Chapter II

REVIEW OF RELATED LITERATURE

A serious and scholarly attempt has been made by the research scholar to go through the literature related to the study. The relevant studies of specific importance are cited below.

Larson\(^1\) measures and compared the abilities and physical characteristics of one hundred eleven collegiate soccer players by position of play. The result showed that a difference existed in the endomorphic components of somatotype with half-back significant than all other position. Differences were also found in height with goalkeeper and full back who were taller than the forwards. In motor abilities difference were found with full back more powerful than forwards, soccer ability with half-back were more skilful than goalkeeper. No differences were evident in the abilities of agility, upper body strength and endurance.

Schneider and Havens\(^2\) reported that physical exertion increases the percentage of haemoglobin, erythrocytes and leukocytes in the blood. They imply that this greater concentration of blood is an increase in the specific gravity in proportion to the increase in the red corpuscles. He also observed in his final rounding up that there was wide variability in the effect of various activities on whole blood viscosity.

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Eaton\textsuperscript{3} has conducted a study to examine the criteria of football offences. The study examined the criteria upon which twenty one Massachusetts high school football coaches built their offences. It was concluded that speed, ball control, simplicity, balance, deception, power, players confidence and timing must be made as basic criteria to be considered for the long gain, balance of offensive and defensive style, quarter back training and blocking angles.

Sobol\textsuperscript{4} conducted a study to determine the validity of subjective ratings of the ability to handle a given weight ball as a criterion measure of bowling ability and to investigate their relationship among anthropometric strength performance. Data were collected for each subject on height, weight, arm strength, grip, pull-ups, three finger bowling grip velocity, fast ball average and games scores. All groups were significantly different in all variables athletes 1 or 5 percent level when an analysis of variance was computed. The Duncan multiple range test was used to determine significant difference between pairs of means.

Carter\textsuperscript{5} has conducted a study of somatotype of college level football players. The findings have indicated that there were somatotypes and size difference between playing position and between players at different college level. Some somatotype which are rare in general population are common in football players. The dominant physique in the study was the extreme endomorphic, mesomorph gross size is an outstanding characteristic of football players.


Price\(^6\) conducted a study on the relationship of college football players strength, speed and agility to the coaches ranking of ability. Playing position were combined into offensive back, defensive back, offensive linesman, defensive linesman and into while group units. The players were further divided into group-I or group-II. Correlation were then computed between the objective test score and coaches subjective evaluation. It was concluded that arm strength and agility were not valid predictor of football ability: total strength and total 't' score were moderate predictors of football abilities and leg strength and speed were significant predictor of football ability.

Caru et. al.\(^7\) compared the maximum anaerobic and maximal aerobic muscular power of young football players with corresponding non-athletic subjects. He found that the average maximum anaerobic muscular power in football players was significantly higher than non-players. On the contrary the maximal aerobic power does not differ significantly between two groups.

Schrciber\(^8\) studied the effect of participation in University athletics on anaerobic fitness and relationship of somatotype to the development of anaerobic capacity. She concluded that all somatotypes improved in anaerobic capacity as a result of training. High intensity work of low duration made the greatest intra-group improvement in anaerobic capacity following participation in their sports. And also the endomorphs and mesomorphs had higher anaerobic capacities than other somatotype categories.


Johnson\textsuperscript{9} conducted a study to investigate the effect of season of inter-collegiate soccer participation on selected components of physical fitness. The elements of physical fitness measure were agility, cardio-vascular endurance, muscular strength of the leg and running speed. The subjects were 16 members of Emory University Soccer Team 1971. The pre-season practice and the competitive season lasted approximately 10 weeks. It was found that participation in inter-collegiate soccer programme was likely to cause adaptation in the circulatory and respiratory system that would result in increased efficiency or improved cardio-respiratory endurance. It produced significant improvement in agility, muscular strength of the legs and running speed also.

Saha\textsuperscript{10} made a study to compare the selected physical fitness variables and anthropometric measures of tribal and non-tribal students. Items of AAHPER Youth Fitness Test i.e., 50 yards run, 4x10 yards shuttle run and 600 yards run/walk and selected anthropometric measurements i.e. chest girth, height, weight, upper arm length, thigh girth and calf girth. In all tests and measurements the means score of the composite score of tribal students were higher than their non tribal counter parts, but non of difference in means were found statistically significant at 0.05 level of confidence.

Brogdon\textsuperscript{11} conducted a study of Mexican-American and Anglo-American males by using anthropometric measurements and AAHPER Youth Test. 13

\textsuperscript{9} Thomas C. Johnson, "The Effect of Season of Inter-Collegiate Soccer on Selected Component of Physical Fitness," \textit{Dissertation Abstracts International} 32 (May 1973) : 3355-A.

\textsuperscript{10} Umesh Chandra Saha, "Comparison of Selected Anthropometric Measurements and Physical Fitness Variables of Tribal and Non-Tribal Students of Tripura," (Unpublished Master's Thesis, Jiwaji University, Gwalior, 1972).

anthropometric measurements, such as standing height, sitting height, weight, shoulder width, arm length, chest girth, wrist girth, hip width, thigh girth, leg length, calf girth, foot length and arm girth were taken. The Scheffe's Test was used to test the significance of the two groups correlations were obtained for each of the different age levels and for the total sample population on the following: physical fitness and anthropometric measures, age and physical fitness measures, age and anthropometric measures. The significance of the difference between the correlations was tested by two techniques.

The report showed that there exists difference in physical fitness and anthropometric measurements in the two subcultures of the United States. Both groups exhibited higher body measurements and fitness scores at each succeeding age level. This denotes a relationship between physical fitness and physical growth. Age as the predictive factor was important to both the groups.

Shreer\textsuperscript{12} studied a group of thirty untrained college males aged 10 to 20 years, who volunteered for test on 100, 200, 400 and 800 yards run, as well as on 1, 2 and 3 miles run. This study was conducted to predict maximum aerobic power and anaerobic work capacity various running performance, and no practice sessions were given for the track running. In addition the subjects were tested for maximum aerobic capacity (max O2 intakes) on a treadmill and anaerobic work capacity (as measured by method of Margaria). It was concluded that distance beyond half mile are significantly related to the aerobic work capacity and distance upto including quarter mile are significantly related to anaerobic work capacity.

Christen\textsuperscript{13} identified the contribution of selected variable to the football game performance. 30 members of the 1973 South-Eastern State college football teams were chosen as the subjects. Each subject was tested on twelve variables and a stepwise multiple regression was used to determine the weight of each of these variables to the ultimate criterion, the performance of plays executed correctly and determined by considering the film of the team 1973 regular session football game. It was found that the best predictor of the game percentage of score for the batch lateral movement with a correlation of 33 for the line; the predictor of game percentage of score was bench steps with correlation of 0.67. When the back and line groups were combined the best predictor of the game percentage score was the vertical jumps with correlation of the 0.03. It was concluded that for the total group, the vertical jump and the 12 minutes run were the two best predictors.

Martin\textsuperscript{14} conducted a study by comparing the selected anthropometric measurements and physical performance between Mexican, American and Anglo-American adolescent boys. Also comparison of body size, body structure and physical performance were made between the subjects at adjacent age levels within each individual racial group. The body size was assessed by standing height and body weight measurements. Body structure was interpreted as upper arm girth, chest girth, abdominal girth, thigh girth and calf girth measurements. The physical performance was determined by selected motor ability tests. It was concluded that the Anglo-American subjects were significantly taller than the Mexican-American subjects. It was also concluded that excluding standing height, the Mexican and Anglo-American


subjects did not differ in body size and body structure and also these two races did not differ in physical performances.

Gettman\textsuperscript{15} compared the physiological responses of adult men to one day per week, three days per week and five days per week training programme. Significant improvements were realised in resting and recovery heart rates, treadmill performance time, VO2 max, maximum O2 pulse and VE max. The degree of improvement was in direct proportion to frequency of training.

Premchand\textsuperscript{16} conducted a comparative study of physical qualities of offensive and defensive football players at college level. He selected thirty two football players of Lakshmibai National College of Physical Education, Gwalior who took part in a district level football tournament. He compared agility, speed, strength, endurance and height, weight in offensive and defensive players. He statistically analysed the data and calculated ‘t’ ratio and concluded that:

1. Defensive players are heavier taller and have more muscular power than offensive players.
2. Offensive players are faster and have more endurance than defensive players.
3. There is not significant difference between offensive and defensive football players in agility.

\textsuperscript{15} Gettman, “Physiological Responses of Men to 1-3-5 day per Week Training Programmes,” \textit{Research Quarterly}, 47 (December, 1976) : 638.

Votto\textsuperscript{17} studied somatotype and physical performance characteristics of major colleges' football players. Twenty three players representing the offensive regulars of the 1975 North Caroline National Championship football team were evaluated on physiological, motor fitness and somatotype measures during spring training on the football team were aged 22.1 year, height 75.5 inches, weight 238.4 lbs, percent body fat (skin fold) 12.7 percent and anaerobic power. The relative somatotype interposition comparison shows the football players markedly classified on endomesomorphic with observable inter position differences. Analysis of variance for repeated measure showed significantly greater anaerobic power in offensive linesman than defensive and defensive backs, while selected flexibility measures showed the offensive lines men to be most flexible.

Cassel\textsuperscript{18} compared the motor ability and physical characteristics of collegiate soccer players by position of play. In motor ability differences (P.05) were found in leg power and in this respect the fullbacks were found to be more powerful than forwards. In respect of soccer ability, the half-backs were found to be more skilful than goalkeepers; and in speed forwards and fullback were much faster than goalkeepers. No differences were evident in the ability of agility, upper body strength and endurance.

Verma, Mohindroo and Kansal\textsuperscript{19} measured the anaerobic power, vertical velocity and weight of 6 Indian National players belonging to different games by using


the technique of Margaria et. al. (1966). The purpose of the study was to compare the anaerobic power of different categories of sportsmen like athletics, basketball, football and hockey and also to workout the real intersportive and intersportive differences using the same technique. The different intersportive groups of players have shown quite different values of the parameters studied and it is very interesting to note that the trend of variability in the various sports categories studied greatly with the demands of the various games. The intersportive differences in the anaerobic power and vertical velocity were found to be statistically significant. On separately computing the anaerobic power, vertical velocity and weight of different groups of football players based on their respective playing position, it was s found that goalkeepers are at the top as far as the mean values of the above mentioned parameters are concerned which seems to suit best to their game requirements because they have to use their energies instantaneously during the game which for them requires short sprints of violent muscular ability. Similar positions wise break-up of hockey players revealed that again the goalkeepers are at the top as far as anaerobic power, vertical velocity and weight are concerned. Forwards who have to carry the ball for attack, considered to be the most briskly engaged players, have shown lower values of vertical velocity with intermediate value for anaerobic power, this combination of lighter body with high vertical velocity represents a beautiful physiological status of forward players for performing their field duties.

Bhanot and Sidhu\(^{20}\) conducted a study on 90 players including 10 goalkeepers, 16 back, 22 half-backs, 44 forwards. Maximal vertical velocity was determined by the technique described by Magorita (1966). The anaerobic power was calculated from the body weight and maximal vertical velocity of the players. The goalkeepers were the fastest in vertical velocity and possessed best aerobic power. They were followed by

batch in anaerobic power and by half-back in vertical velocity. The forwards were the slowest in vertical velocity and possessed maximum anaerobic power. In body weight the backs were heaviest, followed by half-backs, goalkeepers and forwards. In the back line, the lefts had higher anaerobic power with more vertical velocity than right. Among half line players, the centre half back were followed by left half-backs and right half-backs, both in body weight and anaerobic power. While in vertical velocity the left half-backs were the fastest and centre half-backs the slowest. Among the forward line players, the centre forwards had maximum anaerobic power and body weight followed by inside forwards and outside forwards, whereas, in vertical velocity the inside forwards were fastest followed by centre forwards and outside forwards.

Gangadharan\textsuperscript{21} conducted a comparative study that selected anthropometric measurement i.e., height, chest girth, and weight of 60 athletes of different sports and concluded that volleyball players were significantly taller than basketball and hockey players. The groups did not differ significantly in any other anthropometric measurements undertaken in the study.

Kansal et al\textsuperscript{22} studied the physique and body composition of the intervarsity soccer players of zonal champion and runners-up team of the north zone. They concluded that the defence line players were significantly taller and heavier than forward line players. Forward line players had narrow hips and broader femur bicondylar diameter accompanied by better developed thighs and calves in comparison to the defensive players. The forward line players had also slightly lesser percentage of body fats and more of lean body mass.

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In the study of J.R. Morrow et al\textsuperscript{23} anthropometric strength and performance data were evaluated for 49 American discus, hammer, javelin throwers and shot putters who participated in pre Olympic training camp. Comparison between participants indicates significant differences on the anthropometric and strength variable but were alike in terms of motor performance variables.

Haynes\textsuperscript{24} examined the differences in aerobic capacity, strength and power relative to weight and lean body weight between male and female collegiate athletes. Forty one male and thirty seven female alpine skiers, cross country skiers and middle-distance and distance runners at the University of Colorado served as subjects, VO2 max, isometric, knee extension strength, margarim kalamen stair run and the vertical jump. It was concluded that training has reduced the differences in aerobic capacity and strength but not power to the point where they can be explained by the differences in lean body weight between male and females.

Chattopadhyay\textsuperscript{25} has made an attempt to compare the physical fitness of the university level soccer players and hockey players. The criterion measures selected for assessing the physical fitness have been resting pulse rate, Cooper's 12 minute run/walk and AAHPER Fitness test battery and he found out that there is significant different only in 50 yard dash favouring the soccer teams and pull-ups favouring the hockey team.


Dey\textsuperscript{26} compared offensive and defensive football players (N=44). The study revealed that:

1. Offensive players possess more cardio-vascular endurance and explosive leg strength than that of defensive players.
2. Defensive players have leg length, thigh girth and height.

Dureha\textsuperscript{27} compared the selected motor components such as agility, speed, explosive strength and endurance and selected anthropometric variables such as height, weight, leg strength, arm strength, thigh girth, and wrist diameter of offensive and defensive hockey players at college level. The subjects were 50 male students of 3 colleges of Gwalior in the academic year 1983-1984. Statistical analysis of data employed the ‘t’ test so as to compare offensive and defensive hockey players. It was included that there was significant difference between the offensive and defensive hockey players in selected motor components and selected anthropometric variables.

Baacke\textsuperscript{28} utilized data of 87 male students of high school to determine the relationship of anthropometric and physical performance measures to perform the running, hop-step and jump. He concluded that all variables as measured in a body showed significant relationship with criterion beyond the 0.05 level of confidence.

\textsuperscript{26} Tara Shankar Dey, "Variations in Selected Anthropometric Measurements and Physical Fitness Components of Offensive and Defensive Football Players," (Unpublished Master's Thesis, Jiwaji University, Gwalior, 1984).

\textsuperscript{27} 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).

Ozkan\textsuperscript{29} conducted a study of 77 male high schools soccer players between the age of 15 and 18 years old. The purpose of the study was to investigate the physical and physiological and motor skill characteristics of the players. A secondary purpose was to compare the experimental variables between playing position, age group and playing qualities. Test items consisted of age, height, weight, percentage of body fat, resting heart rate, 1.5 mile run, 50 yard sprint, vertical jump, agility, trunk extension and flexion ball control, wall volley and obstacle dribble skill tests. The statistical analyses reveal an average height and weight of 174.92 cm and 64.72 kg. for entire group. The average resting heart rate and body fat were 70.7 bpm and 10.38 percent respectively. The other results were excellent in 1.5 mile, fair on the 50 yard and vertical jump. In agility similar level as college, below average in trunk extension and flexion and in three soccer skill tests, the players scored 85th - 100th percentile.

Chakraborty\textsuperscript{30} conducted a comprehensive study on 20 male soccer players and concluded that strength, speed, endurance was significantly co-related with their performance in soccer. The physical characteristics i.e. height, weight, fore leg length, thigh length, shoulder width, trunk length, ponderal index and crural index were not significantly related to performance in soccer.

Dhaka\textsuperscript{31} conducted a study to compare sportsman participating in different events of track and field on the selected physical and physiological variables. For this purpose, 60 male athletes, 20 each belonging to the categories of sprinters, jumpers,

\textsuperscript{29} Hayri Ozkan, “Physical, Physiological and Motor Skill Determinants in Male High School Soccer Players,” \textit{Dissertation Abstracts International}, 45 (September 1984): 786-A.


\textsuperscript{31} Amita Dhaka, “Comparison of Selected Physical and Physiological Variables in Sportsmen Participating in Different Events of Track & Field,” (Unpublished Master’s Thesis, Jiwaji University, Gwalior, 1986).
and long distance runners from Delhi were selected as subjects, due to non availability throwers could not be considered. The speed, strength and flexibility of the sports persons were selected as the physical variables whereas their blood haemoglobin content, blood pressure and pulse rate were selected as the physical variables. The data on the selected physical and physiological variables were collected by administering the relevant standardized tests/procedure after establishing its reliability for comparing 3 groups of athletes. Analysis of variance was applied to test significance of differences between the paired means. Scheffe’s Post Hoc test was applied where F-ratio was found significant.

Panigrahi\textsuperscript{32} conducted a study to compare the anthropometric measurements of the sprint swimmer and sprint runners. 40 subjects (20 from each group), who represented National and All India Interuniversity Swimming and Athletics Championship were chosen. The subjects belonged to different parts of India and belong varying socio-economic status. The average age of the subjects ranged from 20 to 28 years.

Rao\textsuperscript{33} and Uppal observed that haemoglobin in the blood increases as a result of endurance training. They also concluded that exercise caused an increase in the number of leucocytes in the circulatory blood.

Kapri\textsuperscript{34} studied the relation of somatotype to soccer playing ability in 1988. He took 60 male subjects studying in Laxmibai National College of Physical Education,


Gwalior. Results of the study revealed that endomorphy and ectomorphy are negatively related to soccer playing ability and mesomorphy has significant relation with soccer playing ability. Statistical treatment also reveals that ectomorphs have better ability to perform well in soccer than the endomorphs.

Douglas\textsuperscript{35} conducted a study to observe the effect of competition and training on the haematological status of women field hockey and soccer players. Thirty collegiate athletes participated in the 14 week study. Blood samples were drawn prior to the start mid point and end of the sport season and analysed using a J.T.Baker 700A analyser. Results indicated that mean values of haemoglobin, haematocrit mean corpuscular volume, and red blood cell count increased for both experimental and control groups. Values for all haematological parameters were within the normal range for females.

Biswas\textsuperscript{36} investigated the differences in selected aerobic, anaerobic and physical characteristics among goal keepers, backs, halves (link mans’) and forward players in soccer. Fifty four soccer players who participated in All India Inter-varsity Football Tournament for the year 1991-92 were selected according to their position in game during competition. Out of these fifty four subjects, 10 players were goal keepers, 15 backs, 14 players were halves and remaining 15 players were forwards. ANOVA at .05 level of confidence was administered to the procured data.

Midfielders (halves) showed significantly higher score in aerobic capacity as compared with goal keepers, backs and forwards, whereas goal keepers and forwards


have to be very fast and explosive to excel in soccer than that of halves and backs. Goal
keepers showed significantly longer and heavier in weight, more leg length and thigh
length as compared to backs, halves and forwards respectively. In case of halves and
forwards there were no significant difference in aerobic capacities and among the goal
keepers and forwards, backs and forwards in anaerobic capacities. Backs and forwards
showed no significant differences in height. The goal keepers and backs, back and
forwards, halves and forwards were not significantly different in body weight,
moreover, among the backs and forwards, halves and forwards there were no significant
differences were found in leg length. In case of thigh length the difference among
backs and forwards, halves and forwards were insignificant.

Chakraborty\textsuperscript{37} compared the aerobic, anaerobic capacity and body composition
of children between North and South regions of India. A total of six hundred students
(three hundred boys and three hundred girls) studying in different educational
institutions in the North and South regions of India were selected at random as
subjects for this study. Aerobic capacity of the subjects were measured by distance
covered in 9 min. run/walk test to nearest 50 mt.; anaerobic capacity by 50 mt. dash.
To obtain body composition variables for each subject, skinfold measurement was
taken at four selected sites in the body namely biceps, triceps, subscapula and
suprailliac. Two-Way Analysis of Variance (F-ratio) of mean scores of the criterion
measures of two regions were done with respect of the variable for both the sex, the
level of significance was set at .01 and .05 levels. The analysis of data revealed that
there were significant difference between boys and girls of two regions in aerobic,
aerobic, total body weight, fat percentage and lean body mass. Data analysis also
revealed there were no significant difference between two regions in aerobic total
body weight, fat percentage (16 to 18 years age group) and lean body mass. There also

\textsuperscript{37} Tapas Kumar Chakraborty, "A Comparative Study of Aerobic, Anaerobic and Body
Composition, Characteristics Among the Students of Different Sex form Southern and Northern
was significant difference in anaerobic capacity and fat percentage (18 to 20 years) between north and south regions.

Verma\textsuperscript{38} investigated the differences in selected anthropometric characteristics between senior-junior and offensive-defensive players of football. Forty football players of Greater Gwalior were selected as subjects. They were divided into two groups of junior offense-defense and senior offense-defense groups respectively of 20 each. 'T' test were employed to find out the difference with the level of significance at .05. There were no significant difference between senior offensive and defensive players in calf girth, thigh girth, leg length, height and weight. However there were also no significant difference between junior offensive and defensive players in case of calf girth, leg length, height and weight, but they showed significant difference in thigh girth.

Bhattacharya \textsuperscript{39} compared the difference in selected anthropometric measurements and motor fitness components among football players in relation to positional play. Sixty male national level football players were selected as subjects for the study from West Bengal and Orissa. The age level of subjects ranged from 23 to 28 years. The anthropometric variables were body weight, standing height, arm length, leg length, fore-leg length, thigh girth, calf girth and foot length. The motor fitness components were speed, agility, power and cardio-respiratory endurance. The test-retest method were used to establish the reliability of the data. Speed, agility, power


and cardio-respiratory endurance consisted the motor fitness components. One-way Analysis of Variance was used with the level of significance at .05 level.

The results of the study indicated that defenders, mid-fielders and attackers had no significant differences in anthropometric measurements i.e., body weight (F = 2.31), standing height (F = .396), arm length (F = .14), leg length (F = .468), fore-leg length (F = .222), thigh girth (F = 1.50), calf girth (F = .68), and foot length (F = 3.02) to be significant at the value of required 3.17 at .05 level of confidence. The findings also showed that there were no significant differences among defenders, mid-fielders and attacker of football players in motor fitness components, i.e., speed (F = 2.92), agility (F = 2.20), and power (F = 1.01). However cardio-respiratory endurance (F = 3.41) showed significance among defenders, mid-fielders and attackers of football players.