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 not only serves to solve the problem but also enormously helps in broadening and deepening 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 imbibe 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 the 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 frame of scientific reference.

The review enlisted in this chapter was based on various sources viz-à-viz journals, periodicals, encyclopedia, newspaper, unpublished thesis etc. which were available in various libraries. The libraries which the scholar consulted, were Panjab University, Chandigarh, Punjabi University, Patiala, Netaji Subash National institute of sports, Patiala, Kurukshetra University, Kurukshetra, Lakshmibai National Institute of Physical Education, Gwalior. 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.
REVIEW OF LITERATURE TO BASKETBALL

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

Dyer (1939) has concluded that skill is necessary to be successful in basketball are of two general types:

(i) Strategic ability
(ii) Motor ability

He has further concluded that possession of high motor skill alone does not make a player successful and four skills namely “passing to a moving target”, “Ball handling”, “bouncing and shooting to a target” and jump are also necessary to be successful in basketball.

The playing ability in women’s basketball is reported to depend upon the ability in skills “Speed passing,” “accuracy in passing to moving target,” “bounce and shot,” basketball handling Skills” and “jump and reach ability” of a player by young and Moser (1939).

Peterson (1962) tried to predict basketball performance using psychomotor, cognitive and anthropometrics measures. The sample included forty- three female basket bell players. The contribution of GPA, anaerobic power, leg power, fifteen yards dash, thirty yard dash, total body RT, TRT height and weight to basket ball performance once was determined by specially 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)

Ellen (1963) conducted a study on the relationship of height and weight to the performance of college women and selected basketball skill test. A three-item basketball test (push pass, half minute shoot, and bounce and shoot) was
administered to 100 college women who participated in the intramural basketball tournament. Four groups of each were selected to represent the extremes in height and weight. Height had a statistically significant relationship with weight and the combined test with the bounce and shoot.

Poskar (1965) had employed three skill tests namely-distance pass, dribbling and foot work in defense, to measure the performance abilities of polish Olympic basketball players for 1960 Olympics.

Synder (1965) designed an experiment involving proficiency in performance four selected physical skills, which were the predictors of basketball playing ability. The four skill tests not requiring ball-handling ability were given as a pre-test. After three weeks instructions of Johnson basketball tests were given and performance was recorded during low scrimmage performance. It was concluded that the highest correlation (r= 0.526) was found in Johnson basketball test and scrimmage performance.

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 Basket ball 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

Harrison (1969) has stated that performance abilities in basketball are dependant upon four main areas of skills namely shooting, passing, dribbling and jumping.

Gilbert (1969) conducted a study of selected variables in predicting basketball player’s ability and performance at college level. He demonstrated that
at the college level a battery of four independent variables were selected from total of ten variables. The best reflect composite basketball ability and performance and these four variables include ability criterion, arm strength, Penny cup test and speed pass. However, since the desired multiple $r$ of .95 was most reached. This limits the utilization of this battery as a predictive measure of basketball ability.

Strain (1970) conducted a study on the predicting future high school basketball player's success, as measured by estimated varsity game point production from individual sophomore game statistics. During the year 1961 through 1968, 30 juniors and 21 seniors of the Rapid City High School Basketball varsity teams who had completed the sophomore, junior and senior basketball season, furnished the data for the formulation of three predictive equations from the relationship of individual sophomore game statistics and varsity point production. In the development of the multiple regression equation five-predictor variables – successful free throw average per game, field goal percentage and rebound percentage were correlated with the success variables as measured by varsity point production.

Gallagher (1970) investigated the relationship of agility to performance in women's intercollegiate basketball. The hypothesis of the study that a high positive relationship exists between items of test (Mc Canliff Agility Components Tests) and performance was not supported. The lack of evidence to support the hypothesis, attributed author to some unexpected peculiarities of the sample. The author made several recommendations for continued investigation.

Ellen burg (1971) conducted a study to predict selected physical variables in determining competitive performance in high school basketball players in 1969. The performance data were collected by performance rating chart. Product moment correlation, Multiple Correlation and Multiple Regression Equation were applied. The result of the study were as follow:
1. Out of the variables used in the study, thirty seconds shooting test and vertical jump were most reliable predictors for the performance used in this study.

2. Height, handgrip, vertical jump, wall volley and thirty-second shooting tests were most important variables contributing to a player's performance.

3. The five items battery consisting of height, handgrip, vertical jump, wall volley, Thirty second shooting test can be a practical and useful instrument in predicting basket ball performance of high school basket ball players.

Childress (1972) conducted a factor and discriminate analysis to identify and determine the effectiveness of selected physical variables in predicting successful basketball performance. Twenty-four test items were selected through a review of literature as a valid measure of components of high school basketball ability. The test items were administered to 106 high school basketball players and the resultant data were analyzed through factor analysis. Seven factors were isolated and six were identified as agility, speed, relative muscular endurance, basketball speed manipulation, gross muscular strength, total body movement time and manual dexterity. Two test batteries were constructed, the first consisting of seven test items. The second was composed of the ten test items. The result of the study showed that the component of basketball ability could be isolated, measured and utilized to construct an evaluation tool for classifying players into two populations identified as successful and unsuccessful.

Dahl (1973) studied the relationship of jump shooting ability in basketball to selected measurable traits. College basketball players (N = 24) were tested on 11 independent variables and three criterion variables i.e., accuracy from ‘10’ feet’s from ‘21’ feet’s and total accuracy. Wrist strength and flexibility correlated significantly with ‘10’ feet’s accuracy. Wrist strength, hand size and hand reaction correlated significantly with ‘21’ feet’s accuracy. He concluded that the
jump shooting ability from ‘10’ to ‘21’ feet’s can be predicted from the developed regression equation.

Verma et al (1977) have observed high level of anaerobic power with Indian National Level basketball players as compared to national Level athletes, footballers and hockey players. The results of Verma et al (1977) were later confirmed by Fox (1979). He found that performance in basketball largely depended upon anaerobic energy systems and aerobic energy system contributed towards playing for many minutes.

Madved and Madved (1977) found an average heart volume of 1307 ccm with Yugoslavian Olympic basketball players as an extraordinary enlargement of heart which can be explained as a specific biometrical characteristic of basket ball players and also of modern basket ball training methods. The largest heart volume of top class basketball players confirms that the cardio- respiratory fitness is required to be possessed by modern basketball players.

Gordon (1979) conducted a study to predict basketball ability of college women. The variables included in the study were cardio- vascular capacity, leg power, upper body strength and endurance, body composition and body weight. The sample of the study included twenty women varsity basketball players from two colleges. The author developed separate prediction equation for five criterion measures, an ability rating consisting of four offensive -defensive descriptive terms the Tut ko –Richard General Personality Rating. Composite score of the two measures, the Noll Comparative rating scale, which utilized games statistics and the ranking of the players by the coach. The data were analyzed through step- wise Multiple Regression Programme. The best prediction equation was found to be:

\[ \text{Basketball ability} = 9.053 + 1.364(12 \text{ minute run and walk}) - 0.113 \text{ height}. \]

Battles (1980) tried to develop a prediction equation for selection of women inter- collegiate basketball team members. The sample of the study included thirty-three female basketball players. Each subject completed a data
form and tested on, the Athletics Motivational Inventory (AMI), the Knox Basketball Test, Sargent Jump Test, and the field goal speed Test. In addition to these some selected anthropometrics measurement were also taken. Three different rankings including head coach’s ranking, the assistant coach ranking and averaged ranking of head and the assistant coaches were included in the statistical analysis the results revealed significant analysis. The results revealed significant correlation (0.05 level) between head coach’s ranking and the age and college basketball experience. The Step-Wise Multiple regression indicated that the players ranked high by coaches tend to score high on a combination of physical experience, height, vertical jump, and mental toughness and AMI total score. It was also found that the Assistant Coaches tend to select players with high score on psychological variables, which include trust, responsibility, mental toughness and aggression. The average ranking of the Head coach and Assistant (S) favoured players with college basketball experience, responsibility, mental toughness, ages and self-confidence.

Jeantte (1980) investigated the factor structure of basketball skills in the domain of human motor performance to identify the robust factors in that domain. The subjects for this study were 16 high school girls. A battery of 20 experimental variables was selected on the basis of their representation of a theoretical domain possessing. The following hypothesized dimensions:

1. Shooting
2. Passing
3. Jumping
4. Moving without the ball
5. Moving with the ball

The study concluded that hypothesized dimension of basketball playing ability were not supported. The multi dimensional model resulting from this investigation was represented by dribbling, explosive leg strength, lay-up shooting and passing.
Paul Vaccaro, et.al (1980) have studied thirteen college men basketball players of University of Maryland confirmed very high values of Vo2 Max., which was similar to the mean value as reported by Withers et al (1977) for Australian basketball players and Barnet et. al. (1975) for Russian basketball players. They further reported that such high values of Vo2 max as observed in those basketball players was due to the emphasis of the training and conditioning program for collegiate players. They further concluded that high aerobic capacity had not been clearly established as a dominant factor for good performance in basketball. However, severe physiological stresses encountered during basketball game make it desirable to have high level of maximum O2 uptake capacity.

Hochn (1980) studied the Knox basketball test as a predictive measure of overall playing ability of female high school basketball players. The Knox basketball test was administered on one hundred and ninety eight (N=198) girls. The step-wise multiple regression procedure was used to analyze the predictive value of this test. It was found that for the selection of the players dribble shoot test was the significant predictor. The dribble shoot test also significantly correlated with the coaches ranking of junior varsity players and varsity players. The speed pass and speed dribble significantly predicted the division between the junior varsity and varsity players. Although the comparison was significant to skill test accounted for only 11.1% to 28.31% of the total variation in the dependent variables.

Ostrovsky (1980) after studying seventy-three Basketball players with twenty-seven tests found that the following seven factors share up to 84.0 percent in the total dispersion of playing ability.

Physical qualities
a. Speed combined with dexterity
b. Quality of jump
c. Speed endurance
Technical qualities

a. Accuracy of long shooting
b. Nationality of dribbling
c. Technique of defense
d. Accuracy of high speed Pass

An inter-connected test battery involving all those factors was constructed and utilized by him in coaching four top league basketball teams.

Pease (1981) conducted a study on the relationship of selected hand and wrist measurements to ability to shoot in basketball. In this study 64 college age males were selected as the subjects and he concluded that speed of hand was the only significant predictor of the ability to shoot in basketball.

The five members expert committee constituted by American Alliance of Health, Physical Education, Recreation and Dance (1984) based upon the survey conducted through male and female basket ball coaches representing professional colleges, high schools, and elementary levels and also based upon the literature review has identified that “shooting”, “passing”, “dribbling” and “defensive movement” are the most essential basket ball skill to be possessed by every player.

Williams (1984) examined the relationship of selected ‘Natural’ traits to statistical game performance in basketball to determine what relationship, if any existed between the selected natural traits of quickness speed jumping, powers, shooting, success, agility, height and weight and game performance of basket ball players as measured by statistics. He tested fifty male college basket ball players to evaluate their natural traits of quickness, speed, jumping power, shooting success, agility, height and weight. Conference basketball game statistics were kept on each subject. These statistics were used to compute a statistical game performance for each subject. The simultaneous solution and the multiple regression analysis were administrated to the raw data. Individual and
group correlation was determined to see the relationship of the natural traits (independent variable) to the statistical game performance (dependent variables). It was found that out of the seven natural traits of quickness, speed, jumping, power, shooting success, agility, height and weight only shooting success was found to have a significant, correlation (at the .05 level of significant) to the statistical game performance of basketball players as measured in the study. In addition all seven of the natural 'traits' accounted for only a small portion (10 percent) of the variance of the dependent variable to statistical game performance. The author concluded that statistical game performance was significantly affected by shooting success but not the tested measurement of quickness, speed, jumping power, agility, height and weight further more factor other than those 'Natural' traits studied in this investigation must account for much of the variance of the statistical game performance.

Sinha’s (1984) investigated the relationship of selected motor traits and anthropometries variables with performance in AAHPER basketball skill test. The finding of the Study indicated that performance in AAHPER basketball skill test was significantly related to agility, cardio-vascular endurance, explosive strength, height and Crural index, whereas it was not significantly related to speed, grip, strength, back flexibility, weight and Ponderal-index. The finding indicated that.

1. Explosive power, agility and cardio-vascular endurance were the Key motor traits underlie performance of Skills in Basketball.
2. Heights as well as the relative leg length were the main anthropometries characteristics, which contributed to skill in Basketball.
3. The motor traits of speed, grip, strength and flexibility were not the prime factors for performance of skills in basketball.
4. Excess body weight had restricting effect on basketball performance

Hassan (1987) did a study on analysis of skills, motor abilities and psychological components as predictive factors of basketball playing ability at
different levels of achievement. Eighty-four (N= 54) University and fifty-one (N=51) national level players were selected as the subjects of the study. Subjects were tested by AAHPER test. It included basketball skill test of front shoot, side shoot, foul shoot, under basket shoot, speed pass, jump and reach test, over arm pass for accuracy and dribble Motor ability test (Power, speed, agility, cardiovascular strength, endurance) were selected to check the players ability of jump and shoot, respond vigorously several times and to run fast to change his path frequently. It was found that with respect of university level players skill variables i.e. push pass of accuracy, under basket shoot and motor components of speed and cardiovascular endurance were significantly correlated to their performance in basketball. Skill variable i.e. dribble, push pass for accuracy and front shoot were found significantly more related to playing ability in case of national level players. Whereas speed pass, over arm pass for accuracy, foul shoot, side shoot and under basket shoot and among motor fitness components, power was found more effectively correlated will playing ability. The remaining components like cardiovascular endurance, speed, and agility showed significant relationship with playing ability.

On the basis of finding it was suggested that basketball-playing ability could be predicted on the basis of combined efforts of skills and motor abilities at any given level. It was also suggested that combined effects of these motor-abilities and skills could be more appropriately utilized instead of using each skill items and motor ability separately.

Anand (1988) attempted to study the physiological variables inclusive of certain motor abilities through which the performance in basketball could be predicted. The result of the study conducted on 400 inter college and intervarsity level basketball players (200 males and 200 females) selected from different universities of India enabled him to conclude that nine physiological variables namely right hand grip strength, left hand grip strength, leg press, vertical jumping ability, resting heart rate, lung capacity, anaerobic fitness, agility and
flexibility were the good predictors of performance in basketball for both male and female players.

Sharma (1989) administered a study on 75 female basketball players from various universities for testing the players, in different basketball skill tests i.e. passing, dribbling, shooting, jump and reach test and motor ability test viz. speed, agility, power, cardio-vascular endurance were selected. It was concluded that the basketball skill abilities of intervarsity female players were dependent upon the motor-abilities and the playing ability of inter-varsity female basketball players was dependent upon the skill and motor ability.

Bala (1989) has reported leg power (explosive strength) to be one of the main factors responsible for playing ability of basketball players.

Hasrani (1991) conducted a study on 25 male basketball players of the professional college of Physical Education Gwalior. The subjects have represented the college basketball team and were still doing practice daily. Physical fitness components like speed, power, cardio-vascular endurance and agility were selected to study their relationship to performance. It has been observed that physical fitness variables of agility contributed to the performance in basketball to a much greater extent. Cardio-vascular endurance and power also affected performance. However speed variables did not affect the performance in basketball.

According to Hoare (2000) “Given the complexity of basket ball, it is understandable that a degree of skepticism exists as to the relevance of talent identification and for selection, but this assumption is largely untested and therefore the study entitled “predicting success in junior elite basketball players. The contribution of anthropometrics and physiological attributes have undertaken” His study explored that anthropometrics and physiological profiling can contribute to selection procedure in junior basketball at elite senior level.

Mozumdar Indu and M.Edwin (2000) Conducted study on 180 male basketball players in Mini, Youth and Junior Category of Bombay region for
finding relationship of selected physical fitness variables to playing ability in Basketball at different levels of performance they took four variables namely:

1. Vertical jump (Sargent Jump) for leg power
2. Thirty meter dash for running speed
3. Agility run
4. Coopers 12 minutes run/walk

Test for Cardio- Vascular endurance were administered on the players of finding their physical fitness level and Basketball playing ability was graded (out of ten points) by a panel of three qualified judges during the competition and the average of three grades were considered as the subject playing ability. The relationship of physical fitness variables and playing ability was established by computing Pearson’s Product Movement Correlation Coefficient Comparisons of the co-efficient of correlation for Mini, Youth and Junior playing ability, was done by using the ‘t’ test the finding indicated.

(i) There was a positive relationship between 30m dash and under basket shooting for the junior group

(ii) Relationship between other physical fitness variables and basketball playing ability for the three groups were not significant.

(iii) The mini group had a significantly higher relationship between playing ability and 30 m dash than the youth group.

(iv) There were no differences among the three groups i.e. mini, youth and junior as far as the relationship between physical fitness variables and basketball playing ability variables was considered except for the above-mentioned differences.

Kaur, et. al. (2001) In their study measured the anthropometrics attributes of 17 boys junior basketball players ball players attending national camp for preparation of an international championship. It was important to observe that out of 17 players, only 6 have fallen in the required Olympic somato type circle. On
the whole it was observed that Indians were still smaller in height and lighter in their body mass and required somato type development to be best of successful basketball players. They also mentioned that certain anthropometrics attributes were used in predicting the excellence in junior elite basketball players.

**Performance in Basketball As a correlate of Psychological and social factor**

A number of investigators have tried to examine performance in basketball as a correlate of psychological factors included anxiety, cognition, emotionality, mood states, conformity and other personality factors.

Smith (1980) studied the effect of anxiety and shooting proficiency among college women basketball players. The subject twelve in number were administered in State Anxiety Inventory (SAI), Sports Competition Anxiety Test (SCAT) Pre-game HR, Game field goal percentage, Game free throw percentage, Season field goal percentage, Season free throw percentage. Subjects in group I consisted of players who attempted over 122 field goals during season while group II attempted ninety five field goal or less. The results of ANOVA indicated significant differences between groups on Season field goal percentages and State Anxiety Inventory (p < .05) subsequent data Analysis through out this study incorporated only the values from group I. A significant difference was found between score on State Anxiety Inventory and Sports competition Anxiety (p < .05) Multiple Regression Equation was used to estimate field goal shooting proficiency from selected measures of anxiety produced R’s ranging from 0.47 to 0.66 and accounted for between 22 and 44 percent of variance in performance. A multiple regression equation for producing free throw success was not found to be significant.

Backer (1981) investigated the cognition and personality dimension of basketball players. He tried to describe and delineate the attention (cognitive) and interpersonal (personality) characteristic among three groups of basketball players. The sample included forty-seven basketball players and twenty-five
non-athletes who served as controls. Forty-seven basketball players were divided into three distinct categories based on their competitive status. These consisted of twenty amateur players, sixteen varsity/college players and eleven professional basketball players. The seven hypotheses were examined with correlation techniques, and ANOVA procedures. The result showed that basketball players did not exhibit a significantly different attendant profile from the non-athlete controls. The basketball athlete exhibited the ability to adopt their attention and concentration to fit the demands of a given situation. Among the three basketball players groups the professional players exhibited the greatest amount of behavioral control as measured by TAIS (Nideffer's Test of Attention and Interpersonal Style) which was significant at the $p < 0.05$ level. This finding suggested that as basketball mastery increased, so did the level of behavioral control. Thus, the basketball players were characterized as being more emotionally stable showing greater emotional reactivity and as having more somatic complaints than the non-athletes.

Toner (1982) examined the relationship of physical fitness, skill and mood variables with success in female high school basketball candidates being chosen to become university players. McNair's profile of mood status, Cooper's 12 minutes Run-Test, AAHPER jump and reach of the three teams were treated on three separate occasions during the regular mid-afternoon practice, items for the teams. At the end of the testing and evaluation period, the jury of coaches, on the basis of their observation during drill and scrimmage competition independently rated each candidate as either a successful or an unsuccessful performer. Discriminant analysis procedures supported the hypothesis that the fitness, skill test and personal factors known together as pre-season variables were successful indicators at group membership while the POMS variables with lesser extent and the battery of tests of coaching ratings.

Lidstone (1983) examined the relationship of selected psycho-social variables associated with achievement to the performance of male and female inter-collegiate basketball players. In this study a total of fifty-four males and
fifty-three female athletes completed the work and family orientation questionnaire and Gordan’s survey of interpersonal values. The scales measured were work, mastery, competitiveness, personal unconcern, support, conformity, recognition, independence, benevolence and leadership. A significant difference was observed between male and female athletes on only two of the ten psychosocial variables support and conformity. Female athletes obtained higher support scores and lower conformity scores. It was concluded that with respect to achievement motivation and interpersonal values

(a) Male and female athletes were more similar then different.

(b) Athletes performance as significantly by MVP ranking could not be predicted satisfactorily utilizing by psychosocial variable alone.

REVIEW OF LITERATURE FROM OTHER GAMES

Larson (1940) conducted a study to analyze a number of motor ability tests designed to measure the elements of motor ability for the primary components. Regression equation was developed for the prediction of each primary component. To determine the significance each of the combination in term of a criterion measure of motor ability, the zero order correlation was calculated for the test items and tests. The correlation ranged from 0 to 0.85. The study verified general motor ability for college men. Motor ability tests correlated high with dynamic strength and comparatively low with static strength.

Everettf (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 analysis of data, Pearson's Product Moment Coefficient Correlation was computed. Following conclusion was drawn the Sargent jump was the best single measures for selecting baseball talent in the study.
Pierson and Phillip (1960) conducted a study on Bruce physical fitness index as a predictor of performance in trained distance runners. Eleven (N=11) high school cross-country runners were taken as the subjects of the study. An effort was made to determine the relationship between scores and performance. The lean body mass was calculated according to Rathbum-pace and Cawgill formula. The inter-correlation of the selected anthropometrics and physiological measurements were recorded during the investigation. The mean score of 32 found for the subjects was considerably above the 26 considered characteristics of athletes on the Bruce continuum. The man with best performance (9.56 min.) made the highest score (40) on the Bruce physical fitness index, but the man with poorest performance (11.39 min) made the second highest score (37). When performance of all subjects was correlated with their Bruce physical fitness index, ‘r’ was found to be 0.47, which was not significant. The correlation between performance and the total heart count for the first three minutes, immediately after exercise was r=0.52 which was also not significant.

Morehouse (1963) it was recognized that development of muscular strength was the primary factor in the increasing fight against joint injuries.

Prestige (1972) emphasizing the role of co-ordination and timing stated that there must be co-ordination for each skill achievement and when coupled with correct timing will produce the successful performance of that skill.

Michalek (1974) in his study on “Selected Measure as predictors of success in gymnastics”, found that the gymnasts differ significantly on explosive power, the vertical jump, than the non-athletes where as and track and field athletes was found significantly better than non-athletes on vertical jump.

Willmore (1977) states that a flexible athlete not only is more proficient but that he is less prone to serious injury.

Dashaies (1978) conducted a study on psycho-bio-logical approaches as the prediction of individual performance of junior ice hockey players. One hundred and sixteen (N=116) junior major league hockey players from Quebec
were selected as the subjects of the study. All subjects were measured on fourteen variables fall in the biological, psychological and specific motor skill categories. The step-wise regression analysis had been done. A prediction equation was obtained which included the following four variables i.e., forward speed skating, motivation, visual perceptual speed and anaerobic power. The multiple correlation coefficient obtained was r=0.74. The 55 percent of variance in the ice hockey playing ability accounted for the psychological profile. It was larger than that observed individually for the biological 17 percent, psychological 20 percent and the specific skill profile 33 percent.

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).

Zhou, Hodgson and Soto (1982) in their study of prediction of running speed among middle and long distance runners, anaerobic power output (APO) and Heart rates during and after 30 sec., all-out cycling were measured on top level US runners. \( V_0^2 \) max was measured separately during treadmill running. Among 800 m runners, anaerobic power output was the most important predictor whereas \( V_0^2 \) max, became progressively more important as running distance increased.

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 game whereas grip strength did not do so.

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.

Adhikari (1983) opined 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 jump in volleyball. A different set of tests like Sargent Jumps, 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.

Ozkan (1984) conducted a study of 77 male high school soccer players between the age of 15 and 18 years old. The purpose of this study was to investigate the physical, physiological and motor skill characteristics of the players. A secondary purpose was to compare the experimental variables between playing position, age groups and playing qualities test items consisted of age, height, weight, percentage of body fat, resting heart rate, 1.5 mile run, 50 yard sprint, vertical jump, agility, trunk extension and flexion, ball control, wall...
volley and obstacle dribble skill tests. The statistical analysis revealed an average height and weight of 174.92 cm and 64.74 kg for entire group. Average resting heart rate and body fat were 70.07 bpm and 10.3%. The other results were excellent in 1.5 mile, fair on the 50 yard and vertical jump, in agility similar level as college, below average in trunk extension and flexion and in three soccer skill tests, the players scored 85th-100th percentile.

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.

Kela (1984) undertook a study to find out the relationship between speed of movement (Nelson Method) agility (Shuttle run) and Spine and shoulder flexibility (flexometer) 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.

Siridhar (1984) conducted a study on 30 college volleyball players to determine the relationship between agility, flexibility, muscular endurance and 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.

Khamdram (1984) conducted an investigation to determine the relationship of selected physical variable with performance in shot put. The variables were strength, agility, speed and flexibility. Anthropometric measurements included weight, height, arm length, leg length, fore leg length, thigh girth, ponderal index and crural index. The finding of the study revealed that there was significant correlation between the arm strength with shot put performance ($r=0.45$) leg strength with shot put performance ($r=0.42$) flexibility with shot put performance ($r=0.47$) speed with shot put performance ($r=0.42$). The following conclusion were drawn:

(a) There was significant correlation between arm strength, leg strength, speed, and flexibility with shot put performance.

(b) There was no-significant correlation with anthropometrics measurements.

Murlidharan (1984) examined a relationship of anthropometrics and physical performance variable with performance in long jump. The finding indicated that the anthropometrics and physical performance variable were very reliable for predicting performance in long jump. These variables were leg length, height, standing broad jump, 50 yard dash, shuttle run (10x4 meter) sit and reach test and vertical jump and found most significant independent variables as correlated with performance in long jump.

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.
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.

Sharma (1987) constructed and standardized specific physical fitness test for badminton players. He used factor analysis techniques on the data of 100 inter-colleges and district level badminton players of north India. As many as 7 factors of physical fitness were obtained and five of them were considered as meaning full to select test items from each factor. One test item having the highest loading on the factor was included in the test battery from each factor. The test items, thus derived, were applied on 500 badminton players to develop the norms and standardize the test item.

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 of the 4 motor skill variables, volleying and serving were the best contributors for volleyball playing ability.

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.

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.

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 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.

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.

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 meters 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.

Singh Gurdial (1990) studied the psychophysical characteristics of the Indian male gymnasts. He reported that leg strength; leg power, arms and shoulder girdle strength, concentration, sports competition anxiety and some of the personality characteristic had significant correlation with competitive performance in gymnastics. He further reported that Indian top level performers were better than the mediocre and low level performers in leg strength, grip strength, arm and shoulder strength.

Uppal (1990) investigated that the explosive leg strength measured by standing broad jump contributes in predicting the performance in 100 m run, 800 m run, long jump and shot put.

Kanwaljeet et.al. (1991) Conducted a study on the prediction of Physical fitness on the basis of cognitive style, an important aspect of personality. For the purpose of study a sample (N=60) consisting of male and female sport participants and non-participants were taken. The participant's level of participation ranged between inter-university and National. Different cognitive styles were studied through their 'locus of control', 'personal causation', 'self-efficacy', and 'engagement style', by employing standardized test batteries. Physical fitness was measured with the help of AAHPER test. Data were analyzed with the help of step-wise multiple regression equation. The value of F-ratio showed that engagement style (4.88), Personal Causation (3.33) self-efficacy (2.87) and influence of powerful others (2.86) were having significant contribution at 0.5 level in predicting physical fitness.
Kumar (1992) conducted a study of motor fitness components as a limiting factors 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–Doolittle 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, 2nd, 3rd, 4th order. The regression equation was finally made through wherry – Doolittle test statistical method. The result of the study reveals that prediction equation of \( X_c = 3.419 X_3 + 0.265 X_6 - 0.141 X_{16} - 0.185 X_{12} + 2.565 X_{14} + 0.693 \) may be considered as valid predictor of performance in handball.

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.

Chandel (1993) conducted a comparative study on physical fitness, physiological and anthropometrics variables between the tribal and the non-tribal. 260 tribal and 220 non-tribal students were taken as subjects of the study. AAHPER youth fitness test battery consisting of six test items- sit up, pull up, standing broad jump, 50- yards dash, shuttle run, 600- yard run/ walk was used to measure physical fitness of the subject. Selected physiological parameters such as pulse rate, blood pressure, and hemoglobin were measured and some anthropometrics measurements were taken. The following conclusions were drawn:

1. A significant difference to mean score of anthropometrics variables was found in favor of the tribal. They were found heavier in weight, better in height, possessing broader shoulder, wider chest cavity, bigger hip, thigh and calf circumferences.
2. The tribal were found superior in all except on physical variables, as significant mean differences was found in variables which were sit ups, standing broad jump, shuttle run, 50-yard dash, 600-yard run/walk. Hence, it could be safely concluded that the tribal were superior in speed, agility, endurance and counterparts.

3. The tribal were superior to non-tribal in physical fitness, cardiovascular endurance and anthropometrics measurements.

Kumari (1993) investigated motor abilities as predictor in performance of hockey player. 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 test for measuring the motor abilities and 10 Hockey skill test 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.

Sangral (1994) studied on thirty nine (N=39) student 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, 6-10 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-sM. 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.

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.

Kennedy et. al. (1994) Attempted a study to 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 ½ 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. These results indicated that in relatively homogenous populations continuous walk, jog movement (1/2 mile run), increased body size, improved balance, bilateral coordination and strength, viz., negatively affected run performance. In contrast more interval related activities increased strength levels in Kindergarten and first grade children’s.

Bracko and Feelingham (1997) conducted a study on prediction of ice skating performance with off ice testing in youth hockey players. The purpose of 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 skating performance. Measurements taken were those of weight, fat percentage and tests were sit and reach test, hip abduction, flexibility, vertical jump, standing long jump distance, vertical jump average and peak mechanical power, sit ups and push ups for one minute. The results indicated that vertical jump, push-ups and average mechanical vertical jump, power were reasonable predictors of skating 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.

Duey et. al. (1997) conducted a study with purpose of developing the prediction of VO2 max in youth soccer players. Highly trained players performed 20-meter shuttle run and laboratory treadmill evaluation. Correlation between directly measured VO2 max and values were predicted by the many equations. It was also concluded that the 20-meter shuttle run is a valid predictor of VO2 max.

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 test 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

\[
Y = 0.3224 X_8 - 1.3957 X_9 + 0.1707 X_6 + 0.2438 X_4 + 0.1536 X_{11} - 1.3532 X_2 + 44.9797
\]

Singh (2003) conducted a study to investigate anthropometries, 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 hand ball players was measured by the panel of three expert judges during 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 –

1. Anthopometrics 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.
The following regression equation were came out to be as
\[ Y = -4.22 + 0.036 X_3 + 0.100 X_{11} + 0.046 X_{13} - 0.094 X_{14} - 3.11 X_{17} - 0.218 X_{18} \]

2. Motor fitness variables namely speed, agility, power of arm, power of legs, cardiovascular endurance and left hand-grip strength were found to be significantly related to the performance of handball players. The equation came to be as under:

The following regression equation were came out to be as
\[ Y = 1.77 - 0.117 X_{19} - 0.331 X_{21} + 0.051 X_{25} + 100 X_{26} + 0.033 X_{31} \]

3. Motor skill variables namely Dribbling, Passing, non-dominant hand throwing ability, throwing accuracy and defensive moment were found significantly related to the performance of handball players the find equation were

The following regression equation were came out to be as
\[ Y = -0.310 + 0.042 X_{30} + 0.050 X_{31} + 0.054 X_{32} + 0.016 X_{34} - 0.169 X_{35} \]

4. 30 m sprint, shuttle run, Sargent jump, 12minute run and walk, handball throw, defensive movement tests belongs to anthropometrics, motor fitness and motor skill variables were found significantly related to the performance of male handball players.

The following regression equation for combined contribution of anthropometrics, motor fitness and motor skill variables were came out to be as
\[ Y= 2.57 - 0.112 X_{20} - 0.285 X_{21} + 0.041 X_{25} + 0.001 X_{26} + 0.030 X_{31} - 0.083 X_{35} \]