CHAPTER –II
REVIEW OF RELATED LITERATURE

There cannot be two opinions about the need for review of the related literature. In the very beginning it helps in a careful and methodical perusal of the study at hand. It and only serves to solve the problem but also enormously helps in broadening and depending our understanding of the published research work in the related field. A review of the concerned literature helps to ascertain that the same has not been put to scrutiny before.

The review, cited in this chapter has definitely helped the researcher to imbed his awareness and understanding of the various techniques available for conducting such a study and formulating ideas that profoundly contributed to the overall rational and interpretation of the data gleaned and compiled with great effort. In this process of conducting the study the researcher was bound to be zealous and meticulous which, in turn, brought about awareness of the peripheral issues that undoubtedly helped his study in the form of scientific reference.

The review enlisted in this chapter was based on various sources viz-a-viz journals, periodicals, encyclopedia, newspaper, unpublished thesis etc. which were available in various libraries. The libraries which the scholar consulted were Mahrishi Dayanand University, Rohtak, Panjab University Chandigarh, Punjabi University Patiala, Banarus Hinhu University Varanasi, Kurukshetra University Kurukshetra and Netaji Subash National Institute of Sports, Patiala. The relevant literature pertaining to the present study has been abstracted in this chapter to provide the background material to evaluate the significance of this study as well as to interpret its findings.
Reviews related to anthropometrical variable: -

Fleck (1985) observed the physique and performance differences between volleyball players of various calibers. According to him the better players have been older, stronger, larger and able to jump higher.

Frohner et al (1992) investigated that in the XIII women junior European volleyball championships the teams with a high average age had the best results. The experience gained in youth is apparently an important factor as far as age is concerned. Regarding the age of players the interval of 24-28 years has been considered to be the best age for a top male volleyball player and 21 to 26 years for top female players.

Hirata (1996) examined 116 Olympic volleyball players who were found to be tall and lean. Their overall height was 183.3 cm and weight 79 kg. Further in his study he observed that generally volleyball players are not as tall as basketball players.

Khosla (1983) stated that although an ideal physique was not sufficient in itself for excellence in sports, it lack (even in presence of compensating attributes) may be severe handicap to a potential athlete such statement can be suitably applied to sports such as volleyball and basketball.

Lamp (1954) examined 806 junior high school students to see their playing abilities in relation to various physical growth factors, i.e. age, height, weight and strength. He observed the relationship between pubescent status and volleyball performance in both boys and girls.

Mathew (1984) undertook a study to determine relationship of selected anthropometric measurements to performance on Brady volleyball test Pearson’s product Moment correlation was employed to study the relationship of volleyball playing ability to each of the selected anthropometric measurements. The following conclusions were drawn:

1. The height and weight of the players contributed to a much greater extent to the performance of Brady volleyball playing ability.
2. Arm length was also found to be an advantageous factor in the performance of Brady volleyball test.
3. Leg length and upper body length contributed to the performance on the said test to a very limited extent.

Shondell (1972) investigated the relationship of selected motor performance and anthropometric traits to successful volleyball performance. This study was conducted to identify the physical and anthropometric traits possessed by successful volleyball players and to develop a physical performance test battery that would prove valid, reliable and practical when used to identify the successful collegiate volleyball players. Cross validation procedure employed supported the validity of the six-item battery as a predictor of expected volleyball performance.

Sodhi (1980) examined the data on volleyball players of different level and observed that the average height of the players was greater with the increase of standard of game. He compared the height and body weight with the Czechoslovakian Olympic team of 1972. The average height of Indian national team was 185.6 cm and the average weight was 71.1 kg as compared to 191 cm and 85.8 kg respectively of Czechoslovakian team.

Sodhi and Sidhu (1984) have mentioned in their book that, it is evident that physical and body composition has an important role to play in the performance of various physical activities; such as athletics, cycling, weight lifting, wrestling, football, hockey, basketball and volleyball.

Spencer et al. (1980) conducted a study on the anthropometric and performance characteristics. Subjects were 13 and they were members of the national volleyball team of the United States. Out of 15 players, 6 players were selected for the Pan-American team. Comparisons were made "between selected and not selected players. The selected players were taller and heavier and demonstrated better motor ability than the not selected Players. Strength measurements did not indicate consistent differences between the two sub groups, where the VO2 max was greater in the non selected players.

Joseph (1983) conducted a study the determined the relationship of power, agility, shoulder flexibility, arm length and leg length to volleyball playing ability. Subjects were 30 male volleyball players. Product Moment Coefficient of correlation was; used to
compute correlation between playing ability and each of the selected independent variable. It was found that:

1. Power was the most reliable variable in prediction of playing ability of men volleyball player's.

2. Arm length and leg length were also reliable variables in prediction of playing ability of male volleyball players.

3. The variables of agility and shoulder flexibility showed insignificant relationship to the prediction of playing ability of male volleyball players.

Chauhan, M.S. (2003) developed the regression equation for the prediction of sprinting ability of secondary school boys. The data was collected from the age range between 16 to 18 years (x=17 years) by anthropometric rod, skin fold caliper, varnier caliper and steel tape. The Pearson’s Product Moment coefficient of correlations method, Wherry Do little method for the calculation of multiple correlation and development of regression equation were utilized. Linear measurements i.e. height, leg length, total arm length, thigh length and foot length, Girth measurement i.e. shoulder, chest, abdomen, hip, thigh and calf. Body diameters i.e. biacromial, and ankle diameters, sub scapular and thigh skin folds, fat weight and lean body mass, body weight and age have significant and negative correlations with sprinting ability. The multiple correlation of a selected combination of variables i.e. length, Bi-acromial diameter and lean body mass with sprinting ability have been found highly significant. The developed multiple correlations are of sufficient size and the regression equation can be put in the prediction of sprinting ability of secondary schools boys.

Cureton (1973) found the relationship, of body composition and physical performance. The age of the subjects was 8 to 11 years. The subjects were tested on three independent body composition measures and thirteen physical performance items. The body composition measures include- body density, total body potassium and sum of ten skins fold thickness measurements. The physical performance items included the seven items of the AAHPER youth fitness test-vertical jump, mile -run and four dynamometric strength tests. The value of the body composition measures was inter-correlated with the physical performance items using the Pearson's Product Moment
Body density was positively related to all types of physical performance except static strength. The higher relationship was obtained between body density and performance on pull-ups, 600-yards run and 50-yards Dash. Negative correlation was obtained between skin fold thickness measurements and scores of all motor performance test items except the softball throw. The highest negative correlation was obtained between the skin fold sum and performance on 600-yards run, pull-ups and mile run.

Cozens (1930) studied stature in relation to physical performance of college men. He found that:

a. There was a negligible correlation between age and height;
b. Negligible correlation between age and weight;
c. Age had no bearing upon performance in general athletic ability;
d. Height and weight were apparently influencing factors to some extent in the matter of performance.

Datta (1984) while investigating on selected physical, physiological and psychological variables as predictors in hockey performance found that there was a significant relationship between cardio-respiratory endurance, resting pulse rate, hand reaction time, speed of movement, response time and body composition to hockey playing ability. The relationship between percentage body fat and playing ability showed that a higher percentage of body fat might be considered as an extra burden or dead weight which the individual had to carry and which consequently reduced the efficiency of the player. The hockey players who had scored better in hockey playing ability had a lower percentage of fat as compared to those who gave poor performance in hockey playing ability.

Espenschade (1963) evaluated relationship between physical performances and their age/height and weight of boys and girls of California. Physical performance test was studied in order to evaluate these factors on the basis of grouping of students and for the establishment of norms for test performance. Where age is held constant,
relationships of all performance with height and weight are low. The highest correlations were obtained for boys of junior high school age in the events of jumping and throwing. Significant changes with age do occur in relationship with the most events for both sexes. Age is recommended as a basis for test norms. If grouping according to sex desired the California classification plan is superior. It shows that age has direct bearing on physical performance.

Ghosh (1975) suggested that assessment of athletic potential by chronological age is not sufficient, bearing in mind that skeletal and chronological age maturity are likely to vary in individuals of the same age group.

Ghuman (1990) conducted a study to examine the relationship of selected motor fitness and anthropometric measurements to gymnastic performance at different levels of achievement. The study was conducted on 140 male gymnasts who participated in Senior National, All India Inter-University and National School Games. Motor fitness components selected were speed, agility, arm power, arm strength endurance, abdominal strength endurance, legs power, flexibility and dynamic balance. Selected anthropometric measurements of height, sitting height, leg length, arm length, weight, shoulder width, chest width, hip width, arm circumference, chest circumference, hip circumference, thigh circumference and calf circumference were taken. On the basis of the study the following conclusion were drawn

1. The motor fitness components of strength, endurance, dynamic balance, power, speed, agility, flexibility of hip region and shoulder flexibility were significantly related to gymnastic performance at all the three levels.

2. At the Senior National level, anthropometric measurements of height, weight, hip width, hip circumference, arm length and leg length correlated significant but negatively except chest circumference, which resulted significant positive correlation with gymnastic performance.

3. At the National School level, weight, arm circumference and shoulders width resulted significant positive correlation with gymnastic performance but at Inter
University level none of the anthropometric measurement showed significant correlation with gymnastic performance.

4. There were no significant differences between Senior National and Inter-University level gymnasts in all the selected anthropometric measurements.

5. The Senior National gymnasts differed from the National School gymnasts in all the anthropometric measurements except arm length and leg length.

6. The Inter-University level gymnasts also difference from the National School gymnasts in all the anthropometric measurements except arm length.

Gladden and Calacino (1978) investigated height, weight, skin folds, vertical jump and maximal anaerobic power of female participants of national tournament in United States. They found that the tournament was significantly correlated with age, height, vertical jump and maximal height on-jump. The partial rank correlations showed that height and vertical jump were the major factors correlated with final standing.

Hooda, B.S. et al. (2008) determined the relationship between basketball test scores, stature and physical fitness variables. The subjects for this study were 81 male basketball players, in the age group of 15 to 18 years, who participated in junior national or school national championship from Haryana, Punjab, Rajasthan, Delhi, Gujrat, Madhya Pradesh, Karnataka.

Peterson (1962) tried to predict basketball performance using psychomotor, cognitive and anthropometries measures. The sample includes forty-three female basketball players. The contribution of GPA, anaerobic power, leg power, fifteen yards dash, thirty yard dash, total body RT, TRT height and weight to basketball performance once was determined by special designated formula given by H.K. Kay. It was found that only height \( r = .388 \) was a significant \( (p < .05) \) of level. The fifteen-yard dash total body RT and power, were next in order. The ‘r’ for the four top variables was 0.56 \( (p < .01) \).

Singh (1990) focused his study on motor fitness of physical education majors as related to psycho-physiological variables and body composition. One hundred fifty seven male were taken from professional colleges of physical education as subjects. Revised AAHPER youth fitness test was used to measure their motor fitness, which was
considered as criterion measures of the study. Their body composition measures comprised body weight, lean body weight and percentage of body fat taken from skin folds. From the results, it has been observed that:

1. Individual items, such as body weight, lean body weight and percentage of fat did not show any significance correlation with power.

2. When body weight and percentage of fat were held constant, power showed a negative and positive significant correlation with body weight and percentage of fat respectively.

3. Physical education majors possessing lower pulse rate would be more agile.

4. The increasing percentage of fat reduces the agility performance.

Singh (2003) conducted a study to investigate anthropometrics, motor fitness and motor skill determinants of performance in inter-college level handball players. The data was collected on 108 players from nine teams through purposive sampling technique. Seventeen anthropometries, eleven motor fitness and six motor skill test were taken for study and over all playing ability of the male handball players were measured by the panel of three expert judges during the inter-college competition on five point scales.

Pearson's Product Moment Coefficient Correlation (r) statistical technique was used to analysis the data to assess the relationship of handball player to each of these anthropometrical, motor fitness and motor skill variables. Multiple and step-wise regression was applied to assess the combined contribution of anthropometrics, motor fitness and motor skill variables with performance. On the basis of study he found that - Anthropometrics variables, height, calf circumference, supra-iliac skin fold, thigh skin fold, Bicep skin fold, Triceps skin fold were found significantly related to the performance of handball players.

Toor (1996) conducted a study to investigate physical, physiological and anthropometric determinants of performance in male inter-college level sprinters, jumpers and throwers. The data was collected on 105 sprinters, 100 jumpers and 100 throwers. Ten physical, ten physiological and twenty anthropometric measurements were taken. The Pearson's Product Moment Coefficient of correlation was used to analyze the
data to assess the relationship of performance of sprinters jumpers and throwers with physical, physiological and anthropometric variables. The multiple step-wise regressions were applied to assess the combined contribution of physical, physiological and anthropometric variables with performance. In order to the asses the limited factors for top performance, the regression equation was worked out. On the basis of study he found that:

1. The sprinters performance was significant related to physical variables namely sit ups, Sargent jump, standing broad jump, back lift and 50 yard dash, physiological, variables namely recline pulse and sitting pulse rate and anthropometric variables namely age and calf circumference.

2. The performance of jumpers was found significantly related to physical variables name sit ups, Sargent jump and standing broad jump and anthropometric variables namely age and bicep skin fold.

3. The performance of throwers was found significantly related to chest, normal chest expended variable, elbow width, shoulder width, chest width, knee width and hip width, weight variables.

Voll (1977) conducted a study, on the predicting ability in basic modern dance skill through selected anthropometric and physical fitness measurements. On the basis of the findings, the author concluded that the ability in basic modern dance skills could be predicted from selected anthropometric and physical fitness measurements.

**Reviews related to motor fitness:**

Motor fitness might be referred to as an efficient performance in such basic requirements as running, jumping, dodging, falling, climbing, swimming with sustained effort, in a variety of situation and therefore would involve such element as power, agility, speed and balance. "Motor fitness is the final criterion through which all other elements of physical fitness or total fitness are seen and measured in man" (Book 1952).

Adhikari (1983) in his research study, conducted on 30 college boys to find out the comparative relationship of power, agility and selected speed characteristics to block
jump and three stride jumps in volleyball. A different set of tests like Sargent Jump, Nelson Speed Movement test, Squat thrust, etc., were used to measure different components and their relationship to each other. The results showed that:

1. Power of an individual contributed much to performance of block jump and three-stride jump and showed positive relationship with each other.

2. Agility which was required factor in performance in vertical jump, co-relate significantly with block jump and three-stride jump.

3. Speed, reaction time and speed of movement did not contribute much in performance of block jump and three-stride jump.

4. Power and agility played an equal role in the performance of block jump as well as three-stride jump because there was no significant difference between the 'r' of power and agility to the performance at the block jump and three-stride jump.

Bakker (1986) studied factors associated with volleyball. Subjects were 28 members of the women’s extramural volleyball team at rating each player on her playing. The following variables were measured: height, weight, leg extensor strength using the multi angle testing unit, grip strength using an adjustable dynamometer, skin folds using the large caliper, jumping ability using jump and reach test and an apparatus constructed by the investigator to measure reaction and movement time. Through ‘t’ test and correlation, it was found that jumping ability and reaction time were significantly related to success in volleyball. A multi correlation (R) of 0.718 was obtained between the nine variables and the criterion. An R of 0.53 was obtained between the criterion and reaction time plus jumping ability and one of 0.52 between the criterion and jumping ability plus weight. The regression equation computed in this study could be used to predict success in volleyball playing ability.

Beals (1989) suggested that strong volleyball teams should be based upon the agility, coordination, strength, power and flexibility factors of volleyball players. Therefore fitness is a prerequisite to the desired end of optimum efficiency in high class volleyball team, which can be achieved through appropriate conditioning programs.

Belyaer (1983) analyzed that in a five game match, on an average a volleyball player executes 250-300 motor actions of which 50 to 60 % are jumps, 27 to 30 % are
dashes and 12 to 16 % are dives. All these tasks demands a very high degree of physical fitness, mental alertness, exceptional precision, differentiation of movements, fast switching from one form of movements to another movement performed with different rhythm, speed and character by the player for the development of all the above qualities. The systematic and scientific training program should be implemented to achieve agility and vestibular steadiness in volleyball players.

Clarena (1969) investigated the relationship of certain factors with success in volleyball. It was found that jumping ability and reaction time were significantly related to success in volleyball.

Clarena (1991) conducted a study on 28 women volleyball players to find the factors associated with success in volleyball. She found that reaction time and jumping ability were significantly related to success in volleyball.

Devi (1985) conducted a study on 36 college level volleyball players to determine the relationship of depth perception, agility and speed of movement. It was revealed that depth perception, agility and speed of movement significantly contributed to volleyball playing ability. A significant correlation of agility and speed of movement might be expected in volleyball, as it demands a quick acceleration rate, along with performing movements in any direction. The results showed a significant relationship between speed of movement and agility.

Gregori1980, Chaudhary 1989: Volleyball is a game dominated by jumping actions on the net. The height of jumping reach is influenced by the body and jumping ability of a player. In last few years, we have experienced that in international competitions, the participating teams are in commanding position not only due to extraordinary height of the players but also because of an impressive jumping power.

Heimer et al (1988) stated that the characteristics of volleyball are that a player jumps 140 to 200 times with maximum effort during an average match. Over 50% of striking also takes place during a jump. That is why the explosive power is one of the most important factors in volleyball. It shows that arm and shoulder strength is one of the important prerequisite to be a high level volleyball player.
Kaur (1999) investigated motor abilities as a predictor in the performance of Secondary School Female Volleyball Players. Two hundred forty (N=240) female volleyball players of various secondary schools of Punjab were used as subjects of the study. The sample includes only those players who participated in district and inter-district as well as in open tournament. The age range was from 14 to 19 years. She administered eleven tests of motor ability for evaluating the motor fitness level of the player and to judge the performance of player in volleyball game, five-skill tests were used. Analysis of data revealed significant relationship of volleyball performance to each of the following motor ability components i.e., standing broad jump (r=0.26), vertical jump (r=0.28), push up (r=0.39), right hand grip strength (r=0.27), left hand grip strength (r=0.26), sit ups (r=0.45), 40 meter sprint (r=-0.34), 10x4 meter shuttle run (r=0.26). However the remaining motor ability components were not found significant at 0.05 of level.

To predict the performance of female volleyball players the following prediction equation was made as

\[ Y = 0.3224 X_8 - 1.3957X_9+0.1707 X_6+ 0.2438 X_4 + 0.1536 X_{11} -1.3532X_2+44, 9797 \]

Murgeson (1981) conducted a study on relationship of some anthropometric and fitness variables with spiking in volleyball. He measured height, agility and vertical jump. He found that vertical jump is the most reliable single factor, which underlies the performance’ in spiking ability.’ Height and vertical jump combined variable proved to be the most reliable. For three variables height, agility and vertical jump were found to be valid and reliable for predicting spiking ability of male volleyball players.

Pulh et al. (1982) conducted study to examine the absolute and relative physical and physiological characteristics of elite men and women volleyball players. The variable measures included percentage o body fat, VO2 max, post exercise blood lactic acid, and measures of vertical jumping ability and peak isokinetic torque for knee flexion and extension, shoulder extension and planter flexion. They found that the men were taller, heavier, had a higher body density and lean body weight and lower body fat. For gross
measures of jumping ability, the mean achieved was greater and higher for the jump and reach and greater jump distance above the standing reach.

Rivet (1979) collected data on during volleyball tournament of 10 matches played by an elite woman’s teams. Out of 868 jumps counted 541 were block jumps (62%) and 327 were spike jumps (38%) when these data were further subdivided into percentage distribution of the jumps for each position, it was discovered that 158 block jumps (29.2%) were made by zone 2 player, 297 (54.8%) by zone 3 player and 86 (15.8%) by zone 4 player. Further more zone 2 player made 78 spike jumps (23.8%), zone 3 player made 124 spike jumps (37.9%) and 125 spike jumps by zone 4 player (38.2%). In other words the center player made nearly half numbers of jumps of whole team. At international level one would expect a higher proportion of spike jumps from the power hitter than reported in Rivet’s study.

Shondell (1975) conducted a study on the relationship of selected motor performance and anthropometric traits to successful volleyball players. He found that power appeared to be the most significant factor in successful volleyball performance.

Siridhar (1984) conducted a study on 30 college volleyball players determine the relationship between agility, flexibility, muscular endurance with playing ability in volleyball. The tests conducted were the sargent Jump, side step, trunk flexion, pull ups, sit ups and one minute lateral jumps. The finding showed that motor fitness component of power, muscular endurance, cardio respiratory endurance, as well as flexibility contributed to the game of volleyball. The study also showed the significant relationship between power and performance.

Smith' (1969) studied the relationship of volleyball playing ability to scores achieved in the sargent vertical jump. It was concluded that vertical jump is not accurate predictor of volleyball playing ability.

Smith (1992) states that in modern volleyball physical characteristics, fitness and skills have been the key factors limiting technical performance. Technical demands of the game and the tactical systems employed are the determinant factors of performance at the elite level.
Amusa (1979) selected 46 subjects, who were well conditioned soccer player with at least two years playing experience at the college level. They were tested for running speed, power, agility, VO\textsubscript{2} Max., strength, aerobic capacity and flexibility. In addition, anthropometric measurements consisting of skin fold and body diameters were taken, soccer playing ability served as the criterion and was measured by the rating of three experienced soccer coaches based on selected soccer skills and strategies. Analysis of data was done by zero order correlations and multiple R analysis resulting in the following findings:

- Age (experience) is the best single predictor of playing ability
- Weight, lean body mass and height are considered good predictors of playing ability.
- Alam (1983) investigated the relationship of reaction time, agility and flexibility with the performance in running broad jump. The product moment correlation method was used to compute correlation between dependent variables and independent variables. Thus the significant correlation was found between reaction time, flexibility, agility and performance of running broad jump. The obtained value of correlation was found statistically significant at .05 level of confidence.

Bandyopadhyay (1982) investigated the relationship of selected anthropometric measurements, physical fitness and motor ability to Soccer skill performance. Height weight, calf girth, thigh girth upper arm girth and chest girth were measured. Subjects were also tested in AAHPER youth fitness test for estimating physical fitness and Barrow's motor ability test for assessing motor ability and Mc Donald Soccer Skill Test for measuring soccer skill performance. He concluded that:

i. There was a high correlation in physical fitness level as obtained from AAHPER youth fitness test with soccer skill performance;

ii. Soccer skill performance was highly correlated with motor ability as obtained from Barrow's Motor Ability Test of the soccer players;

iii. Among the selected anthropometric measurements only thigh girth had
significant relationship with soccer skill performance of the soccer player;

iv. The upper arm girth, chest girth, calf girth, weight and height had no relationship with McDonald soccer skill performance;

Book Walter (1952) found the relationship of physique and shape to Physical performance. The Indiana motor fitness test was administered. The subjects were elementary school boys. He found that:

a. The obese body has the poorest physical performance.

b. Size and shape seems to have an influence on physical performance.

c. The large and fat boys were poor in physical performance than the normal and thin boys.

Barger (1972) also states that optimum improvement in skill may not occur unless there is a minimum of strength. He further states that this can be reason for slow learning in weak children and female.

Bracko and Feelingham (1997) conducted a study on prediction of ice skating performance with off ice testing in youth hockey players. The purpose the study was to identify the off ice-variables that were associated with high performance, skating acceleration, speed, full speed and agility. Thirty male (N=30) players age ranged between 10 to 14 year were selected as the subjects. Subjects continued their practice in ice from one to three times a week for three weeks. Different measurements and tests were taken to check the ice performance. Measurements taken were those of weight, fat percentage. Other tests were sit and reach test, hip abduction, flexibility, vertical jump, standing long jump distance, vertical jump average and peak mechanical power, sit ups, pushups for one minute. The results indicated that vertical jump, push-ups and average mechanical vertical jump, power were reasonable predictors of acceleration speed and full speed in youth hockey players. The results suggested that consideration of these off ice variables might be important in training of youth hockey players.

Councilman (1976) coach of the USA Olympic swimmers from 1962-76 states that the vertical jump is a good test of power. He further described that the power of the
muscles in the leg is indicative of the potential power in the rest of the muscles of the body.

Debnath (1983) in her study concluded that a high level of motor ability was an important factor in determining the level of performance in gymnastics.

Digiovanna (1943) investigated the relation selected structural and functional measures to success in each of several sports. It was found that factor of body explosive power was associated with athletic success; It also indicated that these factors were of varying importance to performance ability in different sports.

Edgren (1932) attempted to predict the actual playing ability of beginners of basketball players through the developed motor ability and specific basketball skills tests and concluded that the potential playing ability in basketball could be predicted through the general motor ability.

Evereff (1952) conducted a study on the prediction of baseball playing ability. Thirty players of Iowa University were selected as subjects of the study. Different tests were conducted on subjects i.e., throw for distance, running for speed, shuttle run for agility and Sargent jump for explosive leg power. These subjects were rated according to playing ability by the coach. For analyses of data Pearson's Product Moment Coefficient Correlation was computed. Following conclusion was drawn the Sargent jump was the best single measure for selecting baseball talent in the study.

Gandhi (1982) said that outstanding performance in sports activities, after revival of the modern Olympics has witnessed the result of the scientific approach adopted by the Physical Education and Sports personals. She had rightly said that science applied to sports has enabled modern youth to develop physical capacities beyond anything earlier imagined. As a result, sports have become highly competitive and records are being broken at an increasing rate.

Gill (1983) conducted a study on relationship between grip strength, arm strength, hand foot and stepping reaction time to playing ability in badminton. Fifteen (N=15) male badminton players who participated in Gwalior district badminton championship were selected as the subjects of the study. It was found that hand, foot, and stepping
reaction time were significantly related to playing ability in badminton whereas grip strength and playing ability in badminton were not significantly related to each other. Variables like strength, hand, foot and stepping reaction time, contributed significantly to better performance in badminton game whereas grip strength did not do so.

Harre (1979) for achieving a higher level of efficiency in technique and tactics in most of the sports a high level of physical fitness is most important.

Harre (1979) pointed out that flexibility was a primary pre-requisite for qualitatively and quantitatively for good execution of the movements. He further stated that lack of flexibility could result.

1. Difficulty in learning new movements.
2. Injuries
3. Incomplete expression of conditional abilities i.e. strength, speed endurance and their complex forms and coordinative abilities i.e. reaction ability, rhythmic ability, coupling ability and agility.

Joseph (1984) studied the relationship of selected anthropometric and the strength variables to speed performance. It was found that there was a significant relationship of leg power, abdominal strength, thigh girth and calf girth to speed performance.

Kela (1984) undertook a study to find out the relationship between speed of movement (Nelson Method), agility (Shuttle run) and Spine and shoulder flexibility (Flexo meter) to performance in gymnastics on twenty-five inter-university women gymnasts. Rank-difference method of correlation was used in order to find out the relationship. It was concluded that

(1) Agility had a significant relationship with performance in gymnastics

(2) Speed of movement and shoulder and spine flexibility did not contribute to performance in gymnastics.

Kennedy et. al. (1994) attempted a study find out the relationship between fitness components and Motor Skill in first grade children. Fifty children's (N=50) were selected
as the sample of study. The purpose of the study was to determine how the fitness components were related to motor performance skills according to Bruininks Oseretsky test. All recorded values of the fitness component were compared to standardized motor skill score. It was found that run performance was negatively significant with body weight but independent of skin fold sums for the ½ mile run and pacer tests. Comparison of fitness parameters and motor skills indicated significant correlation with 1/2 mile and pacer fitness test. The result showed that ½ mile run was negatively correlated with balance, bilateral co-ordination and strength, whereas pacer test was positively correlated only with the strength motor skill variable. The results indicated that in relatively homogenous populations’ continuous walk, movement (½ mile run), increased body size, improved balance, bilateral ordination and strength, viz., negatively affected run performance. In contrast more intervals related activities increased strength levels in Kindergarten and grade children's.

Kishore, (2001) constructed standardized specific physical fitness test for boxers 20 boxers were selected to develop the norms. Twenty one physical fitness test items were selected to evaluate the strength, speed, endurance, flexibility and agility components of physical fitness. Factor analysis technique was applied. The following conclusions were drawn:

1. The application of factor analysis technique yielding eight specific physical fitness variables of boxers are listed on the basis of factor loading:

   (a) Push ups related to arm strength
   (b) Medicine Ball Throw (Left Hand) related to explosive arm strength
   (c) Medicine Ball Throw (Right Hand) related to explosive arm strength
   (d) 30 meters run related to leg speed
   (e) 6 minutes run and walk related to endurance
   (f) 1500 meters run related to specific endurance
   (g) Forward Bend and Reach related to trunk flexibility
   (h) Side step related to agility
Kruczalak (1969) is of the view that strength training is essential as it assists in the development of other motor factors including speed.

Kumar (1992) conducted a study of motor fitness components as a limiting factor in handball performance. Indian male (N=85) handball players were taken as the subject of the study. The age ranged between 20 to 30 years. Five motor fitness components were selected as the predictors through Wherry - Do little test statistical method. The selected predictors were arm strength, back strength, spine flexibility, standing broad jump, and 50- meter sprint. Further in order to examine relationship between selected motor fitness components and handball performance. Data were analyzed through Pearson's Products Moment Coefficient of correlation, partial correlation of 1st, 11nd, IIIrd, IVth order. The regression equation was finally made through Wherry – Do little test statistical method. The result of the study reveals that prediction equation of ~Xc=3.419 Xs + 0.265 Xe - 0.141 Xie - 0.185 Xi2 + 2.565 Xm + 0.693 may be considered as valid predictor of performance in handball.

Kumari (1993) investigated motor abilities as predictor in performance of hockey players. The sample of the study was 100 boys and 100 girls through 307 boys and 307 girls, representing various States and Union Territories of India were chosen through purposive sampling method, 10 Motor ability tests for measuring the motor abilities and 10 Hockey skill tests to measure the skill performance were used. Whereas game performance was evaluate through rating by six experts coaches. After analyzing the data she made the following conclusion.

1. Three motor ability measures namely, forward bend and reach, standing broad jump and standing shot put were significantly and positively related to some of the skill measures in male hockey players.

2. In females the relationship of all the motor ability measures with the skill were found significantly related.

3. Motor abilities that most efficiently predict total skill performance in male hockey players were explosive strength of arm and shoulder girdle, active flexibility of hip and trunk, agility and co-ordination of body muscles and strength endurance
of abdominal muscles. In female hockey player these variables were explosive strength of arm and shoulder girdle, speed endurance, agility and co-ordination of body muscles and explosive strength of leg extensor muscles. Two of the abilities namely, explosive strength of arm and shoulder girdle and agility and coordination of body muscles are common in both male and female hockey players.

4. None of the motor ability measures was significantly related to game performance in males. In females however three variables namely, standing shot put, 40 meters sprint and 800m run are significantly related with game performance.

Malik (2005) used motor fitness and motor skill test variables to predict the basketball playing ability of University level players. He used nine motor fitness and seven motor skill variables on 66 male and 50 female basket ball players during Panjab University inter college tournament.

The multiple step wise regression technique was used and found seven motor fitness and motor skill variables in case male basketball players i.e. 50 yard dash Semo agility, basketball throw for distance, standing broad jump, speed spot shooting from 12 feet's, control dribble and lay up shooting. In case of female basketball players he found four fitness and skill variables as important predictors in female basketball playing ability i.e. sit up, speed spot shooting from 9 feet's, speed shooting from 15 feet's and passing.

Motto (1977) stated that performance depended upon inherited characteristics like height, speed and limb length. The establishment of such factors become all the more important, he further suggested that there was an optimal age for testing of various physical characteristics, as there were certain age when development reached at a stage where trend was predictable for example adult level of agility reached around 12-14 years with little development after that, speed of movements which depends on central nervous system functions which matures at around fourteen years, with limb growth. Testing for running speed should have been continued up to 16-17 years. Power development was
largely dependent up to third decades of life, but strength touched about 80% at 17 years of girls and 16 years of boys.

Nandi (1990) investigated motor fitness as a predictor in the performance of high jump. Thirty (N=30) boys of a middle school of Delhi were used as administering suitable tests collected subjects of the study. Data pertaining to the selected physical fitness components i.e. speed, agility, flexibility, strength, and power. The findings of the study revealed that there was significant relationship of high jump performance with power, flexibility and strength.

Nayak, A. et. al. (2007) predict swim speed performance on the basis of selected anthropometric characteristics, arm and leg speed of thirty top class Indian male swimmers randomly selected from the Open National Swimming Competition held at Talkatora Stadium, New Delhi. The standard testing procedures were applied to measure the performance of height, weight, leg length, arm length, body composition, arm speed, leg speed and 50m Swim speed performance. Initially, Zero Order Co-relations were applied between the dependent variable and each selected independent variable. Further, multiple regression analysis was made, to find out prediction equation. The obtained prediction equation was as follows.

\[ X_C = 1.289 X_6 - 0.7395 X_7 - 0.385 X_8 + 65.05 \]

\( X_C \) = 50m swim performance
\( X_6 \) = Arm speed
\( X_7 \) = Leg speed
\( X_8 \) = Body composition

On the basis of Zero Order Co-relations, as well as obtained prediction equation, it was concluded that the selected anthropometric characteristics have significant relationship to the 50m Swim performance and the arm speed has a higher predictive value than the leg speed in Swim performance.
Pekka (1988) stated that in ball games, player can move with or without ball with varying pattern of motion. These actions vary in duration, speed, space, directions and tactical goal.

Roy (1985) Predicted that the performance in 100 meter sprint was significantly related to selected physical variables namely explosive leg strength and agility and as such these motor abilities might be used in predicting performance in sprints and thus might be treated as factors limiting performance in 100 meters run.

Sangral (1994) studied on thirty nine (N=39) students in 10-Ball shooting, Rolling for 20-M and Dribble and roll for 20 Sec. tests as criterion measures for hockey performers and motor fitness components were coordinative ability, standing broad jump, 50-M fly start, vertical jump, 6x10 M shuttle run, sitting ball throw, 800-M run and backward run for 20 m. The analysis of data showed that 10-ball shooting had significant relationship with coordinative ability and backward run for 20-M. Similarly, rolling for 20-M has significant relationship with standing broad jump, 30-M fly start, 6x10-M shuttle run, ball throw, 800-M run and Backward run for 20-M and Dribble and roll for 20 sec (distance) had significant relationship with co-coordinative ability, 30-M fly start, 6x10 M shuttle, 800-M run and backward run for 20-M. The regression equation for prediction showed different contributions of motor abilities to performance.

Sethi Parmod Kumar (2004) investigated physical fitness component as a predictors in the performance of male weight-lifters. The subjects of the study were one hundred male weight lifters studying in different universities of India and who had participated in the All India inter-universities weight lifting championship in 2002. He studied seven physical fitness component i.e. speed, strength, cardiovascular endurance, static balance, agility, power, flexibility which were measured by test items i.e. back fall squat test, military press test, sit-ups, stick drop test, 50 yard run test, Harvard step test, stork stand test, Squat thrust test, standing broad jump Test, Shoulder rotation test and forward bend and reach test respectively. The criterion measure was performance in weight lifting skill performance in Snatch and clean and jerk during the championship.

The data were analyzed using the Pearson's Product Moment Coefficient of correlation (r) for reassessing the relationship of weightlifting performance to each of the
physical fitness components and Regression equation for predicting the weight lifting performance from fitness components. On the basis of the study he found that:

1. The physical fitness components namely speed, maximum strength, explosive strength, strength endurance, agility, power were significantly related to Snatch in Weight lifting.

2. Among physical fitness components maximum strength, explosive strength endurance, agility, power were significantly related to Clean and Jerk.

3. Truck and shoulder flexibility, speed (acceleration ability), cardiovascular endurance and static balance were not found to be significantly related to Snatch.

4. The relationship of trunk and shoulder flexibility, speed (acceleration and speed of movement), cardio-vascular endurance, static balance to Clean and Jerk respectively was partial led out.

Shergill (1992) reported that playing ability and performance of hockey players were significantly related to the agility of the players and the progressive resistance exercises, tends to affect favorably the co-ordination of performer.

Singh Gurdial and Debnath (1989) investigated the contribution of strength variables toward competitive performance in men gymnastics. They reported a significant contribution of arm, shoulder, abdominal strength and leg power to competitive performance in men gymnastics. They concluded that competitive performance in gymnastics could be predicted with 75% accuracy with strength variables.

Singh (1991) physical fitness as one of the performance determining factor has to be developed along with other performance factors. Physical fitness includes endurance, strength, speed, agility and flexibility.

Uppal and Datta (1988) conducted a study on motor fitness components as predictor of hockey performance. Seventy-four (N=74) male hockey players were selected as the subject of the study from different universities of India. The motor fitness included speed, strength, power, agility, flexibility, dynamic balance and kinesthetic perception components, strait field hockey rating scale served as the criterion measure to evaluate the playing ability. It was concluded that speed, grip strength (both right and left
hand grip), agility, balance and Kinesthetic perception contributed to hockey playing ability, whereas power and flexibility were not significantly related to hockey performance.

Uppal and Gill (1989) studied on 80 male gymnasts ranging in age from 18 to 33 years. Who were belonging to different states of India" The data was collected in the 27th National Gymnastics Championship held at Jabalpur. Each subject was administered on four strength test i.e. arm strength, abdominal strength, grip strength and explosive strength of legs. The relationship of strength to performance in gymnastics was established by computing Pearson's Product Moment coefficient of Correlation. The strength variables were found significantly related to performance in gymnastics. Hence, it was possible to predict gymnastic performance on the basis of strength variables. The combined effect of strength variables can be more profitably utilized.

Uppal and Lakew (1990) did a pilot study on school level athletes and the purpose of the study was to develop equations, which may be used for identification of talented students. The students were taken from Schindia School Fort, Gwalior, studying in ninth, tenth and eleventh classes. Subject's age ranged between 14 to 18 years. 100 meter run, 800 meter run tests was performed by them. Subjects were classified in to four groups based on their performance i.e., Sprinter, Middle distance runner, Jumper and Thrower. Twenty five subjects were randomly selected from the four groups. Their average age was 16 years, different motor fitness tests were selected i.e. speed, strength, endurance, agility and flexibility. Pearson's Product Moment Coefficient of correlation, multiple correlation and Regression equation analysis were applied for analysis. The multiple regression analysis was performed to develop equation for prediction of performance based on motor fitness components.

Schnabel (1981) suggests that the study of performance during the competition and training is of utmost importance for understanding the nature of the performance in a sport. It is also essential for determining the relative importance of various factors which contributes towards performance. On the basis of the talent identification, training has to be formulated to enable the sportsmen to achieve high level sports performance.
Review related to motor skills: -

Phipps (1982) investigated a study to determine which of general ability variable, specific skill variable and personality trait variables has the highest relationship with overall volleyball performance in high school girls. Three general ability tests, three specific volleyball skill tests and a personality test were administered and found that

1. There was little relationship between selected tests of general physical ability and personality traits and volleyball performance.

2. There was a substantial relationship between selected specific-skill tests and volleyball performance.

Rawat (1989) conducted study to determine the physical, physiological and motor skill variables of men volleyball players, which could best contribute in the playing ability of volleyball players. He collected data on 135 school volleyball players (male) in 23 variables consisting of 12 physical, 7 physiological and 4 motor skill variables. He found that explosive power, agility and ankle flexibility were main contributors for the volleyball playing ability, and out of 7 physiological variables, cardiovascular endurance, lean body weight and pulse pressure were contributors and among motor skill variables two variables were i.e. volleying and serving were the best contributors for volleyball playing ability.

Sagger (1994) studied the skill tests and tactics of volleyball and provided a detailed descriptive knowledge of different skills and tactics required for successful participation in the game of volleyball during competitive play.

Scates (1984) spiking is the act of jumping in the air and hitting the ball from above the level of the net into the opponent’s court. An offensive play usually drives the ball into the court with great force. Spiking requires coordinating the jump and arm swing in order to contact the moving ball.

Selinger (1986) explained about the serve as team’s first attack. It has two primary objectives: to hinder the opponent’s serve reception attack by slowing it down, thereby making it more predictable for the blockers or to score a direct point. At high level of play 2 to 4 points in a game are scored directly by serving. At lower level of play,
the number of aces may reach 6 to 7 points per game. This is because of the imbalance between serving ability and serving receiving ability of young players. It is easier and takes less time become an effective server than an effective receiver.

Diwarka (1991) conducted a study to investigate the relationship of physical, physiological and motor skill variables to volleyball playing ability and to assess the combined contribution of physical, physiological and motor skill variables to volleyball playing ability. Physical variables included speed, arm length, explosive power, dynamic balance, agility, flexibility, age, height and weight are taken. Physiological variables including pulse rate, systolic blood pressure, diastolic blood pressure and cardiovascular endurance were measured. Motor skill variables were volleying, serving, passing and set up. One hundred women volleyball players who participated in the inter-college level tournaments were taken as subjects.

Holland. (1965) conducted a study on the predictive value of selected variables in determining the ability to play basketball in small high schools. In order to predict Basketball playing ability, he included variables such as speed, agility, upper arm strength, power, ball handling ability, reaction time, shooting ability, passing ability, height, weight, age and previous experience. The criterion was the rating of Basketball playing ability of each squad member by his coach. The most important variables were found to be experience, ball-handling ability, passing ability and shooting ability. The weighted index with ‘r’ = 0.76; basketball ability score=1.54; number of year of experience =+1.23; score on speed dribble =+. 26; speed on wall volley =+. 15; and score on shooting test = -10.11

Wharton (1980) investigated the AAHPER youth fitness test as predictor of skill development in field hockey. One hundred seven subjects were examined. A significant relationship was found between the scores of the youth fitness test and field hockey achievement as measures by the Schmithals-French field hockey achievement tests.