CHAPTER - II

REVIEW OF RELATED LITERATURE

A sincere and exhaustive attempt has been made by the researcher to present in this chapter some relevant and useful studies and references covering different areas after exploring all possible sources and the findings and conclusions of those studies and references have been carefully extracted and cited below in order to make a comparison with the present study and interpretation thereon.

II.1 Related Studies on Football

Rydalch\(^1\) conducted a study on 812 football players from 17 junior colleges located in eight states to see the relationship between fourteen biographical factors and players' success in junior college football. The head football coaches of their respective participating colleges rated their own footballers and then the ratings of the coaches were analyzed by multiple correlation and regression analysis. The findings of the study were: (i) twelve independent variables which were analysed were significantly related to football success at 0.01 level and (ii) six factors - honours, speed, weight, team record in high school, height and size of school were selected as those variables with the highest relationship to success.

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Donald Doyle Rydalch, "A Study to Identify and Analyse Biographical Factors which predict player success in Junior College Football" \textit{Dissertation Abstracts International} 32 (September 1971): 1323 - A.
Talton\textsuperscript{2} made a study to determine whether selected physical and psychological assessment can be utilised as the predictors of successful interscholastic football players. Subjects were 156 football players selected from eleventh and twelfth standards of a public school and the subjects were grouped as successful and unsuccessful footballers based on the performance in the 1971 football season.

The 34 structural, strength, motor and Psychological assessments in this study were statistically evaluated as a combination of variables which have a high predictive power in differentiating the successful footballers from the unsuccessful ones.

A single predictive variable was not identified; however two combination of variables were selected such as the Short Test Battery and the long Test Battery.

Bandyopadhyay\textsuperscript{3} in a study tried to establish a relationship between soccer skill performance and selected anthropometric measurements, physical fitness and motor ability. Thirty male soccer players were randomly selected from the undergraduate classes of L.N.C.P.E, Gwalior to act as the subjects. Subjects were tested in selected anthropometric measurements (chest girth, upper arm girth, thigh girth, calf girth, height and weight).

\begin{footnotesize}
\begin{enumerate}
\item[3] Subhas Chandra Bandyopadhyay, "Relationship of Selected Anthropometric Measurements, Physical Fitness and Motor Ability to Soccer Skill Performance" (Unpublished Master's Thesis, Jiwaji University, Gwalior 1982).
\end{enumerate}
\end{footnotesize}
physical fitness (AAHPER Youth Fitness Test), motor ability (Barrow’s Motor Ability Test) and soccer skill performance (McDonald Soccer Skill Test). After computing zero order correlation it was concluded that: 1) there is a high correlation between physical fitness and soccer skill performance and between motor ability and motor 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.

Amusa\(^4\) conducted a study on 46 well conditioned experienced college level soccer players. They were tested for running speed, power, agility, max VO\(_2\), strength, anaerobic capacity and flexibility. In addition, eleven anthropometric measurements consisting of skinfold and body diameters were also taken. Soccer playing ability served as the criterion which was measured by the ratings of three experienced soccer coaches based on selected soccer skills and strategies. The conclusions of the study were: 1) age (experience) is the best single predictor of playing ability; 2) weight and height are considered good predictors of playing ability; 3) VO\(_2\) max and running speed are considered important factors in soccer playing. Flexibility, agility, lactate concentration and leg power are not considered as valid indicators of playing ability.

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Campbell\textsuperscript{5} administered tests on height, weight, 10, 20, 30 and 40 yard dash, speed, vertical jump, agility, upper body strength and lateral movement on 40 male members of the 1978 Springfield College Varsity football squad. Additionally, each player was awarded a game performance score assessed by the grading of a game film selected at random. He observed that 1) no relationship were found between height and weight and performance nor between agility and performance 2) no relationship was found between upper body strength and performance 3) Speed was found to relate positively to performance. Finally he concluded that performance in football can not be effectively predicted by combinations of the structural and physical performance variables utilised in his study.

Ellena\textsuperscript{6} in a study to find the relationship between physiological factors and football performance administered on the footballers the tests in 50 yard dash, right grip, left grip, and arm push and pull strength. The criterion measure of the study was the duration computed in minutes played by the footballers during the 1958 football season. Speed correlated 0.60 and total strength 0.40 with the criterion. Both correlations were significant but the predictive value for minutes played was little.

\textsuperscript{5} Donald R. Campbell, "The Relationship of Selected Measures of Physical Performance and Structure to Quality of Performance in Collegiate Football" \textit{Completed Research in Health, Physical Education and Recreation} 22 (1980) : 142.

Basunia\(^7\) studied the relationship of height, agility and flexibility to reaction time, vertical jump and sprinting speed of soccer players. The subjects were the soccer players of the undergraduate classes on L.N.C.P.E., Gwalior. The findings of the study reveal that there was no significant correlation between height and reaction time, vertical jump and speed. There was a high correlation between flexibility and speed (0.53) at 0.05 level of confidence. Flexibility has no significant relationship with vertical jump and reaction time. From this findings it was concluded that 1) agility was the most important variable in the prediction of reaction time and speed of men soccer players but no contributed in the performance of vertical jump; 2) Flexibility contributed much in developing speed but did not contribute in developing the reaction time and vertical jump; 3) Height was not a factor in developing the reaction time, vertical jump and speed; 4) It may be concluded that in selecting soccer players greater emphasis may be given on agility and flexibility.

The purpose of the study of Kaiser\(^8\) was to determine any relationship or differences in pain tolerance and mental toughness with the collegiate football players. The study was conducted on 65 varsity football players of Idaho State University. In order to measure pain tolerance and mental toughness the author made use of an adaptation of Poser's

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\(^7\) Satyajit Roy Basunia, "Relationship of Height, Agility, Flexibility to Reaction time, vertical jump and sprinting speed of soccer players" (Unpublished Master's Thesis, Jiwaji University, 1982) : 54-57.

\(^8\) Richard Allen Kaiser, "Relationship and Differences in Pain Tolerance and Mental Toughness for Collegiate Football Players". *Dissertation Abstracts International* 42 : 6 (December 1981) : 2561-A.
mechanical gross pressure stimulator and the athletic motivation inventory respectively. The statistical analysis included correlation coefficients for variables and an inspection of unit and position means. The conclusion of this study was evident between the pain tolerance and mental toughness within collegiate football players.

II.2 Related Studies on Volleyball

Mathew\textsuperscript{9} undertook a study to determine the relationship of selected anthropometric measurements (height, weight, arm length and upper body length) to performance on Brady Volleyball Test. Product moment correlation (zero order) was computed to study the relationship between the volleyball playing ability and each of the anthropometric measurements as stated above. It was concluded from the findings of the study that the variables of height, weight and arm length showed significantly higher relationships to performance on Brady Volleyball Test as compared to the significant but low relationships of leg strength and upper body length with performance on the same test.

Joseph\textsuperscript{10} conducted a study to determine the relationship of power, agility, shoulder flexibility, arm length and leg length to volleyball playing ability. The subjects were 30 male volleyball players studying in L.N.C.P.E., Gwalior. Product moment correlation was computed for finding the correlation between volleyball playing ability and each of the selected independent variables.

\textsuperscript{9} Pins Mathew, "Relationship of Selected Anthropometric Measurements to Performance on Brady Volleyball Test" (Unpublished Master’s Thesis, Jiwaji University, 1984) 18 - 40.

variables. The conclusions drawn from the findings were: 1) power is the most reliable variable in prediction of playing ability of men volleyball players; 2) arm length and leg length are also reliable variables in prediction of playing ability of male volleyball players; 3) agility and shoulder flexibility were not significant in prediction of playing ability of male volleyball players.

Smith\textsuperscript{11} did a study to establish the relationship between volleyball playing ability and the scores achieved in the Sargent jump. Subjects were 68 beginning volleyball players, 11 varsity volleyball players and 3 highly skilled and experienced volleyball players. It was observed in the study that vertical jump correlated 0.35 with the Brady Volleyball Test, 0.55 with the judges evaluation and 0.50 with a combination of Brady Volleyball Test and judges evaluation for the beginning players. The 'r' between the vertical jumping ability of the varsity players and potential playing ability ranking by their coach was 0.36. Conclusion was drawn that the vertical jump is not an accurate predictor of volleyball playing ability.

Bakker\textsuperscript{12} made study to identify the factors contributing to success in volleyball. The subjects were 28 members of the Women's extramural Volleyball teams in Illinois State University. Two experienced Volleyball coaches established the criterion by rating each player on her playing. Variables selected for the study were: height, weight, leg extensors strength, grip strength, skinfold measures, jumping ability, reaction time and movement

time. 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 mine variables and the criterion, and 'R' of 0.53 was obtained between the combined reaction time and jumping ability and the criterion, and 'R' of 0.52 between the criterion and jumping ability plus weight. The author concluded that the regression equation computed in this study could be used to predict success in volleyball playing.

Marrow et al.\textsuperscript{13} conducted a study to establish the importance of strength, speed and body size for team success in women's inter-collegiate volleyball. Various anthropometric, strength and speed variables were collected on 180 intercollegiate women volleyball players who participated in the regional round robin tournament. The results of the study showed that the stronger, faster and leaner, the teams were the most successful in tournament play. The multiple discriminant analysis helped to identify the two most important individual variables of team success. Upper body strength and fat weight were identified as most important in differentiating between players of the most and least successful teams.

Phipps\textsuperscript{14} compared selected general ability tests, specific skill tests and personality traits as predictors of volleyball playing ability in high school girls. Another purpose of the study


\textsuperscript{13} James R. Marrow et al., "Importance of Strength, Speed and Body size for Team Success in Women's Inter-Collegiate Volleyball", Research Quarterly 50 (October 1979) : 429.

was to find out which of these variables had the highest relationship with overall performances. To develop prediction equations from the three variables or combinations of the variables and to determine the validity of the selected equations was also another purpose of this study.

The general ability tests, three specific skill tests and a personality test were administered on 120 high school girls trying out for varsity teams in six schools. The coaches of each team assigned a subjective pre and post season score of each of their respective players. The post season score was used as a criterion measure. The data from three of the schools were used to develop prediction equations while the data from the remaining schools were used to validate the equations. It was concluded that 1) there is a little relationship between selected tests of general physical ability and volleyball performance; 2) there is a substantial relationship between selected specific skill tests and volleyball performance; 3) there is a little relationship between selected personality traits and volleyball performance; 4) there is a substantial relationship between volleyball performance and the following combined models: Specific and general, specific and personality and specific, general and combined; 5) the specific test model is the best predictor of volleyball performance; 6) the best combined model for prediction is the general and specific; 7) the specific test model and combinations of the general ability and personality with the specific are better predictors of volleyball performance than the coaches.
Shondell\textsuperscript{15} conducted a study to identify physical and anthropometric traits possessed by successful collegiate volleyball players. On the basis of literature review and interview of the coaches, a group of 25 tests and measurements was selected to measure the characteristics of a successful player. The overall volleyball performance judged by four experts served as the criterion measure. Subjects were 93 who completed all 23 items. Statistical techniques used provided inter-correlation coefficients of the independent variables and the dependent variables, stepwise regression coefficients and constants and the square of the multiple correlation coefficients for the regression equation at each step. Conclusion of the investigation were: 1) power was the most significant factor in successful volleyball performance; 2) strength did not appear to be a factor in successful volleyball performance and 3) six item battery is valid prediction of volleyball performance.

Sridhar\textsuperscript{16} made a study to determine relationship of power, agility, flexibility, muscular endurance and circulo-respiratory endurance to volleyball playing ability. Subjects were 30 volleyball players studying in L.N.C.P.E., Gwalior. Sargent jump was used to measure power. Side step test to measure agility, trunk flexion for flexibility, pull-ups and bent-knee sit-ups for muscular endurance, and one minute lateral jump test to measure circulo-respiratory endurance. The playing ability of each player was judged by a panel of three experts. Product moment

\textsuperscript{15} Donald Stuart Shondell, "The Relationship of Selected Motor Performance and Anthropometric Traits to Successful Volleyball Performance", \textit{Dissertation Abstracts International} 32 (March 1972) : 5026-A.

correlation was computed to statistically analyse the data. The findings of the study led to the following conclusions: 1) Power was the most significant motor fitness component that contributes successful performance in volleyball; 2) muscular endurance, circulo-respiratory endurance and flexibility also contributed to the volleyball playing ability and 3) agility showed an insignificant relationship to volleyball playing ability.

II.3 Related Studies on Basketball

Peterson\textsuperscript{17} conducted a study to determine some variables based on Psychomotor, cognitive and anthropometric measures as predictors of basketball playing ability. Subjects of the study were 43 female basketball players of the top four teams in the 1929 Missouri Small College Basketball Tournament. The selected variables were G.P.A., anaerobic leg power, 15 yard dash, 30 yard dash, total body RT, TRT, height and weight. Basketball performance was assessed by a specially designed formula developed by A.K. Kay. Height ($r = 0.388$) was the only significant ($P < 0.05$) predictor observed in this study. The 15 yard dash, total body RT, and power were next. The R for four top variables was 0.56 ($P < 0.01$).

Battles\textsuperscript{18} undertook a study to develop a prediction equation. Thirty-three subjects were selected from three colleges in Florida. Each subject completed a personal data from the


Athletic Motivational Inventory the Knox Basketball Test, Sargent Jump Test, and the Field Goal Speed Test. Some selected anthropometric measures of the subjects were also included in the investigation. Each head coach and each assistant was asked to rank each member of the team in order of his contribution to achieve success of the team. Head coach's rankings, assistant coach's rankings and the average rankings of the head and assistant coaches were included in the statistical analysis. This study observed a significant correlations (0.05 level) between the head coaches' rankings and the age and the basketball experience at college; and between the average of the head and assistant coaches' rankings and college basketball experience. Results of the stepwise multiple regression indicated that the players who were ranked high by the 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 AMI total score. Players who scored high on Psychological variables such as trust, responsibility, mental toughness and aggression were favoured by the assistant coaches in selection. The average ranking of the head coach and the assistant(s) favoured players with college basketball experience, responsibility, mental toughness, age and self confidence.

Holland\textsuperscript{19} conducted a study of some selected variable predictive in determining basketball playing ability in small high school. Selected variables were speed, agility, upper arm strength, power, ball handling ability, reaction time, shooting ability, passing ability, height, weight, age and previous

\textsuperscript{19} Kenneth A. Holland, "The Predictive Value of Selected Variables in Determining the Ability to Play Basketball in Small Schools", \textit{Completed Research in Health, Physical Education and Recreation} 7 (1965) : 37.
experience. The criterion measure was rating of the basketball playing ability of each subject done by his coach. The findings of the study were that 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.

Gilbert\(^{20}\) investigated a study on selected variables for predicting basketball playing ability. The author observed that ability criterion, arm strength, penny-cup test and speed pass test are those four independent variables which form a battery selected from 10 variables and this battery test reflects composite basketball ability and performance at the college level. However, since the derived multiple ‘r’ of 0.95 was not reached. This limits the utilisation of this battery as a predictive measure of basketball playing ability.

Gardan\(^{21}\) used selected tests as predictors of basketball playing ability of college women. The purpose of the study was to determine the value of cardiovascular capacity measure (Cooper’s 12-minutes Run/Walk) Leg power measure (Modified Sargent Jump-Reach) or upper body muscular strength and endurance (flexed arm hang), a percentage of body fat measure (skinfold thickness) and a body height as predictors of basketball playing.

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ability and to develop a statistical equation for predicting success in playing college basketball. The basketball playing ability or criterion measures were ability rating, personality ability rating, composite ability/personality rating, Null comparative rating scale and ranking of players by the coaches. The subjects of the study were 20 female basketball players from the 1976-77 University of Arkansas and North Eastern Oklahoma State University teams.

The stepwise multiple regression programme was utilised to form prediction equations by the five tests of predictor variables being correlated with each of the five basketball playing ability measures. The prediction equations were selected using only those variables which had the lowest standard error of estimate and the greatest 'F' value. The equation produced a correlation coefficient of 0.786 and a standard error estimate of ± 0.392. The prediction equation from stepwise multiple regression programme of basketball ability = 9.0532 + 1.36421 (12 min. run) - 0.11303 (Height).

From the results of the study the following conclusions were drawn: 1) The cooper's 12 minute run and height are the best measures for predicting basketball ability in this study; 2) Measures of leg power and upper body strength and endurance are of limited value; 3) Body composition measures have some value in predicting basketball playing ability of college women.

Hachn\textsuperscript{22} undertook a study on Knox Basketball Test as a predictive measure of overall basketball playing ability in female high school basketball players. The four test items of Knox

basketball test was administered in 198 women basketball players. The stepwise multiple regression analysis showed that the only test item that significantly predicted (P < 0.05) the selection of players to the varsity and junior varsity teams was the dribble shoot test. This test item also had a significant correlation with rankings of the coaches for varsity as well as junior varsity players. The speed pass and the speed dribble significantly predicted the division between junior varsity and varsity players. Although the comparisons were significant, the skill tests accounted for only 11.1% to 28.3% of the total variation in the dependent variables.

Ellenburg²³ conducted a study to determine the value of a battery of ten skill tests and the personal factors of age, height and weight in predicting game performance of high school basketball players. Subjects of the study were 110 selected high school varsity basketball players in the 1969-70 basketball season. The performance rating chart designed by the winter was used to collect data on performance. Means, standard deviations, product moment correlation coefficients and beta coefficients were computed from the data on the preseason and performance variables. The study revealed the following: (1) The 30 seconds shooting test and vertical jump are the most reliable predictors for the performance variables used in the study, (2) Height, hand grip, vertical jump, wall volley and 30 seconds shooting test are the most important variables contributing to a player’s performance in this study. The five item test battery consisting of height, hand grip, vertical jump, wall volley and 30 second

shooting test can be practical and useful instrument in predicting zone performance for high school basketball players.

Childress\textsuperscript{24} in his study to identify and determine the effectiveness of selected physical variables in predicting a successful basketball performer through a factor and discriminant analysis administered twenty four selected test items after a review of related literature on 106 high school basketball players. The resultant data were analysed 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 and the second consisting of ten test items. The results of the study indicated that the components of basketball playing ability could be isolated, measured and utilised to construct an evaluative tool for classifying players into two populations identified as successful and unsuccessful.

Toner\textsuperscript{25} tried to find out the relationship of physical fitness, skill and mood variables with success in female high school basketball players seeking selection for the varsity teams. McNair's profile of Mood states, Cooper's 12 Minutes Run Test, AAHPER's Jump and Reach Test, 30 Yard Dash, Shuttle Run Test,

\textsuperscript{24} James Thomas Childress, "A Factor and Discriminant Analysis to Identifying and Determine the Effectiveness of Selected Physical Variables in Predicting Successful Basketball Performer," Dissertation Abstracts International 33 (November 1972) : 2146-A.

\textsuperscript{25} Mark Keven Toner, "The Relationship of Selected Physical Fitness, Skill and Mood Variables to success in Female High School Basketball Candidates" Dissertation Abstracts International 42 (March 1982) : 3909-A.
underbasket Shot Test, Speed Pass Test, Speed Dribble Test were administered to 81 female high school basketball candidates. At the end of the testing and evaluation period, the jury of coaches, on the basis of their observations during drills and scrimmage competition, independently rated each candidate as either successful or an unsuccessful performer. Discriminant analysis procedures supported the following hypothesis: (a) the fitness factor, skill tests and personal factors were successful indicators of group membership while POMS variables were to a lesser extent, and (b) the battery of tests preseason and POMS, did correlate with coaches ratings.

II.4 Related Studies on Hockey

Deshais26 made a study on some Psychological variables to predict individual performance in Ice Hockey players one hundred and sixteen Quebec Jr. Major League hockey players were measured on 14 variables falling in biological, Psychological and specific motor skill categories. These variables were included in a stepwise regression analysis with ice hockey playing as the criterion. A production 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% of variance in ice hockey playing ability accounted for by the psychological profile was larger than that observed individually for either the biological (17%) psychological (20%) or the specific skill profile (33%).

In order to identify the predictive qualities if any, in a group of skilled women field hockey players Chapman conducted a study on 106 players who participated in International Selection and Training Camps sponsored by the United States Field Hockey Association during summer 1978. The variables selected for the study were anxiety, visual perception, manual dexterity, ball control and dynamic balance. Fine tests selected to assess the prediction variables were: (i) Sports Competition Anxiety Test, (ii) Herkowitz's Moving Embedded Figures Test, (iii) Minnesota Rate of Manipulation Test, (iv) Chapman ball control test and (v) Seat forward Leap Test. The level of camp participation determined by player selection based on subjective evaluation of field hockey playing ability served as the criterion measure in the study. A multiple discriminant function analysis was computed to identify those variables which determined between the groups of selected camp participants. A one way analysis of variables was used to assess the differences between groups of players according to their playing positions. The Shaffe's Post Hoc Test was applied when a significant 'F' ratio indicated that differences existed. The Pearson's correlation technique was utilised to determine the relationship between some selected predictor variables for the groups of selected women field hockey players. Visual perception and manual dexterity, as 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 step-

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wise discriminant function analysis indicated that on the basis of the three discriminating variables, the group membership could be predicted 78.95 per cent of the time, provided the ball control skills of the goalkeepers were analysed separately from those of the forwards and backs.

Reid\textsuperscript{28} investigated the relationship of flexibility, strength and anthropometric measurements of the lower limbs to the skating speed of hockey players. Subjects were seventeen University hockey players whenever measured for leg and grip strengths, lower limb flexibility, anthropometry of legs and skating speed under standing and flying start conditions with or without sticks over two distances, 40 ft and 25 mts. The strength, flexibility and anthropometric measures were the independent variables while the skating speeds were the dependent variables. The data were analysed by Pearson Product Moment Correlation and stepwise regression methods (P < 0.05). The results of the study 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 tests encompassed many factors of the other six, flexibility was related to strength and anthropometry, strength and anthropometry were related, and flexibility and anthropometry were not related to skating speed. The regression analysis accounted for all of the variance in each dependent variable but the variables entered were different in order and in contributing weight in each analysis. Skating speed was indicated as being specific to the distance and conditions under which it was performed.

In an attempt to identify selected personality and psychomotor variables which would discriminate the successful goal tender from within a group of ice hockey players Maloy administered a battery of tests consisting of the Sysenck Personality Inventory, the State Trait Anxiety Inventory, a Pursuit Roter Device and a Multiple Choice Reaction Times on the hundred hockey players selected from National Hockey League and other state hockey leagues, college and high schools. Multivariate analysis of variance and discriminant analysis were used to statistically analyse the data. Significant Multivariate F values were found for difference between successful and less successful goal tenders; and for differences between high school, college and professional players. A discriminant function was produced which was able to classify goal tenders as either successful or less successful based solely on the individual scores for the selected variables. Significant univariate differences were found for both neuroticism/stability and trait anxiety between goal tenders and nongoal tenders.

Bobb conducted a study on 177 women field hockey players who attended at Mt. Pocono Hockey Conference in Tablyhana, Pennsylvania in August of 1976 to determine the characteristics of women field hockey players according to positions played and levels of competitions. The 16 PF scores and

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the semantic differential scores were treated by analysis of variance. Responses to situations were treated by chi-square analysis.

The findings of the study fed to the following conclusions: 1) Offensive, defensive players and goal keepers did not differ significantly in personality traits; 2) Selected players had a more favourable attitude toward the concept, “myself as a hockey player”. Then did non-selected players and non-selected players were found to be more tensed than selected players and 3) college and club players did not differ significantly in attitudes toward selected field hockey concepts and differed significantly in only few personality traits.

Lamba\textsuperscript{31} carried out a study to compare selected physical fitness components and physiological variables of college level offensive and defensive hockey players. Physical fitness components were agility, speed, strength and physiological variables were blood pressure, pulse rate breath holding capacity and cardiovascular endurance. Sixty male students representing four colleges of Gwalior in 1978 - 79 intercollegiate tournament acted as the subjects of the study. After administering the tests 't' ratio was used to statistically analyze the data. Conclusions of the study were: 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 players in agility, blood pressure and breath holding capacity.

\textsuperscript{31} Manmohan Kaur Lamba, "Comparative study of selected Physical Fitness components and Physiological Parameters of Offensive and Defensive Hockey Players of College Level" (Unpublished Master's Thesis, Jiwaji University, Gwalior 1980).
Dureha\textsuperscript{32} made a comparative study on selected motor components such as agility, speed, explosive strength and endurance and selected anthropometric variables such as height, weight, leg length, arm length, thigh girth and wrist diameter of offensive and defensive hockey players at college level. Fifty male students of three colleges of Gwalior during the session 1983-84 were the subjects of the study. The ‘t’ test was employed for the statistical analysis of data to compare the offensive and defensive hockey players. It was concluded from the results of the study that there was no significant difference between offensive and defensive hockey players in respect to selected motor components and selected anthropometric variables.

\textbf{II.5 Related Studies on Swimming}

Lapman\textsuperscript{33} investigated the relationship of Psychological variable, anxiety on the performance of competitive swimmers and to determine the differences if any, between champion and non-champion swimmers. The subjects of the study were 15 members of the University of Florida Swimming Team. An anxiety test was administered on the swimmers before the season of approximately one hour before the competition. The general conclusions drawn were an upward fluctuation in anxiety one hour before competition facilities in anxiety patterns between the two experienced groups, swimmers performed better of their pre-

\textsuperscript{32} Dilip Kumar Dureha “Comparison of Selected Motor Components and Anthropometric Variables of Offensive and Defensive College level Hockey Players” (Unpublished Master’s Thesis, Jiwaji University, Gwalior, 1984).

\textsuperscript{33} James Joseph Lapman, “Anxiety and Its Effect on the Performance of Competitive Swimmers”, \textit{Completed Research in Health, Physical Education and Recreation} 10(1968) : 34.
meet anxiety level was relatively equal to or slightly above their pre-season anxiety level.

Crites\textsuperscript{34} studied the relationship of swimming performance to selected physiological and psychological factors, as they related to the beginning swimmer's ability to perform the crawl stroke and contribute to the teacher's understanding and instructional approach toward a beginning swimmer.

Subjects of the study were forty members of the two beginning swimming classes which met for forty minutes twice a week. Prior to any swimming instruction, measurements were collected on shoulder rotation, shoulder extension strength, hip extension strength, body composition, swimming anxiety and swimming ability as measured by the power test (revised). After five weeks of crawl stroke instruction, measurements were again taken on swimming anxiety and swimming ability. Pearson's Product Moment correlation was used to analyse the data to identify significant relationships.

The conclusions of the study were (i) shoulder rotation, shoulder extension strength, hip extension strength and body composition were not significant factors in the performance of crawl stroke and (ii) a significant relationship was found between swimming anxiety and the ability to perform the crawl stroke.

Albrecht\textsuperscript{35} investigated the relationship between certain physique and flexibility measures and high school swimming success on 89 varsity swimmers from six different high schools.

\textsuperscript{34} Jerry Keith Crites, "A study of Selected Physiological and Psychological Factors to Determine their Relationship to the Performance of the Crawl Stroke by Beginning Swimmers," Dissertation Abstracts International 36 (October 1975) : 2084-A.

Measurements were taken for height, weight, upper arm length, lower arm length, torso length, bust height, arm span, chest normal, chest expanded, chest deflated, hand and foot area measurement, body surface area, ankle flexion and hip flexion. Coach's rating was used to measure success and success (percentage) was determined by the state record for the event divided by the time in the conference meet. No relationship was found between physique measures and swimming success nor between flexibility measures and swimming success.

Gross and Thompson found high and significant relationships between dynamic balance and speed in swimming and dynamic balance and ability in swimming. Also 't' ratios calculated between the same abilities indicated that dynamic balance is not a chance factor and may be an important factor in speed and in ability in swimming.

Mishra made an attempt to establish relationship of selected physical and physiological variables to performance in fifty meter front crawl swimming. He conducted the study in twenty five professional students studying in L.N.C.P.E., Gwalior. The selected variables were arm strength, ankle flexibility, vital capacity and body surface area swimming performance was recorded in seconds. Product moment correlation was computed to analyse statistically the relationship of physical and physiological variables to speed in fifty meter

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36 Elmer A. Gross and Hugh L. Thompson, "Relationship of Dynamic Balance to Speed and to Ability in Swimming" Research Quarterly 28 (December 1957) : 342.

crawl swimming. It was concluded from the findings that 1) there was a significant relationship between arm strength, ankle flexibility and vital capacity to swimming speed and 2) there was no significant relationship between body surface area and swimming speed.

Matheson\textsuperscript{38} did a study to determine relationship of selected physiological, anthropometric, developmental and skill variables to swimming in 10 - 12 years old female competitive swimmers. Forty girls who were measured on several selected variables acted as the subjects of the study. Each subject completed a 400-yard and 50-yard time trial. The data were initially examined by Pearson ‘r’ matrix. Subsequently, the swimmers were classified into top and bottom groups. Stepwise multiple discriminant function analysis was done to compare the two groups. The intercorrelation matrix indicated that the best single predictors of swimming performance were height, aerobic capacity and stroke efficiency. Body size, skill and exposure to swimming were considered the most significant group of factors when two classes of performance were compared.

In a study of attentional and anxiety responses of athletes to mental training techniques, Zwart\textsuperscript{39} explored the change in competition anxiety, attentional direction and focus, and performance in 13 - 15 years old swimmers (n = 30) after exposure to the superlearning mental training programme. The experimental treatment consisted of engaging the subjects in a six

\textsuperscript{38} Lovilee Matheson, "Selected Physiological, Anthropometric and Skill variables contributing to success in 10 - 12 years old Female competitive swimmers", \textit{Completed Research in Health, Physical Education and Recreation} 20 (1978): 293.

\textsuperscript{39} Elizabeth Fell Zwart, "Attentional and Anxiety Responses of Athletes to mental Training Technique", \textit{Dissertation Abstracts International} 49 (January 1987): 2504-A.
week (two one hour sessions per week) programme of (i) relaxation-training (ii) positive affirmation statements synchronised to breathing exercises and music and (iii) visualisation for mental rehearsal.

The Sports Competition Anxiety Test (SCAT) was employed as a measure of competition anxiety, and the test of attentional and interpersonal style (TAIS) was used as a measure of attentional direction and focus.

The results of the study indicated that there was a statistically significant (a) increase in performance outcomes (b) change towards effective attentional direction and focus and (c) reduction in competitive anxiety in athletes after exposure to the superlearning mental training programme. There was also a marked improvement in competitive swimming performance in athletes who reported low competition anxiety compared to those with higher level of competition anxiety.

Maxson\textsuperscript{40} tried to establish a relationship between achievement motivation and performance in competitive swimming. Subjects of the study were fortyfour college swimmers (29 males, 15 females) from four Universities, who were given the Mehrabian measure of achievement tendency and a survey of a swimming achievement instrument designed by the investigator. Following were the results obtained from the study:

1. There were significant positive 'r' between the scores of achievement motivation questionnaire and the swimming success survey.

2. College swimmers achieve significantly higher scores on Meharabian measurement of achievement tendency than the norm for college students in general.

3. Female swimmers obtained significantly higher level of achieving tendencies than the level of the male swimmers.

### II.6 Related Studies on Gymnastics

Breedlove\(^{41}\) made a study to predict gymnastic performance on the basis of personality traits and professed self concept. Jackson’s Personality Research Form and the TN self concept scale were administered to 48 collegiate gymnasts. Scores obtained from application of these instruments were compared to performance in four individual gymnastic events (vault, balance beam, uneven parallel bars, and floor exercise), and the all-round event as determined by meet scores. Significant results were found between gymnastic ability and self-concept measures of physical self, moral, ethical self, total variability and column total variability. In the area of personality and frequency, additional statistical analysis using ‘R’ techniques were applied to determine if selected clusters of personality traits or self-concept measures would be predictive of gymnastic performance. No significant factors were found.

Feigl\(^{42}\) administered Cattell 16 P.F Test to 175 college male gymnasts in South Eastern United States and from seven other teams of selected colleges of South-East to assess their


personality. The author reached the conclusion that the college gymnasts differed in personality from general college male population. A distinct personality type did not exist from specific gymnastic event. The level of gymnastic performance could not be differentiated by personality factors and gymnast of a successful team did not necessarily have similar personality. Successful teams were not differentiated from the unsuccessful teams by personality factors.

Giese\textsuperscript{43} administered the tests of 12 physiological parameters, the State Trait Anxiety Inventory and Lakies Test of Competition Attitudes to 19 male all-round gymnasts from the Big Eight Conference and a control group of 21 male Kansas University Students. All 40 subjects were classified in four groups - two experimental and two control according to their level of gymnastic placement and experience. ANOVA between the Big Eight Gymnasts and the control revealed that four of the 12 physiological parameters (flexibility, strength, percent fat and balance with vision) were significant at 0.05 level. ANOVA across the four groups revealed three parameters (flexibility, strength, and percent fat) showed significance between four groups. Two methods of prediction were used in an attempt to classify the gymnasts into elite or good groups. Stepwise multiple regression analysis, using six selected parameters revealed that mean arterial blood pressure could best predict the gymnasts actual all-round score. A discriminate analysis indicated that the psychological questionnaire classifies better than physical or existing questionnaire.

A prediction test battery was developed by Greenockle for women gymnasts. Subjects were twenty two students enrolled in a physical education professional's gymnastics course. The test battery consisting of seventeen physical fitness tests were administered to all subjects at the beginning of the semester. After eight weeks instruction, subjects were rated on ten 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 $r = 0.79$ with the ratings.

Wettstone compiled a list of qualities which a good gymnast should possess and sent the list to twentyfive of the country's outstanding coaches and gymnasts. Listed qualities were ranked by the author according to their importance. Tests for fifteen of the highest ranking qualities were administered to a selected group of twenty two active gymnasts at the University of IOWA. Eleven anthropometric measurements were taken. A test was constructed which consisted of three elements, thigh circumference / height, strength test (consisting of chinning, dipping and thigh flexion) and the Burpee test which predicted potential ability in gymnastics with a multiple correlation of 0.79.

Moffatt et al made an attempt to compare the body composition, physical dimensions and maximal physiological

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responses of 13 female high school elite gymnasts to 13 randomly selected non-athletic high school females. Data were collected on age, height, body fat, lean body weight, body density, VO₂ max and anaerobic capacity. Data were analysed through 't' tests, multivariate analysis of variance and univariate F-tests were used to determine fat folds individual differences. Analysis of variance for repeated measures was utilised to determine the effect of time on anaerobic power. It was concluded that female high school gymnasts had similar skeletal structure when compared to non-athletic controls. Non-athletic high school females had less lean tissue and more body fat as indicated by densitometry and anthropometry. The percent body fat of these gymnasts was 14 - 22 percent less than that reported for more mature female gymnasts. The female gymnasts also exhibited higher VO₂ max and performed better on tests to estimate anaerobic capacity and anaerobic power output than controls.

Mesug\textsuperscript{47} conducted a study to find out the relationship between the athlete's level of achievement and gymnastic meet performance. Another purpose of the study was to see whether achievement motivation differed between male and female gymnasts. The McCelland theoretic appreciation test (MTAT) was administered to measure the levels of achievement motivation among male and female members of the SUSU intercollegiate gymnastic teams. The scores obtained by the subject in the gymnastic meet were recorded as the measure of gymnastics proficiency. Peerson's product moment correlation

was calculated and the value of ‘r’ found no significant relationship lasting between achievement motivation and gymnastics meet performance among male and female subjects (P 0.05). Use of ‘t’ test indicated that a significant difference existed between scores attained by male and female gymnasts on the MTAT (P 0.05).

Gates\(^{48}\) studied certain selected structural and functional measures as predictors of success in various gymnastic skill areas for homogeneous grouping in gymnastic activity classes. A total of 12 measures (three structural and five functional along with four others) generated through combining some of the original, structural and functional measures) were obtained from 48 subjects as predictors during the first week of instruction in a semester of gymnastics. At the end of the term, subject were assessed by a battery of gymnastic skill tests which were used as the criterion measures for the study. Conclusion drawn from the findings was that structural and functional measures can be used as bases for predicting ability in several areas of gymnastics.

### II.7 Related Studies on Athletics

Carlson\(^{49}\) carried on a study on morphological, cardio-respiratory and biomechanical model of endurance running

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performance. From the findings of the study the condition drawn was that selected cardio - respiratory body size, composition and structure, biomechanical variables contribute significantly to endurance running performance in trained adult recreational runners. The degree of the contribution of the cardio respiratory measures as predators of endurance performance was greater than the contributions of the body size, composition structure and other running mechanics variables. Forrell, Wilmore and Coyle⁵⁰ made a study on exercise heart rate as a predictor of running performance. Eighteen male distance runners acted as the subjects of the study. Body density, residual long volume and relative body fat were measured according to the referenced procedures and performance data were obtained on a road race from 3.2 to 42.2 km. Whenever a subject ran a competitive race during the time span of the steady state treadmill tests, his time was recorded and distance verified if possible using a calibrated measuring wheel. The purpose of this study was to determine if a readily observable variable could be used to predict performance at several race distance. Many physiological reasons exist for the inability of exercise heart rate to accurately predict performance. Murlidharan⁵¹ tried to find the relationship of anthropometric and physical performance variables measures to performance in


long-jump. Product moment correlations were computed to see the relationship of long jump performance to each independent variable such as standing broad jump, 50 yard dash, shuttle run (4 x 10 yards), sit and reach, vertical jump, leg length, height and weight. The data were tabulated in the form of scatter grams. The findings of the study indicated that the anthropometric and physical performance variables are very reliable for predicting long jump performance. Conclusions were (1) Leg length, height, standing broad jump, 50 yard dash, shuttle run (4 x 10 yards), sit and reach, vertical jump were the most significant independent measurements in the prediction of running long jump. (2) Body weight did not prove to be reliable when single independent variable was correlated with the performance of running long jump. Therefore, weight should not be used singly for predicting performance in running long jump.

Pinheiro\textsuperscript{52} investigated the relationship of strength, flexibility, agility, reaction time and speed of movement to the acceleration phase in sprinting. Thirty male students specialising in sprinting at L.N.C.P.E. were the subjects. It was revealed from the analysis of data that a significant relationship existed between acceleration time and explosive leg strength and also between acceleration time and right leg stepping reaction time. The results of the study led to the following conclusions (1) The explosive leg strength and the right leg stepping reaction time significantly correlated with performance in the acceleration phase; (2) The left leg stepping reaction time was not significantly related to the performance in the acceleration phase, (3) The foot reaction time,

speed of movement, agility and flexibility were not significantly related to performance in the acceleration phase in sprinting.

Promoda Dev\textsuperscript{53} studied the relationship of selected physical variables such as strength, arm strength, leg strength, agility, speed, flexibility, anthropometric measurements, weight, height, arm length, leg length, foreleg length, thigh height, ponderal index, crural index to performance in shot-put. Product moment correlation method was used to complete correlation and significance of the study. Following conclusions were drawn from the results of the study: (1) There was significant correlation between arm strength, leg strength, speed, flexibility and shot-put performance. (2) There was no significant correlation between weight, height, arm length, leg length, foreleg length, thigh length, ponderal index, crural index and shot-put performance.

II.8 Related Studies on Badminton

Gill\textsuperscript{54} conducted a study to see the relationship between grip-strength, arm-strength, hand, foot and stepping reaction times to badminton playing ability. Sixteen district level badminton players were the subjects of the study. Grip dynamometer was used for measuring grip strength, electronic reaction timer for reaction time, Roger's formula for arm strength and Round Robin tournament for playing ability of the subjects. By using rank difference correlation coefficient the scholar


\textsuperscript{54} Ranjot Gill, "Relationship Between Grip-Strength, Arm-Strength, Hand, Foot and Stepping Reaction Times to Playing Ability in Badminton". (Unpublished Master's Thesis, Jiwaji University, Gwalior, 1983).
reached the following conclusions: 1) arm strength, hand foot
and stepping reaction times were significantly related to playing
ability in badminton; 2) grip strength was not significantly
related to the playing ability in badminton.

Ikeda55 conducted a study on 72 women students to
establish the relationship of wrist flexibility, shuttle run, and
various measures of Kinesthesis to the badminton skills of
volleying and clearing. The test scores of wrist flexibility, Shuttle
run and measures of Kinesthesis were compared with the scores
on the volley and clear badminton tests. The results showed that
there was no significant relationship between wrist flexibility,
Kinesthesis or agility and badminton playing ability.

In a study Thorpe56 administered the Otis quick-scoring
Mental Ability Test and two badminton or tennis skill tests on 375
women enrolled in badminton and tennis classes at different
Universities. The criterion measure was the singles round robin
tournament in each league with the percentage of points own
used as the measure of success. Success in the tournament
correlated 0.65 with badminton skills and 0.60 with tennis skills
as measured by the skill tests but the correlation of skill and
success with intelligence was practically zero. The success of the
group with higher skills was significantly greater in each sport
than that for the lower skill group with intelligence being
considered as constant, but the success of the more intelligent

55 Namiko Ikeda, "Relationship of Selected Measures of Wrist Flexibility
Kinesthesis and Agility to Badminton Playing Ability", Completed
Research in Health, Physical Education and Recreation 2 (1964) : 44.
56 Jo Anne Lea Thorpe, “A Study of Intelligence and Skill in Relation to
Success Achieved by College Women Engaged in Badminton and Tennis
Singles Competition”, Completed Research in Health, Physical
Education and Recreation 7 (1965) : 102.
group was significantly greater in either sport when skill was considered as constant.

Greene\textsuperscript{57} conducted a study administering two static balance tests and a badminton playing test on 58 subjects who were grouped on the basis of sex as well as high and low badminton skill. Mean differences were tested for significance and correlations were computed between static balance and badminton playing ability. The lengthwise and crosswise static balance test showed no difference between tournament and beginning playing ability except in two cases. The author concluded that except for the low skillmen on crosswise balance where the prediction was fairly good, the correlations between playing ability and static balance were zero.

Tergersen\textsuperscript{58} conducted a study on 23 Sophomore college women who had just completed a semester of badminton and administered on them the French Short Serve and Clear Test and the Miller Wall Volley Test. The Scott test was used for measuring motor ability, tensiometer for palmer and dorsal flexion strength, perimeter for temporal vision, and Howard-Dolman apparatus for depth perception. The results showed a significant correlation between the total badminton playing ability and general motor ability, depth perception, and peripheral vision while a significant correlation was observed between the wall volley test and motor ability and depth perception.


II.9 Related Studies on Wrestling

Bowman\(^{59}\) carried out a study on twenty-nine biographical, physiological and psychological factors to predict success in wrestling. One hundred and thirty-six high school wrestlers had undergone the tests during the 1969-70 wrestling season. The data from the factor tests and the season’s win-loss records were analysed by multiple correlation and regression analysis. The findings of the study were: (1) all twenty-nine independent variables, the biographical variables and the physiological variables were significantly related to wrestling success at the 0.05 level (2) Seven factors—age, years of wrestling experience, hand grip strength, upper body strength, cardiovascular endurance, desire to achieve and desire to experiment were significantly related to wrestling success at the 0.05 level.

Silva\(^{60}\) and his associates assessed the effectiveness of psychological variables on wrestling success. The study was conducted on 15 male wrestlers from the 1979 U.S. junior world wrestling camp. Athletic performance in the camp determined whether a wrestler qualified or not for the touring United States team. Subjects were evaluated on anthropometric, physiological and psychological variables over a three day interval. Descriptive data analysis indicated that physiologically the average qualifier was marginally lower in grip strength, lower in relative dynamic anaerobic muscular endurance, more aerobically fit and slightly

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\(^{59}\) Bill C. Bowman, “A Study to Identify and Measure Biographical, Physiological and Psychological Factors Which Predict Success in High School Wrestling” *Dissertation Abstracts International* 31 (March 1971): 4513-A.

higher in percentage of body fat as compared to the average non-
qualifier.

Psychologically, the average qualifier was higher in state
anxiety and tension but less expressed, angry, vigorous, fatigued
and confused than the non-qualifier. Multivariate analysis of
variance indicated that the group centroids differed significantly
on the selected Psychophysiological variables considered in this
study. Discriminant function analysis of the data supported the
Psychophysiological model as the most accurate in predicting
group membership.

Horswill\textsuperscript{61} investigated the correlation between success in
college wrestlers and the physiological capacities like maximum
aerobic power, maximum anaerobic power, and dynamic
endurance. He conducted the study on 31 wrestlers and the
variables selected were VO_2 max, max anaerobic power and upper
body dynamic endurance. The success of each wrestler was
determined by a performance index (P-1) based on performance
in two early season tournaments. It was concluded from the
findings of the study that VO_2 max, HR and upper-body dynamic
endurance contribute significantly to the success of college
wrestler, while other variables like skill, experience and
Psychological factors, may have an even greater influence on
wrestling success.

\textsuperscript{61} Craig A. Horswill, "An Investigation of the Correlation Between Success
in College Wrestlers and the Physiological Capacities : Maximum
Aerobic Power, Maximum Anaerobic Power, and Dynamic Endurance"
Completed Research in Health, Physical Education and Recreation 22
Jones administered the Thematic Appreciation Test, the Test Anxiety Questionnaire on high school wrestlers. The expectancy ratings were done by the individuals and by their coaches. Data on performance were obtained from match scorebooks and observations. The results of the study concluded that personality traits of anxiety and need for achievement had a tendency to influence both the expectancy and the actual performances of these wrestlers. Subjects who measured low in anxiety level performed better than those with high anxiety level. The group scoring highest in performance was that of low anxiety and high need of achievement. The group with high anxiety and low need for achievement exhibited lowest level of performance.

II.10 Related Studies on Tennis

In a study to identify the personality differences among the outstanding male tennis players in two categories established by tennis experts, Olson concluded that 'Champions' were more inner-directed, more pragmatic and more extroverted than 'near-great' tennis players.

Atkinson developed regression equations using physical traits and class commitment as predictors for determining potential skill in beginning tennis, badminton and handball for college-men. Agility, Power, hand eye correlation and visual accuracy were the physical traits. Round-robin tournament was the

criterion chosen for each sport event to determine the skill level of the subjects. Whether the scores on the physical traits would be significantly improved by practice in the sport was another purpose to be determined in the study. 140 college men enrolled in beginning classes and taught by whole-part method for each sport were the subjects of the study while 138 students enrolled in other beginning classes and taught by the part method acted as the control group. Conclusion of the study were:

1) Class commitment is probably an integral part of skill attainment in the sports studied 2) students taught tennis and badminton by the whole-part method experienced greater gains in agility and hand-eye coordination 3) students taught by part method experienced greater gains in shoulder girdle power.

In a study to establish relationship between a battery of performance tasks and tennis playing ability, Summers\textsuperscript{65} administered on 43 right handed male tennis players of the varsity tennis teams and beginning and advanced tennis classes of Oregon University a battery of Performance tasks consisting of i) Kinesthetic memory of varying hand position, ii) completion time of a short hand arm movement, iii) two choice reaction time, iv) four choice reaction time, v) reciprocal tapping, vi) a programmed movement of a hand-arm movement completed in 190 milli seconds or less and measured for accuracy and vii) a coincident timing task which involved meeting a moving target at a predetermined point with a hand-arm movement and timing tasks prevented utilisation of Kinesthetic feedback to correct

\textsuperscript{65} Emory Floyd Summers, "Tennis Ability and Its Relationship to Seven Performance Tasks", Dissertation Abstracts International 34 (March 1974) : 5697-A.
performance errors. An abbreviate scoring system in a round robin tournament was utilised to assess the tennis playing ability.

Correlation, multiple correlations and one way analysis of variance were computed. The conclusion drawn was that there existed a little, if any, relationship between tennis ability and the aforesaid battery of performance tasks.

Bruke\textsuperscript{66} investigated on male and female advanced tennis players the effectiveness of a concentrational training technique enhancing attentional skills related to the tennis service and as a means of reducing sport competition anxiety in advanced tennis players. Another purpose was to see the effects of attentional training on the performance of a tennis serving accuracy task: The experimental group received a treatment of concentration training based on tennis specific meditational procedures between the first and second post-test. The treatment was given for two weeks (28 sessions maximum).

Experimental group was administered an attentional training questionnaire to analyse their perceptions of the effectiveness of cognitive technique. In conflict with the ANOVA analysis, 75\% of the trained subjects reported that concentration training technique helped their tennis game. Implications of findings in this investigation indicate that the proposed benefits of cognitive attentional training interventions should not be proclaimed or disclaimed until further research in this area has been performed.

\textsuperscript{66} Kevin Lamax Bruke, "The Effect of a Perceptual Cognitive Training Program on Attention/Concentration Style and Performance of Tennis Service" \textit{Dissertation Abstracts International} 49 : 12 (June 1989) : 3654-A.
II.11 Related Studies on Others

Raman\textsuperscript{67} conducted a study on 30 male cricket players studying at LNCPE, Gwalior to determine the relationship of grip strength, Leg power, agility and hand and foot reaction times to performance in cricket. Data on grip strength were collected by grip dynamometer, Leg power by standing broad jump, agility by 40 yard shuttle run and hand and foot reaction time by electronic reaction timer. Cricket performance was assessed by subjective ratings of three experts during practice and match situations. Statistical treatment of the data was done by product moment correlation. It was concluded that (1) hand and foot reaction time is the most important variable in the prediction of cricket performance, (2) Leg power is another important variable in the prediction of performance in cricket, (3) grip strength is also important variable of prediction of cricket playing ability and (4) agility is not an important factor in the prediction of cricket performance.

Everett\textsuperscript{68} conducted a study on the prediction of baseball playing ability. Thirty University baseball players of IOWA varsity were tested on ability to throw for distance, running speed and agility (shuttle run) ability to visualise spatial relationship, ability to make decisions quickly and motor capacity. The playing ability of the subjects were rated by their coach. Product moment correlation, partial correlation and multiple correlation were computed and the following conclusions were drawn from the results obtained: (1) The

\textsuperscript{67} Gopinath Raman, “Relationship of Grip Strength, Leg Power, Agility and Hand and Foot Reaction Time to Performance in Cricket” (Unpublished Master’s Thesis, Jiwaji University, Gwalior, 1983)

Sargent jump is the best single measure for selecting baseball
talent. (2) The best economical combination found in this study to
predict baseball playing ability is the Sargent jump, 'S' test and
the Blocks test. T score = 0.92 Sargent jump (cm) - 0.08 'S' test
(score) - 0.23 Blocks Test + 16.19.

Voll\textsuperscript{69} predicted the basic modern dance skills through
selected anthropometric and physical fitness measurements.
Twenty four female students participating in one of the three
non-eastern Pennsylvania Colleges volunteered as the subjects of
the study. Measurements of height, weight, sitting vertex-height,
upper-leg length, flexibility, upper abdominal strength, leg
strength, cardiovascular fitness and somatotyping were taken. As
a result of the statistical treatment, a regression equation with a
multiple R of 0.8678 was presented by the author for the
prediction of ability in basic modern dance skills and prediction
tasks for its computation were developed. The author concluded
that the ability in modern dance skills can be predicted from
selected anthropometric and physical fitness measurements.

Weinberg\textsuperscript{70} investigated to determine between competitive
Trait Anxiety (CTA) State anxiety and golf performance in a field
setting. Ten low moderate and high CTA collegiate golfers (10
percent) performed in a practice round on Day 1 and Day 2 of a
competitive tournament State anxiety results indicated a
significant CTA main effect with low CTA subjects displaying
lower state anxiety than moderate or high CTA subjects. The

\textsuperscript{69} Bonnie M. Voll, "Predicting Ability in Basic Modern Dance Skills
Through Selected Anthropometric and Physical Fitness Measurements",
\textit{Completed Research in Health, Physical Education and Recreation}

\textsuperscript{70} Robert S. Weinberg, "Relationship Between Competitive Trait Anxiety,
State Anxiety and Golf Performance : A Field Study", \textit{Abstracts
competition main effect was also significant with post hoc tests indicating higher levels of state anxiety during Day 1 and Day 2 than during the practice round. Performance results produced a significant CTA main effect with low CTA subjects displaying higher levels of performance (i.e. low score) than moderate or high CTA subjects. The competition main effect was also significant and post hoc test indicated that subjects performed at a higher level during practice and Day 1 of competition than during Day 2 of competition. Correlations between SCAT and State Anxiety indicated that SCAT was good predictor of precompetitive state anxiety.