CHAPTER II

REVIEW OF RELATED LITERATURE
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An attempt has been made by the scholar to locate literature related to the study. The relevant studies of specific importance are cited in this chapter.

In order to understand the various aspects of physical fitness evaluation, it is essential to have an idea about the various methods of teaching physical fitness. A study of related literature is essential to know the work done in the field of physical fitness and its components. Various studies have been conducted in the past to evaluate the fitness on the basis of tests, measuring the same components of fitness but varying the activities or events.

The researcher could not find much study directly related to the present study and the literature was restricted to the books and magazines available in the library of Manipur University and in the Department of Physical Education, Health Education and Sports, D.M.College of Science, Imphal, Manipur.
AAHPER,¹ Youth Fitness Test was originally developed in 1957 by a Committee of Research Council of the AAHPER as a means of surveying the fitness of American Youth, tested, 8500 children in 1957-58 and derived the norms in 1960. Percentile norms were prepared for college men based on testing on 2200 students for various institutions. The current manual contains 1960 norms for college men and women. No statistical evidence of scientific authenticity was presented in the manual.

The Committee² modified the AAHPER test to render it appropriate for assessing the physical fitness of mentally retired children. The development statistics was not given. Whittle studied two groups of 81 twelve year old boys on the basis of maturity factors such as chronological age, skeleton, age, weight, height and development level. He found the pronounced difference between the groups in various effective factors. He further discovered that boys in each groups who participated "a lot in and out of classes" physical activities showed strong superiority over those who participated a little.

A similar study by Drewalaskey and Modarey demonstrated that youth, without physical education in eleven or twelve grades had lower average physical fitness test score than did any other grade in Corbay Oregon School system.

To simplify administration of the JCR Test in Britain Schools, Cooper modified to order and items of the test. He did not report the scientific authenticity regarding the modifications.

Clarks and Brockoff constructed the result of Oregon students of boys who participated in and did not participated in physical education programme utilizing the physical fitness test for seven students entering the university of Oregon with four year high school physical education definitely have higher average results than those with two years. Comparable results were obtained at Oregon State University by Kasho.

Regsdol reports the difference between the boy of modified Oregon Public School who elected and did not elect physical

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education in the eleventh grade. Although the difference obtained were not always significant, more boys who did not elect education were inferior to all other groups on 22 tests of maturity, physique body size, muscular strength and motor performances.

Further in the year, Fashrner\textsuperscript{7} undertook a study on "A Comparison of Physical Fitness with the out of school physical activity, their grade in academy achievement and intelligence quotient of the high school students". The results of the AAHPERD Physical Fitness test for 45\textsuperscript{th} grade boys were compared with the boys records of out of school physical activity, their grade in academy subjects and their intelligence quotient were measured by the California test of mental maturity.

Boone\textsuperscript{8} investigated a comparison of physical fitness level of urban and rural boys in the year 1966. The test was administered to 100 rural and 100 urban boys and found that urban boys were superior to the rural boys.


In 1966, Baron\textsuperscript{9} investigated "A Comparative analysis of the change in physical fitness stars boys". The DIAPERED youth fitness set was administered of 50, 12 years old boys in grade seven (N-50) before and a fewer a physical fitness programme with another group of 14 years old boys in grade (N-30). It was found that both group improved but the greater gains of the grade seven boys were significant at 05 level.

Box\textsuperscript{10} prepared percentile arms tables for selected measures of strength; power, ability, flexibility, boys composition. Cardiovascular and muscular endurance from data collected in five schools of the Unity Christian School system of measure on velle.

Pulse\textsuperscript{11} compared the performance of elementary school children in selected fundamental skills and found that the level of every subsequent class was higher than the proceeding class. All performance were found significant at 1.01 level of confidence the ‘t’ ratio obtained in Class I and II and Class SIIV and V were higher

than the rate of the other classes in 25 meters race and cricket ball throw for distance. In standing board jump this difference was observed between Class III and IV and V.

Robert\textsuperscript{12} in his study on highs old boys say that boys of different physical type were significantly different in skeletal age, strength, index (Rogers) and standing broad jump, mature boys by skeletal age were longer in the body weight, height long capacity of upper arm, girth and stronger in gross strength as measured by strength index average of eleven able tension tests were more mature and had better motor ability score than weaker boys.

Eckberr\textsuperscript{13} in his study to determine the anacrobic/anaerobic power of legs among elementary school children (426 boys and girls) concluded that power output increase at each grade level for boys and girls.

\textsuperscript{12} Huldmarkh Robert, "Significance of Physical Motivational Body Size, Strength; Motor Ability and Reaction Time Characteristics of Right Year Old Boys", \textit{Completed Research in Health, Physical Education and Research}, 5(1963), P.66.

Frederick\textsuperscript{14} made a study to determine motor ability difference along with five age groups composed of back boys and girls; in the performance of running 30 yards vertical jump, standing broad jumps, balance on right foot balance on its foot and kicking for distance rowing for accuracy children were also measured for height, weight. He arrived at the following findings:

(1) Significant difference was found among the five groups for all right moor jerks.

Apyster\textsuperscript{15} studied in relationship between physical motivation (carol development) and measure of motor performance and muscular strength of grade two boys and girls.

The study indicated 49 boys and 19 girls with mean age of 100 months and 100.2 respectively. Assessment of both ages was made by applying the standard of Gramtech and Pyle to X- keys of he hand and wrist. Motor performance was measured by scores on 35 years dash broad jump and baseball throw. Stick dynamic measures strength. It was found that when the effect of height,


weighty and chronological age were held corniest, skeletal age was not highly corrected with the motor performance and strength measures.

Hahn\textsuperscript{16} examined selected measurer of muscular strength and endurance in 60 boys of ten, twelve and fourteen years of age standard pull-up and bar push-ups test were employed to measurer muscular strength and endurance related to boys weight and cyber service. Dynamometer was used to examine muscular strength and endurance performance of the muscular involved in right arm flexion movement. The data were submitted of analysis variance and correlation project.

Smith\textsuperscript{17} studied the relationship between gross and related strength and the maturity physical Ye-moor ability elements of boys nine, twelve, fifteen and seventeen years of age. The strength were the average of 11 cable tension strength, tests and strength index for gross strength were divided in upper body and lower body strength. Rogus physical Fitness Index was utilized for


relative strength with exception of end morph and clear dips significant correlation were found with the few exceptions between the gross strength and the experimental variable for the relative strength.

Singh\textsuperscript{18} conducted a study on “A Comparative Study of the Motor Fitness of Nepali and Bihari Boys Boarding the same hostel”. The purpose of the study was to determine the present standard of motor fitness of the boys of Nepal and boys of Bihar residing in the same hostel and awaiting the same facility.

Total 100 boys (age ranged 12 to 16) was selected randomly (50 from each group) from the hostellers of Delhi Public Schools, New Delhi. The J.C.R. test was adopted for the evaluation of motor fitness of boys and ‘t’ test was completed to find out the significance differences.

It was concluded that boys of Nepal were significantly superior in motor fitness to the boys of Bihar residing in Delhi Public School.

\textsuperscript{18} Kundan, Singh. “A Comparative Study of the Motor Fitness of Nepali and Bihari Boys Boarding the same Hostel.” Unpublished Master’s Dissertation.
Gurray\textsuperscript{19} et al. conducted a study where pre-season health, strength and fitness evaluations were performed on 40 professional baseline players to assess for levels of conditioning and potential for injury. Screening identified many players with problems or potential problems. Test findings results in at least one training or lifestyle recommendation in each player tested. Body composition, muscular endurance, flexibility and aerobic capacity were the parameters tested.

Scott\textsuperscript{20} conducted a study on the relationship of some selected flexibility and strength measures to time in 100 yards crawl stroke. Male SHS swimmers (N=26) who bettered as equated to time of 56 seconds for the 100 yards crawl stroke were tested for flexibility of the ankle, knee, hop trunk and shoulder. Upon completion of these tests the subjects were timed for a 100 yards kick, pull swim. It was concluded that certain flexibility measures were significantly related to swimming time. However it


was determined the knowledge of certain strength and flexibility measures will not be used to predict 100 yards crawl stroke times.

Gloria Lee\textsuperscript{21} Conducted a profile photography of 92 undergraduate women which were taken as a basis for measuring angular deviations of the head and neck, trunk and hops from a straight line. The deviations were submitted for an overall assessment of body alignment. The strength of the upper thoracic extensions, trunk extensions, hop flexuous and extensions and factorial and scapular adductors was measured and five flexibilities were measured. The positive and significant linear correlations between strength of opposing muscle groups indicated that alignment depended on a balance in muscular strength. Standard score strength ratios for trunk extension to flexion strength of 1:2:1 were associated with small angular deviation of the trunk. The relation of imbalance to deviation was generally higher with curvilinear correlations. Excess hip flexion strength was associated with pelvic tilt and other misalignments were generally related to muscular imbalances.

Clarke stated that the type of an individual’s physical structure is an essential factor in his motor performance. Evidence of this is common place: observe the well-proportioned physiques of Boxers and Gymnasts, the super structure of great Basketball competitions, the solidity of top flight football players. The wiriness of champion distance runners and the massive builds of great shot putters and discuss throwers.

The purpose of Aloysius\textsuperscript{22} study was to compare the explosive power of swimmer and volleyball players, in which fifty subjects (from each activity) were selected from the swimmers and volley-ball players of Degree College of Physical Education, Amrabati. The raw scores obtained from each test were arranged in frequency table and mean, standard deviation and ‘t’ test were used for the calculation. It was found by the analysis that the arm explosive power and leg explosive power were greater in volley-ball players than swimmers.

Amaresh\textsuperscript{23} studied the effects of break in training on selected motor components of professional students of physical education. It was conducted on thirty male students of B.P.E. II year ranging an age 16 to 24 years of Lakshmibai National College of Physical Education, Gwalior. After a regular schedule of training and exercise for three and a half months it was again conducted after 21 days of break in training. It was found that in case of professional students of physical education. The break in training for short duration would not affect the motor components of the body.

S. Lievers\textsuperscript{24} conducted a comparative study on wrestling and soccer teams with regard to physical fitness and cardiovascular endurance. The subjects were men in required physical education classes at the University of Florida. Wrestling and soccer contributed endurance with games in physical fitness were not significant and neither sport appeared superior to other. Therefore cardiovascular endurance is of vital importance for the total duration of the soccer game equally (e.g. canoeing) or unequally.


\textsuperscript{24} Ibid.
e.g. football) therefore while imparting soccer training the above paints should be kept in mind by coach for better performances in soccer competitions.

International Fitness Association\textsuperscript{25} reported that if any sports, training for successful competition has become virtually a year round endeavour. To assist in better preparation, a competitor's year may be divided into phases such as off-season and in-season, indicating reduced or increased competition confrontments/ confrontments, respectively. A number of studies have described the effects of seasons or periods of competition, training detaining and reduced training on aspects of physical fitness, depending on performance level, the type of sport and the fitness parameter in question, the swings in fitness variables reported may be as high as 13\% from one season to another. In elite competitions anaerobic parameters, heart frequ\textsc{e}ncies, subcutaneous fat, flexibility and hemoglobin levels remain relatively unchanged throughout the year. Aerobic metabolism and muscular strength may demonstrate noticeable changes and plasma hormonal levels normally follow genetics, and to appropriate training are just a few

\textsuperscript{25} International Fitness Association Web at h\text{H}p://www.ifasfitness.com.
explanations for these observation for these observations. It is still not known whether greater fitness gains attainable with longer off-season training programmes can be successfully maintained over the duration of the competition season. However, the consensus would seem to be inadequate for fitness maintenance and improvements. This is perhaps supported by the general trends found in the literature regarding muscular strength.

While supervised off-season conditioning programmes may result in significant improvements for both recreational and competitive athletes, no such changes are normally observed after competition seasons. These findings may reflect, amongst other factors, a lack of optimal training intensity to bring about strength increases during in-season periods. In novices and in athletes at low competitive levels, training seasons may lead to considerable functional improvements of the cardio respiratory system coupled with occasional increases in muscular strength and decreases in body fat. Relatively low fitness levels at the beginning of training have been put forward as an explanation for these improvements. Seasons of training and competition results in so significant changes in flexibility measurements happen. Similar changers to
those found in movies and in athletes at low competitive level may also be seen in children and adolescent engage in sport, although their fitness improvements are consistent with normal patterns of growth and development. No differences have been identified between male and female athlete participating at between competition levels.

Prakash\textsuperscript{26} conducted a study comparison selected physiological and physical fitness factors of soccer and cricket player of 15 players each for the group of student undergoing special coaching in soccer and cricket were selected. Criterion measures selected were vital capacity, maximum aspiratory breath holding capacity, maximum expiratory pressure, pulse rate, systolic blood pressure, diastolic blood pressure and speed (50 yard dash) shoulder girdle explosive strength (soft ball throw) leg explosive strength (standing broad up) muscular endurance (sit up) and flexibility (toe touch in long sit position). He conducted that in swell-conditioned collegiate soccer players seem to have potential to develop cardio pulmonary fitness, muscular endurance

as measured by chin-ups and explosive leg power by standing broad jump more than cricket players.

Richard\textsuperscript{27} studies the functional capacities of Shri Vishnu Devendra, physical examination structure. Dynamometric test showed about average comparatively low heart rate upon cessation of the harmed low lest. The result of the respiratory and ECG studies found that the yogic techniques utilized in controlled utilized in controlled breathing produced by privatization. Test revealed unusual degree of flexibility without evidence of traumatic and pathologic changes. He also conducted a study on effectiveness of overload on accuracy of throwing football described that experimental groups who have used weight ball for accuracy were superior to other groups who sued normal ball for throwing. Thus it reflects that work load for longer duration gives better cardiovascular endurance and better adaptation on soccer game.

\textsuperscript{27} Hopock Richard, “Study on Effectiveness of Overload of the Accuracy on Throwing Football”, \textit{Completed Research in Health, Physical Education and recreation}, 10(1968).
Aver \(^{28}\) found out the relative effects of selected warm up exercise strength, agility, flexibility and power. Researcher had taken 90 college men as subjects. They were tested in five volleyball classes before and after the weeks of activity, involving 4 or 8 minutes of isometric activity per class period. No significant difference among treatment results except for dipping strength occurred.

Jackson\(^{29}\) studied the relationship of grip strength and lateral to skill in gold. For this grip strength and wrist strength were measured over an eleven week period on thirty male students in required physical education gold classes meeting for one half, twice a week. The right hand grip strength increased significantly. The correlations between initial and final grip strength and skill were not significant. Bilateral differences in grip and wrist strength were not correlated.

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Roy\textsuperscript{30} has conducted a study on the body size strength, muscular endurance and power of top flight team in England Rugby and soccer players. Mean superiorities by tea were amateur Rugby players in weight and vertical jump, amateur soccer player push ups and pull ups and muscular endurances, professional soccer players in back strength and sit ups. The offensive amateur and professional rugby players were superior to the defensive players in physical fitness and some muscular endurance tests. The defensive soccer players were superior to towards in body weight and height and the amateur defensive players were superior in strength index.

Tiva\textsuperscript{31} selected twenty-two women physical education majors at the University of California, Las Angeles, who were tested for arm strength and flexibility. The weaker arm was trained three times a week for four weeks with specific isometric exercises. The strength of the trained arm increased and the range of motion in extension increased slightly but the correlations between strength and flexibility were not significant.

\textsuperscript{31} Barnea Tiva. "Effect of Balanced Development on Flexibility of the Shoulder Girdle", M.S. in Physical Education (W. Massey, 1964), P.64.
Segal\textsuperscript{32} in his study, administered fourteen arm and shoulder girdle performance measures, including pull-ups hanging, push-ups, medicine ball push, dynamometer and tensionometer strength measures, to 28 college women, regression equations for predicting each of the items were in order of 45 to 97 with eight of these being 80 or better. The hanging test possessed the highest observable strength component among the performance tests and of the four types administered, the Oregon test in the supinated hand position is recommended on the basis of the greater comfort for the performer and the high inter-correlations (81 to 90) between the hanging tests.

Abido\textsuperscript{33} conducted a study on leg strength, height, weight factors in relation a cardiovascular efficiency of college women. Chest width and pelvic width were also among the factors studied. Data collected from 198 subjects were inter-correlated. The result indicated that excess weight had the greatest deleterious effect on cardio-vascular efficiency. While leg strength correlated positively


with step performance. The linear correlation between cardio-vascular and pondered index was significant. But the regression line leveled of four women with high cardio-vascular efficiency.

Singerseth\textsuperscript{34} and Haliski conducted a study the specific purpose of which were (a) to compare the flexibility of 21 joint or areas of football players with the normal college students,(b) to compare the flexibility of linesmen and backfield men in the same joints and areas, (c) to determine whether there is a difference in the flexibility of comparable right and left joint of the body. Data was obtained from 100 football players. Leighton had earlier collected similar data from 56 normal college students. A goniometer called Leighton flexometer was used in taking the flexibility measurements of ankle flexion and extension, trunk hop flexion and extension, side trunk hip flexion, weight flexion and extension, arm flexion, elbow flexion, head notation, head extension and flexion and shoulder flexion and extension. When right and left side measurements of similar joints of football players were compared, only the differences between right and left knee flexion and between right and left elbow flexion were large enough.

to be significant. In no instance was the difference in flexibility between the right and left joint on service course members significant.

Chakraborty\textsuperscript{35} studied the relationship of selected physique characteristics and motor components to the performance in soccer. Twenty male soccer players who represented in all India Inter University Tournaments were selected as subjects analysis of data revealed that there was a significant relationship between soccer performance and speed and also soccer performance and endurance. Whereas in case of height, weight, foreleg length, thigh length, shoulder width, trunk width, pondral index, crucial index and soccer performance did not seen to have significant relationship.

Price\textsuperscript{36} studied the relationship of college football players' strength speed and agility to the coaches, rankings of ability, playing position were combined into offensive backs, offensive linesmen and defensive linesman and into whole group units. The

\textsuperscript{35} Devanand Chakraborty, “Relationship of Selected Motor Component and Physique Characteristics to Performance in Soccer” (Unpublished aster's Thesis, Jiwaji University, 1986).

players were further divided as two groups. One or group two, correlation were then computed between the objective te4st scores and the coaches subjective evaluations. It was conducted that arm strength and strength and total ‘6’ scores were moderate predictors of football ability, and strength were significant predictors of football ability.

Chand\textsuperscript{37} conducted a comparative study of physical qualities of offensive and defensive football players of college level. He selected 30 football players of Lakshmibai National College of Physical Education, Gwalior, who took part in district level football tournament. He compared agility, speed, muscular strength, endurance and height, height initially, analyzed the data and calculated t-ratio and concluded: (1) defensive players are heavy, taller and have more muscular power than offensive players, (2) offensive players (3) there is no significant difference between offensive and defensive football players in agility.

\textsuperscript{37} Prem Chand, "A Comparative Study of Physical Qualities of Offensive and Defensive Football Players of College Level", (Unpublished Master’s Thesis, Jiwaji University, Gwalior).
Ferris\textsuperscript{38} obtained low mostly insignificant correlations between trunk flexibility and measures of abdominal isometric and isotonic strength and endurance. For the most part, he found boys six through thirteen years of age with high and low scores on motor ability items did not differ significantly on flexometer tests. The significant difference obtained were the more skilled boys in the standing broad jump, 30 yard dash, and softball distance throw were more flexible in trunk extension, those with greatest distances in the softball throw had greatest neck rotation and trunk lateral flexion flexibility.

Getchell\textsuperscript{39} reported that the most difficult part of a strength and local endurance weight-training programme is their development and not so much their retention. In fact, once improvements have been made, it appears that they are relatively easy to keep. While evidence involving complete immobilization following training is scarce, evidence is available involving subjects who have refrained from exercise and training for a given period of


time following a period of training. The available evidence shows that strength when gained from a 3-week isotonic training programme was still retrained following a 6-week period of detraining the weight-training programme consisted of 3 sets at a 6 maximum resistance 6-week training regime in which the subjects performed only one set of exercises one time per week. The work load consisted of one maximum resistance.

Downic\(^{40}\) studied the age differences in the flexibility of boys from six through fourteen years, utilizing nineteen flexometer tests. Generally, flexibility increased to age twelve years and then declined.

Chauhan\(^{41}\) conducted a study to compare the selected general motor ability components, i.e. speed, agility, flexibility, muscular endurance, balance, leg strength, arm and shoulder strength and co-ordination of women basket ball and volleyball players. The number of subjects was fifteen from each game.


Clarena\textsuperscript{42} studied the relationship of certain factors with success in volleyball. Subjects were eight members of men extramural volley-ball teams at Illinois State University. Two experienced volley-ball coaches established the criterion by rating each player in her playing. The following variables were measured: height, weight, leg extension strength using dynamometer, skin fold using the large caliper, jumping ability, using the jump and reach test, reaction time and movement was measured by apparatus constructed by the investigator. Through 't' test and correlation it was found out that jumping ability and reaction time were significantly related to success in volleyball.

Wilmore and Others\textsuperscript{43} conducted a study on body compositions changes with a 10-week programme of jogging. The following conclusion was drawn that the change in body composition induced by training are as follows: (1) a decrease in total body fat, (2) no change of slight increase in lean body weight and (3) a small decrease of total body weight. For the most part, these changes, particularly that a fat loss are more pronounced for


obese men and women than for the already ‘lean’ individual. It is important to note that more calories are expended when running rather than walking because weight is directly related how many calories are expended during training.

Franklin and others ⁴⁴ conducted a study on lean and obese middle aged female subjects who participated in the 12 week aerobic training programme. The programme was structured along ALSM guidelines (walking – jogging 15 – 25 minutes, 4 days per week, 95% max vo2). Normal – weight subjects decreased their body fat from 24.7 to 23.99%. Obese subjects reduced from 38.0 to 36.2% and the sum of 10 skin fold decreased significantly in both groups. This moderate intensity physical conditioning programme affected both obese and lean women in a similar fashion.

Tooshi⁴⁵ investigated the effect of three different duration endurance training on serum cholesterol, body composition and other fitness measures. Twenty-four adult men between the ages

of 27 – 54 years were selected randomly from men who have requested to be included in the adult fitness programme. These groups were divided into three experimental groups on the basis of their screen cholesterol values. Group B exercised 30 min./day. Group C exercised 45 min./day for five days/week for a total of twenty weeks. A control of eight sedentary men was used for the purpose of the study. The training programme consisted of walking, jogging and running, endurance training of 30 and 45 min./day decreased resting pulse rate than 15 min./day for five days used per week.

Saudler et al\textsuperscript{46} conducted a study focusing on age and physical activity as determinants of muscle strength. The study involved 620 women 25 – 73 years of age. The five muscle groups assessed were: grip, planter flexors, hip abductors, trunk flexors and trunk extensors. Person correlations yielded significant negative correlations of muscle strength with age and positive correlations with height as well as physical activity. In step-wise regression analysis age was the strongest predictor of strength of all muscle groups, with smaller contributions to the variance by

physical activity and anthropometrics variables. When the sample population, divided by decades of age, was further sub-divided by fertile of physical activity, the results of factorial analysis indicated that the main effects due to age and physical activities were significant. It was concluded that (1) moderate levels of physical activity feud to improve muscle strength even in older women, and (2) normative values of muscle strength could serve as an indicator of the adequacy of the habitual levels of physical activity.

Duance\textsuperscript{47} conducted a study on relationship of physiological factors to football performance. Minutes played during the 1958 football season was used 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.

Christian\textsuperscript{48} studied the contribution of selected variables to college football performance. Thirty members of the South Eastern State Collegiate football teams were selected for this study. From


the multiple correlation co-efficients it was found that best predictor of game percentage for back was lateral movement, for the live best predictor of game percentage score was bench step. When the combined groups, the best predictor of game percentage score was the vertical jump. It was concluded that for the total group, the vertical jump and the 12 minutes run were the best predictors.

Micheli\textsuperscript{49} conducted as study in connection with development of battery of tests to predict football ability at college level by developing regression equation when this ability could be predicted by analysing selected orthopedic measures, strength tests, power measure, balance standing height and body height. Fourteen measures were determined on each of the forty-six scholarship football players. Six football coach's rating on football ability was used as the criterion measure. For the prediction special type of statistical technique was used. He concluded (1) Jobial Forbion, bow legs, standing height, body weight Margi Kalamen anaerobic power test and knee flexion are the best measure for the prediction of football ability, (ii) strength tests by means of cable tensiometer are not good predictor of football, (iii)

\textsuperscript{49} Ralph Peter Micheli. "Development of A Battery of Tests to Predict Football Ability at the College Level". \textit{Dissertation Abstracts International}, vol.38, no.5(November 1997): 2647-A.
balance test fleishman is not good predictor, (iv) Fidal Forsion and low legs revealed that orthopedic measuring are having value while predicting football agility, (v) through Margaria-Kalamen anaerobic power test football ability can be nicely measured.

Kannus\textsuperscript{50} stated That maximal anaerobic power was not correlated to success in volley ball players and Thin at al (1993) more away from the traditional fitness testing to develop a modern for the sport specific requirement of badminton stating that standardized cycle erg entry was not sufficient for the prediction of successful performance. He suggested that aerobic and anaerobic requirements for sports such as badminton, squash and tennis depended on the length and nature of the rally. Even using a sport specific field test moderate correlations (r=0.65) to rank order of players was found concluding that order factors such as skill, agility and visual facility were there indicative of performance although the test provided a reasonable assessment of fitness.

Kausal and others\textsuperscript{51} studied the physique and body composition of the intervarsity soccer players of zonal and runner up team of the North Zone. They concluded that defensive line players were significantly taller, heavier than forward line; broader semar bi-cyondylar diameter accompanied by better development of thighs and calf in comparison to the defender players. The foreword line players had also slight percentage of body fat and more of lean body mass.

Crews and Meador\textsuperscript{52} investigated the relationship between body composition measures, reaction time and run times at 5, 15 and 40 yards. In addition, each player optimal playing weight (POPW) was predicted and the effect of being above or below one's predicted optimal playing weight or reaction time and run times were evaluated. Negative correlation between percent fat and nine times were found to increase as the distance increased. The players who weight more than their POPW were found to have a slower reaction time and significantly slower run times when compared to those players who weighed less than their POPW.


Peter\textsuperscript{53} investigated the effect of training on body composition and strength of preadolescent body. A perfect/post-test control group design was used to investigate the effect of eight week training programme on the body composition and strength of eighteen weight training subjects and thirteen control subjects ranged in age from nine to fourteen years. The training group participated in warm up and training programmes and cool down on three consecutive days per week. It was found that training group increased significantly in body weight and lean body mass.

Gill\textsuperscript{54} studied the effect of physical training programme on body composition of college male and female students. He observed that physical training programme consisting of raining components of strength, speed, endurance and also of others coordinates abilities significantly reduced the percentage of body fat of male and female college students after experimental period of twelve weeks. However, the rate of the reduction of body fat percentage in male and female subjects to underwent


experimental treatment. The control group (male and female) did not show any significant change in body fat percentage.

Chattopadhyay\textsuperscript{55} made an attempt to compare physical fitness of the university level soccer players and hockey players. The criterion measures selected for assessing the physical fitness was resting pulse rate. Coopers 12 minute men and walk and AAHPWER fitness test battery and he found out that there is significant difference only in 50 yards dash favouring the soccer team and pull ups favouring the hockey team.

Prince N. Garry\textsuperscript{56} studied the relationship of college football players' strength, speed and agility to the coach's ranking and divided the players' in to group correlation was than computed between the coach's subjected evaluations. It was concluded that arm strength and agility were not valid predictor of football ability. Total strength and total 't' scores was moderate predictor of football ability and the leg strength and speed were significant predictors of football ability.

\textsuperscript{56} Prince N. Grany. "The Relationship of College Football Players' Strength, Speed and Agility to the Coaches Ranking Ability". \textit{Completed Research in Health Physical Education and Recreation 10}(1966).
Clark\textsuperscript{57} divided 1000 male students into two groups of 50 each, athletes and non-athletes. The athletes consisted of ten each basketball, gymnastics, volleyball players, football linesmen and football backs. Twenty-five tests were administered to each subject. The finding indicated that performance on agility test were accounted for the past, by reaction time, speed of movement, strength, balance and body size and form. A significant difference was found between the means seems for the various groups of athletes.

Yadav\textsuperscript{58} conducted a study in comparison of selected motor fitness variable of attacking and defensive players in soccer. The purpose of this study was to investigate whether there are differences in selected physical parameters between attacking and defensive player 30 male students were selected as subject. Attacking players showed significant higher scores in speed and cardio-vascular endurance as compared to those of defensive players. In case of agility, strength, reaction time and reaction time there was no significant difference.

\textsuperscript{57} Jennet W. Clark. "An Introduction to Test of Agility". \textit{Completed Research in Health, Physical Education and Recreation 2(1960).}

Chattopadhyay\textsuperscript{59} made an attempt to compare physical fitness of the university level soccer player and hockey player. The criterion selected for assessing the physical fitness and AAHPER fitness test battery and be found out there is significant different only is 50 yards dash favouring the source team and full ups favouring the hockey team.

Cassel\textsuperscript{60} measured a compared the motor abilities and physical characteristics of collegiate soccer players by the position of pay, forwards, halfbacks, full backs and goalkeeper by taking the college soccer players in the state of Ohio. Each subject was somatotype and his percentage of the body fat was estimated. The colour ability test items are agility test, upper body strength test, a test for speed and a test for endurance. Soma to charts was made for the different positions with all the subjects being plotted. The result showed that difference did exist in relation to motor abilities and physical inferences excess in endomorphic components of somatotype with half back significantly (P.O.T.) were also found in height with goalkeeper and full backs taller than forwards. There

were no differences (P.Os) were also founding leg power, with full back more powerful than forwards and the half backs more skillful than goalkeepers in soccer ability. No differences were evident in the ability of agility upper body strength and endurance.

Franklin and others\textsuperscript{61} conducted a study on lean and obese middle-aged female subjects who participated in the 12 week aerobic training programme. The programme was structured along ALSM guidelines (walking-jogging 15 – 25 minutes, 4 days per week, 75% max \textit{vo2}). Normal-weight subject decreased their body fat from 24.7 to 23.9% abuse subjects reduced from 380 to 36.2% and the sum of 10 skinfold decreased significantly in both groups. This moderate intensity physical conditioning programme affected both obese and lean women in a similar fashion.

Janaka\textsuperscript{62} selected fifty-four male volunteer subjects ranging in age from 17 to 56 from a Northern California Community College and stratified into three fitness levels. All subjects were than presented on the hydrostatic and anthropometrics measure.

\textsuperscript{61} B.A. Franklin et al. “Body Composition, Physical Work Capacity and Physical Activity Habits at 18-month Follow-up of Middle-Aged Women Participating in an Exercise Intervention Programme” Cited by Fox; Bowers and Foss, The Physiological Basis of Physical Education and Athletics, p.587.

The population was then randomly assigned to either order 1(12 sessions of aerobic followed by 12 session of anerobic). After each of the exercise sessions anthropometrics measures. It was found that after only 12 – 25 minutes exercise cycles, aerobic exercise resulted in a 4% decrease in the percent of body fat and approximately one inch loss in waist girth for the jogger runners. Anaerobic treatment showed no effects.

Hergenroeder and Klish\textsuperscript{63} suggested that the physician approach to the adolescent athlete who requests information about body composition in the following way:

1. Calculate the ideal of body weight.

2. Estimate the percentage of body fat, realizing in available, use that equipment. In the absence of this equipment, we recommend the equations of Slaughter et al., given earlier.

3. The athlete should by given a range of percentage of body fat values measured in other athletes of the same gender and sport. Health and performance should be

monitored as the athlete attempts to achieve or maintain body composition in this range.

4. If the athlete has an interest in altering body composition, then recommend the athlete seek the advice of a professional who has expertise in nutrition and physiology.

Brownell and others\textsuperscript{64} reported that the athletics engage in a number of dietary and weight control practices which may influence metabolism, health and performance. This paper reviews the literature on these factors with special emphasis on athletes who show large, frequent and rapid fluctuations in weight (wrestlers) and athletes who maintain low weight and low percent body fat (e.g. distance runners, gymnasts and figure skaters). A theory is presented which relates these weight patterns and the accompanying dietary habits to change in body composition, metabolism, metabolic activity of adipose tissue and the distribution of body fat. Changes in these physiological variables may be manifested in enhanced food efficiency (weight as a

function of caloric intake) as the body seeks to protect and replenish its energy stores. This may explain the surprisingly low caloric intakes of some athletes. These changes in fat distribution, risk factors for cardio-vascular disease and hormonal factors associated with reproductive functioning in both females and males. Amenorrhea in female athletes may be mediated at least in part by regional fat distribution depletion of temporal fat depots (lactational energy reserves) may be the stimulus for cessation or disruption of menses.

Frisch\textsuperscript{65} reported that the anabolic properties of growth hormone (G.H.) have been investigated extensively. The effects of GH on normal hypertrophied and atrophied muscles have been studied. Previously in animal experiments that demonstrated an increase in muscle weight and size, but no comparable increase in performance or tension. In adults with GH deficiency, the changes in body composition can be corrected by GH treatment; lean body mass and strength increase within a few minutes. In acromegatics with ling standing GH hyper secretion, the muscle volume is increased but muscle strength and; performance are not improved,

these observations gave rise to the interest shown by healthy subjects and athletes in using GH to increase their muscle mass and strength. The improvements in muscle strength obtained by resistance exercise training in healthy older men or young men were not enhanced by additional administration of G.H. The larger increases in fat-free mass observed in the GH-treated groups were obviously not due to accretion of contractile protein, but rather to fluid pretension or accumulation acids into skeletal muscle protein was not decreased by short-term administration of GH. The results of a study in power athletes confirm the results of these investigations. The study used GH treatment in power athletes compared with a placebo-control group and the results indicated no increase in maximal strength during concentric contraction of the biceps and quadriceps muscles, although level of insulin like growth factor-I were double. In highly trained power athletes with low fat mass and high lean body mass, no additional effect OGH treatment on strength is to be expected.
Bale and Davis⁶⁶ assessed body built, explosive strength, grip strength and cardio-vascular fitness of a group of 43 top class male Roundball players and the finding were compared with investigations of male handball players and sportsmen. The handball players were then divided into 4 groups according to their respective playing positions on the field and the above morphological strength and fitness variables were examined in relation to their field positions. The somatotype and body composition of the forwards and half-backs were similar but both these players were lighter, had lower percentage of fat and clean body weight than the backs and goal keeper. The halfbacks were fittest both on the tests of explosive strength and on the test of cardio-vascular endurance.

Devi⁶⁷ conducted a study on twenty-four volley-ball players to find out the relationship of selected strength and flexibility measures to playing ability in volley-ball. She conducted in her study that arms strength, abdominal strength, leg strength and

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shoulder flexibility were significantly related to playing ability in volleyball. Grip strength did not correlate significantly to playing ability in volleyball. Wrist flexibility and ankle flexibility had insignificant relationship to playing ability in volleyball. Trunk flexibility showed negative but insignificant correlation to playing ability in volleyball.

Saudler et al. conducted study focusing on age and physical activity as determinants of muscle strength. The study involved 620 women 25.73 years of age. The five muscle groups assessed were: grip, planter flexors, hip abductors, trunk flexors and trunk extensors. Pearson correlations yielded significant negative correlations of muscle strength with age and positive correlation with height as well as physical activity. In step-wise regression analysis age was the strongest predictor of strength of all muscle groups with smaller contributions to the variance by physical activity and anthropometrics variables. When the sample population, divided by decades of age, was further subdivided by fertile of physical activity, the results of factorial analysis indicated that the man effects due to age and physical activity were

significant. It was conducted that (i) moderate levels of physical
activity tend to improve muscle strength even in older women, and
(2) normative values of muscle strength could serve as an
indicator of the adequacy of the habitual levels of physical activity.

Rico\textsuperscript{69} reported that this review summaries results from
studies investigating to physical characteristics, daily energy
expenditures, diets, and effects of nutritional supplements to the
habitual diets of soccer players. The results show that players fall
within a wide range of stature and body weight and they are
classified as mesomorphs. Whereas the average for females is
about 10\% of body weight, whereas the average for females is
about 21\%. Energy expenditure for males is about 4,000 Kcal on
training days and 3,800 Kcal on match day, while energy intake
reported in other studies is on the order of 3,700Kcal, and 14\% of
energy intake, respectively, the remaining being from alcohol
intake, there are indications that CHO supplements might be
beneficial during soccer performance, however, more research is
needed to clarify the importance of branched chain amino acid and
creative supplementation in soccer.

Kibler and others\textsuperscript{70} have pointed out that the elite handball players, as well as a large number of active recreational players are involved in a sport that applies high repetitive loads that can create tension overload situations in certain key anatomic areas of the body and add to possible overload situations in other areas of the body. These results in patterns of inflexibility and weakness that can be demonstrated on a handball specific a musculo-skeletal exam and that can be correlated with areas of increased injury occurrence. These players report conditioning programme that are for the most part, inadequate to confer total conditioning of all the muscular parameters important in playing handball. All of these factors, in addition to the frequency and type of playing, contribute to the occurrence of the overload injuries noted. These aspects need to be addressed in a preventative programme for injury reduction. We do not believe that major changes in the way that handball is played should be implemented until the effects of a proper preventative conditioning programme are evaluated. The ideal composition of the programme is in doubt, our studies allow us to recommend flexibility, strength and endurance training for all.

athletes playing handball at frequent intervals. This programme should be guided by the findings on the pre-participation exam.

Carpenelli and Otto\textsuperscript{71} studied the most controversial element of any strength training programmes is the number of sets required to increase muscular strength and hypertrophy. There is a prevalent tally that at least 3 sets of each exercise are required to elicit optimal increases in strength and hypertrophy. However, most of the studies the reported the results of training with single versus multiple sets do not substantiate this tenet. In fact, the preponderance of evidence suggests that for training durations of 4 to 25 weeks there is no significant difference increase in strength or hypertrophy as a result of training with single versus multiple sets. Because of the design limitations of there studies, conclusions concerning the efficacy of multiple sets should be tentative. However, there is suggesting that a greater volume of exercise elicits greater increases in strength or hypertrophy. This information may represent an important practical application of time efficient law volume exercise.