Chapter II

REVIEW OF RELATED LITERATURE

The need for related literature has been widely recognized in the world of research. It provides the researches a broad and deep understanding of the published research work of the related field. The abstracts of the related studies and their findings pertaining to the present study are highlighted in this chapter. This further helped the scholar to interpret his findings as supporting evidences to evaluate the significance of this study.

In the study under taken by Stine\(^1\) 65 male subjects were tested the first week of the terms on the independent variables of strength, power and cardio-vascular endurance and ranked high, medium or lower tests on dependent variables were given last two weeks. There tests results determined the dependent variables relationship to independent variables by use of statistical procedures. The finding indicated strength and cardio-vascular endurance had no significant relationship to the following.

Dependent variables: speed of serve, combination of service placement on speed and the Hewitt's back board test, correlation coefficient test showed significant predictability of strength and power to Hewitt's backboard test and strength alone to percentage of wins.

The purpose of Mishra's\(^2\) study was to find out the relationship of selected physical and physiological variables to performance in fifty meter front crawl swimming. Data on the different variables was collected by administering test adopted standard procedure, arm strength was computed with the help of formula given in Roger's physical fitness index, ankle flexibility with the help of goniometer, vital capacity with the help of spirometer, and body surface area with the help of "Du Dios" surface area formula. Analysis of the data revealed that relationship between speed in swimming and selected physical and physiological variables i.e. arm strength ankle flexibility, vital capacity and body surface was very high correlated positively as the X achieved R values were 0.6758, 0.4658, 0.4941 respectively. The required value to be significant was .05 level of confidence and 23 degree freedom. Relationship between speed in fifty meter swimming and body surface

were not significant as the achieved value was .1710. Within the limitation identified and on the basis of the results of the study, the following conclusions were drawn. There was significant positive relationship between arm, strength, ankle flexibility and vital capacity to swimming speed (2). There was no significant relationship between body surface area and swimming speed.

Gross and Thompson\(^3\) found high and significant r's between dynamic balance and speed in swimming, and dynamic balance and ability in swimming. Also, ratio calculated between these same abilities indicated that dynamic balance is not a chance factor and may be an important factor in speed and in ability in swimming.

Relationship of selected physiological and psychological factors to the beginning swimmers ability to perform the crawl stroke was determined by Crites\(^4\) who used 40 subjects from two beginning swimming classes. The beginning swimming classes met for 40 minutes twice a week. Prior to any swimming instruction, measurements were collected on shoulder rotation, shoulder extension strength, hip extension


\(^4\) Jeory Keth Crites, "A Study of Related 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.
strength, body composition, swimming anxiety and swimming ability as measured by the fox power test (revised). After five weeks of crawl stroke instruction measurement were again collected on swimming anxiety and swimming ability Pearson Product Moment Correlation was used to analyse the data. It was found that: 1) shoulder rotation, shoulder extension, strength, hip extension strength and body composition were not significant factors in the performance of crawl stroke and 2) a significant relationship was indicated between swimming anxiety and the ability to perform the crawl stroke.

Albrecht\(^5\) included varsity swimmers from six different high schools in the south suburban conference as subjects. Measurements were taken of height, weight, upper arm length, lower arm length, tarso length, bust height, arm span, chest normal, chest expanded, chest deflated, hand and foot area measurement, body surface area, ankle flexion and hip flexion. Success was measured by a coaches' rating and success percentage determined by the state record for the event divided by the time in the conference meet. No relationship was known between

physique measures and swimming success nor between flexibility measures and swimming success.

Schwarzkopf\textsuperscript{6} administered the IOWA-Brace test to 33 students in a gymnastics skill class prior to a quarter of instruction. The Minnesota Gymnastic Skill Test and Gymnastic Class Final Performance Test were given following instruction, the correlation between the IOWA Brace test and the gymnastics skill tests were .529 and .646.

Greenockle\textsuperscript{7} developed the prediction test battery for women's gymnastics. Twenty two students enrolled in a physical education professional's gymnastics course at L.U., participated in simplifying the data for the study. The test battery of 17 physical fitness tests were administered to all subjects at the beginning of the semester. After eight weeks of instruction, 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.


A list of qualities which was thought that a good gymnast would possess was compiled by Wettstone\(^8\) and sent to twenty five of the country's outstanding coaches and gymnasts. These authorities ranked the qualities according to importance, test for 15 of the highest ranking qualities were obtained from a selected group of 22 gymnasts actively engaged in gymnastics at the university of IOWA. Elevens anthropometric measurements were taken. A test was constructed consisting 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 .79.

Vendel\(^9\) studied the criteria for predicting success in modern pentathlon. Questionnaire returns from 55 pentathletes active since 1954 showed that the successful ones were distinguished by a knowledge of more Pentathlon related sports before training on 10 of IHI some financial educational assistance, composition in approximately six individual sports, playing chess occasionally, never smoking being lightly under weight for their body build having a low pulse rate (56 at rest), having

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low blood pressure, having five diseases in their life time, having the family wage earner in the 'service' category being cautious self sufficient, and self confident.

Tanaka and Matsura\textsuperscript{10} took anthropometry and physiological variables of 114 Japanese young and long distance runners and concluded that the anthropometric attributes would predict the distance running performance to about the same degree as physiological attributes. As a result of factor analysis and the multiple regression analysis, three factors i.e. linearity of physique, girth of physique and subcutaneous fat, were extracted, and the first two factors were equally related to the 800, 1500 and 5000 meters performance. The 10,000 meters, however was best accounted for by the second factor.

Carter\textsuperscript{11} conducted a study on body composition of the Montreal Olympic athletes and investigated by means of skinfold profiles, sum of skinfold, estimated percent fat from skin folds, estimated percent fat from skinfolds and fractional masses. The skinfold profile for both sexes were similar in shape but differed in attitude among sports. The female profiles


were different in shape as compared to males. The female had longer, skinfold than males at all sites, but the difference were greater at limp sites and trunk sites. The difference on sum of skin folds and estimated percent fat were found among both male and female sports groups. The lowest means were in male and female gymnasts and distance runners and the highest mean the fencers and hockey players for males, and canoeists, rowers and swimmers for females. The student had larger skinfold than athletes even though the student were relatively larger compared to other comparable samples. In terms of factional masses, many within and between sex comparisons revealed similar proportional total body masses, but males had relatively lower adipose tissue mass and higher bone, muscles and residual masses as compared to females.

Boseworth\textsuperscript{12} conducted study on 187 college women who were tested for leg strength and vertical jumping ability, anthropometric measures and ratios were ascertained from photograph. The correlations were computed between the vertical jump and each of the anthropometric variables by strength. A multiple R of (.612) was obtained with the criteria leg left/weight x shape index, bi-iliac width/leg+2, lower leg, and

foot width. Neither the anthropometric measurements as strength variables, nor the cumulative effect of the vertical jump to predict performance adequately.

Margaret\textsuperscript{13} studied body structure and design factors in the motor performance of college women, pure speed, Sargent jump, 600 yards run/walk, back strength, leg strength and strength index were studied in relation to 43 measures of body structure and design. The latter measurements were secured by means of photographic techniques, included measure of length, depth area as well as non linear expression of body built design and experimental combinations of variables. The correlation was significant beyond 0.01 level obtained between performance criterion and one or more variables from each group. The height relationship being consistent with experimental combination of variables.

Walter and Karl\textsuperscript{14} conducted this study to show the relationship of physique and shape to physical performance. The Indiana Motor Fitness Test was administered on Indian elementary school boys. The test for the

elementary level was composed of four test items. Straddle chin-up, push-up, squat thrust and vertical jump. The data were studied from the stand points of the distribution of boys by physique. The distribution of boys according to development level, the physical fitness scores by physique group, the physical fitness scores by developmental level and physical fitness scores by combined grouping of physiques and development levels. He concluded that:

a) The size and shapes had an influence on physical performance.

b) The thin and medium in physique who were large performed equally well physically. The same could be said about the smaller groups.

Cozen's et al.\textsuperscript{15} attempted to classify physical education students by anthropometric measurement for the first time in 1930's. These factors appear to be of some value predating general athlete performance and some studies may be located in the literature concerning height, weight and performance. Cozens stated that there was no relationship between height and weight of girl with fundamental skill achievement in a variety of sports. Where as administration as found little predictive value in

height and weight of track and field performance of 200 junior school girls.

Leady et al.\textsuperscript{16} conducted a study to determine the relationship between the body composition and physical performance and related items which might be useful in estimating body composition in terms of total lean body mass and percent lean body mass as measured by potassium determination in adult men. The data on 19 physical performance items were obtained from 40 subjects between 21 and 57 years of age. The results are of value for researchers in general and researchers in physical education in particular for estimating gross body composition using certain physical performance items.

Murlidharan's\textsuperscript{17} study was to find out relationship between anthropometric and physical performance variable measures to performance in long jump. The average age of the subjects were 22 years. Pearson Product Moment was used to compute correlations between performance in each independent variable namely standing broad jump, 50 yard dash, shuttle run (4x10 yards), sit and reach, vertical jump (leg


length) height and weight. The data were tabulated in the form of scatter
grams. The independent variables were taken on 'X' axis and the
dependent variables on 'y' axis. For 'x' axis and the dependent variables on
'y' axis for testing the hypothesis the level of significance was set at .05
level of confidence. The findings indicated that the anthropometric and
physical performance variables were very reliable for predicting
performance in long jump. From the findings of the study it may be
concluded that 1) leg length, height, standing broad jump, 50 Mts. Dash,
shuttle run (4x10 yards), sit and reach and vertical jump were the most
significant independent measurements in prediction sources in 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.

Hagberg and Edward\textsuperscript{18} studied physiological factors that relate to
20 k.m. walk performance of eight competitive walkers. The walking
velocity and the blood lactate dreaming steady state exercise was highly
correlated to walking pace ($r = 0.94$) and predicated performance time is

\textsuperscript{18} James A. Hagberg and F. Coyle Edward, "Physiological Determinates of Endurance Performance as
6% which agrees with previous observations on runners. The two factors that contribute to velocity at lactate threshold are oxygen uptake at lactate threshold ($\text{Vo}^2$ at Lt.) and sub maximal walking economy measured as the $\text{Vo}^2$ at a standard velocity. The oxygen uptake at lactate threshold was significantly correlated ($R = 0.89$) to performance in the walkers in the present investigation, which agrees with previous observation of walkers. The sub maximal male economy was significantly correlated to performance of walkers ($r = 0.82$). The maximal oxygen uptake measured during walking was not significantly correlated ($r = 0.62$) to performance. These data indicate that the velocity at lactate threshold correlates closely to performance in walkers and that the factor of sub maximal economy, which partly determines velocity at lactate threshold is related more to performance ability in walking than was previously observed in running.

Farrell, Wilmore and Coyle\textsuperscript{19} conducted a study of exercise heart state as a predictor of running performance. Eighteen experienced male distance runners volunteered to participate in the study. Body density residual lung volume and relative body fat were determined according to the referenced procedures. Performance data consisted of road race from

3.2 to 42.2 km. Whenever a subject ran a competitive race during the time span of the study state treadmill tests, his time was recorded and the distance verified it possible using a calibrated. 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 accurately predict performance.

The purpose of Promoda Devi\textsuperscript{20} study was to determine the relationship of selected physical variables each as strength a) arm strength, b) 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. Pearson Product Moment Correlation Methods was used to compute correlation and significance of the study. The findings of the study revealed that there was significant correlation between the arm strength and shot put performance (r = 0.452), significant correlation between leg strength and shot put performance (r = 0.419). Significant correlation between speed and shot put performance (r = 0.428). Significant correlation between flexibility shot put performance (r = 0.512) height and shot put

performance \( r = 0.007 \), leg length and shot put performance \( r = 0.027 \), thigh length and shot put performance \( r = 0.16 \), Ponderal index and shot put performance \( r = 0.5 \), crural index and shot put performance \( r = .07 \) within the limitation of the study the following can conclusion were drawn: 1) there was significant correlation between arm strength, leg strength, speed, flexibility and shot put performance.

There was no significant correlation between weight, height, arm length, leg length, fore leg length, thigh length, Ponderal index, crural index and shot put performance.

Hindmarch\(^{21}\) administered the following tests to 100 Canadian born white boys anthropometric height, weight, height-weight ratio, arm length, sitting height and leg length, performance one minute sit-ups, standing broad jump and one minute squat thrusts, trunk flexibility criteria - Leighton trunk and hip extension - flexion test, cureton trunk flexion test, modified ascot French bobbing test and Krausweber flexion test. The correlation between test. The correlation between the anthropometric and performance tests and the flexibility criteria were low, the highest was .36 between the standing broad jump and the Scots French Test, the Kraus

Webs Test Correlated .887 with the Scott French Test .830 with the cureton test and .779 with Heighton's test.

Alam's study was undertaken to find out the relationship of reaction time, agility and flexibility to performance in running broad jump of the 51 male students from first year degree class of bachelor of physical education at Lakshmibai National College of Physical Education, Gwalior. Pearson Product Moment Correlation Method was used to compute correlation and significance of the study was found by employing Pearson product moment correlation between running broad jump and reaction time, agility and flexibility. The findings of the study revealed that there was significant correlation between dependent variable and independent variables. There was significant correlation between running broad jump and flexibility. The obtained value of correlation was found statistically significant at .05 level of confidence. The following conclusions drawn:

1. There is significant correlation between reaction time and running broad jump.

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2. There is significant correlation between agility and running broad jump.

Burley et al.\textsuperscript{23} investigated the differences among seventh, eight and ninth grade girls in speed and found when speed scores were correlated with height and weight that correlations of .183 and -.003 were obtained when the speed scores were correlated with the various level length of the subject, the following correlations were obtained speed and olecranon to unequal tuberosity. 161: speed and olecranon to acronion process, .120, speed and greater torchantes to the lateral condyle of the tibia, 184. All these correlations indicate a neutral relation between speed and the anthropometric measures used, the mean scores of the eighty grade was .4 second greater than the mean for the seventh grade the mean difference being the only statistically significant.

A study of Smith\textsuperscript{24} presented some important current information on the relationship of certain structural measures and performance in vertical jump. All the correlation obtained were no - significant and almost zero. Similarly a low correlation was found between the vertical

jump and the individual's dynamometric leg strength. It could be pointed out once again that the components of both vertical jump and standing broad jump appear highly specific, on ability in one may not necessarily represent ability in the other.

Dolores\textsuperscript{25} investigated the relationship of shoulder flexibility and other selected factors to throwing performance by college women. Thirty five college freshmen were tested on the over-arm throw involving both accuracy and distance throwing. The variables shoulder flexibility, shoulder strength, speed of arm movement, age, height, weight, background, athletic background, and number and sex of children in the family were studied. Variables which proved to have predictive value in relation to accuracy throwing were the average of shoulder strength, speed of arm movement, athletic background, and the group of three physiological factors. Those variables which showed a significant relationship to determine throwing arm shoulder strength and athletic background, shoulder flexibility was not a significant predictor of throwing, shoulder strength was the best physiological variable flexibility was highly related to strength, either the accuracy of distance test items

could have been used and best predictor of throwing was found athletic experience.

Mosher\textsuperscript{26} examined the relationship of selected body measures to exercise energy cost in women and developed a regression equation to predict energy expenditure during sub maximal exercise. The 100 volunteers who served as subjects were aged 18 to 41. The body measures recorded were age, height, weight body composition (using the hydrostatic, weighing technique). The sub maximal exercise task was treadmill jogging at a predetermined target heart rate oxygen consumption was assessed by the Open Circuit Method. During the sub maximal treadmill exercise task to target heart rate the means values for oxygen consumption were 1.34912/Minutes and 22.1088 ml./Kg. Minutes. A significant relationship was found between heart rate, body composition, and weight with exercise oxygen consumption. Stepwise multiple regression analysis yield a formula for sub maximal exercise energy cost using heart rate and body composition as predictors.

Vole\textsuperscript{27} predicted the basic modern dance skills through selected anthropometric and physical fitness measurements. The purpose of this study was to determine if ability in basic modern dance skills could be predicted by measure of selected anthropometric and physical fitness measurements. Data for this study were collected on 24 female students participating in one of three non-eastern Pennsylvania Colleges. Measurements of height, weight, sitting vertex height, upper leg length, flexibility abdominal strength, leg strength, cardiovascular fitness and somototyping were taken. These measurement and six anthropometric ratios were statistically treated by BMDOZR stepwise regression programme developed by the health sciences computing facility, University of California at Los Angles. A regression equation with a multiple 'r' of .8678 was presented by the author for the prediction of the ability in basic modern dance skills and prediction tables for its computation were developed. The equation required the collection of 5 anthropometric measurement and two physical fitness of 5 anthropometric measurements and two physical fitness test on the basis of the finding of this study the author calculated that ability in modern dance skills can be

predicted from selected anthropometric and physical fitness measurements.

Johnson\textsuperscript{28} studied the explore the relationship balance, speed, strength, height arm and leg length to success in collegiate wrestling. The subjects (N=20) for this investigation were collegiate wrestlers with atleast 2 years varsity experience who had wrestled in at least 50% of their teams matches during the 1976-77 school year. Subjects were classed successful average or unsuccessful according to their win-loss. A second classification was by weight (light weight, middle weight and heavy weight). All subjects were measured fore arm length and leg length and tested to RT.MT., static elbow flexion, strength, explosive leg strength and dynamic balance. Treatment of the data by ANOVA showed no difference among the Wrestlers in the three weight division on dynamic balance, explosive leg strength and RT. In elbow flexion strength the middle weights were stronger than the light weight. The light weight and middle weight were fasters in Mt and Rt than the heavy weights. The unsuccessful wrestlers had longer legs than the average and successful wrestles. Analysis by multiple R and regression showed that no

combination of the independent variables was useful in predicting success.

Smith\textsuperscript{29} studied the relationship of volleyball playing ability to scores achieved in the Sargent Vertical Jump. Three groups of subjects were formed 68 beginning players, 11 varsity players and three highly skilled and experienced players, vertical jump correlated. .35 with the Brady Test. 55 with the judges, evaluation and .50 with a combination of the Brady test and judges evaluation for the beginning players. The 'r' between the vertical jumping ability ranking by their coach was - .36. It was concluded that the vertical jump is not an accurate predictor of volleyball playing ability.

Marrow et al.\textsuperscript{30} conducted a study on various, anthropometric, strength and speed variables. They obtained data from 100 Intercollegiate level women volleyball players. Who participated in regional round robin tournament. The purpose of this study was to determent if there was any relationship between the factors and team success.

Gladden and Colacino\textsuperscript{31} studied the height, weight, skin folds, vertical jump and maximal anaerobic power of 88 female participants of the 1974 United States Association National Tournament. The volleyball player were (172.2 cm.) tall with (68.5 kg.) of weight, with regard to total skin folds. The players were very lean when compared to the national population of females. The final standing in the tournament was significantly correlated with age, height, vertical jump and maximal height on jump. The partial rank correlation showed that height and vertical jump were the major factors correlated with final standing.

Bakker\textsuperscript{32} selected 28 members of the women extramural volleyball teams at Illinois University as subjects. Two experienced volleyball coaches established the criterion by rating each player on her playing ability. The following variables were measured: height, weight, leg extensor strength using the multiple angle testing unit, grip strength using an adjustable dynamometer, skin folds using the caliper, jumping ability using the jump and reach test, and an apparatus constructed by the investigator to measure reaction and movement times through 't' test and correlations, it was formed that jumping ability and reaction time were

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significantly related to success in volleyball. A multiple correlation (R) of .718 was abstained between the nine variables and the criterion. An 'r' of .53 was obtained between the criterion and reaction time plus jumping ability, and one of .52 between the criterion and jumping ability plus weight. The regression equation computed in this could be used to predict success in volleyball playing.

Phipps\textsuperscript{33} studied was to compare selected general ability tests, specific skill tests and personality traits as predictors of volleyball performances in high school girls, 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 their respective players. The data from three of the schools were used to develop prediction equation using a general linear model procedure the specific test model has the highest correlation with overall performance. The combined equation of generally and specific had the highest relationship of any combined model to criterion score. The specific model was the most valid predictor of criterion score followed by the combined general and specific model. There is little relationship between selected tests of general physical

ability and volleyball performance. There is relationship between selected specific skill test and volleyball performance. The specific test model is the best predictor of volleyball performance. The specific test model and combination of the general ability and personality with the specific are better predictors of volleyball performance than the coaches beginning of seasons judgement.

Marrow et al.\textsuperscript{34} established the importance of strength, speed and body size for team success in women's intercollegiate volleyball various anthropometric, strength and speed variable were obtained on 180 intercollegiate women volleyball players who participated in the regional round robin tournament. The purpose of this study was to determine the factors under laying the motor performance of women and then determine if there was any relationship between the factors and team success. Factor analysis of the measured variables showed that the variables could be dimensioned as body size speed, fat and strength multiple discriminate analysis showed that the teams were significantly different on the factors of strength and speed, fat. The two dimensioned discriminate space were plotted and the graphic representation showed that the stronger, faster and

\textsuperscript{34} James R. Marrow et al., "The Importance of Strength, Speed and Body Size for Teams Success in Women's Intercollegiate Volleyball," \textit{Research Quarterly} 50 (October 1979):429.
leaner teams were the most successful in tournament play. The results should that the basic factors of speed/fat and strength were related to team success. Multiple discriminate analysis helped to identify the two most important individual variables for team success. Upper body strengths and fat weight were identified as most important in differentiating between players of the most and least successful teams.

Amusa\textsuperscript{35} selected 46 subjects who were well conditioned soccer players with at least two year playing experience on the college level. They were tested for anthropometric measurement consisting of skinfolds and body diameters were taken analysis of data was by zero order correlations and multiple regressions analysis resulting in the conclusion that age (experience) is the best single predictor of playing ability, weight L.B.M. and height are consider good predictors of playing ability.

Joseph\textsuperscript{36} determined the relationship of power, agility, shoulder flexibility, arm length and leg length to volleyball playing ability. Thirty male volleyball players of the L.N.C.P.E., Gwalior were selected as


subjects. It was concluded that arm length and leg length were reliable variables in predicting playing ability of male volleyball player.

Shergill\textsuperscript{37} conducted a study on some motor fitness components as predictors of hockey performance fortythree women hockey players attending preparatory camp for national games were selected as subjects for the study. The age ranged from 17 years to 22 years. Seven important motor fitness components, which play a significant role in hockey playing performance, were selected, there were speed, strength, strength endurance, flexibility, agility and power. In order to examine the relationship between selected motor fitness components and hockey playing ability. The data were analyzed using correlation technique. The correlation analysis shows that from the selected seven motor fitness components only four are significantly selected to playing performance in hockey. These are speed, endurance, agility and power grip strength and flexibility are not significantly related to playing performance in hockey. In order to examine the contribution of selected motor fitness components in hockey playing ability the following regression model was formulated.

Hockey performance = B0 + B1 (Speed) + B2 (Left grip) + B3 (Right grip) + B4 (Endurance) + B5 (Flexibility) + B6 (Agility) + B7 (Power). The results of regression model shows that the 't' ratio of the regression coefficient of speed, endurance, power and agility are significant at .05 level indicating that they contribute substantially in the prediction of hockey playing ability. In order to examine the contribution made by each components towards multiple correlation, stepwise regression analysis was applied F-ratio was used, backward elimination method was used in this regard. The analysis of data based on motor fitness components as predictors of hockey performance reveals that hockey performance is significantly related to speed, endurance, agility, and power, therefore these selected motor fitness components may be considered as valid predictors of hockey playing performance.

Uppal and Datta\textsuperscript{38} studied the motor fitness components as predictors of hockey performance. The purpose of the study was to identify those motor fitness components which could predict the performance of the game. Seventy four male hockey players from different universities of India served as subjects for the study. The motor

fitness components include speed, strength, power, agility, dynamic balance, flexibility, and kinesthetic perception. Strait's field hockey rating scale served as a criterion measure to evaluate the playing ability. The study included that motor fitness components mainly speed, grip strength (both right and left), agility balance, kinesthetic perception contributed to hockey playing ability, whereas power and flexibility were not significant contributors to hockey performance.

Gilibert[^1] studied the selected variables in predictor basketball players and demonstrated that a battery of four independent variables selected from a total of ten best reflect composite basketball ability and performance as the college level. These four variables are ability criterion, arm strength, penny cup test, and speed pass. However, since the desired multiple of 95 was not recorded this limit, the utilization of this battery as a predictive measure of basketball ability.

Wharton[^2] studied the AAHPER Youth Fitness Test as predictor of skill development in field hockey. One hundred and seven senior high school girls who had no previous field hockey training were used as

subjects. A significant relationship was found between the scores on the youth fitness test and field hockey achievement as measured by the schmithals - French Field Hockey Achievement Test.

Toner\textsuperscript{41} investigated the relationship of selected physical fitness and mood variables to success in female high school basketball candidates. The study examined the relationship of physical fitness, skills and mood variables success in female high school basketball players being chosen to become varsity players. Mc Nair's profile of mod states, Cooper's 12 minutes run test, AAHPER Jump and Reach Test, AAHPER Shuttle Run test, AAHPER under Basketball Test, 30 Yard Dash, Speed Dribble Test were administered to eighty one female high school basketball candidate. Each of the three teams was treated on three separate occasion during the regular afternoon practice time for the teams. At the end of the testing and evaluation period, the few of coaches on the basis of their observation during drills and scrimmage competition independently related each candidate as either a successful or unsuccessful performance. Discriminate analysis procedured. Supported the following hypothesis:

\textsuperscript{41} Mark Keven Toner, "The Relationship of Selected Physical Fitness Skills and More Variables to Success in Female High School Basketball Candidate," \textit{Dissertation Abstracts International} 42 (March 1982):3909-A.
a) The fitness factor, skill testing and personal factors (known
together as per season variables) were successful indicators of group
membership while the POMS variables were to a lesser extent, (b) the
battery of tests pre-season and POMS did correlate with coaching ratings.

Gordon\textsuperscript{42} predicted the basketball playing ability from
cardiovascular capacity (Cooper's 12 minutes run), leg power modified
Sargent jump) upper body strength and endurance (flexed arm hand),
body composition (skin fold thickness) and body weight and height.
Reliability was determined by test retest procedure on six randomly
selected subjects. Separate prediction equation were developed for five
criterion measures, on ability rating consisting of four offensive defensive
descriptive teams, the Tutko - Richards General Personality Rating, a
composite score of the two measures, the Mall comparative rating scale
which utilized game statistics and a ranking of the players by the coaches.
The sample consisted of 20 female basketball players from the 1976-77
University of Arkansas and North Eastern Dklohma State University
Teams. The data were analysed by the stepwise multiple regression

programme. The best prediction equation was found to be: basketball ability = 9.0 53 + 1.364 (12 minute run) - 0.113 ht.

Holland\textsuperscript{43} investigated the predictive value of selected variables in determining the ability to play basketball in small high schools. Measures included speed, agility, upper arm strength power, ball handling ability, reaction time, shooting ability, passing ability, height, weight, age and previous experience. The criterion was the rating of 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 with R = .76 was basketball ability score = (1.54) number of year experience + (1.23) score on speed dribble + (2.26) score on wall volley + (.15) score on shooting test - 10.11.

Everett\textsuperscript{44} studied thirty university of Iowa varsity basketball players were tested by and rated according to playing ability by coach Otho M. Vagal. The rating were used as the criteria against the test results were correlated. To determine the test to be given the qualities needed by a proficient baseball player in each position were listed, running speed and

\textsuperscript{44} Peter W. Everett, "The Prediction of Baseball Ability," \textit{Research Quarterly} 29 (March 1952):15.
agility, eye-hand coordination, foot reaction time, ability to judge distance, ability to visualise spatial relationship, ability to make decisions quickly, ability to throw accurately, ability to relax properly, and motor capacity. Inter correlations were computed by the Pearson Product Moment Method and multiple correlations were computed by the Wherry Doo-Little method in order to determine the relative contribution of the Sargent jump, shuttle run throwing block test and 'S' test criterion (rating). It was recognize that correlations computed from data obtained from a homogenous group of narrow range would be lower then from more variables group.

Gallagher\textsuperscript{45} investigated the relationship of agility to performance in women's intercollegiate basketball. The hypothesis that high positive relationships would exist between items of the test (M.C. Cauliff Agility Components Test) and performance were not supported. The lack of evidence to support the hypothesis was attributed to some unexpected peculiarities of the sample and several recommendation were made for continued investigation.

Yeo\textsuperscript{16} studied the relationship of reaction time, performance time and handball velocity to success in handball. It was concluded that player with the most ability in handball will demonstrate fast reaction time of the non-dominant foot, fast handball velocity of the dominant hand and fast performance time of the dominant hand. The conclusion were reached from data concerning 10 variables related to success in handball collected from 14 players who participated in a round robin tournament.

The purpose Sinha's\textsuperscript{47} study was to find out the relationship of selected motor traits and anthropometric variables to performance in AAHPER basketball skill test, to establish relationship between selected motor traits and anthropometric variables to performance in AAHPER basketball skill test. The coefficient of correlation '$r$' was used. The finds of this study indicated that performance in AAHPER basketball skill test was significantly related to agility, cardiovascular, endurance, explosive strength, height and cural index, whereas performance in AAHPER basketball skill test were not significantly related to speed, grip strength, back, flexibility, weight and ponderal index, on the basis of the findings


\textsuperscript{47} Shailendra Kumar Sinha, "Relationship of Selected Motor Traits and Anthropometric Variables to AAHPER Basketball Skill Test (Unpublished Master's Thesis, Jiwaji University, 1984):72-74.
of the study the following conclusions may be drawn: 1) explosive power, agility and cardiovascular endurance are the key motor traits that underline performance of skills in basketball 2) height as well as the relative leg length measurement (crural index) are the main anthropometric characteristics with contribute of skills in basketball. 3) The motor traits of speed grip strength and flexibility are not the prime factors for performance of skills in basketball. 4) Excess body weight has restricting effect on basketball performance.

Twenty four Childderss\textsuperscript{48} studied test items were selected though a review of the related literature as valid measures of the components of high school basketball ability. The test items were administered to 106 high school basketball players and the resultant data was analyzed through the utilization of the principal exes method of factor analysis with various criterion for rotation, seven factors were isolated and six factors were identified as agility, speed, relative muscular endurance, basketball speed manipulation, gross muscular strength, total body movement time and manual extensity one factor was unidentifiable in terms of common test items with high factor of loadings. The test batteries were constructed

\textsuperscript{48} James Thomas Childderss, "A Factor and Discriminate Analysis to Identify and Determine the Effectiveness to Selected Physical Variables in Predicting a Successful Basketball Performance," Dissertation Abstracts International 33 (Nov. 1972):2146-A.
the first consisting of seven items loading highest on the isolated factors, the second was composed of ten test items. The first battery were utilized in a discriminate function analysis effectively classified the 106 subjects into two population identified as a successful and unsuccessful basketball players.

Battles\(^{49}\) conducted this investigations to develop a prediction equation for selection of women intercollegiate basketball team members. Thirty three females from three colleges in Florida acted as subjects. Each subject completed a personal data form. The athletic motivational inventory the Knox Basketball Test, Sargent jump test and the field goal speed test. Selected anthropomorphic measurements were also obtained from each subject. Each head coach and each assistant was asked to rank each member of the team in order of how each contributed to team success. There different ranking such as head coach's ranking. The assistant coach's ranking and the average rankings of the head and assistant coaches were included in the statistical analysis. Significant correlations (.05 level) were found to exist between the head coaches 'ranking and the age and college basketball experience, and between the

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average of the head and assistant ranking and college basketball experience results of stepwise multiple regression indicated that players 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 AMT total score assistant coaches tended to select players with high scores on psychological variables which included trust, responsibility, mental toughness and aggression. The average ranking of the head coach and the assistance (s) forwarded players with college basketball experience, responsibility, mental toughness, age and self confidence.

This study was under taken by Basunia\(^50\) to find the relationship between height, agility and flexibility to reaction time, vertical jump and sprinting speed of the soccer players. The findings of the study show that there were no correlations between height with reaction time, vertical jump and speed which were not found statistically significant at .05 level of confidence. The study also reveals that there was a high correlation between flexibility and speed with the obtained value of correlations being .53. Which was found statically significant at .05 level of

confidence. But flexibility had no relationship with vertical jump and reaction time with the obtained values were .18 and .34 which were not found statistically significant. Therefore, it can be contended while selecting soccer players greater consideration should be given to agility and flexibility instead of considering height only. From the findings of the study it may be concluded that (1) agility was the most important variable in the prediction of reaction time and speed of men soccer players but not contributed in the performance of vertical jump. (2) Flexibility of individual contributions much in developing speed but does not contribute in developing the reaction time and vertical jump. (3) Height of an individual was not a factor in developing the reaction time, vertical jump and speed. (4) It may be concluded that in selecting soccer players greater consideration should be given to agility and flexibility.

Austin\textsuperscript{51} investigated the relationship of modern dance performance to strength coordination and kinesthetic perception. Fiftyfive subjects were given a grip dynamometer test, the bass dynamic balance test, and Younger's positening test. Three judge rated ability to perform a set

technique. The judges were reliable and consistent. No significant relationship appeared.

Cristin\textsuperscript{52} conducted a study of identify the contribution of selected variables. These subject was the member of south eastern state college football team. Each subject was tested our 12 variables and stepwise multiple regression was determined to use. The ultimate criterion was the percentage of play executed correctly in determining by grading the team 1973 regular reasons football games. It was found that the best predictor of game percentage was the lateral movement with a correlation. \textsuperscript{.33} for the line best predictor of the game percentage score was bench steps with correlation of \textsuperscript{.33}. When the back and line group were combined. The best predictor of game percentage score was vertical jump with correlation of \textsuperscript{.50}. It was concluded that for total group vertical jump ad 12 minute run serve were best predictor.

Money and Whitely\textsuperscript{53} conducted two experiment on the college men in which lateral arm movement of approximately \textsuperscript{90\degree} degree involving about four feet of hand travel was made at maximum speed.

The movement time, effective arm mass. The static dynamometer strength of muscle were measured for each subject. It was concluded that there is no significant correlation between stature strength and strength in action.

Raman\textsuperscript{54} conducted tests on 30 male cricket players from graduate and undergraduate courses at Lakshmibai National College of Physical Education, Gwalior in order to determine the relationship of grip strength, leg power, agility and hand and foot reaction times to performance in cricket. Data was collected on grip strength (grip dynamometer) : leg power (standing broad jump), agility (40 yard shuttle run) and hand and foot reaction time (electronic reaction timer) and performance was the average of subjective rating of there expert during practice and match situations. Pearson Product Moment Correlation was employed to statistically treat and data. It was concluded that 1) hand and foot reaction time is the most important variable in the prediction of performance in cricket. 2) Leg power is another important variable in the prediction of performance in cricket. 3) Grip strength is also as important variable of prediction in cricket playing ability. 4) Agility is not an important factor in the prediction of performance in cricket.

Robert and David\textsuperscript{55} 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 skills items (Mc Clay's classification index, strength power time to hit, audio-visual agility speed, work output). Substantial correlations were obtained between most test items and the test criterion, the sum of 't' scores, size as depicted by Mc Clay's classification index (CT) had a negative non-significant correlation with the criterion. The discriminative power of the battery was evidenced by the highly significant correlation between the test criterion and the coaching staff's ranking of individual player (sho = .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 starts of competition were evaluated on the basis of the same test battery. The battery substantiated a stepwise progression between being noted. The test showed validity in that the criterion (The sum of 't' scores) was significantly different between the teams.

Mccheli\textsuperscript{56} study was to explore the possibility of developing a regression equation where by football ability could be predicted from an analysis of selected orthopedic measures, strength test, power measures, balance, standing height and body height, stepwise multiple regression and polynomial regression were utilized to from predictive equations whereby fourteen measures were multiple correlated with the criterion variables the prediction equation for stepwise multiple regression programme was "Football ability = 190.262 + 8.212 (Bow Legs) - 0.0752 (Tibial Torson to .328 (Body Weight) - 3.595 standing height) - 0.050 (Knee Flexion) R = .458 percent standard error of estimate was 13.3 percentage. The prediction equation for the polynomial regression program was football ability = 787.682 + 7.330 (Bow Legs) - 143.525 (Standing Height) - 2.606 (Tibial Torson) - 33.404 (Horse Power) - 0.408 (Body Weight) R = .573 percent standard error of estimate error was 15.7 percent. The prediction of football ability for scholarship football players as the university of Arkansas. Strength test using a tensiometer are not good predictors of football ability static balance in not a good indicator of football ability. Margaria Anaerobic power test is a good measure of football ability.

Ellena\textsuperscript{57} studied the relation of physiological factors to football performance. Minutes played during the 1958 football season was used as the criterion players were measured in the 50 yard dash, right grip. Left grip, and arm push and pull strength speed correlated .60 and total strength .40 with the criterion. Both correlations were significant but the predictive value for minutes played was slight.

CRT and football performance of SHS varsity football athletic (N=25) from up state NY were investigated by Basles. Each subject performed 21 trials through a "Run to daylight "Photoelectric multi-stage." Timing device, seven trials of each gate yards gained at each carry was utilized as the measure of football performance CRT was subjected to 93 x 7 ANOVA to determine differences between gates and between trials. Inter class correlation revealed a reliability coefficient of .73 for all trials across gates. CRT and yards gained per carry were subjected to correlational analysis. The resultant (r = -.17) revealed a negligible relationship between CRT and footballer performance.

Kacevich\textsuperscript{58} obtained simple reaction times, movement times, and total response times (RT + MT). In the laboratory and on the football field for a group of 82 varsity football players to determine relationship between TRT and general football playing ability and TRT and individuals playing different positions. Finally, simple reaction time as measured in a laboratory situation was compared with simple time as measured in a field situation. Each subject was assigned to one of eight groups. Depending upon the individuals general football playing ability and to one five position categories. Statistically were calculated between TRT and team ranking and TRT and individuals playing different positions. A low positive relationship between simple lab RT and simple field RT was calculated.

Campbell\textsuperscript{59} selected 40 male members of the 1978 Springfield College Varsity Football Squad were tested for height, weight, 10, 20, 30 and 40 yard dash, speed, vertical jump, agility, upper body strength and lateral movement. In addition, each player had a game performance score assessed by the grading of a game filing selected at random. Data were


treated by multiple R and regression and r. No relationship were found between height and weight and performance between agility and performance. No relationship was found between upper body strength and performance speed was found to relate positively to performance. It was concluded that performance in football cannot be effectively predicted by combinations of the structural and physical performance variables utilized in the study.

Evans\textsuperscript{60} conducted this study to identify a general factor of football playing among black high school athletes in Louisiana, and constructed a discriminate function which classified football players into successful and unsuccessful population. The subjects were 154 black high school football players from five public school in Louisiana. Twenty there experimental variables which were related to football playing ability were selected from the literature and from the suggestion of professional football scouts and coaches.

The attempt to identify a general factor of football playing ability was unsuccessful. However, six factors were related to the football playing ability. A combination of four and six test items were used to

compute three discriminate function techniques. The four test items selected were leg lift, 40 yard dash, standing height and body weight. The results were interpreted to mean that the selected test items were effective in identifying successful and unsuccessful football players.

Rydalch\textsuperscript{61} investigated the relationship between fourteen biographical factors and players success in junior college football. Data was collected on 812 subjects football player from 17 junior colleges located in eight state head football coaches at the participating college rated their own individual players and the ratings of the coaches were analysed by multiple correlation and regression analysis at Brigha Young University in Provo, Utah. The findings of study were: 1) the twelve independent variable which were analysed were significantly relation to football success at the .01 level, and 2) six factors-honours, speed, weight, team record in high school, height, and size of school were selected as those variable with the highest relationship to success.

The purpose of Joyner, Albert and Barry\textsuperscript{62} study were to describe the differences in golf ability of college males and to predict gold ability

\textsuperscript{61} Donald Doyle Rydalch, "A Study to Identify and Analyze Biographical Factors Which Predict Players Success in Junior College Football," \textit{Dissertation Abstracts International} 32 (September 1971): 1323-A.

based on performance on a battery of golf skills test subjects in the study were 61 college males who were placed in an advanced, intermediate, or novice ability group based on their average golf score. The golf skill test battery consisted of a drive, middle distance, pitch, chip and putt test.

Descriptive discriminate analysis was used to identify group differences. There analyses were reformulated and the results were similar for each analysis. The most important variables to separating the groups was the drive followed by the pitch and putt. The combination of the drive, pitch, and putt separated the group.

As well as the original five variables combination. The underlying structure separating the groups consisted of the drive, pitch, and putt and was labeled on overall golf factor.

Predictive discriminating analysis was used to classify the subjects into the group that they most closely resemble. For the advanced groups, the classification rate was 85%. The most important test for classifying subjects into the intermediate group was the pitch test. The drive and pitch test classified intermediate subjects with same accuracy as all five tests. The classification rate for the novice group was 90%. For the novice
group, the chip, pitch, and middle tests were similar in importance four
two test combinations classified novice subjects with 100% accuracy.

The major conclusion of the study were (1) the difference in golf
ability are well explained by the drive, pitch, and putt test and (2) for
classification.