CHAPTER I

INTRODUCTION

Movement is involved in every task accomplished by human beings. Today, it is the need of every individual to understand the movement to do any type of every activity efficiently and effectively. Sports biomechanics are at the intersection of sports, biology and mechanics. Sports biomechanics are having relationship with physical activity, human anatomy, physiology and motion. The term biomechanics, defined by James Hay (1973) as “The science that examines the internal and external forces acting on a human body and the effects produced by these forces”. Physical exercise and performance in games and sports are making possible by the force developed by muscle fibers and the cells of muscles is to generate force.

Running jumping and throwing are inborn characteristics of child. Height and weight are the main features which effects the growth and performance of a child. Anthropometric measurements of an individual, his level of motor abilities and cardio-vascular fitness are the main features which are playing a significant role in sports performance.

The scientific selection of sportsmen at their young age may increase the number of participation in various sports events (Hirata, 1979). Therefore, the searching of the most talented
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children from a large number of school boys and girls in the various sports disciplines on the basis of sportswomen and helps to uplift the standards in the various disciplines of sports.

It is the common belief that heredity factors are considered to be the most important to achieve better. The researchers have described that some of the physiological factors which helps to improve sports performance such as anthropometric measurements, body composition, pulse rate, recovery time and strength measurements i.e. leg strength, arm strength, jumping ability with both leg together, agility, mobility influenced by the heredity factors.

Sociocultural studies highlight the role of cultural factors in the incidence of anorexia nervosa in women, such as the promotion of thinness as the ideal female form in western industrialized nations, particularly through the media. A recent epidemiological study of 989,871 Swedish residents indicated that gender, ethnicity and socio-economic status were highly correlated with the chance of developing anorexia, and women with non-European parents were among the least likely to be diagnosed, while women in wealthy, ethnic Swedish families were most at risk. A study by Garner and Garfinkel demonstrated that those in professions where there is a particular social pressure to be thin (such as models and dancers) were much more likely to develop anorexia during their career, and further research suggests that those with anorexia have much higher contact with cultural
sources that promote weight-loss. Although anorexia nervosa is usually associated with Western cultures, exposure to Western media is thought to have led to an increase in cases in non-Western countries. But other cultures may not display the same worries about becoming fat as those in the West, and instead may emphasize other common features. As average body mass continues to increase in Western nations, people are becoming desensitized to obesity and view an increasingly larger amount of body fat as “normal” or “acceptable.” People are especially likely to take cues on acceptable body size from their social circle, gaining weight concurrently with those around them. Obesity has reached epidemic proportions in India in the 21st century, affecting 5% of the country’s population. India is following a trend of other developing countries that are steadily becoming more obese. Unhealthy, processed food has become much more accessible following India’s continued integration in global food markets. Indians are genetically susceptible to weight accumulation especially around the waist. While studying 22 different SNPs near to MC4R gene, scientists have identified a SNP (single nucleotide polymorphism) named as 12970134 to be mostly associated with waist circumference.

Physical activity has also been associated with improved psychological health by reducing levels of stress, anxiety and depression. This is particularly important for women who demonstrate an incidence of depression that is reported to be
almost double that of men in both developed and developing countries. It has also been suggested that physical activity can contribute to building self-esteem and confidence and can provide a vehicle for social integration and equality for women in society. Although in principle women should be encouraged to increase their participation in physical activity, it is important not to overlook the fact that often in rural and in low income urban areas women may be already physical exhausted by other forms of day-long “occupational” physical activities. Women in these areas may need a better balanced set of support actions such as adequate nutrition, income generation initiatives, advice on physical activities most relevant to their specific conditions and adapted leisure pursuits.

Physical education seems to have taken a new turn in the form of sports sciences. The sports sciences in turn have taken their substance and methodology from various basic sciences. For many years the research in sports was being undertaken within these basic sciences but with the advancement of knowledge the new specializations and micro-specializations have taken a respectable position. As a matter of fact the research now-a-days embraces knowledge from various disciplines of human sciences. The human biologist is interested in studying morphology and motor learning in sports: the physiologist, the functioning of various parts of the human body: the kinesiology, the movement and skill; the nutritionist, the food intake; the psychologists, the
personality traits and the sociologists, the social and cultural dimensions of sports participation. In India too in the recent years some research work had been going on in the basic disciplines pertaining to sports.

Physical education and sports, being an integral part of education, have also experienced the impact of scientific advancements. Now the sportsman have been able to give outstanding performance because of involvement of new scientifically substantiated training methods and means of execution of sports exercises such as sports techniques and tactics, improvements of sports gear and equipments, as well as other components and conditions of the system of sports training.

By definition, a sportsman is one who challenges himself to show superior ability in tasks which do not bestow any benefit other than the spiritual satisfaction of achieving something which was not achievable till then by the individual concerned.

A top sportsman is one who performs with an intensity of effort raising his pulse rate to 160-180 per minute where as in healthy sportsman; the pulse rate is increased approximately to 130 per minute i.e. 50% of highest efficiency of his circulation system. Usually a top sportsman achieves that status by being selected on the basis of his performance record successively at school sports and undergoing training at each level which enhances his capacity to record higher levels of performance progressively.
Sports are dynamic in nature and progressive. It is not confined to “what has been” but in largest is to fix new target.1

Sports by their very nature are enjoyable, challenging, absorbing and require a certain amount of skill and physical condition.2

In the order of human values conquest in field of sports hold a unique place. It is a combination of success, victory, triumph and domination of some over other team mates and friends. The sublimity of competition lies in the loser’s acclaim for the winners, which along with the friendly and shake acknowledge both defeat and triumph.3

Technology covers all aspects of life and sports in no exception to it. Sports science has enabled modern youth to develop physical capacities beyond any time imagined. Sports have become highly competitive and records are being broken with greater rapidity.4

Today the preparation of an athlete for top notch achievement is a completely dynamic state characterized by a high level of physical and physiological efficiency and degree of perfection of the necessary skills and knowledge, technique and tactical preparation. An athlete arrives at this stag only as a result of appropriate training. Thus, athletes’ training today is a

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multisided process of expedient use of aggregate factor so as to influence the development of an athlete and ensure the necessary level of participation.

Performance in physical activity or sports not only demands systematic training and physiological variables but also demands training and consideration of psychological characteristics for success in this field. The success or failure of an individual athlete depends on the blending of physical ability, conditioning, training mental preparation and the ability to perform well under pressure.

Bucher opines, “Physical fitness includes more than muscular strength.” He further enunciates that “physical fitness implies soundness of the body organs such as heart and lungs, a human mechanism that perform efficiently under exercise or work conditions, and reasonable measure of performance in selected physical activities.” In describing individual physical fitness, it is not merely the strength factor, but something more has to be accounted for.

Mathews in board sense elaborates on physical fitness as the “capacity of an individual to perform given physical tasks involving muscular effort.”

Troester Jr. states that “physical fitness includes those qualities which will permit an individual to perform life activities

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involve speed, strength, agility, power and endurance and to engage in various kinds of physical activities required of modern-day living including sports and athletics, and to be able to maintain optimum amount of fitness for the individual involved”

The term “motor fitness” became popular during World War II. It may be defined as the limited phase or motor ability, emphasizing capacity for vigorous work. The aspects selected for emphasis are endurance, power, strength, agility, flexibility and balance. More specifically, motor fitness might be referred to as running jumping dodging. Climbing, falling, swimming, weight lifting, carrying loads and enduring effort in a variety of situations.

Actually motor fitness is a limited phase of general motor ability with emphasis placed on underlying elements of vigorous physical activity, but does not enclose the primary elements of coordination and skills. It is also a more general designation than physical fitness. Thus, organic soundness and proper nutrition undergoes the entire physical structure. The basic physical fitness element are muscular strength, muscular endurance and circulatory endurance, muscular power, agility, speed and flexibility are added to compose motor fitness, then kinesthetic arm-eye foot-eye coordination’s are needed for central motor ability.

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10 Clarke, “Application of Measurement to Health, and physical Education”. P. 173
General athletic ability is considered simultaneously with general motor ability. It includes several items such as strength, power, agility, speed reaction time and flexibility. An abundance of these traits enables a person to perform well in such basic activities as running, jumping, climbing, throwing and dodging. If a performer has a large amount of general athletic ability, he is said to be natural athlete. A person with a high level of general athletic ability possesses the basic physical components necessary to achieve excellence in a number of activities. But in spite of this general ability he well still unable to perform well in a particular sport until, through long hours of practice, he develops the skills specific to that sports\textsuperscript{11}.

It has been proved that there are some motor qualities such as social psychological, physical and physiological to be needed for all athletes to achieve better performance in different games and sports. But in spite of these, physique and personal characteristics of an individual also affect performance. As people came to know the importance of games and sports, participation has increased year by year and the sports scientists become motor abilities, physical, physiological and psychological aspects and the potentialities of individuals.

The systematized scientific training has to start in the various sports disciplines from the early age of the child. It is studied that

the systematic scientific training to achieve better sports performance is a long term process and must begin in childhood (Lampart, 1973; Martin, 1980; Harre, 1986). In the long term sports planning of the children, growth and development are the two major aspects which influence the performance of a child.

There is a growing area of knowledge that is beginning to demonstrate without question than physical activity and increased sedentary nature of women daily living habits of are a serious threat to their body, causing major deterioration in normal body functions. Such common and serious medical problems as coronary heart disease, hypertension, obesity, anxiety, depression and lower back problems have been either directly or indirectly associated with out lack of physical activity. On the other hand all the advancement has made the women most inactive and lethargic, creating problems to health. The natural course of life in term of physical activity is affected by biological aging along with sociological constraints. In an active life style is continued into later years a relatively high level of physical fitness and physiological functioning is retained as compared to the physically inactive. Modern technology affects both sexes i.e. male and female both but especially women. This cause many health related problems which affect their different health aspects but overall problems population is not to maintain their fitness or to acquire good fitness they were involved in some short of active physical activities as walking jogging, going to gyms, swimming etc. Some
women participate in sports activities for the sake of competition: so they have high level of fitness. Some women were not involving themselves in any sports activities nor involve in any active physical activities living sedentary lifestyle.

Among the inactive and sedentary population; however, there are many who ask the pertinent question, “Fitness for what?” they claim that they have no need or desire to exercise regularly other than to meet the demand of daily living taking out the thrush, bringing in the groceries, and occasionally shoveling snow. These persons, sports activities do not extend beyond sporadic softball, touch ball, tennis or skiing. Body composition makes an important contribution to an individual’s level of physical fitness, performance, particularly in such activities that require to carry one’s body weight over distance will be facilitated by large proportion of active tissue (muscle) in relation to a small proportion of inactive tissue (fat).

Women in most developing countries play an important role in economic activities, including the production of food. Their health status may affect the nutritional status of their children, particularly during pregnancy and lactation. Despite the major contributions of women to household food supplies and their responsibility for family health, their time usage patterns are insufficiently documented.
Regular physical activity can improve women’s health and help prevent many of the diseases and conditions that are major causes of death and disability for women around the world. Many women suffer from disease processes that are associated with inadequate participation in physical activity:

- Cardiovascular diseases account for one-third of deaths among women around the world and half of all deaths in women over 50 years old in developing countries.
- Diabetes affects more than 70 million women in the world and its prevalence is projected to double by 2025.
- Osteoporosis is a disease in which bones become fragile and more likely to break and is most prevalent in post-menopausal women.
- Breast cancer is the most commonly diagnosed cancer in women.

Every sportsman differs to some extent in muscle size and length of the muscles, bone structure, posture, strength, flexibility, height, weight and personality traits those effect the motor abilities, technique, tactics and performance. So, due to physical, physiological and heredity factors, performance is continuously improving year by year during the last two decades. The performance of an athlete depends upon his level of technical, tactical and motor abilities at the time of competition.
Growth and development are the two major characteristics of all living beings and have the same meaning. Growth refers to increase in size as reflected by the number of body cells, in the weight of the body as its components part. Development on the other hand is changes in biological make up of cells and tissues and alterations in hormonal, metabolic and functional characteristics of organism as they mature (Rarick and Small, 1967). It is important that the training program which starts from the early childhood should be planned according to the principles of growth and development and motor development to avoid the harmful effects on the growth of a child.

There are three aspects of growth and development (a) physical and physiological aspects: (b) psychological aspect and (c) motor development aspect. In the physical and physiological aspect some important changes takes place in height, weight, body proportions, body composition and vital internal organs like heart, lungs, lever and kidneys etc. the psychological aspect of a sportsman helps in the development of personality, behavior and interaction without the society. The third aspect is motor development. The word motor is derived form the relationship of nerve with the muscle when the movement takes place. Motor development consists of motor abilities, technical, physiological, psychological and motor development aspects performance of an individual.

Certain anthropometric configurations, somato types (Sheldon) racial traits (Blumenbach) are identified as advantageous
for performance in specific sports. At best they may provide data for guidance but not selection as such. The empirical methods of training giving place to scientific methods, physical typology has lost its significance. Frenchman Boiteux winning the 400 Mt. crawls swimming at Helsinki had almost a decathlon type but modified his technique to achieve top performance in sprinting.

The measurement of structure and proportion of the body are called anthropometry. It has wide application as one of the essential parameters constituting the selective diagnostics of any game or sports Anthropometry consists of making external measurement of the human body. The result can be used to appraise body build, nutritional status and posture.

Out body is designed to naturally rid us of the toxins that we consume. This is primarily done by the liver. However, many medical experts believe that they are overloading out system with these toxins. The liver is simply not able to process them fast enough so it has to “park” them somewhere, and to do this it encourages the body to accumulate fat in which the toxins can be stored.

Female body shape is the cumulative product of a woman’s skeletal structure (her build) and the quantity and distribution of muscle and fat on the body. There are and have been wide differences as to what should be considered an ideal or preferred body shape, both for attractiveness and health reasons. These have

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varied between cultures and at different times. As with most physical traits, there is a wide range of normality of female body shapes. Human beings and their cultures have perennially focused attention on the female body as a source of pleasure, sexual attraction, fertility and reproductive appeal. The female body occurs in a range of shapes. The female figure is typically narrower at the waist that at the bust and hips, and usually has one of four basic shapes: banana, pear, apple or hourglass. The bust, waist and hips are called inflection points, and the ratios of their circumferences define these basic shapes. Independent of fat percentage, weight or width, female body shapes are categorized into one of four elementary geometric shapes, though there are very wide ranges of actual sizes within each shape:

**Apple (triangle downward)**-Apple shaped women have broader shoulders and bust, and narrower hips. They have (much) higher androgen levels compared to women with other body types. Because of this high androgen level, the skeleton develops in a masculine pattern. Fat is mainly distributed in the abdomen, chest, and face.

**Banana or straight (rectangular)**- The waist measurement is less than 9 inches smaller than the hips or bust measurement. The body has a relatively high androgen level compared to the estrogen level, and this causes the skeleton to develop in a more masculine pattern and body fat to be distributed predominantly in the abdomen, buttocks, chest and face.
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**Pear or spoon or bell (triangle upward)** The hip measurement is greater than the bust measurement. The distribution of fat varies, with fat tending to deposit first in the buttocks, hips and thighs. As body fat percentage increases, an increasing proportion of body fat is distributed around the waist and upper abdomen.

**Hourglass shape (triangles opposing, facing in)** The hip and bust are almost of equal size with a narrow waist. Body fat distribution tends to be around both the upper body and lower body. This body type enlarges the arms, chest, hips and rear before other parts, including waist and upper abdomen. Because of the preference shown to physical symmetry, many celebrities falsely claim hourglass measurements but actually rate closer to a straight figure or apple.

The aging process has an inevitable impact on a person’s body shape. A woman’s sex-hormone levels will affect the fat distribution on her body. Concentration of estrogen will influence where body fat is stored. Before puberty both males and female have a similar waist-hip ratio. At puberty, a girl’s sex hormones, mainly estrogen, will promote breast development, and until menopause a women’s estrogen levels will cause her body to store excess fat in the buttocks, hips and thighs, but generally not around her waist, which will remain about the same size as it was before puberty. These factors result in women’s WHR being lower than for males. During and after pregnancy, a woman experiences
body shape changes. After menopause, with the reduction of production of estrogen by the ovaries, there is a tendency for fat to redistribute from a female’s buttocks, hips and thighs to her waist or abdomen. Each society develops a general perception of what an ideal female body shape would be like. These ideals are generally reflected in the art produced by or for a society. The ideal or preferred female body size and shape has varied over time and continues to vary between cultures; but a preference for a small waist has remained fairly constant throughout history. A low waist-hip ratio has often been seen as a sign of good health and reproductive potential. A low waist-hip ratio has also often been regarded as an indicator of attractiveness of a woman, but recent research suggests that attractiveness is more correlated to body mass index than waist-hip ratio, contrary to previous belief.

Historically, according to Devendra Singh (1994), there was a trend for slightly larger women in the 17th and 18th centuries, as typified by the paintings of Rubens, but that in general there has been a preference for a slimmer waist in western culture. He notes that “The finding that the writers describe a small waist as beautiful suggests instead that this body part—a known marker of health and fertility—is a core feature of feminine beauty that transcends ethnic differences and cultures. New research suggests that apple shape women have the highest risk of developing heart disease while hourglass shape women have the lowest. Body image refers to the perceptions of a human’s own physical
appearance, or internal sense of having a body which is interpreted by the brain essentially a person’s body image is how they perceive their exterior to look, and in many cases this can be dramatically different from how they actually appear to others. Studies have found that females tend to think more about their body shape and endorse thinner figures than men even into old age. When female undergraduates were exposed to depictions of thin women their body satisfaction decreased, but rose when exposed to larger models.

Anthropometric measurements play an important role in the performance of games and sports in the national or inter-national competitions; there is a very less margin to take the top positions. Physique of an individual helps a lot to achieve better performance and to get refers top positions. Physique refers to the size, the shape and the form of an individual. Anthropometric measurements, physiological variables and psychological traits effects performance by improving fitness, technique and tactics.

A number of sports scientists have concluded that top level performance in a particular event demands particular type of body size and composition.

Anthropometric measurements’ were central concerns of the first phase of the scientific are of measurement, which began in the 1860s. Current interest in anthropometric measurements focuses on three areas, growth measures, and body type and body
composition. The uses of such measures include classification, prediction of growth patterns, and prediction of success in motor activities as well as assessment of obesity.\(^\text{13}\)

Anthropometry is the study of human body measurement for use in anthropological classification and comparison. In the 19\(^\text{th}\) and early 20\(^\text{th}\) centuries, anthropometry was a pseudoscience used mainly to classify potential criminals by facial characteristics. For example, Cesare Lombroso’s Criminal Anthropology (1895) claimed that murderers have prominent jaws and pickpockets have long hands and scanty beards. The work of Eugene Vidocq, which identifies criminals by facial characteristics, is still used nearly a century after its introduction in France.

The most infamous use of anthropometry was by the Nazis, whose Bureau for Enlightenment on Population Policy and Racial Welfare recommended the classification of Aryans and non-Aryans on the basis of measurements of the skull and other physical features. For this purpose Craniometric certification was required by law. The Nazis set up certification institute for their racial policies. Not measuring up meant denial of permission to marry or work, and for many it meant the death camps.

Today, anthropometry has many practical uses, most of them benign. For example, it is used to assess nutritional status, to

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monitor the growth of children, and to assist in the design of office furniture. Objectivity is the aim, but it must be remembered that in trying to compare values, there is a wide range of normality within any population, and that standard populations can be misleading in that there are variations of variables with age, sex, race etc.

The Need for Anthropometric Data

Anthropometric data is used in many areas of manufacture to provide information for the design of products such as clothing, footwear, safety equipments, furniture, vehicles and any other object with which people interact. In the armed services this data is of particular importance as the survival of the serviceman may depend upon it. For example, in the accurate shape of close fitting protection equipment such as body amour or combat helmets, or in the optimum ergonomic design of combat vehicles. Also, accurate anthropometric data is required in the determination of size range and stocks for both clothing and personal equipment and the increased use of new materials and designs in military clothing will place additional demands on the accuracy to fit for future clothing systems. Elsewhere, the increasing use of the Internet for on-line electronic retailing has opened up exciting new uses for anthropometric data in virtual clothes shopping applications.

Much of the anthropometric data currently in general use is derived from data acquired by manual measurement of a sample of the population nearly 50 year’s ago. Improvements in diet and
healthcare in recent years have resulted in an increase in the average size of the population, thus making the 50th year’s old data redundant. Recent surveys conducted by the British and US Army and other have endeavored to remedy this situation but have been hampered by the lack of a suitable method of acquiring dense, accurate 3-dimensional data from whole human body quickly and effectively. Manual techniques, which involve the use of calipers and measuring taper, are extremely slow and costly; produce sparse data and are almost impossible to automate. Since the advent of 3D image capture technology, there has been a great deal of interest in the application of this technology to the measurement of the human body and the goal is to develop a 3D image capture system which will be capable of routinely providing dense, accurate anthropometric data.

The purpose of anthropometry is to guide design sizing to fit people. As design becomes more sophisticated, it has been recognized that properties like durability and aesthetics. The various dimensions that users interact with, in a product are an important part of usability, affecting characteristics such as grip, reach, comfort and manipulability. The ability of the human body to adapt can make even badly miss-sized products seem usable enough, but as experience has built up it has become clear that cumulative trauma (RSI) type injuries can emerge as a consequence of miss-fitting products and that user satisfaction is always higher for ergonomically sound products that for other. It
is the difference between being easy to use and merely possible to use. Usability becomes particularly important if usage is to be intensive, or if users will have to learn to use the product themselves.

Although it is easy to select size that suit the designer, it is much more difficult to choose dimensions that are optimized for the whole range of people who will eventually use the product. It is almost impossible to imagine, in the abstract, what it is like to be a different size from how one is, so, for example, a designer who is young, big and male will always need external help in sizing objects for old, small or female users.

A common mistake has been to design for ‘the average’ in the belief that this will generally give the best compromise for a fixed-size dimension. In fact this is seldom true: in most cases, people who are big will have more difficulty that those who are small, or vice-versa.

1 Individuals vary widely in their proportions, so that a tall man may have, for example, long legs and a short back. If you use such a person to decide a car roof height, you will and up with a roof that is too low.

2 The individual may not represent the customers at all. Successful people as group are taller and leaner than the population as a whole, and this tends to bias many designs towards fitting taller people better than they do shorter people.
Individual subjective decision-making can also result in decision-makers’ creating products that don’t even fit themselves, by building in a slouch or some other adaptive posture. We have measured seats that do not fit anyone at all, by excluding tall people in some dimensions and short people in others.

Paper sources are prone to being mislaid or loaned, and tables of data often lack the particular dimensions or populations required. Few people are at home with tables of numerical data, and as a group creative designers are repelled by them.

Consulting several sources of data frequently reveals unaccountable differences in supposedly identical dimensions, creating uncertainty that is a powerful disincentive to using anthropometry at all.

Sometimes the data are there, but disguised by obscure medical terminology.

Any comprehensive paper data source has necessarily to be very big and slow to search.

In the drive to solve the many other problems involved in design, a quick subjective decision on sizing that seems non-critical and common-sense can appear completely sensible. However, to do so is to risk storing up problems and competitive disadvantage for the future. Anthropology (from the Greek word ANTHROPOIA) consists of the study of humankind (see genus Homo). It is holistic in two senses: it is
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concerned with all humans at all times and with all dimensions of humanity. Central to anthropology is the concept of culture and our species’ universal capacity to conceive of the world symbolically, to teach and learn such symbols socially, and to transform the world (and ourselves) based on such symbols. In the United States, anthropology is traditionally divided into four fields:

10 Physical anthropology, which studies primate behavior, human evolution, and population genetics; this field is also sometimes called biological anthropology.

11 Cultural anthropology, (called social anthropology in the United Kingdom and now often known as socio-cultural anthropology). Areas studied by cultural anthropologists include social networks, social behavior, kinship patterns, ideology, religion, beliefs, patterns in production and consumption, exchange, socialization, gender, and other expressions of culture, with strong emphasis on the importance of fieldwork, i.e. living among the social group being studied for an extended period of time;

12 Archaeology, which studies the material, remains of human societies. Archaeology itself is normally treated as a separate (but related) field in the rest of the world, although closely related as a separate (but related) field in the rest of the world, although closely related to the anthropological field of material
culture, which deals with physical objects created or used within a living or past group as mediums of understating its cultural values.

More recently, some anthropology programs began dividing the field into two, one emphasizing the humanities and critical theory, the other emphasizing the natural sciences and positivism.

**Historical and Institutional Context**

The anthropologist Eric Wolf once characterized anthropology as the most scientific of the humanities, and the most humanistic of the social sciences. Understanding how anthropology developed contributes to understanding how it fits into other academic disciplines.

Contemporary anthropologists claim a number of earlier thinkers as their forebearers and the discipline itself has many sources. However, anthropology can best be understood as an outgrowth of the Age of Enlightenment. It was during this period that Europeans attempted systematically to study human behavior. Traditions of jurisprudence, history, philology and sociology developed during this time and informed the development of the social sciences of which anthropology was a part. At the same time, the romantic reaction to the Enlightenment produced thinkers such as Herder and later Wilhelm Dilthey whose work formed the basis for the culture concept which is central to the discipline.
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These intellectual movements in part grappled with one of the greatest paradoxes of modernity: as the world is becoming smaller and more integrated, people’s experience of the world is increasingly atomized and dispersed. As Karl Marx and Friedrich Engel’s observed in the 1840s.

Institutionally anthropology emerged from natural history (expounded by authors such as Buffon.) This was the study of human beings – typically people living in European colonies. Thus studying the language, culture, physiology, and artifacts of European colonies was more or less equivalent to studying the flora and fauna of those places. It could write monographs on both the league of the Iroquois and The American Beaver and His Works. This is also why the material culture of ‘civilized’ nations such as China have historically been displayed in fine arts museums alongside European art while artifacts from Africa or Native North American cultures were displayed in Natural History Museums with dinosaur bones and nature dioramas. This being said, curatorial practice has changed dramatically in recent years, and it would be wrong to see anthropology as merely an extension of colonial rule and European chauvinism, since its relationship to imperialism was and is complex.

Anthropology grew increasingly distinct from natural history and by the end of the nineteenth century the discipline began to crystallize into its modern from – by 1935, for example, it was possible for T.K. Penniman to write a history of the discipline
entitled” A hundred Years of Anthropology”. At that time, the field was dominated by the comparative method. It was assumed that all societies passed through a single evolutionary process from the most primitive to most advanced. Non-European societies were thus seen as evolutionary ‘living fossils’ that could be studied in order to understand the European past. Scholars wrote histories of prehistoric migrations, which were sometimes valuable but often also fanciful. It was during this time that Europeans first accurately traced Polynesian migrations across the Pacific Ocean for instance—although some of them believed it originated in Egypt. Finally, the concept of race was actively discussed as a way to classify – and rank – human beings based on inherent biological differences.

In the eighteenth century, academic disciplines began to organize around three main domains. The “sciences” seek to derive natural laws through reproducible and falsifiable experiments. The “humanities” reflected an attempt to study different national traditions, in the form of history and the arts, as an attempt to provide people in emerging nation-states with a sense of coherence. The “social sciences” emerged at this time as an attempt to provide people in the form of history and the arts, as an attempt to develop scientific methods to address social phenomena, in an attempt to provide a universal basis for social knowledge. Anthropology does not easily fit into one of these categories, and different branches of anthropology draw on one or more of these domains.
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Drawing on the methods of the natural sciences as well as developing new techniques involving not only structured interviews but unstructured “participant-observation” — and drawing on the new theory of evolution through natural selection, they proposed the scientific study of a new object: “human king” conceived of as a whole. Crucial to this study is the concept “culture” which anthropologists have defined both as a universal capacity and propensity for social learning, thinking, and acting (which they see as a product of human evolution and something that distinguishes Homo sapiens — and perhaps all species of genus Homo—from other species), and as particular adaptation to local conditions that takes the form of highly variable beliefs and practices. Thus, “culture” not only transcends the opposition between nature and nurture; it transcends and absorbs the peculiarly European distinction between the natural sciences, social sciences, and humanities to explore the biological, linguistic, material, and symbolic dimensions of humankind in all forms.

Within certain limits, body types may be used as an indication of athletic ability. For example the pyknic type usually will be interested in a sports such as football, soccer or hockey, whereas the asthenic type will choose running or tennis classifications based on body types, however these are not always reliable, and physical educators should be careful as to how much they rely on them as a basis for classifying groups for physical education activities. Age, physiological maturity, interests, skill, size, strength, physical
fitness and other similar criteria should be used with the various body type classifications in making such judgment\textsuperscript{14}.

The quality of physical performance is related to various basic of body and girls such as their maturation, body size and physique type. Many of these traits are acquired through heredity and are affected by environmental influences. Children differ significantly in these basic traits, while participation in physical activity will not appreciably, if at all in some instances, change their maturity, body size or physique type, these individual differences will greatly influence their physical performances. These factors, therefore, should be considered in judging students potentialities for participation in physical activities for example Children with a high degree of mesomorphy generally perform better in many sports; the endomorphs on the other hand are definitely handicapped by their body type. Mature and larger boys have greater advantages over small boys\textsuperscript{15}.

Limits of physical ability among persons are determined in part by body structure. Variations due to structure are exhibited when well trained athletes perform in competition. In the competitive situation the athletes have received sufficient motivation and training to enable them to approach the physiological limits of function of the critical. The difference in performance is then affected by differences in structure. Variations


\textsuperscript{15} A.K. Uppal and Ramesh Pal, “\textit{Relationship of physical Fitness to Selected Anthropometric Measurements}” SNIPESS Journal, 4 October 1978: 27.
in structure that affect performance are found among different age groups. Between the two sexes and among different racial groups. Person with wide differences in structure may all be able to execute the same kind of movement but the difference in quality of execution of the movement shown by each person results largely from variations in the amount of strength, speed, skill and endurance that is possessed by each\textsuperscript{16}.

Cureton studied track and field champion athletes of the United States and reported typical trackmen to be slight in skeletal framework with longer forelegs relative to thighs and longer legs relative to the length of the trunk, but with exceeding well muscles. The jumpers, hurdlers and vaulters were relatively slim in skeletal built and were typically taller with longer legs and shorter trunks. The shoulder width/bi-iliac hip width index was shown to be important from differentiating javelin throwers and gymnasts from other types of athletes.

The typical throwers (including shot putters) were those with greater arm span/height and greater upper arm length/forearm length. The jumpers, hurdlers and vaulters had relatively great leg length/trunk length and relatively large foreleg length/thigh length\textsuperscript{17}.

Scientists and physiologists have held the view that anthropometric measurements and physical components of an


\textsuperscript{17} Cureton, T.K Jr. “\textit{Physical Fitness of Champion Athletes}”, Urbana: University of Illinois Press, 1951 quoted by Sodhi and Sidhu, Physique and Selection of Sportsmen, p.10.
athlete have a lot to do with his performance. More than the technique and tactics of a player or a team, physical and physiological characteristics help him for better performance. The research findings show that a high level of technique perfection alone cannot produce success in competitive sports. Most of the games demand a higher level of speed. Strength, endurance, flexibility, co-ordination and optimum fitness of the organism\textsuperscript{18}.

The poor performance of Indian athletes and sportsmen at the international competitions has been of great concern, especially to the coaches, physical educationists and sports scientists. Efforts have been made to improve the standards of our sportsmen since long; however, little success has so far been achieved in this respect. There are numerous factors which are responsible for the performance of a sports-man. The physique and body composition, including the size, shape and form are known to play a significant role in this regard\textsuperscript{19}.

**STATEMENT OF THE PROBLEM**

The purpose of the study was to find out the relationship between selected anthropometrical measurement and physical variables to the performance of jumpers (vertical & horizontal).

**DELIMITATIONS**

1. The study was delimited to the female athletes of Rajasthan


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participated at University and National level.

2. The study was delimited to fifty female athletes studying in physical education courses.

3. The study was also delimited to the age of selected female athletes were between 18 to 25 years.

4. The study was further delimited to the following parameters:

**Anthropometric Variables:**

1. Standing Height
2. Weight
3. Shoulder width
4. Hip Girth
5. Thigh Girth
6. Thigh Length
7. Leg length
8. Foreleg Length
9. Calf Girth
10. Foot Length

**Physical Variables**

1. Speed (50 meter dash)
2. Endurance (9 min run / walk)
3. Strength (medicine ball throw)
4. Agility (4x10m shuttle run)
5. Flexibility (sit & reach)

**LIMITATIONS**

1. Participation of subjects in different activity was considered as the limitation of the study.

2. Non-availability of sophisticated equipment was treated as limitation of the study.

3. The difference in socio-economic status of the subject was considered as limitation of the study.
HYPOTHESIS

On the basis of the available literature and discussion with different experts and own understanding of the research scholar it was hypothesized that there may not be any significant differences among anthropometric measurements and physical variables on jumping ability of female athletes of Rajasthan.

DEFINITION AND EXPLANATION OF THE TERMS

Anthropometry

Anthropometric measurements form the basis of anthropology which is the science of measuring the human body and its parts\(^{20}\).

According to Philips and Harnak the measurement of the structure and proportion of the body is called anthropometry\(^{21}\).

Physical Variables

Speed: Speed is the ability to execute motor actions, under given conditions, in minimum possible time\(^{22}\).

Agility: Agility is the capacity to change the directions quickly and control body movements\(^{23}\).

Flexibility: Flexibility is the ability of an individual to move the body and its parts through as wide a range of motions as possible


\(^{22}\) Robert Hockey, Physical Fitness: The Pathway to Healthful Living, St. Louis: The C.V Mosby Company, 1973, P.93

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without undue strain to the articulation and muscle attachments\textsuperscript{24}. 

**Strength:** Strength is the ability to overcome resistance or act against resistance.

**Endurance:** Endurance is the result of physiologic capacity of the individual to sustain movement over a period of time\textsuperscript{25}.

**SIGNIFICANCE OF THE STUDY**

1. The study will be of significance in extending the horizon of knowledge in the field of Sports.

2. It will help in apprising the physical education teachers and coaches of the Anthropometrical and Physical variables underlining the performance of the Jumpers.

3. The result of the study will provide criteria for jumper’s selection.

4. The result of the study will further assist to preparing specific conditioning and training program.

5. This study may throw light on various anthropometric and Physical variables needed to be developed for good jumpers.

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