CHAPTER - II

REVIEW OF RELATED LITERATURE
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The known facts build up the edifice of the new theories and principles. Review of research studies serve as buckle between the old and the new, between the known and the unknown. It is a milestone lending the research on the high road of future. Review of literature develops researcher's insight and establishes his intellectual superiority over others. A study of relevant literature is an essential step to get a good comprehension of what has been done with regard to the problem under study. "The literature in any field forms the foundation upon which all future work will be built". The literatures relevant to the present studies which have been collected from different sources of reference are described in this chapter.

The objective of the present study is on the prediction of playing ability as well as on the relationship of certain selected variables. A number of such studies have been carried out on various games and sports. The investigator has made an attempt to bring a brief review of such research to form the background for the present study.

STUDIES ON PREDICTION IN GAMES

Thirty varsity baseball players of the University of IOWA were tested by Everti (1952) on ability to throw for distance, running speed and agility (shuttle run), ability to visualize partial relationships (Thurstone's 'S' test) ability to make decisions quickly (The blocks test) and motor capacity (The General Motor capacity score). These subjects were rated according to playing ability by the coach.

Product Moment Correlation, Partial correlation and Multiple correlation were computed and the following conclusions were made: (1) The Sargent jump is the best single measure for selecting baseball talent (2) The best economical combination to predict baseball ability is the sargent jump, 'S' test and the blocks test.

\[ T \text{ score} = 0.92 \text{ sargent jump (cm)} - 0.08 \text{ 'S' test (score)} -0.23 \text{ blocks test (Sec)} + 16.19. \]
Bakker (1969) selected 28 members of the women’s extramural volleyball teams at Illinois State University as subjects. Two experienced volleyball coaches established the criterion by rating each player on their playing ability. The following variables were measured, height, weight, leg extension strength, jumping ability, using the jump and reach test, and an apparatus constructed by the investigation to measure reaction and movement times, through ‘t’ test and correlations it was found that jumping ability and reaction time were significantly related to success in volleyball. A Multiple 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 jumping ability plus weight. The regression equation computed in this study could be used to predict success in volleyball playing.

Holland (1969) predicted the selected variables in determining the ability to play basketball in Small High School. The measures included speed, agility, upper arm length, power, strength, and ball handling ability, reaction time, shooting ability, passing ability, height, weight, age and previous experience. The criterion was the rating of the basketball playing ability of each squad member by his coach. The most important variables were experience, ball handling ability, passing ability and shooting ability. The weighted index \( R = 76 \) was basketball ability score \( 1.54 \) number of years experience \( + (1.23) \) score on speed dribble \( + (0.26) \) score on wall volley \( + (0.15) \) score on shooting test – 10.11.

Smith (1969) formed three groups of subjects each of beginning players. Eleven varsity players and three highly skilled players and three highly skilled and experienced players in the relationship of volleyball playing ability of scores achieved in the sergeant vertical jump. Vertical jump correlated 0.35 with the Brady test, 0.55 with the judges’ evaluation and 0.50 with a combination of Brady test and judges evaluation for the beginning players. The ‘t’ between the vertical jumping ability ranking by their coach was 0.36. It as concluded that vertical jump was not an accurate prediction of volleyball playing ability.

Sprongens (1970) in his study evaluation of general ability, the evidence failed to support the concept that the basic skills course in specific sports involved two groups of college women of low motor ability. On group participated in
badminton, while control group took part in another sport, both the groups then received badminton instruction. There was no difference in performance despite the prior badminton experience of one group.

David and Robert (1977) conducted a study on predicting potential in football players. In the first part of this study the football potential of 67 football players was predicted from their scores on a football potential test. The test battery consisted of motor ability items as well as football skill items (McClay's classification Index. Strength, power, time to hit, audio visual agility, speed, and workout put). Substantial correlations were obtained between most test items and the test criterion the sum of ‘T’ scores, size as depicted by McClay’s Classification Index (CZ) had a negative non significant correlation with the criterion. The disseminative power of the battery was evidenced by the highly significant correlation between the test criterion and the coaching staff’s ranking of individual players (rho = .840). It was concluded that athletic potential in football can be predicted by testing in the second of this study, football teams from three different strata of competition were evaluated on the basis of the same test battery. The battery substantial a stepwise progression between being is noted. The test showed validity in that the criterion (The sum of ‘T’ scores) was significantly different between the teams.

Greenockle (1977) developed the prediction test battery for women’s gymnastics. Twenty two students enrolled in a physical education professional’s gymnastics course at L.V. Participated in supplying the data for the study. The test batteries of 17 physical fitness tests were administered to all subjects at the beginning of the semester. After eight weeks of construction, subjects were rated on 10 different skill combinations and the Wherry-Doolittle test selection was applied to develop the test battery. The final test battery provided a multiple correlation of r = .79 with the ratings.

Dashaies (1978) established a study on psycho-biological variables to predict the performance of junior ice-hockey players. The researcher selected one hundred and sixteen Quebee Junior Major League Hockey Players as subjects who were measured on the variables falling in the biological, psychological and specific motor skill categories. These variables were included in the stepwise regression
analysis with ice-hockey playing ability as the criterion variable. A prediction equation was obtained \( (P = 0.05) \) which included the following four variables: forward speed skating, motivation, visual perceptual speed and anaerobic power. The Multiple Correlation Coefficient obtained was 0.74. The 55 percent of variance in Ice Hockey playing ability accounted for the psychological profile was larger than that observed individually for either the biological (17 percent) psychological (20 percent) of the specific skill profile (33 percent).

Franklin Forgac and Hellerstein (1978) made a study to determine the accuracy of Marathon finishing time among experienced and inexperienced marathon runners and to examine the relationship between the training mileage per week and marathon performance. Perfect performance predictions were provided by 63 first time marathoners (FTM), 29 second time marathoners (STM) and 35 experienced marathon runners (EM). Both FTM and STM consistently underestimated actual marathon time (AT). The standard error of a single prediction \( (S_{yme}) \) expressed in minutes were 31.14 FTM, 22.64 STM, 13.24 EM. EM estimated race, pack and probable performance more accurately \( (P 0.5) \) than FTM. An inverse relationship between training mileage/week and AT was noted for each group \( r = 0.41 \) \( (P 0.01) \) - 0.53 \( (P 0.31) \) (NS) for ETM, STM and EM respectively. Interpretation of these correlations \( (r^2 x 100) \) indicate that only 16.7, 28 and 9.6 percentages of the variability in performance among FTM, STM and EM were respectively explained by difference in training mileage/week. At a given training mileage per week was lower \( (P 0.05) \) for EM than FTM.

Michale (1978) explored the possibility of developing a regression equation whereby football ability could be predicted from an analysis of selected anthropometric measures. Strength tests power measures, balance, standing height and body weight. Subjects were 56 scholarship football players at University of Arkansas. Six Assistant football coaches, three offensives and three defensive rated each offensive and defensive players respectively. This rating on football ability was used as the criterion measure. Stepwise multiple regression and polynomial regression were utilized to form predictive equation. The equation by polynomial regression was: football ability \(-787.65 + 7.33 \text{ bowlegs} -143.22 \text{ (standing height)} -2.60 \text{ (tibiae torsion)} - 33.40 \text{ (horse power)} - 0.408 \text{ (body weight).} \ R^2 = .573 \) and percentage standard error of the estimate was 15.7 percent.
Voll (1979) studied the prediction ability in basic modern dance skills through selected anthropometric and physical fitness measurements. The purpose of this study was to determine the ability in basic modern dance skill could be predicted by means of selected anthropometric and physical fitness measurements. Data for this study were collected on 24 female students participating in one of three North Eastern Pennsylvania Colleges, measurements of height, weight, sitting vertex height, upper leg length, flexibility, abdominal strength, leg strength, cardiovascular fitness and somatic type were taken. On the basis of the findings of this study the author concluded the ability in basic modern dance skills can be predicted from selected anthropometric and physical fitness measurements.

Lamba (1980) compared the selected physical fitness components such as agility, speed, strength, and physiological variables such as blood pressure, pulse rate, breath holding capacity and cardiovascular endurance of offensive and defensive hockey players at college level.

The subjects were 60 male students of four colleges of Gwalior who participated in 1978-79 inter collegiate tournaments. Data was obtained by administering the tests and was statistically analyzed ratio. It was concluded that (1) the offensive players are faster and have less resting pulse rate and thus have more cardiovascular endurance than defensive players (2) The defensive players have more arm and leg strength than offensive players and (3) There is no difference between offensive and defensive hockey players in agility, blood pressure, and breath holding capacity.

Smith (1980) has conducted a study on the effects of anxiety on shooting proficiency among college women basketball players. Members of 1977-78 South Dakota State University Basketball Team (N = 12) were measured on sport competition anxiety test (SCAT) and on state anxiety inventory (SAI) SS in group-I consisted of player who attempted over 122 field goals during the season. While group-II attempted 95 field goals less. Results of ANOVA indicated significant (P = 0.05) difference between groups. A significant ‘r’ was found between scores on the SAI and SCAT. The significant (P = 0.05) multiple regression equation to estimate field goal shooting proficiency from selected measure of anxiety produced multiple
R’s ranging from 0.47 to 0.66 and accounted for between 22 and 44 percent of the variance in performance. A multiple regression equation for predicting free throw success was not significant (P = 0.05).

Battles (1980) conducted an investigation to develop a prediction equation for selection of women inter-collegiate basketball team members. Thirty three women from three colleges in Florida acted as subjects. Each subject completed a personal data form, the athletic motivator inventory, the Knox Basketball test, Sargent jump test, and the field goal speed test; selected anthropometric measurements were also obtained from each subject. Each head coach and assistant coach was asked to rank each member of the team in order to how each contributed to team success. Three different ranking such as head coaches’ rankings and the average rankings of the head and assistant coaches ranking and the average rankings of the head and assistant coaches were included in the statistical analysis. Significant correlations (0.05 level) were found to exist between the head coach’s rankings and the age and college basketball experience, and between the average of the head and assistant coaches ranking and college basketball experience. Results of stepwise multiple regression indicated that player ranked high by head coaches tended to score high on a combination of physical and psychological variables such as college basketball experience, height, vertical jump, mental toughness and the AM total score. Assistant coaches tended to select players with high scores on psychological variables which included trust, responsibility, mental toughness and aggression. The average scores of the head coach and assistants favored players with college basketball experience, responsibility, mental toughness, age and self confidence.

Bandyopadhyay (1982) undertook a study to find out the relationship of selected anthropometric measurements, physical fitness and motor fitness to soccer skill performance. Thirty male soccer players studying undergraduate courses of the Lakshmi Bai national college of physical education, Gwalior, were selected anthropometric measurements (chest girth, upper arm girth, thigh girth, calf girth, height and weight) physical fitness (AAHPER youth fitness test) and motor ability (Barrow’s motor ability test) and soccer skill performance (Mc Donald soccer skill test). Zero order correlation was computed and it was concluded that 1. There is a high correlation between physical fitness and soccer skill performance; 2. Thigh girth
had a significant relationship with soccer skill performance. And 3. The upper arm girth, chest girth, calf girth, height and weight had no relationship with soccer skill performance.

Joseph (1983) determined the relationship of power, agility, flexibility, arm length and leg length to volleyball playing. Thirty male volleyball players of the Lakshmi Bai National College of Physical Education, Gwalior were selected as subjects. Power was measured by Sargent, agility by 40mts, shuttle run shoulder flexibility by graded stick and arm length by steel tape, the playing ability was based on the average subjective judgment of three experts product movement correlation was used to statistically analyze the data and it was concluded that 1. Power is the most reliable single variable in prediction playing ability of men volleyball players, 2. Arm length and leg length are also reliable variable in the prediction of playing ability of male volleyball players and 3. The variables of the agility shoulder flexibility show insignificant relationship in prediction of playing ability of male volleyball players.

Sidhu Grewel and Varma (1984) investigated the positional difference in physique and body competition among top level Indian women hockey players. Thirty Indian hockey players selected who were to participate in the world cup competition to be held at Spain (Madrid) have been studied for structure, weight, skin fold percentage of body fat and an aerobic power. These players were attending the final training camp at National Institute of Sports, Patiala during August 1978. The results showed that the players differ in physique and body composition according to the field position in which the players specialized forwards are highest where as backs were heaviest among all. Amount of fat was more in forwards and in goal keepers. Distribution of fat at the sites of biceps, triceps and sub scapular also showed the same trend.

Chapman (1986) investigated on the prediction of success in women's field hockey. The subjects were 106 players who participated in the international selection and training camps sponsored by the United States Field Hockey Association during the summer of 1978. The specific areas of investigation were anxiety, visual perception manual dexterity, ball control and dynamic balance. 1. Sports
competition anxiety test, 2. Kerkowitz moving embedded figures test, 3. Minnesota rate of manipulation test 4. Chapman ball control test determined by player selection based on subjective evaluation of field hockey. Playing ability served as discriminate function analysis was computed to identify those variables which discriminated between the groups of selected camp participants. A one way analysis of variance was employed to asses the difference between the groups of players according to their applied when a significant f-ratio indicated that differences existed. The Pearson’s correlation was utilized to determine the relationship between some selected predictor variables results indicated that dynamic balance ball control and anxiety were the discriminating variables for the group of selected women hockey players. Visual perception and manual dexterities measured in this study did not discriminate between successful and less successful field hockey players. Years of playing experience was not an important factor in group classification. Classification of subjects determined by the stepwise discriminate function analysis indicated that on the basis of the three discriminating variables. Correct group membership could be predicted 78-95 percent of the time, provided the goalies ball control skills were analyzed separately from those of the forwards the back.

Epstein Stroschin and Pandoff (1987) conducted a study to predict the metabolic cost of standing or walking (MW) and a mathematical equation was developed. However, this equation was limited to speed 2.25 and over estimated the metabolic cost of walking or running at higher speeds. The purpose of the study was to develop a mathematical model for the metabolic cost of running (MR) in order to be able to predict the metabolic cost under a wide range of speeds, external loads and grades. Twelve male subjects were tested on a level of treadmill under different combination of speed and external load. Speed varied between 2.2 to 3.2 M.S.\(^{-1}\) using 0.2 M.S\(^{-1}\) intervals and external loads between 3kg with 10 kg with 10kg intervals. Four subjects were also tested at 2 percent and 4 percent incline while speed and load (L) carried as follows: \(MR = MW = 5 (1-p^{12}) MW - (15 L - 1850)\) watt. The correlation coefficient between predicted and observed values was 0.99 (P 0.01) with SER of 7.7 percent. The accuracy of the model was variably to predict
the metabolic cost of running under different conditions expressed from the literature. In conclusion, the new equation permits calculation of energy cost of running under a large range of speeds and external loads.

_Wharton (1990)_ studied the youth fitness test as a predictive measure of skill development in field hockey. One hundred and seven senior high school girls who had no previous relationship was found between the scores on the youth fitness test and field hockey achievement as measured by the Schmithal's field hockey achievement test.

_Carolina et.al (2002)_ has studied on Prediction function for identifying Talent in 14-15 year old female field hockey players The object of this study was to identify kinanthropometric, motor-physical and psychological variables and specific field hockey skills that influence field hockey performance at the age of 14 to 15 years. The two top girls' field hockey teams in the North West Province (South Africa) U/15 (under 15 age group) field hockey league (n = 27), as well as the two teams who ended at the bottom of the league (n = 25), were exposed to a test battery. The 52 subjects were classified according to their league results as successful and less successful. The test battery consisted of nine field hockey skills tests, 16 kinanthropometric tests and six physical-motor ability tests and two sport psychological tests. A statistical analysis of the data was done for descriptive purposes and statistical significances between the successful and less successful players were determined. Results indicated meaningful differences in some variables. A prediction function was therefore developed consisting of eight variables that successfully distinguished between successful and less successful 14-to 15-year-old female field hockey players.

_Justin et.al(2003)_ has conducted a study to develop an effective testing battery for female field hockey by using anthropometric, physiological, and skill-related tests to distinguish between regional representative (Rep, n = 35) and local club level (Club, n = 39) female field hockey players. Rep players were significantly leaner and recorded faster times for the 10m and 40-m sprints as well as the Illinois Agility Run (with and without dribbling a hockey ball). Rep players also had greater aerobic and lower body muscular power and were more accurate in the shooting
accuracy test, \( p < 0.05 \). No significant differences between groups were evident for height, body mass, speed decrement in 6 x 40-m repeated sprints, handgrip strength, or pushing speed. These results indicate that, sprinting speed, agility, dribbling control, aerobic and muscular power, and shooting accuracy can distinguish between female field hockey players of varying standards. Therefore talent identification programs for female field hockey should include assessments of these physical parameters.

Elferink-Gemser et al. (2004) has conducted a study to determine the relationship between multidimensional performance characteristics and level of performance in talented youth field hockey players, elite youth players \((n = 38, \text{ mean age } 13.2 \text{ years, } sd = 1.3)\) were compared with sub-elite youth players \((n = 88, \text{ mean age } 14.2 \text{ years, } sd = 1.3)\) on anthropometric, physiological, technical, tactical and psychological characteristics. Multivariate analyses with performance level and gender as factors, and age as the covariate, showed that the elite youth players scored better than the Sub-elite youth players on technical, (dribble performance in a peak and repeated shuttle run), tactical (general tactics; tactics for possession and non-possession of the ball) and psychological variables (motivation) \((p < 0.05)\). The most discriminating variables were tactics for possession of the ball, motivation and performance in a dribble.

Marije T. Elferink (2007) has conducted a study to identify performance characteristics that could help to predict future elite field hockey players, we measured the anthropometric, physiological, technical, tactical, and psychological characteristics of 30 elite and 35 sub-elite youth players at the end of three consecutive seasons. The mean age of the players at the end of the first season was 14.2 years \((s = 1.1)\). Repeated-measures analyses of covariance, with standard of performance and measurement occasion as factors and age as a covariate, showed that the elite players fared better than the sub-elite players on technical and tactical variables. Female elite youth players also scored better on interval endurance capacity, motivation, and confidence. Future elite players appear to have excellent tactical skills by the age of 14. They also have good specific technical skills and
develop these together with interval endurance capacity better than sub-elite youth players in the subsequent 2 years. To verify our conclusions, we will be tracking these players into adulthood.

Tim Gabbett (2007) the aim of this study was to determine whether physiological, anthropometric, and skill test results could discriminate between junior volleyball players of varying ability. Twenty-eight junior volleyball players competed for selection in a talent identification volleyball programme. Participants underwent measurements of stature, standing reach stature, body mass, skin fold thickness, overhead medicine ball throw, vertical jump, spike jump, 5-m and 10-m speed, ‘‘T’’ test agility, maximal aerobic power, and passing, setting, serving, and spiking technique and accuracy. A discriminated analysis was conducted on the selected and non-selected groups to obtain a regression equation that could be used to predict selection in junior volleyball squads based on the dependent variables. Passing and serving technique were the only significant variables included in the discriminated analysis. Cross-validation results showed that 17 of 19 selected players (89.5%) and 5 of 9 non-selected players (55.6%) were correctly classified into selected and non-selected groups, respectively, providing an overall predictive accuracy of 78.6%. The results of this study demonstrate that selected skill test results (i.e., subjective coach evaluations of passing technique and serving technique), but not physiological and anthropometric data, discriminate between successful and unsuccessful talent-identified junior volleyball players. These results demonstrate the importance of developing passing and serving technique in talent-identified junior volleyball players.

Ilias Zaptaridis (2009) The aim of the study was to compare physical fitness and selected anthropometric characteristics between selected (SP) and non-selected (NSP) for the Greek preliminary national team male (n=88) and female (n=73) young handball players. Results revealed that compared to NSP players, male SP players presented higher values in ball velocity (p=0.001) standing long jump (p=0.016), 30-m sprint (p=0.034) and estimated VO2max (p=0.018), while female SP
players presented higher values only in ball velocity (p=.009) and standing long jump (p=.045). Male SP players were taller (p=.042) and had larger arm span (p=.031). Taking into account the different playing positions, significant differences (in favor of SP) were found between SP and NSP male backs in stature (p=.008), hand spread (p=.042), arm span (p=.019) and ball velocity (p=.005). Female SP revealed higher values in stature (p=.041) and arm span (p=.046). For wings, significant differences were found in ball velocity (p=.007), 30-m sprint (p=.039) and estimated V02max (p=.002) between SP and NSP male players (in favor of SP) and in estimated V02max (p=.019) between SP and NSP female players. For pivots, significant differences were found only in ball velocity (p=.001) between SP and NSP females (in favor of SP). Finally, no statistically

Significant differences were found between SP and NSP male and female goalkeepers. Current results suggest that physical and anthropometric characteristics should be included in any testing procedure of junior handball players.

Mandeep Singh (2010) this comparative study was conducted to determine the anthropometric measurements and body composition of field hockey teams of India, Pakistan and Sri Lanka. A total of 53 field hockey players from three teams were studied. The participants' height was measured using the standard anthropometric rod, while their weight was measured with a portable weighing machine. Widths and diameters of body parts were measured using digital caliper. Girths and lengths were taken with a steel tape. Grip strength was measured with a hand dynamometer. Skin fold thickness measurements were taken using the Harpenden caliper at 4 sites (biceps, triceps, sub scapular and suprailliac). The percentage of fat was calculated from the sum of 4 measurements of skin fold thickness. It was found that there were no significant differences in height and weight among the three teams, with the Pakistani players recording a slightly higher weight. The Pakistan team had a significantly higher upper arm length (p<0.05) and bi-humorous diameter (p<0.05) as compared to the India and the Sri Lanka teams. The Sri Lanka team had significantly less wrist circumference (p<0.05), hand width
(p<0.05) and lean body mass (p<0.05) as compared to the India and the Pakistan teams. The India team had significantly less % body fat (p<0.05) than the other two teams. More data would be of interest to document the changes in anthropometry and body composition during the season and out of season and also to attempt an analysis of characteristics specific to field positions.

STUDIES ON PREDICTION IN PHYSICAL ABILITIES

Jackson and Frank wing (1979) constructed the 12 minute swim test to provide a practical field test of swimming endurance using the crawl stroke. The pool of 25 yards longer with lane divers is used as testing area. As the signal step watch is started and the swimming pushes off. A participation as signed to each swimmer counts the number of laps on the signal stop, the partner record the closest yard to the swimmers hand and number of complete laps of the swimmer. The validity co-efficient in 0.898; obtained using criterion measures. The reliability co-efficient is 0.98; obtained for test retest method.

Toner (1982) investigated the relationship of selected physical fitness and motor variables to success in female high school basket ball candidates. The study examined the relationship of physical fitness skills and variables success in female high school basket ball players being chosen to become varsity players. Mc Nair’s profile of mood states, cooper’s 12 minutes run/walk test, AAHPER jump and reach test, AAHPER shuttle run test,39 yard dash, AAHPER under basket ball test, speed dribble test were administered to 81male high school basket ball candidates. Each of three teams were treated on three separate occasions during the regular afternoon practice and evaluation period, the few of coaches on the scrimmage competition independently related each candidate as either successful or unsuccessful performance. Discriminate analysis procedure supported the following hypothesis a)The fitness factor, skill testing and personal factors (known together as preseason variables)were successful indicators of group membership while the pomes variable were to a lesser extent b)The battery of tests pre- season and pomes did correlate with coach’s rating.
Schleihouf (1985) conducted a study to measure describe the propulsive forces and motions which are used in the sprint front crawl stroke. A first stage in the study involved the definition of an analysis procedure which may be used to determine the hand and forearm propulsive forces and arm joint tongues used in swimming. The second stage of the study involved the cinematographically analysis of a sampling of 27 high skilled male swimmers. The resulting data were analyzed to determine 1. The types of propulsive forces (lift and drag forces) which are used in the pull. 2. The distribution of the hand propulsive force as it occurs during the under water arm pull.

Sharon Susan and Karen (1985) studied the effect of prior knowledge of loading phenomenon on performance in group relay task among inter collegiate men athletes. 24 subjects were tested in 55 meters dash done and in relay condition. Prior to the relay performance, subjects in the experimental group were informed of the existence possible courses of the social loading phenomenon. Subjects in control group were given no such information. All subjects were provided with their predicted team times based on the sum of their earlier individual performance.

Uppal (1986) conducted a study on motor fitness components as predictors of soccer playing ability. Thirty male soccer players participated in this study in order to evaluate the extent to which the level of motor fitness can help to predict their performance in soccer. All the subjects performed a series of five motor fitness components that tested speed, agility maximum and explosive leg strength and cardio respiratory endurance. A multiple regression analysis was performed and the results indicated that reasonably accurate prediction of soccer playing ability might be made on the basis of the tests of motor fitness components.

Starke (1987) assessed the relative importance of attributes determined largely by the efficiency of the central nervous system verses cognitive attributes in the determination of expertise in field hockey three groups were assessed on a battery field hockey related perceptual and cognitive tasks. The three groups were comedian men's field hockey team, a university team and a novice group. The attributes assessed were simple reaction time, dynamic visual activity, coincident
anticipation, ball detection speed and accuracy, complex decision speed and accuracy. Shot prediction accuracy both when ball impact was viewed and when it was concluded and recall accuracy of game structured and non structured information. The multi task approach revealed the importance of cognitive abilities in the determination of skill in field hockey.

Devi (1990) conducted a study on 24 volleyball players to find out the relationship of selected strength and flexibility measures to playing ability in volleyball. She concluded in her study that arm strength, abdominal strength, leg strength and shoulder flexibility were significantly related to playing ability in volleyball. With flexibility and ankle flexibility had insignificant relationship to playing ability in volleyball. Trunk flexibility showed negative but insignificant correlation to playing ability in volleyball.

Joseph (1995) undertook a study to determine the relationship of power, agility, shoulder flexibility, arm length and leg length to volleyball playing ability. Thirty male volleyball players of the Lakshmibai National College of Physical Education, Gwalior were selected as subjects. Product Moment correlation was used to compute correlation between playing ability and each of the selected independent variables from the findings of study it may be concluded that:

1. Power was the most reliable variable in prediction of playing ability of men volleyball players.

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

Gillett and Eisenman (1997) determined the effect of intensity controlled exercise on the aerobic capacity of overweight, middle-aged women. Thirty eight moderately overweight women, ages 35 - 37, participated in a 16 week dance exercise program. Random assignment was made to an experimental group (n = 20) in which intensity of exercise was controlled and prescribed, and a control group (n = 18) in which exercise was of an intensity typical to commercial aerobic classes. Prior to the onset of training, and at the completion of 16 weeks the following fitness
tests were administered. Aerobic capacity expressed as VO₂ max, body composition analysis, blood chemistry, blood pressure, resting heart rate, muscular endurance and flexibility. T-Tests, ANCOVA and gain-score analyses were utilized to evaluate data. Both groups showed small changes in weight, percent fat, resting systolic and diastolic blood pressure, resting heart rate, high density lipoprotein – cholesterol (HDL – C) muscular endurance and flexibility, but these changes were statistically non-significant. The VO₂ max for the experimental group increased 41%, while the VO₂ max for the control group increased 22% (p < 0.05). The results suggest that the cardiovascular fitness changes for overweight, middle-aged women are greater when exercise intensity and progression are failures to their age and fitness level.

Keogh (1999) conducted a study on the use of physical fitness scores and anthropometric data to predict selection in an elite under 18 Australian rules football team, this study was conducted to determine if anthropometric and fitness testing scores can be used to discriminate between players that were selected or not selected or not in an elite under 18 Australian Rules football side. A training squad of Australian Rules football players was assessed on a battery of standard anthropometric and fitness tests just prior to the selection of 30 man players’ roster for the upcoming season. Results showed that the selected players were significantly (P < 0.05) taller and had greater upper body strength than no selected players. A discriminate analysis was performed which predicted with an accuracy of 80% whether each player was successful or unsuccessful in gaining selection. This suggested that physical conditioning and anthropometric measurements do play an important part in determining selection in elite junior Australian Rules football Teams. However the discriminate function predicted non-selected players (90.9%) better than it predicted selected players (75.9%). Selected under (90.9%) better than it predicted selected players (75.9%). Selected under 18 players were found to be similar to the values reported for elite to sub-elite senior players on height, sit and reach, CMJ and perhaps aerobic fitness, but considerably less that the senior players on 3RM bench press and body mass.

Mosher et al. (2006) compared the effects of two different methods of step bench training on cardio respiratory fitness, body composition and lipoprotein concentrations in college-aged females. Subjects were assigned to one of three
groups: a traditional continuous step (CS), an interval step group (IS), or a non-exercise control group (C). The CS Session included a warm-up, 30 – 35 min of continuous bench stepping, 10 – 15 min of calisthenics exercises, and a 5 min cool down.

**STUDIES ON PREDICTION IN ANTHROPOMETRIC MEASUREMENTS**

*Rash* (1954) studied the relationship of arm length, weight and length to speed arm movement. In this study the length, strength and weight of the arm and its segments measured and correlated with the maximum speed of voluntary movement. From the experimental finding recorded there is no satisfactory significant correlation between the speed of voluntary movement of the hand, forearm and the weight, length and the strength of the arm its segments.

*Clarke* (1957) a study on strength and anthropometric tests, related by correlation method to trunk and leg measures, involving dynamometric strength, muscular endurance and power. All experimental variables were inter correlated and were correlated with each of the trunk and leg criteria by means of the Pearson’s product moment method a coefficient of multiple correlation was computed to select the experimental variables which best represented or accounted for each criterion by wherry Doolittle method.

The multiple correlations significant at the 0.05 level and 0.01 levels respectively were as follows. For these variables 0.34 and 0.41 for four variables 0.39 and 0.47 and for five variables 0.42 and 0.49.

*Clarke* (1957) conducted studies on strengthened anthropometric tests, related by co relational methods be eight trunk and by measure ,involving dynamometric strength ,muscular endurance, agility and power .All experimental variables were inter correlated and were correlated with each of the trunk and leg criteria by means of the Pearson’s product moment method. A coefficient of multiple correlations was computed to select the experimental variables which best represented or accounted for each criterion by Wherry Doolittle method.
The little correlations significant at the 0.05 level and 0.01 levels respectively were as follows. For three variables 0.34 and 0.41, for four variables 0.39 and 0.47 and for the five variables 0.42 and 0.49 (Harrison Clarke).

Reid (1978) examined the relationship of flexibility, strength and anthropometric measurements of the lower limbs to the skating speed of hockey players. 17 university hockey players were assessed for leg and grip strength using cable tension methods, lower limb flexibility using Leighton’s flexometer and technique anthropometry of the legs and skating speed understanding and flying start conditions with and without a stick over two distance feet and 25 meters. The strength, flexibility and anthropometric measures were the independent variables and the skating speed was the dependent variable.

The data was analyzed by using Pearson’s product movement and stepwise or statistical method, the results indicated that flexibility was specific to each joint measured there was a general strength factor and a general skating body type, two of the skating speed test encompassed many factors of the other six flexibility was related to strength anthropometry and flexibility and anthropometry were not related to skating speed. The regression analysis account for all of the variance in each dependent variable but the contributing weight in each analysis. Skating speed was indicated as being specific to the distance and conditions under which it two performed.

Boris Tabatchnik (1978) conducted study on the relationship of anthropometric variables with swimming ability was shown that height, weight, arm length, leg length, length of the limbs etcetera, have little or no correlation with performances. As there is still no clear understanding of the physiological mechanism of the speed deciding abilities, it appears essential to base the identification of swim potential on parameters of an ideal model (Boris Tabatchnik, 1978).

Conger and Wessal (1978) examined quite extensively the relationship between certain anthropometric measures and certain tests of strength and motor ability among physical education majors and non-majors strength tests included grip
strength and pulling strength, back lift, leg lift and total strength. The results indicated that the majors had significantly higher scores on all six tests.

For the selected anthropometric measurements of height, weight, arm length, leg length, chest girth, arm girth, thigh girth and calf girth the data were collected. Statistical statement of data included correlation analyzing using zero order correlation, multiple correlation and regression equation for prediction. Therefore, it may be concluded that the variables such as height, weight, arm length and leg length influence the performance in swimming.

Voll and Bonme (1979) predicted the basis modern dance skills through selected anthropometric and physical fitness measurements. The purpose of this study to determine the ability in basic modern dance skills by means of selected anthropometric and physical fitness measurement. Data for the study one of the three non eastern Pennsylvania college. Measurements of height, weight, leg length, arm length, flexibility, abdominal strength, leg strength, cardiovascular fitness and somoto typing were taken. These measurements and six anthropometric ratios were statistically treated by stepwise regression programme developed by the health sciences computing faulty, university of California at Los Angles. A regression equation with a multiple R of 86 was presented by the author for the prediction tables for its computation were developed. The equation required the collection of five anthropometric measurements and two physical fitness measurements.

Smith (1980) formed three groups of subjects of 68 beginning players. Eleven university players and three highly skilled and experienced players in the relationship of volley ball, playing ability of soccer, achievement in the sargent vertical jump. Vertical jump correlated 0.35 with the brady test, 0.55 with the judges evaluation for the beginning players. The R between the vertical jumping ability rankings by their coach was 0.36 it was concluded that vertical jump was not an accurate prediction of volleyball playing ability.

Peterson (1980) conducted a study to establish the prediction of basketball performance using psychomotor, cognitive and the anthropometric measures female member (N = 43) of the top 4 teams in 1979 Missouri Small College Basketball tournament served as subjects (SS). The contributors were height, weight and
aerobic leg power. Fifteen yard dash, body RT to basketball performance was determined. Height \((r = 0.338)\) was the only significant \((P < 0.05)\) predictor. The 15 yards dash total body RT and power next, the ‘R’ for the 4 top variables was 0.56 \((P < 0.01)\).

Petric (1981) investigated on a sample of 82 junior soccer players from teams in the first and second national soccer league, aged 16 to 18 in the SAP VOJUODINA served to register 15 variables for assessment of hypothetical factors as explosive strength precision and agility to predict soccer players separately by means of a seven mark scale. The results of regression analysis showed that achievement in soccer in soccer could with great certainly be predicted on the basis of the results in motor tests. The greater contribution in prediction was the tests whose separate elements were similar to those in soccer play.

Pal (1984) tested on 100 students of the first year class of Bachelor of Physical Education of the Lakshmi Bai National College of Physical Education, Gwalior. AAHPER youth fitness test battery was administered to obtain the Physical Fitness battery was administered to most valuable anthropometric measurement in prediction of physical fitness of the male student. The most valid combination of anthropometric measurements in relation to physical fitness of the subjects. He concluded that height was the most valuable anthropometric measurement in prediction of physical fitness of the male students. The most valid combination of anthropometric measurements in relation to physical fitness were height, weight and chest girth.

Burke, Reid and Gollan (1985) conducted a study on Austrian Rules football: an anthropometric study of participants they found anthropometric measurements and personal data were collected from 119 Australian Rules footballers from Victoria. A top level professional league team, a second level association team, and an A - grade amateur association team were observed, representing three levels of ability. The profile of physical features of these athletes at the beginning of the seasons is presented. A gradation of body size was observed between teams. The players in the top level team were slightly taller and heavier than those in the other teams. They had less body fat, as shown by lesser skin fold
thickness, a smaller percentage body fat as determined by prediction equations, and a greater fat-free mass. The intermediate level team showed an intermediate level of body fat and the lower level team had a highest proportion of fat.

A theoretical model was developed by Grimstone and his associates (1986) to identify anthropometric variables relevant to success in swimming Frontal Gross Section area and lengths of body segments were measured on twelve member of a men college team using a photographic procedure. Motion picture films were taken by the subjects competing in free style events and were analyzed to determine the average stroking speed correlation and multiple regression procedures were used to determine the relationship among the anthropometric variables selected with aid of the theoretical model, 6 were found to be significant related to one or more of the measure of swimming performance, when the influence of event distance was pigtailed out.

Toriola, Adelhiran and Orunrenin (1987) comparatively assessed the body composition and anthropometric characteristics of elite male basket ball (n=15) and volley ball (n=15) players and male non athletic (n=20) at the university of Nigeria. The ages of the subjects aged from 19 to 29 years. Analysis of variance and Newman-keup post hoc method were used to determine significant difference in the physical characteristics of the groups, the basket ball players were significantly taller and had markedly larger humerus width than the volley ball and non athletic groups(<0.05).The non athletes had significantly higher percentage of body fat values than both the groups of athletics (0.05) the basket ball(4.30) and volley ball (4.40)players who have where predominantly ectomorph had significantly higher ectomorphic component (p>0.05)than the non athletes (2.5).The difference observed between the athletic groups were related to the morphological factors rich influence the basic components of competitive sports performance.

Quarrie (1996) investigated the anthropometric a physical performance characteristics of New Zealand rugby players of different ages and both sexes. Methods: 356 rugby players (264 male, 92 female) took part in the study during a single season. Playing grade ranged form school boys and school girls to senior men and women. Assessment of height, weight, neck circumference, and somato
type was performed before the comparative rugby season. A battery of six physical performance assessments was completed after the anthropometry. Analysis of variance was used to examine differences in these variables between field positions and grades. Significant differences between forwards and back on anthropometric and physical performance variables were apparent at all grades assessed. In terms of anthropometric characteristics, forwards of a grade assessed. In terms of anthropometric characteristics, forwards of a given grade were generally taller, possessed greater body mass, and were more endomorphic and less ectomorphic than backs of the same grade. The backs tended to perform better on physical performance measure than forwards. Being more aerobically fit, faster, more agile, and possessing a higher degree of muscular endurance. Differences in anthropometry and physical performance attributes were also apparent between players from the various grades. The players at higher levels were generally larger, and performed better on tests of physical performance than the players at lower levels.

Kukolj (1999) conducted a study on anthropometric, strength and power predictors of sprinting performance. The purpose of this study was to examine relation between sprinting performance (i.e., average velocity within both the initial acceleration and maximum speed phases of spring running) and some standard anthropometric, strength, and power test. Methods: Twenty – four male students of physical education were timed over the distance of 0.5 – 15 m and 15 – 30 from the sprint start. Several measures of muscle isometric strength (knee extensors, hip extensions and flexors) and power (height of the counter movement jump on the average power of leg extensors during the continuous jumping) were also collected, in addition to the lean body mass and the percentage of both muscle and fat tissue. The results obtained demonstrated that, except for the height of the tissue. The results obtained demonstrate that, except for the height of the tissue. The results obtained demonstrate that, except for the height of the counter. The results obtained demonstrated that, except for the height of the counter movement jump, all correlation coefficients between the selected variables and sprinting performance were low and, therefore, insignificant. As a consequence, multiple correlation coefficients were also low. (0.43 and 0.56 for the initial acceleration and maximal
speed phase, respectively). Conclusion: Most of the standard anthropometric, strength and power test could be poor predictors of sprinting performance. A better assessment of sprinting performance could be based on more specific tests that, unfortunately, require more complex measurements.

Koo (2000), in his study Infancy is the period of most rapid postnatal growth and is accompanied by major changes body composition (BC). There are many challenges to successfully measuring BC of infants in vivo, which include the inherent limitations in the underlying assumptions for each technique. The small body mass and rapid non uniform changes in body parts, that is, the components of BC during infancy, can strain the technical limits of all methods. Many techniques for in vivo BC measurement used in older people have been applied to infants. However, the vast majority of them are either difficult to adapt for widespread use in infants, or the roles and limitations for using them during infancy all defined because of limited or no critical validation and cross-calibration studies. Based on validation data from animals, well-defined methodological issues in data acquisition and analysis, availability of normative data, and pertinent accuracy and precision of the technique to allow us to determinate clinically relevant changes in BC within a reasonable time interval, three techniques appear to be most suitable for in vivo BC measurement in infants.

Anthropometric measurements can be used in field studies or for group comparisons and total body electrical conductivity (TOBEC) and selected dual energy X-ray anthropometry (DXA) measurements can be used to compare BC in individual infants. DXA has the advantages of being able to measure bone mass and the potential to be adaptable to the widely available existing instruments. However, regardless of the techniques used in measuring BC in infants, meticulous attention to details in data acquisition and data analysis, and knowledge of the limitation of the particular technique are the prerequisites for generating valid data.

Wang and Thoroton (2000), in his study Anthropometry is a simple reliable method for quantifying body size and proportions by measuring body length, width, circumference, (c), and skin fold thickness (SF). More than 19 sites for SF, 17 for C, 11 for width, and 9 for length have been included in equations to predict body fat
percent with a standard error of estimate (SEE) range of +/- 3% to +/- 11% of the mean of the criterion measurement. Recent studies indicate that not only total body fat, but also regional fat and skeletal muscle, can be predicted from anthropometrics. Our Rosetta database supports the thesis that sex, age, ethnicity, and site influence anthropometric predictions: the prediction reliabilities are consistently higher for Whites than for other ethnic groups, and also by axial than by peripheral sites (biceps and calf). The reliability of anthropometric depends on standardizing the caliper and site of measurement, and upon the measuring skill of the anthropometric. A reproducibility of +/- 2% C and +/- 10% for SF measurements usually is required to certify the anthropometric. Long as the treatment thrust was in a posterior to anterior direction and the hand contact fit onto the sensor pad (are = 100 cm(2)).

RESULTS: There were no significant differences (P < 0.05) between male and female chiropractors for any measurements in the upper thoracic area. For the lower thoracic manipulations, the preload forces for the male chiropractors were significantly greater (P < 0.05) than those female chiropractors. The remaining variables were the same between the 2 female chiropractors. The remaining variables were the same between the 2 groups. CONCLUSIONS: Female chiropractors produce, from a mechanical point of view, similar manual treatment as their male colleagues.

Rienzi (2000), investigated anthropometric and work – ratio profiles of elite South American soccer players during international competition and examines the relationship between anthropometric profile and work – rate variables. Methods: Seventeen full – time professional soccer players were filmed while competing for their countries; Anthropometric profiles were obtained for eleven of these players. Six full – time professional players from the English premier league were also filmed for comparative purpose Results “The South American international players covered significantly less (P < 0.05) total distance during match – play than English Premier League players (International, 8638 +/- 1158 m; English Premier League, 10104 +/- 703.) Them total distance covered during the second half distance for both groups of players (mean +/- SD first half 4605 +/- 625 m; mean +/- SD second
half 4415 +/- 634 m). The data for both groups of players were combined to evaluate positional difference in the work rate profile. Midfield players covered a significantly greater (P < 0.05) distance than forward players covered a significantly greater (P < 0.05) distance than forward players (midfield, 9826 +/- 1031 m; forwards, 7736 +/- 929 m) and defenders covered a greater (P < 0.05) distance jogging backwards than forward players (defenders, +/- 155 m; forward 68 +/- 25 m). Forward sprinted a greater distance (P < 0.05) then defensive players (defenders, 231 +/- 142 m; forwards 557 +/- 142 m). Mean somato type was balanced mesomorph (2-51 / 2-2). Body mass related to the total distance covered (=0.43, r = 0.53, P < 0.05). Conclusions: Based on these data, it seems that an individual's work-rate profile is dependent upon the type of competition and playing position. Relationship between anthropometric profile and work-rate are complex due to the interaction between the variables that determine work-rate.

Maroos and Landor (2001) found out that physical activity and fitness have important health promoting effects with respect to arteriosclerosis and coronary heart disease in particular. An intervention study of physical status and activity in university undergraduates (university of Tartu) has been carried out. The physically inactive (Group I) consisted of 310 undergraduates (235 females and 75 males) of the Faculty of Medicine. They physically active (Group II) was recruited among undergraduates (22 females and 23 males) of the Faculty of Exercise and Sport Sciences, who participated in training sessions regularly, 3 to 5 times per week. Anthropometric body measurements, arm force, vital capacity and exercise test on the bicycle ergometer (PWC 170) were performed. There were no statistically significant differences between the mean values of anthropometric indices in case of physically inactive and physically active female.

Subjects in the group of physically active male undergraduates, weight and shoulder width were larger than in students with physically sedentary life style (P < 0.05). Most of the female and male students had normal BMI. There were statistically significant differences in the mean values of vital capacity, arm force and
aerobic working capacity \( (P < 0.001) \). Mean anthropometric indices demonstrated a statistically significant increase in both female and male university undergraduate after the interval of 30 years. Normal BMI and anthropometric indices do not serve as a graduate of physical fitness for university undergraduates who are involved in sedentary life style. Regular physical activity has a strong positive impact on physical fitness, particularly on aerobic capacity, which is the most important health promoting component of physical fitness with respect to coronary heart disease.

Strudwick, Relly and Doranl (2002) administered anthropometric and fitness profiles of elite players in two football codes. The aims were to describe anthropometric and performance characteristics of elite players in two footballs codes and explore the differences between them. Data was compared by means of \( t \) - tests. Subjects were 19 professional soccer players and 33 inter-countries Gaelic football player. Settings: measurements were made on members of Premier League soccer team throughout their regular session, whilst the Gaelic footballers were members of the Mayo squad preparing for the 1999 All – Ireland championship. Result will be the variability in stature was significantly grater in the soccer players compared to the Gaelic footballers \( (p < 0.01) \). Performance in the 10-m and 30-m sprints and in vertical jump was superior in the soccer group compared to the Gaelic footballer \( (P < 0.01) \). Conclusion is that the intra – group variability on the anthropometric and performance measures of the soccer players is likely to be due to the specificity of positional roles. The combined groups could be described as lean and muscular with a reasonably high level of capacity in all areas of physical performance. Anaerobic characteristics of the professional soccer players were superior to those of Gaelic football players. It is concluded that anthropometric and performance assessment of elite footballers using mean values the heterogeneity evident within the football codes.

Nahum and Stanislaw (2003) investigated the relationship between paternal characteristics and birth weight. STUDY DESIGN: A total of 241 gravitas with uncomplicated, singleton, term pregnancies were studied. Maternal demographic and pregnancy – specific characteristics were used to previously validated birth
weight predication equation. The additional independent predictive value of 4 paternal variables was assessed using multiple regressions. RESULTS: Before adjustment for other variables, paternal age and body mass index did not. After controlling for maternal and pregnancy-specific factors that are known to influence fetal weight, only paternal height was significant as a predictive variable. The proportion of variance in birth weight that could be independently explained by paternal height was 2% A 10-g gain in fetal weight was associated with each centimeter of increase in paternal height (P < .02). Using the resulting combination equation that included paternal height as a variable, 31% of the variance in term birth weight could be explained, and birth weights could be accurately predicted to within 8.3% (288 g). Fathers with heights 2 SD above and below the mean had the term birth weight of their offspring increased and diminished by 125 g, respectively. CONCLUSION: Paternal height explains an independent portion of the variance in term birth weight among normal newborns of up to 250 g that cannot be explained by other maternal or pregnancy-specific factors. Paternal age, weight and body mass index do not independently influence birth weight.

Sports participation, backpack weight, and way of carrying (one versus both shoulder) in relation to magnitude of scoliosis, thoracic kyphosis, lumbar lordosis, and DP and LBP and DP than boys (P < 0.001). There was no difference in the prevalence of LBP and DP between adolescents and children. Student's age, height, and body weight as well as magnitude of kyphosis, lordosis and did not correlate with either LBP or DP. At the age of 11 years, girls and boys showed the highest prevalence of LBP (72% and 38.5% respectively), while at the age of 14 years, girls reported significantly (P < 0.05) more DP than bys. Girls showed the highest prevalence of LBP (71%) at the age of 11 years, while for the boys, it was at the age of 15 years (21%). Girls showed at the age of 11 years significantly more LBP (P < 0.05) than boys. Sports exposure seemed to increase LBP in girls (P < 0.001). The results of this study suggest a differential DP and LBP prevalence in school children and adolescents carrying backpacks with regard to gender and age. The peak in pain prevalence was immediately before puberty as well as immediately after its onset.
Girls who participated in sports activities seem to experience more often DP and LBP than boys. Short children who carry backpacks as heavy as do tall children at the same age are more prone to LBP.

**APPRAISAL**

An analysis of early studies presented in this chapter clearly showed that there are number of studies on speed, endurance standing height, arm length, dribbling, dribble and shooting, and other games like football, Basketball etc.

But there is no single study which has included all the variables such as physical, anthropometric variables and fundamentals skills on Hockey playing ability. Therefore a need is felt in the present investigation to study the relationship between physical variables namely speed, and endurance, Anthropometric variables namely standing height and Arm length, fundamental skills namely dribbling, and dribble and shooting to hockey playing ability.