Chapter-I

Introduction
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INTRODUCTION

“Sports records are borne not in stadia but in scientific laboratories”

......Valentine Petrovsky

“Science has revolutionized the life of the modern man. The amenities we see these days in modern life are the result of scientific innovations and inventions. No doubt, this super-civilization with its industry, automation and motorization has made man’s life enjoyable, comfortable, easier and luxurious but it has also created many complicated problems for the human life.” The life has become more competitive and faster with many social, mental, economical and emotional problems. “It has made man’s life less vigorous and comparatively inactive and sedentary because due to mechanization and lack of manual work, he does not use his limbs/organs as frequently and adequately as before.”

Today, people in civilized communities are lacking in strength and endurance because of artificial life encouraged by modern civilization, in which life is made as soft and easy as for as possible with physical effort diminished to a minimum. The average man spends more time in attending his automobiles than attending his own machine his body (Featherstone, 1965).

The need of implementation sports programmes has become all the more important in these rapidly changing conditions of life. It helps to attain and maintain health and physical fitness of the individual. It also sublimates the mental, social and emotional tensions and develops healthy and integrated personality. Keeping in view the importance of sports, there is a growing awareness among the developed countries that instead of spending money on treatment and establishment of hospitals, it is much cheaper and better to spend money on physical education and sports programmes. The old saying ‘Preventions is better than cure’ is absolutely true and surely we can overcome
the problems created with the advancement of science in this modern age with participation in games and sports activities.

The modern world appears to be much more concerned with the world of sports. The hold of sports has grown very strong on the mind of individual in the society at large. Sportsmen and spectators are very clear about the values and significance of sports. There is hardly any individual who has been left out of its impact in the countries of the present world. Now winning the competition involves national prestige as each nation strives to win a tournament in which they compete. There are certain nations/states, which try to project the superiority of their political ideology and socio-political system through spectacular achievements in the field of sports. They show their excellence by winning the maximum number of medals at the international competitions like Olympic Games, world cup and world championship etc. The participating competitors in sports, at the international level bring name, fame and laurels for their countries and raise their prestige high in the world.

Physical Education and sports have now become an integral part of the educational process as it prepares an individual for real life (Charles, 1983). It has received worldwide recognition when in 1978 UNESCO charter clearly gave great importance and held that it should be treated as one of the Fundamental Human Right by the national governments (Sharma, 1981). Increased participation in sports has resulted in competition which has become an important element of modern life. Competition provides the means by which one can show one’s worth by competing successfully. For top level performance, it is very important to spot, select and nurture a budding sportsman as it is recognized by all that athletes must possess some inherent qualities, which can be developed by means of systematized and scientific training (Frost, 1971).

Sports originated from the simple play form have gone through a process of transformation via the organized structure of game. Sports can be said to be
complex outgrowth of play. Play is a natural, spontaneous, pleasure giving and creative activity in which man finds self-expression. The natural play form gradually developed into organized game form to make it more purposive, systematic and more objective. As game become more complex, more organized, more competition-oriented, the structure become more rigid and institutionalized and transfer into sport. Coaklay defines “Sports is an institutionalized competitive activity that involves vigorous physical exertion or the use of relatively complex physical skill by individuals whose participation is motivated by a combination of intrinsic and extrinsic factors” (Bhattacharya, 1981).

Sports as it is defined, require that participants use relatively complex physical skills and physical prowess or vigorous physical exertion. From the sociological point of view, sport involves competitive physical activity that is institutionalized. Institutionalized pattern or set of behaviours sustained over a period of time from one situation to another. thus, competitive physical activity can be considered sport when it becomes institutionalized. Institutionalization occurs when there is standardization and enforcement of the rules governing the activity, emphasis on organization and the technical aspects of the activity and a formalized approach to skill development (Wuest and Bucher, 1992).

Every individual or team which participated in any sports/game want to win, as our society attaches great significance to “winning”. According to Renewes (1972), “Performance is key note of all sports its basic principles. Since the sports have become prestigious aspect to prove one’s superiority, the philosophy of participating in games and sports has undergone a great change”.

Sports performance is a multidimensional product of athlete’s capacities and their interaction with athletic environment. Being multidimensional suggests that a variety of factors are involved in actually attaining performance goals.
The term sport, in itself, encompasses the qualities of competitiveness, excitement and development of identification by sports persons with their teams at different levels. Society, at large, is becoming highly concerned for the performance of athletes at national and international levels, thereby transforming sports competition into a highly exciting enterprise. The prestige of a region and nation is frequently at stake. The athletes are under pressure to perform their best and to create records. As the timings in time oriented sports are reducing and the distance to be achieved in throw oriented sports are increasing, the scenario at international and national level parts is gradually changing.

Sometime player takes part in sport without proper guidance. It is thus sheer chance that his choice of the sport may be suitable to his inherent capabilities. If it does not suit to him because of the lack of some of the basis pre-requisites for that sport, it may be difficult for him to switch over to any other event at a belated stage. Therefore, it is most essential to provide guidance endowed with such suitable characteristics that form the basis of performance in a sport. It may prove helpful to raise the standard of the sports. Consequently, it appears more important to study those factors in order to identify the area effecting to the particular sport.

In order to give the best possible performance at any of the competitions the assistance of scientific disciplines is sought. Induction of the basic principles of science, physical education and sports has become a subject of scientific research. Now various special branches of science such as kinanthropometric, biomechanics, physiology of exercises, psychology of sports, sociology of sports etc. have been established which are connected with better performance in sports. New techniques have been evolved, based on insight and understanding of the sports researchers. Astounding performance in sports activities after revival of the modern Olympics have witnessed the result of this scientific approach adopted by the physical education and sports. Smt. Indira Gandhi had rightly said that science applied to sports has enabled
modern youth to develop physical capacities beyond anything earlier imagined. Sports have become competitive and records are being broken at an increasing rate (Gandhi, 1982).

The origin of scientific approach in physical education and sports could be traced back when Edward Hitchcock (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 so doing, he contributed substantially to the establishment of physical education as a science. Fitz (1980) advocated that physical education would fail to receive due recognition if it was not provided with its scientific base. His innovation is pointed towards the application of new knowledge of physical education with scientific foundation to achieve excellence in sports activities.

Harrl Dhetrich (1982) explained that at each Olympic Games and international competitions the standard of performance is raised and new records are set for human skill and endurance. Partially it is due to the improvement in sports facilities and equipment but mainly due to the development of modern training methods and adaptations of sports training on more scientific lines. Sports training has become more efficient and effective as a result of the applied and fundamental research in the area of mechanics, physiology, psychology, nutrition and sports medicine. It also aims at understanding and assessing the athlete in totality. Competition at all levels are so keen that no coach or player can afford to neglect the application of scientific training principles that can give him as advantage over or at least keen him in pace with his/her opponent.

The Indian performance in comparative to other countries in all the games and sports is deteriorated and unsatisfactory. It is a matter of great dismal and pathetic to India, the second largest country in terms of population, ranking third in scientific man power, is making tremendous progress in industrial and scientific development, however it would not make much progress in the field
of sports. Many smaller nations, much lower in the rank of developing countries like Korea, Israel, Romania, Ethiopia, Somalia, Kenya etc. Are ways ahead of India in some sports or the others. Even our country sometimes fails to qualify for prestigious important international competition. It shows that something is wrong somewhere in the management, selection or training of athletes. It put our sports scientists and trainers in a great challenge and has compelled to think how we can improve our existing standard of sports for better performance in international competitions.

Even though Indian Government has been framing national sports policies time to time to map out the short comings and show some sign of progress in this field. But the pace of improvement is very slow as compared to the pace improvement of other countries of the world. The other countries including a few small countries made giant astride by improving the performance in games and sports. It is because of their adaption of scientific principles in the field of games and sports. Our country also should give more emphasis on training programme or scientific principles. To implement the principles on a training programme, it is most urgent to find out existing situation and explore the short comings which are responsible for the poor performance in the field of games and sports.

BACKGROUND OF KHO-KHO

Kho-Kho, the game of running and chasing is an indigenous game. The popularization and development of this game has been associated with the development of Akharas and Vyamshalas in Maharashtra. Kho-Kho has played historical role during freedom from British rule. YMCA and RSS movement has played a key role to spread the game throughout India.

There were no set rules framed earlier to conduct the game but as the time passed the rules were changed time to time with advancement of game. The first code of rule was drawn up by a team of kho-kho experts appointed by the Deccan Gymkhana, Pune in 1914. The rules were remodeled by the Hind
Vijay Gymkhana, Baroda in 1924 which were again streamlined by Akhil Maharashtra Sharirik Shikshana Mandal (AMSSM) in 1928. The first book of rules was published in 1935, by the AMSSM and second edition in 1949 (Ramraj, 1993).

The kho-kho Federation of India was formed in 1960 and it organized the first kho-kho National for men at Vijayawada (A.P.) in the same year. The Championship for women was conducted at Kolhapur (Maharashtra) in 1961. The first National Junior kho-kho Championship for boys was organized in 1971 at Hyderabad and for girls in 1975 at Madhya Pradesh. The first Sub-Junior Boys/Girls Championship was held at Indore (M.P.) in 1980 (Verma, 2011).

At present various competitions are being conducted from cluster level to National Level as Sub Junior (boys and girls), Primary School Championship (boys and girls), High School Championship (boys and girls), Senior (men and women), Nehru Cup, University/Inter-varsity (men and women) and federation cup. Special awards as Eklavya, Rani Laxmibai, Veer Abhimanyu (under 18 boys), Janaki (under 16 girls) Bharat Puraskar (Sub-Junior boys), Veer Bala Puraskkar (Sub Junior girls) and Arjuna Awards are being given to kho-kho players who show excellency of their skills during the prestigious matches. The Dronacharya Award is also conferred to the coach whose team brings outstanding achievement in the prestigious competitions in the field of kho-kho (Mishra, 2007, 2011).

The efforts to include the game in Olympic Games has been continued since 1936 Berlin Olympic Games in which a request for exhibition match was made before the organizers but it could not be accepted. The exhibition matches were played in Sweden and Denmark in 1949. But due to no set rules and poor techniques, it could not make impression to the foreigners.

The exhibition matches were also played in 1982, Asian Games held at New Delhi and in SAF Games at Calcutta in 1987. The Asian kho-kho
Federation was also formed during the third SAF games, held at Calcutta competition. As a result of this, the game was included in the Asian Games Competition. The credit of this endeavour goes to All India kho-kho Federation and its affiliated State Federations. The two Asian kho-kho Championships were conducted in 1996 and 2000. Netaji Subhash International Gold Cup was also organized in 1999 (Mishra, 2007, 2011).

Now the game has become most popular in India as well as in other countries. Its popularity can be judged that now the game is looking forward for a glorious entry into INTERNATIONAL SPORTS ARENA. Its popularity can be judged in terms of international kho Kho Participation. Its popularity is known with the fact that it requires a minimum space and equipments. It can be played on any surface that suits open field sports. It is inexpensive and therefore poor players can also take part in this game. Besides this, as the game is played with different type of fast body movements which required speed, agility, strength, explosive power, muscle co-ordination, lung power and above all intelligence and quickness of thought and action during the game situation. In turn, it will endow them with many sterling benefits like development of physical, mental, moral, social characteristics which make them good citizens of the country.

EVALUATION OF PLAYING ABILITIES

In team game like kho-kho, true assessment of playing ability is done through evaluation of game performance. Objective evaluation of game performance is not found possible. It is also observed that all the abilities of the players could not be assessed through game performance evaluation. Generally the game performance is evaluated by three expert coaches through observation, which is subjective in nature. The performance during kho-kho Competition is being assessed to a certain extent, objectively, through statistical information. It is revealed that the tests which can predict the actual match performance of the player are composed of techniques of the body
movements that are requires to be performed during game. Research findings have revealed that kho-kho playing ability can be indirectly evaluated through the performance in running and chasing movements as the playing ability assessed through expert ratings was found related with performance in during game running and chasing movements.

KINANTHROPOMETRY AND PERFORMANCE

The term was first used by Ross et al (1980) in the year 1972. It means the application of measurement to the study of human size, shape, proportion, compositions, maturation and gross function. The purpose is always to understand human movement in the field of growth, exercise performance and nutrition. The word Kinanthropometry is derived etymologically from Greek Words - Kineein meaning “to move” and Anthrepos meaning “man” and matrecin meaning “to measure.”

Kinanthropometry provides a convenient framework for the study of human body. It studies quantitative, interaction between human structure and human function. It is defined by international society for the advancement of Kinanthropometry (I.S.A.K.) as “a scientific specialization dealing with the measurement of man in variety of morphological perspectives its application to movement and those factors which influence movement including composition, shape and maturation, motor abilities and cardio-respiratory capacities, physical activities including recreational activity as well as highly specialized sports performance.”

Kinanthropometry is the study of human size, shape, proportion and composition maturation and gross function in order to help understand growth exercises, performance and nutrition Kinanthropometry is a vehicle for individual to contribute to basic research and application in medicine, education and government and also as a science has so far driven maximum potential of development for the science of sports and physical education. For
the high performance athletes, as Ross explains, the gross function is represented in kind by the sport event and level by the selection as well as relative success in the competition (Ross et al 1980).

Kinanthropometry equips us with the techniques of various body measurements and idea about the player’s shape, size and proportions. How does an individual look like from various directions and with respect to his various body parts. It is essential to examine the athlete from every possible aspect. This is in order to win in any sport or event in the Olympic as well as other international competition. To achieve success in this, objectives have to examine the best Olympic athlete as all perhaps the best in the world and Olympic Games. Estimation of the kinanthropometric measures of these athletes provides a valuable reference point in human structure and function.

Kinanthropometric investigations have been conducted on the Olympic athletes during the recent Olympic Games. The different Kinanthropometric characteristics examined include investigation of their size and shape, using large number of variables by sport and event (Carter, 1982. 1984).

Kinanthropometric experts have analyzed various anthropometric measurements over 1000 children in 75 cities of the United States. This was done in order to discover possible ways of considering individual concluded that the items that passes the greatest significance in ascertaining the amount and quality of soft tissue relative to skeletal build in children age 7 to 12 years and are namely hip width, chest depth, height, weight, arm girth and subcutaneous tissue of the upper arm (Franzen and Palmer, 1934).

Identical to the mechanistic approach of human motion, anthropometry has a rich tradition in sports sciences and sports medicine. For instance, the physique of Olympic athletes was studied by Kinanthropometric since a long back. Though, in different times, different terms were used like dynamic anthropometry, sports anthropometry, biometry, physiological anthropometry,
anthropometric etc. by scientists. They tried to establish some relationships between the body structure and the specialized functions required for various tasks. They have also tried to understand the limitations of such relationships.

Kinanthropometry provides quantitative interface between human structure and function. That's why the application of Kinanthropometric knowledge is getting tremendous importance and popularity to identify the potential talents in sports for particular event. India is a country of population with enormous sports for particular variations. There is an ample scope for Kinanthropometric study in India. Nowadays, Kinanthropometry is widely used for sports talent identification.

It is a scientific discipline that is concerned with the measurement of individuals in a variety of morphological perspectives, its application to movement and those factors which influence movement, including; components of body build, body measurements, proportions, composition, shape and maturation; motor abilities and cardio respiratory capacities; physical activity including recreational activity as well as highly specialized sports performance.

Kinanthropometry is the interface between anatomy and movement. It is the application of a series of measurements made on the body and from these we can use the data that we gather directly or perform calculations using the produce various indices and body composition predictions and to measure and describe physique.

Today, physical educators and trainers are more interested in Kinanthropometry as it pertains to the selection of some problems in the field for example, has deviation in height seriously influence performance in tests in separate areas? Should body build be reviewed to clarify standard for physical fitness tests and further programmes of physical education?
The human body size and form various in a variety of ways and depends upon age, sex, race and geography. One of the main concerns of the physical anthropology and human biology is to acquire and convey the knowledge on the true ways and reasons of individual variability and differentiation. This also applied to the whole of biology contribution taken in morphological, physiological and psychological aspects as reported by Tanner (1947). Research is aimed at obtaining knowledge of the variables, real qualities of body measurements and through their analysis or the effects on the genetic and environmental factors acting on the human body.

The world of games and sports has crossed many milestones, as results of different achievements in general and their application in the field of sports in particular. Scientific investigation in to performance of sportsman has been playing an increasingly important role in the training of athletes in the scientific way to attain excellence in performance in different spheres of sports (J.T Powell 1983).

Kinanthropometry is an oldest type of body measurements used, dating back to the beginning of recorded history. The concepts of the ideal proportion varied over period of time. For example, Polyclitus 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).

Evidence of this is a common place; observe that well proportionate physique of boxers and gymnasts, the super structure of great basketball players, the wryness of champion distance runners and the massive build of great shot-putter and discus throwers. The hurdlers have been found to have long legs and short trunk (Cureton1951, Tanner, 1964).

Mohan Singh (1978) has reviewed the literature on human physique and performance. He has emphasized that an individual differs significantly in his basic traits and his participation in physical activities will not appreciably
change his maturity, body size and physique type, these individual difference will drastically influence physical performance. Thus these traits should be considered in judging individual potential for participating in physical activities of different types.

BODY COMPOSITION AND PERFORMANCE

With the advent of new physical fitness test (AAHPER) the physical education teachers/coaches are more interested to find out the body composition of the athlete because it effects the performance very much and also change as the physical activity change. So, it is important to know the norms suitable for body composition on the basis of which the suitable training schedule may be constructed to improve the performance in sports and may also help to choose the event or activity according to an individual body composition.

Body composition refers mainly to the evaluation of three principle tissue component of body i.e. muscle, bone and fat. The section deals with the methods of evaluating the different components. Hydrometer, densitometry, roentgenogrammetry and somatometry on anthropometry are the main methods of study in this section.

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 (Cater & Yuhasz, 1984) and insulation provided by the fact to be a reduced heat loss.

Studies of body composition in certain sports indicated that the athletes who were very lean but heavy because of a well-developed musculature were superior in performance in certain competitive sports such as football, weight lifting and the shot put (Bullen, 1971). On the other hand athletes who have substantial amount of adipose tissue have creased energy demands owing to the inert weight of fat, thus rendering the work more difficult to perform in endurance activities, whereas the body has to move longer with greater weight, Sills 1953.

So, the physical structure worked out can be used as a tool of talent hunt for a particular game or sports. 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 day’s international sports competitions and their result 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.

PHYSICAL FITNESS AND PERFORMANCE

Physical fitness has very serious implications for the health and wellbeing of all individuals. It is defined as the degree of task under specific ambit conditions, most authors define physical fitness as a capacity of carrying
out every day activities work and play without excessive fatigue and with enough energy in reserve for emergencies.

Clarke (1978) has thus exhorted that physical fitness is a vital biological need, the neglect of which handicaps the total effectiveness of the individual.

The same degree of physical fitness is not essential for everyone. However, everyone needs a minimal amount of fitness to be healthy and everyone is capable of achieving minimal fitness levels, all professional such as doctors, engineers, executives and others need physical fitness. However, the degree of fitness required would vary, depending upon the profession of the person concerned. The level of fitness necessary depends of factors such as the tasks you must perform and your potential for physical effort Physical Fitness varies with the individual and with the demands and requirements of specific task. The athlete must constantly work to improve his or her strength, endurance flexibility, speed and cardio respiratory efficiency, whereas the non-athlete requires less effort to maintain his or her level of physical fitness. The physical fitness various according to the circumstances of a person at different time in his or her life. There are varying degrees of physical fitness. Practically anyone can improve his or her fitness status and physical activity is essential to achieving physical fitness. There are no shortcuts physical fitness cannot be stored up, it summer and then gives up all physical activity when autumn starts will not remain physically fit.

People, who are physically fit look better, feel better and possess the good health for a happy and full life physical fitness is one’s richest possession it cannot be purchased, it has to be earned through daily routine of physical exercise.

Physical fitness is not entirely dependent on exercise desirable health practice also play an important role. Physical fitness affects the total person
their intellect, emotional stability, physical conditioning and stress levels. The load to physical fitness includes proper medical care, the right kinds of food in right amounts, good oral hygiene, appropriate physical activity that is adapted to individual needs and proper amounts of rest and relaxation.

Physical fitness is not to be confused with health. Both are connected but not interdependent it is necessary to be fit, but not necessary to be fit to be healthy. Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. W.H.O. (1976) declares physical fitness as an important facet of health. Research evidence suggests that when one is physically fit one is able to lead a more enjoyable life because of mental, emotional and social development as well as physical development (Taxton 1988).

Physical fitness is an important and inseparable part of sports performance and achievement. The quality of the individuals sportsman’s fitness, as a layman thinks, is directly proportional to the level of performance. Meaning thereby, that the greater the ability of a sportsman to attain higher level of performance.

PHYSICAL FITNESS DEFINED

Actually, different definitions have been offered by the educationists, but physical fitness defined by the American Association for Health, Physical Education and Recreation is “That state which characterizes the degree to which the person is able to function. Fitness is an individual matter. It implies the ability of each person to live most effectively with his potentiality of function and depends upon the physical, mental, emotional, social and spiritual components of fitness which are related to each other and are mutually interdependent”.

Bud Gatchell (1964), defines Physical Fitness as the “capacity of the heart, blood vessels, lungs and muscles to functions at optimal efficiency”.
Karpovitch (1965), offered the following definition of Physical Fitness strictly speaking, Physical Fitness means that a person possessing it, meets certain physical requirements. These requirements may be anatomical, physiological or both.

Bucher (1967), defined Fitness as “the degree to which a person functions physically, mentally, emotionally and socially, all aspects of which impinge upon each other and are closely inter-woven into the fabric of the human being.

Physical fitness is an important component of total fitness. The term “Physical Fitness” means more than muscular strength and stamina. It implies efficient performance in exercise or work and a reasonable measure of skill in the performance of selected physical activities.

Thomas (1964), remarked that “physical fitness is the condition of one’s body judged in terms of age, height, weight, and chest expansion, in term of absence of defects from disease, constitutional affection or bodily infirmity pull physical development vigour, vitality and radiant health should be seen in one who is physically fit.”

Clarke (1987), “Physical Fitness is most appropriate considered as the ability to carry out daily tasks with vigour and alertness without undue fatigue with ample energy to engage leisure in pursuits and to meet emergencies situations”. The physical fitness is the ability to last to bear up to with stress and to preserve under difficult circumstances whereas unfit person would be ineffective and would quit. The definition implies that physical fitness is more than “not being sick” or merely “being well, it is a positive quality” extending on a continuum from death to abundant life. Thus living individual have some degree of physical fitness which is minimal in the severally ill and maximal in the highly trained athlete. It varies considerably in different people and in the same person from time to time.
John T. Powell (1972), says, “Fitness is not an end, it is beginning: A person must get fit to perform and will not necessarily get fit by performing. Fitness is not matter of physical capacity alone. Man is a unit training can make a person physical fit. But one should be interested in total fitness (including the realms of mental, moral, social, emotional as well as physical fitness) when coming someone reach his potential”.

Barrett (1974), reported, “Evidence is mounting that physically fit person lead longer lives, have better performance records, and participate more fully in life than those who are unfit.

According to Harre (1979) for a high level of performance physical fitness is most important. Therefore, physical fitness is considered to be fundamental criterion for developing an efficient system of selection strategy.

Physical fitness is the most important determinant of excellent performance in sports. However, importance of various components of fitness varies with different sports for better performance. Physical fitness is possible through the study of motor fitness. The motor fitness can be understood by analysis of its components like speed, strength, endurance flexibility, agility, coordination ability and balance. Although physical fitness is conditioned by heredity, physical organic and behavioral components. It is also affected by factors such as social class, socio-geographic (rural-urban) environment cultural values norms and symbols (Renson et al 1980)

The kinanthropometric and fitness variables are very important for kho-kho players because the nature of the game demands more leg explosive power, fast speed and reaction ability in chasers for putting out the maximum runners in a minimum time. The runners also require all these characteristics maximum speed, agility and endurance to defend them-selves from the chasers powerful attack.
It is found from perusal of various studies, research work and periodicals on physical education and sports that topic under research has not received particular attention at the hands of the scholar in India and thus remains explored. Because discovery of talent for particular sport at an early age and molding the player in a manner appropriate to his talent through carefully and systematically planned training programme is an important factor in producing top class performance. This can only be possible if factors contributing to particular sport are identified. Hence, the scholar has undertaken the present study to predict the playing ability of male kho-kho players of inter college level through kinanthropometric and fitness variables.

The investigator of the present study has earnestly made an attempt to expose the relationship of selected kinanthropometric variables and physical fitness with the playing ability of kho-kho players and also attempted to find the prediction equation of kho-kho playing ability which would help the coaches and trainers to select the talented players on the basis of the results of this study.

STATEMENT OF THE PROBLEM

The purpose of the study was to predict kinanthropometric and fitness variables to evaluate the playing ability of male kho-kho players of Himachal Pradesh University, Shimla. Therefore, the problem has been stated as “Kinanthropometric and Fitness Variables as Predictors of Kho-Kho Playing Ability”.

OBJECTIVES OF THE STUDY

The objectives of the present study are formulated as under:

1) To determine the relationship between selected kinanthropometric variables and playing ability of male kho-kho players.
2) To determine the relationship between fitness variables and playing ability of male kho-kho players.

3) To determine the multiple correlation of selected kinanthropometric, fitness variables and playing ability of male kho-kho players.

4) To set up the regression equation for the prediction of playing ability on the basis of kinanthropometric and physical fitness variables of kho-kho players.

**HYPOTHESES OF THE STUDY**

1) There would be a significant relationship between kinanthropometric variables and playing ability of male kho-kho Players.

2) There would be a significant relationship between fitness variables and playing ability of male kho-kho Players.

3) Playing ability of kho-kho players could optimally be predicted on the basis of kinanthropometric and physical fitness variables.

**DELIMITATIONS OF THE STUDY**

1) The present study was based on 120 male kho-kho players which were playing from their respective colleges affiliated to Himachal Pradesh University, Shimla.

2) The study was confined only to male kho-kho players.

3) The study was delimited to the kinanthropometric variables, physical fitness variables and playing ability of kho-kho players.

4) The kinanthropometric variables were measured with the help of Anthropometric Rod, steel tape, Vernier caliper and lange’s skinfold caliper.

5) Physical fitness variables were tested through AAPHER Youth Physical Fitness Test (1976) pull-ups, bent knee sit-ups in 60 sec., shuttle run 10 x 4 yards, standing broad jump, 50 yards dash, 600 yards run/walk, wrest flexibility and ankle flexibility.
6) The overall playing ability of the subjects was measured with five points rating scale.

7) Body composition was calculated by using skinfold measurements i.e. biceps, triceps, sub scapular and suprailiac skinfolds.

8) For the analysis and interpretation of data, statistical treatment was confirmed to Pearson’s product movement correlation (Zero order), multiple correlation and regression equation.

9) Data was collected during morning and evening session.

10) The age of the subjects was between 18 to 25 years.

LIMITATIONS OF THE STUDY

1) The factors like socio-economic condition, diet, rest, daily routine, lifestyle, habits etc. which might effect the result of the study were considered as limitation of the study.

2) The effect of weather condition during collection of data could influence the results and it was accepted as limitation of the study.

3) No special motivational technique was used during the test. Therefore, the difference that might have occurred in performance due to lack of motivation was recognized as the limitation of the study.

THE DEFINITIONS AND TERMS USED

The terms which are frequently used in the present study are defined as follows.

1) Kinanthropometry

2) Physical fitness

3) Playing ability

1) **Kinanthropometry**: According to Ross (1978), It is defined as the scientific study of human size, shape, proportion, composition, maturation and gross function in order to understand growth, exercise,
performance and nutrition with implication of medicine, education and
government with respect to individual right in the service of human­
kind. In other words, Kinanthropometry is the application of
measurements of human size, shape, proportion, composition,
maturity and gross function. It has the purpose of helping to
understand human movement in the context of growth, exercise,
performance and nutrition.

**Kinanthropometric Variables**

1) Age
2) Weight

**Linear Measurements**

3) Height
4) Sitting Height
5) Leg length
6) Lower leg length
7) Total arm length
8) Fore arm length
9) Foot length

**Skeletal Diameters (width)**

10) Shoulder diameter (Biacromial)
11) Abdominal diameter
12) Hip diameter
13) Elbow diameter
14) Femur bicondylar diameter
15) Ankle diameter

**Body circumferences (Girths)**

16) Chest circumference (Normal)
17) Upper arm circumference
18) Shoulder circumference
19) Thigh circumference
20) Calf circumference

**Skinfold Measurements**

21) Biceps skinfold
22) Triceps skinfold
23) Sub scapular skinfold
24) Suprailiac skinfold
25) Thigh skinfold
26) Calf skinfold
27) Chest skinfold

**Body Composition**

The body composition generally refers to the type and amount of tissues which make up the body. The most widely accepted model is the two components scale, lean body mass and fat weight. The lean body mass consists of skeleton organs and other tissues which are approximately 40 to 50 percent muscles mass, and is used to represent the active energy fat (Behnke, 1963) fat weight on the other hand, is the inactive storage tissue that, while serving as a long term energy pool, is considered excess fat weight for most activities.

The study of body composition can be approached in a number of ways: organ systems, fluid compartments, kinds of tissue and so forth (Karpovich, 1971). In the present study body composition is concerned with the kinds of tissues and consists of measurable variables such as biceps, triceps, subscapular and suprailiac skinfold measurements and estimated variables like:

1) Body Density
2) Percentage Fat
3) Fat Weight
4) Lean Body Mass
PHYSICAL FITNESS

According to AAPHER Youth Physical Fitness Test (1976) “Fitness is the ability to carry out daily task with vigorous and alertness, without fatigue and with sample energy to enjoy leisure time pursuits and to meet unforeseen emergencies.”

1) Muscular Strength : (Pull-Ups)
2) Muscular Endurance : (Bent Knee Sit-ups)
3) Agility : (Shuttle Run)
4) Muscular Explosive Power : (Standing Broad Jump)
5) Speed : (50 yards dash run)
6) Cardiovascular endurance : (600 yards run/walk/12 min. run/walk)
7) Flexibility : (Wrist and Ankle Flexibility)

Strength

- Methew and Fox (1976) defined muscular strength as the force, tension of the muscle that a muscle can exert against resistance in one maximum effort.
- Phillip and Harnek (1979) explain that the strength is the constructive power of muscles attained by a single maximum effort.

Endurance

- Endurance is the ability of circulatory and respiratory systems to adjust to vigorous exercise and to recover from the effect of exercise. (Phillips, D. Allen et. al 1979)
- Hockey (1973) has defined muscular endurance as the ability of the muscles to apply force repeatedly or to sustain a construction for a period of time.
• **Hardayal Singh (1991)** defined “Endurance is the ability to do sports movements with designed quality and speed, under condition of fatigue”.

**Agility**

• Agility is the physical ability which enables an individual to rapidly change body position and direction in precise manner (**Johnson and Nelson, 1982**).

**Explosive Power**

• **Harold M. Barrow and Rosemary (1979)** Explosive power is an action where maximum muscular force is released at maximum speed.

**Speed**

• Speed is the ability or capability of an individual to perform successive movements of the same pattern to perform successive movement of the same pattern at a fast rate or even one single movement (**Borrow, 1977**).

**Flexibility**

• **Johnson and Nelson (1982)** say that the flexibility is the ability of an individual to move the body and its part through as wide a range of motion as possible without undue strain to the articulations and muscle attachment.

**Playing Ability**

It is the prerequisite quality of players which makes capable player to achieve top level performance in a particular game and sports.

It determines the level of performance of each player during actual game. It is the judgment of a player’s in defensive (running) and offensive
(chasing) situation by the experts during the match. In the present study, the playing of kho-kho players was judged with five point rating scale by three experts during the match and average score was considered the playing ability score of an individual.

SIGNIFICANCE OF THE STUDY

Physical education and sports is becoming more and more competitive and scientific so physical and sports scientists are working hard to develop suitable methods of enhance existing level of performance. Numerous researchers are being conducted as to certain, effective and most economical methods of selecting and training of kho-kho players in order to get the best performance. The selection and training can be done better with adequate knowledge of kinanthropometric and physical fitness measurements of the successful kho-kho players. The findings of the study may contribute to the promotion of the kho-kho in the following ways:-

1) The results of the study would provide a guideline about the relationship of selected kinanthropometric variables, physical fitness variables and kho-kho performance with kho-kho playing ability.

2) The results of the study would provide criteria for the selection of talented kho-kho players.

3) The physical education teachers and coaches may be benefited to inform their trainees about the specific qualities that should be required by each kho-kho players.

4) The study may help coaches and trainers for preparation of training schedules for better performance in kho-kho game.

5) The study may motivate others kho-kho lovers to take similar studies at different levels and standard so that kho-kho could become a more scientific game in India.
6) This study may also help and guide the research scholars to undertake similar studies in different games and sports, so that the best criteria for selection of players may be constructed for better performance.

7) The finding of the study will be of significant to physical education teacher and coaches in selecting the best suitable male kho-kho players on the basis of their predicted kinanthropometric and physical fitness variables.