”. Hippocrates (before 400 B.C.), the Greek physician was perhaps the first person to classify people on the basis of certain body characteristics. He designed fundamental physical types and called them “phthisic habitus and apoplectic habitus”. The former has a long, thin body dominated by the vertical dimensions, the later was short, thin individual, strong in horizontal dimensions.

In the beginning of this century Viola, an Italian physician gave his method of evaluating physique. He classified human being in four categories as longitype, brachitype, normotype and mixeotype. These types were based on ten anthropometric measurements. Later on Kretschmer (1921), a German psychiatrist, evolved another method. This method is based on visual observation, which means an individual could be
either pyknic (fat), leptosome (thin & lean) or athletic. This method could not be brought in practice because of its discrete nature, though this method was considered quite useful for studies of physique in different conditions.

Sheldon & Collaborates (1940) made the first scientific attempt to classify individual on the basis of body constitution. Sheldon’s theory of body classification is commonly known as, “somatotyping” which is a method of classifying the human body into genetic type on the basis of dominance of fat, muscle or bone. Sheldon considered only three components of body built and identified them as endomorphy, mesomorphy and ectomorphy, respectively. Name of these three descriptive components are related to the three germinal layer viz. endoderm, mesoderm and ectoderm, which are responsible for developing for the viscera, musculature and skeleton, respectively. The part of Sheldonian theory, which has supposedly its genesis in the embryonic germinal layer, is yet to receive general approval of the scientific world. Having theoretically established the three extremes of his classification system, Sheldon rated each of the components on a 7 point scale. The extreme type would be 7-1-1, 1-7-1 and 1-1-7 for endomorphy, mesomorphy and ectomorphy, respectively.

The different somaotypes are determined by varying expressions of three bodily components of structure in an individual. These are endomorphy, mesomorphy and ectomorphy. Endomorphy implies a trend towards the predominance of soft-roundness through the different regions of the body and particularly a massiveness of the digestive viscera. It was so named because the digestive viscera are derived embryologically and principally from the inner germ layer, the endoderm. Mesomorphy refers to the accentuated development of certain body structure derived from the embryonic mesoderm particularly bone, muscle and connective tissue. Ectomorphy means predominance of surface area relative to bulk and of the brain and central nervous system relative to mass. When ectomorphy is in the ascendancy, the body build type is linear and fragile, the sensory exposure to the outside world is relatively greatest, and the individual is “Skinny”. The skin and the nervous system take their origin from the embryonic ectoderm.

Function and structure is intimately related in the field of sports. Right from informal type of play at home to highly competitive Olympics games, body built of an individual plays an important role in sports accomplishments of greater magnitude. Sportsman has body build which is ordinarily a type in itself. So their body type is most suited to type of function they have to perform in the realm of sports. Human body is
compound of various genetic, morphological, physiological and psychological characteristics talent and acquired. There have been a number of investigations into the body types of sportsmen who have taken to various sports events. It has generally been found that such subjects are more physically fit and lend to fall on mesomorphy on Sheldon’s somatotyping scale. Many investigations have found a very significant relationship between body types and sports events. (Cureton, 1951; de Garay, et al. 1974; and Tanner, 1964).

Various scientists related body composition variables and somatotype (Babulian, 1984; and Slaughter and Lohman, 1976) finally indicate that average endomorphs are heavier, taller and fatter than mesomorphs or ectomorphs where as mesomorphs have greater fat free weight and are shorter than endomorph and ectomorphs. On the other hand, less fat and lower body weight has been observed for ectomorphs. This general association has been found between body structure and somatotype, which made somatotype dependant on physiological functions.

In all sports, the higher is the competition the narrower is the distribution of somatotype within a given sport. The somatotype distributions of athletes of all sports in 1968 and 1976 Olympics indicated that a majority of the males was dominantly mesomorphic and were also less ectomorphic than females (Carter, 1970; De Garay et al, 1974 and Carter et al, 1982).

Body composition makes an important contribution to an individual’s level of physical fitness, performance, particularly in such activities that require one to carry one’s body weight over distance, will be facilitated by a large proportion of active tissues (muscle) in relation to a small proportion of inactive tissues (fat).

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.

Body fat is such a component in the composition of body, which affects performance of the sports person. It has been that there is a criteria for the level of body fat according to their respective game discipline, which needs to be maintained. It is also there that sports person is maintaining the expected level of fat but the distribution of fat percentage is not similar on whole body, sometimes because of that performance affects. It also needs to be known whether the amount of total fat, which exists in adipocyte, is similar or dissimilar with respect to the distribution of fat on whole body.

In physical education the evaluation of fat is essential for the common man too, for most men and more particularly the women. In modern society everyone would like to avoid having large fat depots and protruding extreme endomorphic bellies and breasts. This is an essential feature of one's organic, psychic and physical fitness. However, the screening of modeling of only the extreme fats, both males and females on the televisions all over the world, is a challenge to such new dimensions of physical fitness and to all those having opened fitness business centers in streets and markets.

In general, women have a greater percentage of fat than do men, whether trained or untrained. Therefore, when performing in a distance running event, women tend to be fat at a disadvantage compared with their male counterpart.

The science of body composition is an important morpho-physiological characteristic. The proportions of these components are different in males and females. Such sex differences exist even when the amount of fat, muscle and bone is expressed as percentage of body weight. It is not known how much of this differences in body fat is biological or how much is behavioral, owing perhaps to the more sedentary life style of the average female more than likely. However, hormonal differences between the sexes play an important role to maintain all these components.

Moreover, its relative development is dependent on the environmental influences, sex, socio-economic conditions, occupations nutrition – genetics and exercises. The relationship of structure and body composition is well established. As we know that body composition includes muscle, bone and fat, these components vary from individual to individual, one place to another place and one population to another population. All such differences in physical and body composition are reflected through all functional changes in the body due to climatic condition, genetic reason, and nutrition and population structure.
In the process of adaptation, when such differences or changes take place in the body, the changes are first reflected in the bio-chemical functioning of the body. This leads into physiological changes or adaptations, which finally leads to changes in one’s body composition internally and physical externally.

The terms structure and body composition are separated for pedagogical reasons, which otherwise are both closely inter-related. This is because the development of the three components in the body, i.e. muscles, bone and fat, is reflected in the physique or physical characteristics or in other words, the structure of an individual. It is said that different types human body have presumably different advantages in different circumstances and at different times. The process of natural selection may favour first one build and then another. There is evidence, for example, that the long, thin build of Nilotic Negro has origin through the very definite advantage, such a build confers in maintaining physiological function in hot environment. The mean body-weight of populations in hot region is demonstrably lower (in all continents) than that in temperate and cooler climates. The ratio of sitting height to total height becomes less, as mean temperature increases geographically, i.e. lower limbs tends to be longer in hotter climates. The tendency towards attenuation of limbs in hotter climate is seen also in upper limbs, since the ratio of span to height is greater. The dimensions of the trunk also become less in hotter climates. Further Schrider has done to show that the body weight/surface area ratio declines from temperate hotter climates. However, it should be noted that the correlation between body shape and mean temperature account for about 50 or 60 percent of the total inter-population variance; clearly other factors, particularly population movements, also influence the variation in physique and body composition (Cf. Tanner, 1977).

The data on subcutaneous fat covering different population is meager. American Negroes clearly have a smaller mean and range of skinfold, thickness than American whites, and it is probable that Eskimose have thicker fat covering than Negroes. In keeping with this, is the finding that the endomorphic component in the physique of Kikuyu and other Africans in hot climates is lower than that of Europeans or Japanese (Banby). The Eskimos are shorter in stature and possess relatively longer trunks and shorter legs. There is a clear morphological pattern, which provides a measure of adoption under conditions of artic cold for them (Johnston et al, 1985).

Studies of body composition in certain sports indicated that the athletes who were very lean and heavy because of a well-developed musculature were superior in performance in certain competitive sport activities, such as football, weight lifting and the
shot put (Bullen, 1971). On the other hand, athletes who have substantial amount of adipose tissue have increased energy demands owing to the inert weighing of fat, thus rendering the work more difficult to perform in endurance activities where the body has to move longer with greater weight (Buskirk and Taylor, 1957; Sills, 1960). It may be far this reason that the long distance runners are found to be less endomorphic than other runners and their counterparts at a lower level of competition (Tanner, 1964; Carter, 1970).

However the degree of excess fat may play an advantageous role, if not a vital one in physical performance carried out under conditions of cold stress. It was observed that the middle distance runners and channel swimmers were endowed with a substantial amount of sub-cutaneous adipose tissue and often were obese (Cureton, 1933). Their ability to tolerate cold water for long periods was largely attributed to the incitation provided by the fat and to a reduced rate of heat loss (Pugh & Bdholm, 1955).

While many sports (figure skating, gymnastics) often have an aesthetic aspect to them (that is, part of the athletes score is based on appearance), this isn’t true of the majority of sports. Rather their, performance is being judged and the simple fact is that the amount of body fat being carried can impact on performance. As a general rule and this is especially true of sports where the athlete has to move himself against gravity, more body fat tends to mean poor performance. That is because body fat is just dead weight, mass to be carried that doesn’t improve performance (and often actively hurts it). This isn’t true of all sports and some sports (including many of the combative sports such as football, rugby, etc.) benefits from higher levels of body fat.

The characteristics of world champions or Olympians are surely typical in nature for the particular sport in which they are specialists. We may have to therefore look for more superior, typical or classical types of athletes in our young growing athletes (Sodhi, 1991). Individuals who are gifted with specific physique required for particular game generally excel (Singh et al. 1998).

So, the physical structure worked out can be used as a tool of talent hunt for a particular game or sport. Training of same sports has to begin at an early age so as to have any hope of reaching to the top. Training every individual as to be a “future champion” may be futile exercise. While selecting player for any event, physical structure of top most achievers or the profiles of high level performers of that event could be considered as a model. In the light of such a situation future champions can be selected and trained.
Now a days international sports competition and their results have gained attraction in India too, although success has eluded us in the international competitions. Thus the carrying out of scientific studies on sports persons have become more important, especially in the events which have not yet been studied.

The data available in such sports may be helpful in finding the reason for ‘unsuccessful results’ and formulating tools to succeed in these sports. Keeping all this in view, the present scientific study; focused on the study of body composition and physique of athletes of individual and team sports of Himachal Pradesh University. Second important prospective that has been kept into mind is that very few studies on Himachal Pradesh University athletes have available or done. The present study will fill the gap of such an important data requirement.

**STATEMENT OF THE PROBLEM**

The research problem is entitled as "A study of body composition and physique of athletes of individual and team sports".

**SIGNIFICANCE OF STUDY**

Games and sports have a very important and special position in the life of an individual. They have been taught as a compulsory subject in our schools. Children now play games not only for entertainment or body fitness but for achieving medals and other honours in this field. We have different categories of games at different levels i.e. sub-junior level, junior level, high school level and senior level. Sports lovers always look for India’s achievement at national and international levels. Govt. of India has always been taking keen interest in the upliftment of the players and tried to give every help to the budding players.

The search for the identification of genetically gifted children in sports has gained importance over the years and competition at every level has been intensified. Scientific scouting of talent at optimum age is essential for converting the genetically and physiologically gifted children into future medal hopes in various competitions at national and international level. Hence the significance of present study is penning down.

- The present study would equip the physical education teachers, coaches with latest knowledge about physique and body composition which will help them to select right type of player for a particular sports discipline.
The present study might be useful in sports where the counseling 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 sports.

The present study will help to evaluate and see the differences in body composition and physique of athletes of individual and team sports and make recommendations in their development in player.

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

OBJECTIVES OF STUDY

- To determine the body composition and physique of athletes of individual and team sports.
- To compare the body composition and physique between athletes of individual and team sports.
- To compare the body composition and physique among athletes of individual sports.
- To compare the body composition and physique among athletes of team sports.

HYPOTHESIS OF STUDY

- Individual sports athletes and team sports athletes would differ significantly from one another in relation to body composition and physique.
- There would be significant difference in body composition and physique among athletes of individual sports.
- There would be significant difference in body composition and physique among athletes of team sports.

DELIMITATION OF STUDY

The study was delimited as follows:

- The study has been confined to five individual and five team sports.

| Individual Sports | Team Sports |
1. Athletics 1. Basketball
2. Boxing 2. Football
3. Judo 3. Handball
4. Weight Lifting 4. Hockey
5. Wrestling 5. Volleyball

- The study has been delimited to the male athletes only.
- The study has been delimited to H.P.U. inter college level players.

DEFINITION & EXPLANATION OF TERM

A) PHYSIQUE: Physique is body built, structure and proportion of the body. It includes following anthropometric measurements such as height, weight, skinfolds, circumferences and diameters of the body.

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) ATHLETE

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.

D) INDIVIDUAL SPORTS

Sports in which individual athletes participate individually

E) TEAM SPORTS

Sports in which a specific number of players/athletes compete collectively against equal number of opponents