CHAPTER-II
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"The literature in any field forms the foundation upon which all future work will be built and the flaws of old one to remove. If we fail to build the foundation of knowledge provided by the review of literature, our work is likely to be shallow and native and will often duplicate work that has already been done better by someone else." Borg, W.R. 1978.

"Practically all human knowledge can be found in books and libraries; unlike other animals that must start a new with each generation man builds upon the accumulated and recorded knowledge of the past." Mauly (1964) pointed out that "man is the only animal that does not have to begin a new in every generation, but can take advantage of knowledge which has accumulated through the centuries". The importance and need of the study of old literature for healthy and proper guidance is clearly understood by many more investigators and research workers in various fields. We are fully agreed with the opinion because we must be well aware of the various facts and foundations of our field in the same manner as the competent physician must keep abreast of the latest medicine and newer technologies and the students of educational researchers should become familiar with the location and use of sources of educational information.

The keys to the vast store house of published literature may open doors to source of significant problem and explanatory hypothesis and provide useful orientation for definition of the problem and comparative data for interpretation of results.

Keeping in view the objectives of this study a review of related literature has been kept up in this chapter. Various studies, which have been completed, serve as a guideline not only to provide knowledge with regard to the quantum of work already done in the field but also serve as a pointer to the gaps and lacunae that still exist in the concerned field of research.
2.1 STUDIES RELATED TO PHYSICAL FITNESS

Mean (1954) conducted a study on Philippines entering freshmen students. American and Japanese boys, performance was tested through AAHPER youth fitness test. It was reported that Philippines boys were generally lower in their performance in pull-ups, softball throw for distance. Sit-ups showed considerable deficiency in arms and abdominal fitness. There is enough evidence indicating the influence and involvement of various physical and motor characteristics on the physical fitness and attitude of student towards physical education.

Knuttgen (1961) conducted this study to compare the physical fitness of Danish School, children with that of American standards. 319 male and 134 female Danish School children were randomly selected as the subjects and AAHPER Youth fitness test was administered to these subjects, which correspondence to the 7th through 12th grades in the United States. Then results of the testing were compared to the American standards, which were compiled in terms of both age and to Neilson Cozens classification index. It was concluded more than 50% Danish boys did exceeded the American averages in 6 of the 7 events. The only event in which they fell short of American averages was the softball throw. In pull-up 59%; sit-up 62%; shuttle run 90% of Danish boys were as high or higher than the American averages similarly Danish girls exceed the American averages in all the seven of the tests. In 50 yard dash 71 %; softball throw 76%; the sit-up 82%; standing broad jump 89% and pull-up 90%. Danish girls equaled or exceeded the American averages. The best result for Danish girls was in shuttle run and 600 yard run/walk. Two percent of the boys scores and 86% of score of the girls exceeded the various American mean scores.

Frank (1963) conducted a research study on certain physical fitness components and sports skills among subjects of rural, urban and parochial school background. He examined the effect of different elementary school experiences upon achievement certain aspect of physical fitness and sports skills. He tested 85 grade 9 boys (27 with the rural background, 38 with an urban background and 20 with the parochial school background) for speed, power, muscular endurance and skill in different games. The investigation showed that boys with rural, parochial or urban experiences did not differ in physical fitness, but those boys from urban and parochial schools were superior in sports skills.
Bitcon (1965) constructed norms tables for the students of grade 9-12. The battery included 4 items viz. pull-ups, two minute sit-up, standing broad jump and 300 yards shuttle run. Validity and reliability of these norms were compared with those of AAHPER Youth fitness test and the co-efficient found were 0.934 and 0.961 respectively.

Mequi (1966) compared physical fitness of Philippines students with Japanese and American students. He found that Philippine students had generally lower performance in pull-ups Softball throw and sit-ups as compared to Japanese and American students.

Cobb (1972) constructed a scientifically designed evaluative instrument for assessing the motor fitness of first, second and third grade girls. Thirty test items selected through a pilot investigation were administered to the 183 subjects. Pearson Product Movement Raw Score Formula, the zero order correlation coefficient were used to construct correlation matrix for the factor analysis of the data using the principal axis method. The battery of the seven most valued measure which loaded highest on each factor was developed and included Clark’s strength composite, McCloy endurance ratio, leg extension and flexion, Well’s sit and reach, dogging run, Bass Lengthwise stick balance and vertical jump.

Veeraswami (1973) conducted a study to evolve physical fitness norms for Higher Secondary School of Grater Gwalior. 212 male students were selected from four higher secondary schools and AAHPER Youth fitness test was administered on them. Again 793 male students from the remaining 27 schools out of 27 higher secondary schools selected for this study, acted at subjects and AAHPER Youth physical fitness test was administered the norms for pull-ups and sit-ups, shuttle run, standing broad jump, 50 yard dash, softball throw and 600 yard run/walk for the boys age group 13, 14, 15, 16, 17 were worked out. It was concluded that in all items except pull-ups of the AAHPER Youth fitness test, the mean score of Indian boys in all age groups were lower than the 50th percentile of American norms. There was a positive but low order of relationship between physical fitness and participation in physical activities. There was a positive low correlation (R=0.13) between physical fitness and academic achievement.
Brar (1975) conducted a study to compare the physical fitness of two different socio-economic groups. The AAHPER Youth fitness test was administered to the subjects- thirty in each group taken from central school, Gwalior and Railway Colony School, Gwalior. The data was compared by converting the raw score into standard score using ‘t’ scores. It was concluded that the socio-economic difference did not have any effect on physical fitness of an individual. The subjects belonging to the lower socio-economic group were as good as subjects belonging to the higher socio-economic group.

Robson et al. (1978) undertook a comparative study on 150 boys and girls belonging to both defense and non-defense personnel. The test battery composed of six items (viz: 50 yard dash, 4X10 shuttle run, sit-ups, modified push-ups, vertical jump, 600 meter run/walk) was administered to both boys and girls. In conclusion they found that elementary school girls and boys studying in grade 1 to 5, and belonging to defense personnel performed significantly better in physical fitness as compared to girls and boys belonging to no-defense personnel.

Juteja (1978) administered the AAHPER youth fitness test and the national physical efficiency drive test to hundred rural and hundred urban male school students in Delhi. The subjects ranged from 14-17 years of age. He concluded that mean score of the AAHPER youth fitness test were slightly higher in the case of urban high school students when compared to those of rural high school students. The mean score of rural high school students were slightly higher than those of urban high school student in the national physical efficiency drive test. However, none of the differences in the mean scores was found statistically significant of the 0.05 level of confidence.

Mookherjee (1978) made a comparative study of physical fitness of young boys in the age group of 13-17 years belonging to rural and urban and also less active boys of the same age group. The result of this study was that there is no doubt that regular physical activity contributes significantly to the enhancement of physical status. Physical fitness of rural active subjects was definitely of superior level than the boys living in the cities. Pure food, fresh unpolluted air and reasonable regular physical hardships are chief contributory factors in promoting physical fitness.

Saha (1980) made a study to compare the selected physical fitness variables and anthropometric measures of tribal and non-tribal students of Tripura. They were
listed with selected items of AAHPER youth fitness list and selected anthropometric measurements. In all lists and measurements, the composite mean scores of tribal students were higher than their Non-tribal counterparts but none of the differences in the mean was found statistically significant at 5% of confidence.

Mehta (1981) compared physical fitness of tribal and non-tribal school girls of Indore division; the girls were administered AAHPER youth physical fitness test. The results of the study showed that tribal girls were better in arms strength, abdominal strength and agility. Further non-tribal girls were better explosive strength and endurance.

Barbanti (1983) conducted a comparative study of physical fitness and anthropometric measurements of Brazilian and American school children. The subjects were 2342 boys and girls enrolled in a public school. A trained team collected anthropometric measurements, Height, weight, triceps and sub scapular skinfolds, health related physical fitness test battery, sit and reach test; Modify sit ups test, 9 and 12 minute run test, 50 meters dash and standing broad jump were administered to test athletic ability. The results of the study could be summarized as follows:

1. In the selected Brazilian school population aged 6 to 14 years, height and weight of both sexes increased at approximately same rate. The girls were significantly taller and heavier than boys during adolescence.

2. The Brazilian girls had higher values than boys for triceps and sub scapular skinfolds measurements and in sit and reach test.

3. The Brazilian boys performed better than girls in modified sit ups, 9 and 12 minutes run test, test, 50 meters dash and standing broad jump test.

4. The comparison between norms for Brazilian and American boys and girls showed that they were in standing broad jump test. The Brazilian children exhibited greater amount of triceps and sub scapular skinfolds and had higher scores of the 9 and 12 minute run test than American children.

Robbins (1985) conducted a study to develop percentile norms for Alabama students in grades 1-9 based on their performance on both the AAHPER Youth Fitness Test and AAHPER Health Related Fitness Test. The two tests were applied to 2,545 Alabama boys and girls in the 6-14 age groups. Percentile tables were
constructed for each test item based on age and sex. The Alabama mean was compared with the national mean. The test was used to determine significant difference between the mean. Alabama students performed better on events measuring agility, speed and cardiovascular endurance. The national group performed better on events measuring abdominal muscular endurance and flexibility.

**Singh, Ajmer (1986)** undertook a study on 4000 college students of Punjab University, Chandigarh. Fleishman test battery was used on the 17 to 22 years old students. In conclusion he found that physical fitness improved linearly according to age and the students belonging to the rural area were significantly superior in their performance on different items.

**Kaur (1989)** conducted study on the physical fitness of high school girls of Punjab falling age group 12 to 15. The purpose of the study was to prepare norms for the girls of the Punjab belonging to this age group. The norms were prepared on Fleishman Physical Fitness Test Battery. The study also intended to show how development in physical fitness takes place in this age group. Further efforts were made to compare the levels of physical fitness of urban and rural girls of Punjab. Data were collected on 4000 girls. The test battery administered consisted on 11 items: twist and touch, shuttle run, softball throw, hand grip, push-ups, leg lifts, cable jump, balance-A test, 600 meter run/walk, standing broad jump, 50 meter dash. Percentile norms for physical fitness test were found to be valid and suitable to access the physical fitness levels of the high school girls. The urban girls were found superior in most test items as compared to the rural girls. There was a linear relationship of fitness with age accept in the variable of flexibility.

**Sandhu (1989)** conducted a study on the construction of motor fitness for college volleyball players (female) between the age group of 17 to 20 years with the minimum college level participation. The sample was drawn from three universities of Punjab viz. Guru Nanak Dev University, Amritsar; Punjabi University, Patiala; and Punjab University, Chandigarh. The study was conducted in two phases. In the first phase of study, seven test items comprising the test battery through factor analysis technique were selected. These test items were W.M. agility, spike Jump, stick test 20 Meters run, W.M. bend and reach and push-ups. In the second phase of the study, the test items were standardized on 400 volleyball players’ and norms were developed in T and Hull-scores for each age group.
Mentheny (1989) studied the differences between Negro and white athletes in respect to their body measurements. Forty-seven direct and derived anthropometric measurements on 51 American Negro and 51 white male college students were analyzed and compared with finding of other investigators in this field. The Negros were found to exceed the whites in weight, arm length, elbow width, leg length, lower leg length, knee width, shoulder breadth, chest depth and width, neck girth, all relative to stature. While the white exceeded negro in sitting height, total fat, hip width and ileum width, certain differences in foot proportions, chest conformations and pelvic proportions were also noted.

Akkus Hasan (1990) Measured and compared the selected physical fitness components of 18-20 years old male students attending the faculty of Medicine and the Department of Physical Education and Sports at Selcuk University. Physical fitness components were height and weight, resting heart rate, resting systolic and diastolic blood pressure, percent body fat, flexibility, reaction time, hand grip strength, anaerobic leg power (vertical jump), aerobic power (12 m. run). There were significant differences between the subjects from the subjects from the Department of Physical Education and Sports and the subjects from the Faculty of Medicine except for weight and flexibility.

Aujla (1990) in her study has observed difference in physical fitness if any, between Jat Sikh girls living in rural and urban areas in Punjab. (N=202) each rural and urban Jat Sikh girls were randomly selected for the purpose of the study. The age ranged between 14 to 16 years. The result of the study revealed that urban girls were slightly higher in height. Further the result show that rural girls were better in 100 meters, 200 meters run and vertical jump. But urban were better then rural in shot-put.

Chandel (1993) compared physical fitness, anthropometric and physiological variables of tribal and non-tribal boys of Himachal Pradesh. AAHPER Test Battery was administered to 260 tribal and 220 non-tribal boys. The statistical analysis of the data revealed that the standing and sitting height of the tribal students was more but shorter in their leg strength than the non-tribal boys. Tribal were found superior in speed, agility, endurance and explosive strength of the legs than the non-tribal boys. Tribal were found superior in physiological fitness as their heart rate, systolic and diastolic blood pressure in lying, sitting and standing position was found significantly lower than the non-tribal.
**Dhara and others (1995)** investigated the body dimension and sports performance ability of tribal and non-tribal boys. The study was conducted on 35 school boys (age range 14-17 years) selected from tribal and non-tribal population. Different anthropometric dimensions, example weight, height, width of the hip, arm girth, thigh girth, calf girth, chest girth of the boys were measured. To evaluate their sports performance different tests, viz., broad jump, shuttle run, push up, flying start, and hamstring looseness were performed. Results showed that there was significant difference in body dimensions between tribal and non-tribal except for weight, arm girth, thigh girth. Tribal boys showed significantly better sports performance abilities then that of the non-tribal boys. The broad jump score and the push up score were found to be significantly correlated with calf girth and arm girth respectively. It was concluded that a sports talent program should be undertaken among the tribal boys.

**Anayanwa and Samule (1997)** attempted to establish physical fitness norms for Nigerian boys and girls in the age group 11 years to 18 years. The study included the following test items. Shuttle run: push-ups for boys, chair push-ups for girls; flexed knee sit-ups; 45 meter dash; standing long jump; pull-ups for boys, flexed arms hang for girls; a minute run for subjects 13 to 18 years: The results of the study show.

1. The high correlations were obtained on the test re-test method. The test items were considered objectives.
2. The activities can be accepted as true test items for the component of physical fitness, which they support to measure.
3. In most of the test items the performance of the boys improved from the lower to upper age level.
4. The boys performed better than girls in all the test activities.
5. The mean score revalued that the girls of lower age level tend to possess better physical fitness status than the girls of the upper levels.

**Sharma (1997)** constructed motor fitness battery for elementary school children of Delhi (U.T). He concluded that the advancement in age has been found positively related with better performance on all the variables, except toe touching variable. Percentile norms have been promoted to record the performance of the subjects on the basis of motor fitness test battery.
Kumar (1998) The main purpose of this study was to evolve physical fitness norms on various items of Fleishman’s fitness battery for high and higher secondary school boys of Himachal and also Himachal Pradesh evaluate the physical fitness level of the secondary school male students of Himachal Pradesh. To accomplish the study 3,840 students between the age group of 13 to 16 years were randomly selected from both the urban and rural area. The results have shown that there was a significant difference from fifteen years to sixteen years male subjects of Himachal Pradesh in almost all fitness components. The boys of 16 years age were found significantly superior than 15 years to 13 year boys. The fifteen boys were better than 14 and 13 years boys. Similarly 14 years boys were superior then 13 year boys in all the components of Fleishman’s test battery. The result of the study have also shown that the male subjects of rural areas were significantly superior than urban subjects in six of ten fitness components of Fleishman’s test battery.

Domic (1999) studied the relationship of motor fitness components and anthropometric variables to the velocity of basketball throw. Motor fitness components chosen were wrist, and shoulder flexibility, speed of movement of arm and anthropometric variables were upper arm length, lower arm length and total arm length with height, sitting height, weight and leg length. 25 male basketball players in the profession of physical education were chosen as the subject of the study. Analysis of the data showed that there is a significant correlation between the velocity of long and hook basketball passes and the anthropometric variables.

Kaur (1999) compared the motor fitness of rural and urban girls studying in Punjab School. The secondary purpose of the study was to prepare grading scales in motor fitness for the school girls studying in grade eleven and twelve. In all 4000 girls of grades eleven and twelve were selected as a sample for the study. The AAHPER Youth Fitness test was used for the purpose.

Based on the findings of the study, the following conclusions were drawn:

1. Rural girls possessed better shoulder strength than urban girls.
2. Abdominal strength of rural girls was found better than urban.
3. Leg strength of rural girls was found better than urban girls.
4. Agility was found lesser in urban girls than rural girls.
Cardiovascular endurance was found better in rural girls than urban girls.

Keogh J. (1999) this study was conducted to determine if anthropometric and fitness testing scores can be used to discriminate between players that were selected or not selected in an elite Under 18 Australian Rules Football side. A training squad of 40 Australian Rules football players was assessed on a battery of standard anthropometric and fitness tests just prior to the selection of the 30 man player roster for the upcoming season. Results showed that the selected players were significantly (P<0.05) taller and had greater upper body strength than non-selected players. A discriminate analysis was performed which predicted with an accuracy of 80% whether each player was successful or unsuccessful in gaining selection. This suggested that physical conditioning and anthropometric measurements do play an important part in determining selection in elite junior Australian Rules football teams.

Devi (2000) conducted a comparative study of physical fitness and psychological traits of tribal and non-tribal high school students on a sample of 1200 drawn from high altitude. Fleishman Physical Fitness Test battery was used for the purpose she concluded that:

1. The tribal (boys and girls) were found superior in explosive strength than the tribal (boys and girls).
2. The non-tribal (boys and girls) were better in extend flexibility than the tribal (boys and girls).
3. The tribal boys were found superior in agility and dynamic flexibility to the non tribal boys.
4. The non – tribal boys were better in endurance than the tribal boys.
5. The tribal girls were better in speed and endurance than the non-tribal girls.
6. The non-tribal boys of lower altitude were better in dynamic flexibility than the non-tribal bots of higher altitude.

Meir et al (2001) A total of 146 professional rugby league football players, contracted to 2 teams competing in England (n = 45) and Australia (n = 101), participated in this study. All players completed the following series of physical fitness performance tests: 1 repetition maximum squat and bench press, 15- and 40-m sprint, agility run, 5-minute run for distance, 60-second sit-up, 30-second plyometric
push-up, and measurement of body weight and subcutaneous skinfold (4 sites). Analysis of variance with a criterion alpha level of p < 0.05, was used to determine if any significant difference could be found when grouping players into 3 different positional categories typically identified in the sport. There were a number of significant differences with respect to test results between categories, and this was apparent for all 3 systems of categorization. On the basis of these findings, we recommend that to more efficiently structure the physical fitness training of players, the players should be grouped either according to the 2 broad positional categories of forwards or backs or according to the 4 categories of forwards, distributors, adjustable, and outside backs. Grouping players according to the 9 specific positions played on the team is not warranted.

Singh (2002) conducted the study between height and weight with physical fitness variables on 368 girls of 10-14 years age group. It was found that height shows significant relationship to body weight, 30m run, medicine ball put, standing broad jump and standing vertical jump test performance in 10 and 11 years group. A non significant relationship was found between height and selected motor tests in age group of 13 years. It was concluded that the relationship trend is not similar in all age groups.

Monyeki MA, and Others (2005) determine the relationships between the body composition characteristics, body mass index (BMI), sum of skin folds (SSF), % body fat (%BF), fat-free mass (FFM) and waist-to-hip ratio (WHR), and nine physical fitness items in undernourished rural primary school children in Ellisras, South Africa. Design: A cross-sectional study. Setting: The study consisted of 462 boys and 393 girls who were aged 7-14 y. Five body composition measures were assessed: BMI, SSF, %BF, FFM and WHR. Nine physical fitness tests items were assessed: standing long jump, bent arm hang, sit-ups, 10 x 5 m shuttle run, 50 m sprint, 1600 m run, flamingo balance, sit and reach.

Sanga. S. S (2010) determined and compared the physical fitness level and personality traits among male wrestlers, across their level of participation i.e. inter college, inter district and inter university. It has been observed that all the three groups significantly differ on six variables/components of physical fitness namely pull up, sit up, shuttle run, standing broad jump, 50 yard dash and 600 yard run. It was also found that physical fitness and performance were too co-related with each other.
Deol et. al (2010) compared the physical fitness of selected parameters of high altitude and low altitude students of Physical Education. It was found that the endurance capacity of students of high altitude was better and the low altitude students were better in strength. This was due to at high altitude metabolic rate increase, heart rate increase which leads to Anorexia, which reduces the body mass. There was no effect of altitude on speed but in case of endurance and strength difference is found.

Purashwani and Rathore (2010) compare the physical fitness youth of north-eastern and western regions of India. Analysis of data revealed that the youth of both of the regions had no significant difference in relation with the flexibility and agility, whereas in abdominal strength endurance, leg explosive strength, arm and shoulder strength endurance, cardio vascular endurance and speed significant difference was found.

Malik and Hemlata (2011) compare the physical fitness variables of 15-16 years boys of urban and rural are in relationship of physical fitness with age. The result showed that some significant differences were found between rural and urban areas boys according to their age. The respondents of rural areas were strong in strength, more speedy and have better endurance than the urban respondents.

Singh and Ram (2011) compare the physical fitness level of senior secondary school boys from Mandi and Kullu district of Himachal Pradesh. Results revealed that Mandi district students have higher value Kullu district students in the variable of standing broad jump, 50 yard dash and 600 yard run/walk and show significant difference between them.

Vishaw et al (2011) investigate the significant differences of selected physical fitness variables between individual games and team games athletes. An independent samples t-test revealed that individual games athletes had significantly higher muscular strength, agility, power, speed and cardiovascular endurance (p<0.01) than team games athletes.

Arazi and Asadi (2012) examine the effects of condensed multiple-set resistance training and circuit multiple-set resistance training on muscular strength, endurance, body composition and arm and thigh circumference in healthy males. Subjects in the COM performed resistance training exercises for 3 sets continuously;
whereas subjects in the CIM performed resistance training program for 1 set of each exercise and come back to the first exercise and this approach was performed 3 times each training session. Pre and post 8 weeks of training, one repetition maximum (1RM) and muscle endurance (60% of 1RM) for leg press and bench press, body weight, arm and thigh circumference and body composition were measured. No significant differences in body mass, arm and thigh circumference and muscular strength for the bench press exercise were observed for any group during the 8 weeks of training period (p > 0.05). A significant increase in muscular strength for the leg press exercise was observed for COM after 8 weeks of training (p < 0.05). Both the COM and CIM groups showed significant improvement compared with pre training and CON in muscular endurance for the bench press and leg press exercises (p < 0.05). In conclusion, it can be recommended that, COM is better for improving muscle strength and both training programs are proper for increasing muscular endurance.

Meswaniya (2012) compared the selected physical fitness variables of school level football and cricket players. Study concluded that significant difference found between the means of selected physical fitness variables such as speed and agility (shuttle run), explosive strength of legs (SBJ), speed of lower extremities (50mt. dash) and explosive strength, cardio-vascular endurance (12 min run & walk) and no significant difference found between the means of muscular strength (dynamic) and endurance of arm & shoulders (Pull-ups), muscular strength and endurance of trunk (bent-knee sit ups) of school level football and cricket players.

2.2 STUDIES RELATED TO ANTHROPOMETRY

Parnell (1951) used a set of measurements taken by tanner on members of the Oxford University athletic club and acknowledged the inadequacy of his sample but responded the following interesting facts. The shortest mean sub-sichial leg length, was found in a control group of college men, slightly longer in sprinters, greeters still in long distance runners, hurdle and high jumpers and greatest in discus, javelin and shot put group.

Harold’s (1953) study investigated the following aspects:

a) Size and shape seem to have an influence on physical performance.
b) The very obese are poorest performance.
c) Maximum size, body shape does not provide maximum physical fitness.
d) The large and fatty body varies in physical performance than the normal and thin boys.

Sheldon and his associates (1954) have made many interesting observation regarding the somatotype of college football players in America. They have brought out the probable nature of the somatotypes which are successful in the case of players playing at various fields positions.

In a case of junior high school athletes Shelley (1960) found that those athletes who were outstanding in football were largely mesomorphic or mid types, and that they were taller and heavier than other athletes.

Wiley (1963) compared 12 years old non-athletes and football players and found no difference between the somatotype means, but the football players were taller and heavier than the non athletes.

Heath (1963) somatotyped 66 university football players, using her modification of Sheldon’s method when compared with means for college students rated by Sheldon and others (1940), these football players were approximately one half unit higher on the first component, and one and one quarter units lower on the third component.

Espenschade (1963) studied relationship between physical performances of school children and their age, height and weight. The relationship of age, height, and weight to performance of boys and girls on California Physical Performance test was studied in order to evaluate these factors on the basis of grouping of students and for the establishments of norms for test performance with height and weight were low. The highest correlations were obtained for boys of junior high school age in the events of jumping and throwing. Significant changes with age do occur in relationship with most events for both sexes desired; the California Classification Plan is superior. It shows that age has direct bearing on physical performance.

Baacke (1964) took three anthropometric and eight physical performance measures and were related by correlation methods to the performance of 87 secondary school boys in hop-step and jump. All variables showed a significant relationship with the criterion beyond 0.05 levels. The criterion could be employed as a measure of motor ability since three of the highest single variable correlations with the criterion
were measures that are known predictors of motor ability, the running broad jump \(r = 0.859\), 50 yard dash \(r = 0.815\) and standing broad jump \(r = 0.778\). Three selected combinations of measures yielded multiple correlations with criterion, which were significant beyond 0.01 level of confidence. A regression equation developed from the optimal set of administration in school systems consisted of two items from the Youth Fitness Test Manual; the standing broad jump and the 50-yard dash.

**Margaret (1964)** studied body structure and design factors in the motor performance of college women. Speed, Sargent Jumps, and 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.

An extensive study on college football players including somatotype assessment was carried out by **Allen (1965)**. The mean somatotype of 66 college football players studied by Heath was found to be 3.5-5.5-2 (Carter, 1970)

**Novak (1965)** conducted a study on high school football and basketball boys and concluded that their average total body fat amounted to be 7.2 percent and lean body mass 92.8 percent.

**Carter (1968)** summarized Sheldon's (1954) colorful description of college and professional football players. When the Heath-Carter rating shows that the physiques are even more extreme than Sheldon suggested. In addition, the trend is towards greater size and higher mesomorphy among contemporary college and professional players. Sheldon (1940) observed that a coach who cannot distinguish between a 5.5 and 6 in mesomorphy might not win many football games. Perhaps this is true today of small college level teams, but at higher levels it appears that well trained, rugged 6's, 7's and 8's are mandatory for even a glimmer of success.

**Neilsen (1969)** studied the relationship of body composition to selected measures of muscular strength. Twenty eight male student, 18 to 25 years of age, were tested for body density from percent body fat, percent body lean mass and lean
body weight were calculated. The strength of nine major muscle groups of the body measured isometrically. The inter correlations of the strength measures were all positive except for the elbow flexion and hip extension, although a little relationship was found to exist between strength and body composition variables. The multiple correlation coefficients indicated that strength was unusable as predictor of body composition.

Carter (1970) rated members of the 1964 San Diego state football team and 20 university of Iowa football players according to the Heath criteria. It appears from his results that performance of endomorphs is a prerequisite for success in football.

Shondell (1972) studied the relationship of selected motor performance and anthropometric traits of successful volleyball performance. The purpose of this study was to identify the physical and anthropometric traits possessed by successful volleyball players and to develop a physical performance battery that would prove valid, reliable and practical, when used to identify successful collegiate volleyball players. The statistical techniques used provide inter-correlation coefficient of the, independent variable and the dependent variables step wise regression coefficient, constant and square of the multiple correlation coefficients for the regression equation at each step. The reliability coefficient of all items were computed by using interclass correlation techniques with in the limitations of the study and based on findings, the following conclusions were made the cross validation procedure employment supported the validity of six item battery as a predictor of expected volleyball performance.

Gunney (1973) reported that if two athletes are equally trained with identical body built the taller gymnasts is at disadvantages because he or she has a smaller strength body weight ratio than the shorter gymnast.

Malhotra and associates (1973) reported that the forwards players of the Indian hockey had minimum percentage body fat which increased gradually the halves, backs and goal keepers.

Sodhi et al. (1974) conducted a study on the physique of hockey players and reported the mean height, weight, and age with respect to the field position of the players. The backs were found to be tallest followed in a descending order by the half backs and the forwards. However, in respect of weight, the forwards were lighter and
the backs were heaviest, the body fat which increased gradually towards the halves, backs and goalkeepers.

Sidhu and Sodhi (1975 a) worked on the effect of physical activity on body composition of top ranking Indian hockey players undergoing coaching for the Asian games of 1974. The players in these investigation were divided into three main groups in accordance with the load of exercise on different players which was maximum in group-I, and decreased gradually in the case of the group-III players. Group-I consisted of inside left, inside right and centre half, group-II consists of outside left, center forward & right half and group-III consist of right back, left back and left half. The group-I players registered the maximum decrease body fat after 52 days of intensive training. Similarly, the group-III players who underwent the minimum load of physical activity had shown an increase in the amount of body fat. The group-II players manifested a decreased but to smaller extend than group-III.

Martin (1976) conducted a study by comparing the selected anthropometric measurements and physical performance between Mexican American and Anglo American adolescent boys. He also compares the body size, body structure and physical performance between the subjects at adjacent age level within each individual racial group. The body size was assessed by standing height and body weight measurement. The body structure was interpreted as upper arm girth, chest girth, abdominal girth, thigh girth and calf girth measurement. The physical performance was determined by selected motor ability test. 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 these two races did not differ in physical performance.

Amuso (1979) selected 46 subjects who were well- conditioned soccer players with at least two years playing experience on college level. They were tested for anthropometric measurements consisting of skinfold and body diameters. Analysis of data was by zero order correlation’s and multiple regression analysis resulting in the conclusion that age (experience) was found to be the best single predictor of playing ability. Weight, lean body mass and height were considered good predictors of playing ability.
Bell (1979) studied body composition components of 56 second class survey union football players: 28 forwards and 28 backs. Forwards were found to have 19.5% TBF (Total body fat) and 80.5 % LBM (Lean body mass). Backs had 12.2% TBF and 87.8% LBM. It was felt that greater attention should be given to the ratio of TBF to LBM in determining body weight and that there should be an increased emphasis of the LBM at the expense of TBF.

Sidhu and Sodhi (1979) worked on the effect of physical activity on body composition of elite Indian hockey players undergoing coaching for the Asian games of 1974. The players in the investigation were divided into three main groups in accordance with the load of exercise on different players which has maximum in group I and decreased gradually in the case of the group II and group III players. Group I consisted of left in, right in and centre half; group II, left out, centre forward and right half; group III, right back, left back and left half. The group I players registered the maximum decrease in body fat after 52 days of intensive training. Similarly, the group III players who underwent the minimum load of physical stress had shown increase in the amount of body fat. The group II players manifested a decrease but to a smaller extent than group I. After taking account of the varied degree of physical activity of different players, they suggested a need of differential conditioning for players specializing at different field position.

Bhatnagar (1980) Conducted a study on 23 rural sportsmen (athletics = 8, volleyball =8, kabaddi = 7), of Madhya Pradesh (India) pertaining to their weight, height, sitting height, subcutaneous tissue folds of biceps, triceps, sub scapular and suprailiac region. They were found to be lighter, shorter and with less amount of fat as compared to sportive activities indicated that volleyball players were lightest, shortest with maximum of fat as compared to kabaddi players and athletes, whereas kabaddi players were heaviest and tallest among all the rural sportsmen of Madhya Pradesh.

Sodhi (1980) has mentioned that in body composition studies the most important aim is not only an overall characterization of body components but also its quantitative evaluation as exact as possible according to actual methodological possibilities. Absolute amount of lean body weight serves together with body weight as basic somatic characteristic of body type and as a reference of standard to which oxygen plate and muscle strength etc. are related. On the other hand, the quantitative
changes in depot fat can provide an important information on lipid metabolism and shifts in every substrates used as a fuel for muscle work.

Spence et al. (1980) studied the anthropometric and performance characteristics of 15 highly skilled members of the United States Women’s National Volleyball training team. Out of these, six women players were selected for the Pan American team. The selected players were taller heavier, faster, more agile and better jumpers than the non selected player. The strength measurements did not indicate consistent difference, where as the Vo^2 max was greater in the non selected than selected player. In establishing the profile of specific qualities and ability that volleyball players require, this study suggested that body size and motor ability were particularly important.

Sharma and Shukla (1981), collected data on 300 subjects on five sports specialties [athletics – track and field, hockey, football, cricket and volleyball] drawn from institutions of sports in the state of Uttar Pradesh. The result showed that volleyball players and throwers somewhat similar in characteristics except that throwers found to be more mesomorphic and less ectomorphic than the volleyball players. Significant differences among the long distance runners, sprinters, throwers and volleyball players were revealed on the first component [endomorphy], while on second component [mesomorphy] and the third component [ectomorphy] there existed dissimilarity showing variation among throwers, volleyball players, sprinters with cricketers and footballers, hockey and long distance runners.

Kansal (1982) attempted to develop scientific criteria for the selection of budding athletes based on morphological status. He conducted a study on 246 male students ranging from 11 to 17 years. Their height, weight, bi-acromial, humerous, bicondylar, chest and calf circumferences and performance on the 100 meters run, shot put and standing broad jump was examined. They concluded that the above listed measurements show significant degree of these differential roles, they attempted to prepare selection criteria for choosing budding athletes at young age.

Thirty Indian women hockey players selected to participate in the world cup championship held at Spain were examined by Sidhu and his colleagues (1984). The results showed that players differ in body composition according to the field of specialization. Amount of fat was minimum in forwards and maximum in
goalkeepers. Distribution of fat at the sites of biceps, triceps and sub scapular also showed the same.

The stoppers and the goal keepers in the national level football in India had more lean tissue in limb segments, with broader distal epiphyseal diameters of humerus and femur (Sodhi and Sidhu, 1984). It was found that the lean tissue in the limb segments of forwards. Halves and goalkeepers was better developed in the national level football players than those of the university level footballers. The body fat was found to be least in the forwards, and maximum in the goal keepers of the national level football players. In the case of the University level football, both the forwards and halves got less of body fat than the backs and the stoppers. However, in case of the national level football, the subcutaneous tissue in the limbs was found to be less in the forwards halves and backs which gradually increased in the stoppers and goalkeepers of this group. All players in university level; and national football possessed better developed lean tissue in the thigh in relation to that in the upper arm and possessed less of body fat than the controls. However, among the players of similar field’s positions in the two groups, the body fat was considerably greater in the case of the state level football players.

Sodhi and Sidhu (1984) reported that among Indian hockey players the forwards had greater lean body mass. The fullbacks had maximum development of the lean tissue in the limbs. The goalkeepers were less developed in respect of the lean body mass.

(Sodhi and Sidhu, 1984) the overall mean for the two studies was 3.5-4.0-3.0. Endomorphy gradually increased from forwards to halves, fullbacks and goalkeepers. The forwards, the halves and the full backs were greater in mesomorphy but less in ectomorphy than the goalkeeper. Both samples were more mesomorphic and less endomorphic and ectomorphic than their respective control groups of non-athletes.

Mathur and Salokun (1985) conducted a study on 150 female subjects, found that the athletes were significantly taller, heavier, and had larger bi-acromial and bi-cristal diameters as compared to non-athletes. The percentage of fat was significantly higher in non athletes. The significant difference between the anthropometric variables and body composition of university and national level athletes were observed. The measurements were significant between athletes and non-athletes.
athletes and between athletes of different sports i.e. volleyball, throwers within the athletes group have been attributed to physical demand of each sport.

Chauhan (1986) studied the relationship between selected anthropometric variables and endurance running performance. He concluded that height, leg length, total arm length, shoulder, chest, abdomen, hip and knee girths, thigh and calf skin fold, lean body mass had significant and negative correlations with 1500 meter endurance running performance, whereas 10,000 meters running performance had statistically insignificant correlations with linear segments, girth and diameter measurements, except with skin fold measurements (triceps, suprailliac, midaxillary, thigh and calf skin folds) and body composition variables i.e. body density, fat percentage, fat weight and lean body mass.

Multiple correlations of 1500-meter running performance with combination of selected anthropometric variables were significant. Similarly, the multiple correlations were not of significant size to put them into the prediction equation.

In another study Mokha and Sidhu (1986) reported data on the female hockey players. The forwards and halves possessed lesser amount of body fat as compared to backs and goalkeepers because in case of former players a lot of running – around is required as compared to the other ones.

Chauhan et al. (1987) conducted a study on the relationship between selected anthropometric variables and performance in standing broad jump of college level women and concluded that age and foot breadth had positive correlation with performance in standing broad jump, whereas hip girth and calf skinfolds, fat weight and lean body mass had significant but native correlation with the performance in the standing broad jump. Further, the multiple correlation of the combination of selected anthropometric variables i.e. age, height, foot breadth, hip girth and thigh girth with performance in standing broad jump was found to be significant at 5% level. The multiple correlations found were not sufficient to be used in the prediction of performance.

Kansal et al. (1987) conducted a study which the anthropometric measurements were taken of 23 football and 15 volleyball players who attended an inter-varsity coaching camp with a view to study there physique and body morphology. They also studied 100 control subjects. The differential anthropometric
variables including linear, circumferential and skin fold measurements were taken. The body physique was calculated from skin fold using Health-Carter Methods (1969), and body fat was computed from skinfolds using Durnin and Womersely (1974) equations. It is found that the footballers were of average height, however, the volleyballers were taller than their control counterparts. The footballers had larger trunks and smaller lower extremities than the volleyballers had larger trunks and smaller lower extremities than the volleyballers who did not differ much from the controls in this relationship. The volleyballers had linear physique and large limb girths but less body fat than controls indicated their relatively more musculature. The anthropometric somatotype of volleyballers and footballers were 2.16, 23.3, 9.7, 1.87 and 3.59 respectively indicating less endomorphic components than controls. When compared with Olympic level players, the players of present study were found shorter and lighter.

Martirosov et al. (1987) examined 254 leading footballers of the world from 10 national young combined teams. The leading footballers of the world are of more than middle height and tall, the body mass is proportional to its length, the fat mass values are not great. Their specific somatotype is well-balanced mesomorphic and ectomesomorphic types. The average somatotype of the footballers examined can be presented as 1.7-5.6-2.6.

Sodhi et al. (1987) studied anthropometric characteristics of Indian volleyball players at different level of competition. The result revealed that the volleyball group possessed less rating of mesomorphic components than the control group. In ectomorphic component, volleyball players were found to be more lean and thin than the control group.

Kuriaokose (1988) conducted a study of anthropometric measurements and body composition variable on judo players. He took nine anthropometric measurements and three body composition variables for this study. The judo player’s ability was taken as the criterion measure and all the variables were taken as the independent variables. The Pearson’s product Movement correlation was used to find out the relationship between anthropometric measurement and criterion measure. A multiple correlation was computed to find out the combined effect of the anthropometric measurement to judo performance. He concluded that:
1. The performance in judo is positively significant related to the chest girth.

2. The judo performance is negatively significant related to ponderal index, which means that for better judo performance a judoka should possess greater body weight in proportion to body height.

3. The lean body mass, upper arm/fore arm ratio of sitting height are the most important predicting variables under the limitation of the study.

Dey (1991) conducted a study of anthropometric measurements and body composition on high and low cardio-respiratory fitness of boys and observed that in secondary schools belonging to high cardio-respiratory fitness, fitness group possess significant small abdominal girth measurements, lower percentage of body fat, less fat weight, higher lean body mass as compared to low cardio-respiratory fitness groups. Multiple correlations of absolute variables from both high and low cardio-respiratory fitness group reveals that both the groups possess a peculiar physique and absolute anthropometric variables among themselves maintain certain amount of proportions which is quite unique in itself.

Sodhi et al. (1991) conducted a study on 116 selected ball game players, who participated in national games (45 volleyball players, 26 basketball players and 46 hockey players). Each group was compared with Olympians as well as, the Indian reported already. The somatotype of each player was estimated by using modified Heath-Carter method. In about a decade result of a study showed a trend of improvement in the body size of Indian players of each sports. In comparison to their Olympian counterpart they were still shorter in size, lighter in weight and poorer in development of mesomorphic component, greater predominance of ectomorphic component was still persistent in their Indian sportsmen.

Musaiger et al. (1994) selected 304 athletes from first class clubs related to four common sports football, handball, volleyball and basketball and compared with 53 non-athlete adults. The findings revealed that there were differences in body composition among athletes according to the type of sport. Basketballers and volleyballers were the tallest athletes, while handballers were the heaviest ones. Skinfold thickness measurements showed that basketball and handball players have more subcutaneous fat than other athletic groups. As compared with non-athletes, the
Bahraini players had higher means for height, weight, subscapular, suprailliac thickness and mid-arm circumference.

**Kumar (1995)** studied the relationship between selected anthropometric variables and performance in athletics programme of high schools and senior secondary school students. He concluded that performance in all running events 100 meters, 400 meters, 800 meters, 1500 meters, and 10,000 meters events have significant relation with age, body weight, height, leg length, thigh, calf, femur biocondyral, biacrominal, fat weight and lean body mass.

**Sparling et al. (1998)** evaluate total bone mineral density (BMD) and body composition (% fat) in world class women field hockey players. They reported that the mean whole body BMD value for members of the 1996 United States Olympic women's field hockey team is one of the highest reported for any women's sports team. Moreover, the mean fat free mass per unit height was quite high and % fat was low. In this group of world class sportswomen, low % fat was not associated with low BMD.

**Dey and Debray (1999)** investigate the morphological and physiological parameters of Indian national female soccer players according to their playing position. Results of the present study showed that goalkeepers were superior in height, weight and body fat percent as compared to the players of other field position though the difference was found to be statistically insignificant except back strength where goalkeeper showed significantly higher values. On the other hand mesomorphic component was found to be more in midfielder. Like mesomorphic rating, maximum oxygen uptake capacity and related parameters were also found to be more in the midfielder as compared to other groups. The present study also reveals that the values of different morphological and physiological parameters were found to be more than Indian sedentary female population and comparatively less than their International counterparts. The above values were well comparable with Indian National female hockey players. Similar trends in all morphological and physiological parameters were observed as male soccer players except body fat percent where values were found to be reversed.

**Reeves et al. (1999)** conducted a comparative study to determine the anthropometric measurements and body composition of football teams in the UK and
Malaysia. A total of 32 footballers from two teams were studied. The UK teams were significantly heavier, taller and had a higher body fat content than their Malaysian counterpart. There was no significant difference in VO2 max between the two teams, with the Malaysians recording a slightly higher VO2 max. With regard to playing position, the defenders were found to be the most physically robust and yet had the highest VO2 max, while the midfielders had the lightest body weights.

Mansoldo (1999) studied the anthropometric profile of collegiate soccer players and high performance players and found that soccer players were heavier, taller and the skinfold adding identical ball group: the dancer would be shorter, lighter and with fat mass adding identical to the soccer players will no significant difference in the skinfold.

Kaur (2000) investigated 260 SAI trainers of team and individual game in relation to somatotype and psycho-social variables. The games were athletics, boxing, cycling, gymnastics, judo, swimming, wrestling, handball, hockey, basketball, football, and volleyball. It was observed that the mean somatotype of athletes were 2.02-4.2-2.95, wrestlers were 1.85-4.57-2.61. The judokas were 1.67-3.77-3.99 and somatotype of cyclists were 1.78-3.88-3.14 and average somatotypes of team games were 1.89-3.25-3.83. It was also concluded that the average somatotype of basketball players were 2.14-3.28-3.33, football players were 1.95-3.91-3.29, volleyball players were 1.66-3.07-4.39 and the somatotype of hockey players were 1.75-3.04-3.86.

Chauhan (2003) conducted a study on relationship between anthropometric variables and middle running performance and concluded that age, linear measurements i.e. height, leg length, thigh length, total arm length, shoulder, chest, abdomen, hip, thigh, knee girth, ankle diameter and calf skinfold have positive and significant correlation with middle distance running performance. Lean body mass also has positive and significant correlation. The multiple correlation of combination of anthropometric variables i.e. height, thigh girth, bi-cromial, thigh skin fold with middle distance running performance is significant at 1% level, multiple correlation is not of sufficient size, so the regression equation can not be put into prediction of the running performance.

Noel et al. (2003) assessed body composition of Division I football players (n = 69) and compared the findings with previously reported data to ascertain whether
the increase in player total body mass that has been observed over the past 10 years has been accompanied by an increase in body fat. Body fat varied significantly across playing position, with the defensive backs, offensive backs, and receivers being the leanest and the offensive linemen and tight ends the most fat. There was no significant relationship between body composition and playing year or scholarship status, nor were any differences observed between ethnic groups.

**Cavas, I. et al., (2004),** conducted a comparative study to investigate the anthropometric parameters and body composition in handball, basketball, badminton, volleyball and underwater rugby players who were students in physical Education and Sports Department in turkey. 49 female and 51 male athletes have taken part in this study. Skinfolds of triceps, abdomen, supra-iliac, chest (for only male), rear thigh (for only female), sub-scapular and front thigh have been measured in both female and male athletes. Estimated percentage body fat, body fat, body fat weight and fat free body mass have also been measured in athletes. The skinfolds of rear thigh in female players are significant (p<0.05) higher than those of other female and male skinfold values. Minimum skinfold value has been observed in sub-scapular and chest of female and male athletes, respectively. Although estimated percentage body fat and body fat weight values in female athletes are significantly (p<0.05) higher than those of male athletes, fat free body mass in male athletes who have taken part in this study are appropriate for the sports they are exercising. The results have also shown that ability selection has been applied successfully by physical Education and Sports Department in Turkey. Similar selection should strongly be recommended for secondary school students, particularly for adolescents.

**Moreno et al. (2004)** assess body composition in young male football players (n=239) and compare the results with those of reference population (n=453). Body mass index do not showed any significant difference between football (soccer) and reference groups in any age category. The percentage of total body fat was significantly lower in the football (soccer) group than in the reference group at 9, 11, 12, and 14 years.

**Carter et al. (2005)** compare the somatotype and size of elite female basketball players in terms of playing position and team performance. Anthropometry and somatotype data were collected on 168 players from 14 countries before the Women’s World Basketball Championship, Australia, 1994. There were 64 guards
(mean+s: age 25.4 years, height 1.72 m, mass 66.1 kg, somatotype = 2.9 – 3.9 – 2.6), 57 forwards (age 25.2 years, height 1.81 m, mass 73.3 kg, somatotype = 2.8 – 3.5 – 3.2) and 47 centres (age 24.1 years, height 1.90 m, mass 82.6 kg, somatotype = 3.2 – 3.1 – 3.4). Guards had greater mesomorphy than centres and less ectomorphy than forwards and centres. In the four top versus four bottom teams, guards were taller and more ectomorphic, forwards were taller, with lower mesomorphy and higher ectomorphy, and centres did not differ.

Chauhan and Chauhan (2005) investigated the relationship between anthropometric variables and explosive arm strength of volleyball players. They found that linear measurements ie. Height, sitting height, trunk length, leg length, foot length, body girth; body diameters; skinfolds and body compositions variables, ie fat percentage, fat weight and lean body mass have positive and significant correlations with explosive arm strength of volleyball players.

Kang et al. (2005) conducted a study based on the longitudinal somatometric measurements of national female hockey players (senior N=19, junior N=40). They found that height, weight and mesomorphic component of international players showed significant dominance over Indian national players and also showed significant differences. The senior players are heavier in weight, less in height, high % body fat, low % LMB and having lesser musculoskeletal development when compared to the international players.

Bayios et al. (2006) determine the anthropometric profile, body composition and somatotype of elite Greek female basketball, volleyball and handball players. Volleyball athletes were the tallest among the three groups of athletes, had the lowest values of body fat and their somatotype was characterized as balanced endomorph (3.4-2.7-2.9). Basketball athletes were taller and leaner than Handball players, with a somatotype characterized as mesomorph-endomorph (3.7-3.2-2.4). Handball athletes were the shortest of all, had the highest percentage of body fat and their somatotype was mesomorph-endomorph (4.2-4.7-1.8).

Devi and Singh (2006) studied the somatotype of 18 Manipuri and 18 Punjabi women football players. They found significant variations in age and stature between the two groups. The Manipur players are shorter and lighter in all lines of play, with the exception of goal keepers. Comparing the somatotype component rating of the
players, it is observed that, except the goal keepers, all other players show dominance of endomorphic component (being highest) over mesomorphic and ectomorphic rating (being the least). At the same time, Manipur players have higher endomorphic and mesomorphic rating than the Punjab players.

Christoph and Christina (2007) examined 39 soccer players of the third division as well as 22 handball players of the second division and 17 handball fourth division players. The group differences are here for the endomorphy and mesomorphy highly significant, for the ectomorphy significant. The proportional fat portion is high-significantly lower for the soccer players with 6.6 % than for the handball players (8.4%). All height and longitudinal dimensions as well as the circumferences with exception of the thigh girth were for the larger handball players very to highly significantly higher than for the smaller soccer players, whereby no important proportional differences were registered.

Vasques, Giordani Daniel et al. (2007) assessed Handball Players in which he compared the anthropometric and body composition variables from the best male handball athletes competing in the Santa Catarina state youth competition to variables from the other athletes in the same competition, by game position. Seven of the twelve coaches participating in the Santa Catarina open youth games 2004 (up to 18 years) freely consented to select the seven best athletes in the competition to these seven best athletes in the competition (one goalkeeper, one pivot, two wingers and three backcourt players). In addition to these seven players, there were a further 79 team members taking part, bringing the total sample size to 86 athletes. The following variables were analyzed: body weight (MC), height (ES), arm span (ENV), hand breadth (DPA), wrist breadth (DRU), forearm (PA), parentage fat (%G), fat mass (MG) and lean body mass (MCM). Descriptive statistics (means and standard deviations) were employed to classify the athletes according to court position. The chosen athletes were compared with the others using the single-sample t-test (p<0.05) and percentage rank. It was found that four of the chosen athletes (pivot, left winger, central and right backcourts) exhibited superior morphology in relation to other athletes playing in the same positions (p<0.05). Body morphology appears to be an important criterion for the performance of the chosen athletes. It is suggested that studies be undertaken to relate morphology with game performance in different age categories.
Bandyopadhyay (2007) selected 50 sedentary males and 128 sports persons (volleyball=82, soccer=46) of 20-24 years from West Bengal, India, to evaluate and compare their anthropometry and body composition. Skinfolds, girth measurements, body fat percentage (%fat), and endomorphy were significantly higher among sedentary individuals, but lean body mass (LBM) and mesomorphy were significantly higher among the sports persons. Soccer and volleyball players were found to be ectomorphic mesomorph, whereas sedentary subjects were endomorphic mesomorph. The soccer and volleyball players had higher %fat with lower body height and body mass than their overseas counterparts.

Sinha and Kapri (2008) find out the relationship of selected motor traits and selected anthropometric measurements on the performance of archery shooting. It was found that height has got significant positive correlation with arm span and leg length. It was further found that arm span had significant positive correlation with leg and flexibility. Body fat showed significant negative correlation with endurance performance. Leg strength and abdominal strength had significant influence on the speed and agility performance.

Gopinathan and Helina (2009) determine the relationship of anthropometric and physical fitness variables with handball performance. Results revealed that the anthropometric variables of height, weight, arm length, leg length, palm span and sum of four skinfolds and physical fitness variables of speed, agility, explosive power, shoulder strength, strength endurance and endurance were having significant relationship with handball performance and only flexibility was not having significant relationship with handball performance.

The purpose of the Chauhan, M.S. and ramchander, (2009) investigation was to scribe the correlation between the selected anthropometric variables and explosive leg strength and also to develop the regression equation for the prediction of expositive leg strength of volleyball players between the ages of 18 to 24 years. The data was collected from inter collegiate volleyball players taken as subjects of the study by using anthropometric rod, skinfold caliper, vernier caliper steel and tape. The product movement method for correlation and regression equation was used. Linear measurements i.e. height, lower leg length, total arm length, foot length and foot breadth, girth measurements i.e., shoulder, chest, abdomen, hip thigh and calf girth, body diameters i.e., biacromial, bitronchantric, femur bicondylear and ankle diameters
and skinfold measurements i.e., biceps, triceps, sub scapular, suprailiac mid-auxiliary and thigh skin fold measurements and fat percentage, fat weight and lean body mass have been found highly significant and hence the developed equation can be used in the prediction of explosive leg strength of volleyball players.

Kaur et al. (2009) showed that hockey players of both levels ie. National and state, were found to be significantly taller and lighter than control group. State level female hockey players possess significantly greater bone mass as compared to national level and control group. The national level female hockey players significantly greater muscle mass than state level: but, both groups national and state level have more muscle mass than the control group and national level female hockey players have lesser percent fat then state level. The female players of both groups’ national and state levels were found to possess significantly lesser percent fat than the control group.

Kumar e. t al (2009), analyze the selected anthropometric variables and iso-inertial strength with hitting speed, among different playing positions. From the results, it was observed that except the standing height all other variables namely hitting speed, body weight, iso-inertial strength of dominant and non dominant arm show significant relationship. Hitting speed of fullbacks was better than halfbacks; and in body weight fullback was better than forwards and halfbacks. Hitting speed of forwards was better than halfbacks. In iso-inertial strength of dominant arm the fullbacks were better the forwards. Iso-inertial strength of both dominant and non dominant arm the halfbacks was better the forwards.

Singh et.al (2010) compared the anthropometric measurements and body composition of field hockey teams of India, Pakistan and Sri Lanka. It was found that there were no significant differences in height and weight among the three teams, with the Pakistani players recording a slightly higher weight. The Pakistan team had a significantly higher upper arm length (p<0.05) and bi-hummers diameter (p<0.05) as compared to the India and the Sri Lanka teams. The Sri Lanka team had significantly less wrist circumference (p<0.05), hand width (p<0.05) and lean body mass (p<0.05) as compared to the India and the Pakistan teams. The India team had significantly less % body fat (p<0.05) than the other two teams. More data would be of interest to document the changes in anthropometry and body composition during the season and
out of season and also to attempt an analysis of characteristics specific to field positions.

Patil, Vijay (2011) determined the relationship of selected of anthropometrical, physical and physiological variable with performance of 1500 mts running. The results revealed that strength endurance, resting pulse rate and resting respiratory rate are significantly related to 1500 mts running performance, and body weight, height, leg length, arm length, vital capacity, flexibility, fat weight and lean body weight do not have significant relationship to 1500 mts running performance.

Singh et al (2011), find out the difference in selected anthropometric variables in volleyball players at different level of performance. The results revealed that loser players were inferior in block jump and spike jump along with height and weight. This showed that the teams with better height and weight along with good jumping ability had better performance in the tournament.

Karkare (2011) compared the anthropometric measurements and body composition of hockey players with respect to their playing position. Two hundred and ten junior national hockey players seventy each from half line, back line and forward line was selected different state of India. Anthropometric measurements including height, weight, diameter, breadth, girth, and skinfold thickness was taken from entire subjects. Body composition was measure with the help of Matiegka's method (1921). To find out significant difference statistical method one way ANOWA was performed. Results found that, hockey players playing in different position found to be differ on some anthropometric measurements and body composition.

Ali et al (2012) determine relationship between anthropometric properties with vertical jump on 40 male elite volleyball players (27.93±3.92 years old and 8±1.53 years sport history) in Iran premier league. There are significant differences between vertical jump of spikers and liberos, also between setters and liberos, but there are no significant differences between vertical jump of spikers and setters. There is significant relationship between vertical jumps with shank length, maximum calf circumference, foot length for spikers and setters, also tight circumference and weight for liberos.

Sharma et al (2012) investigate the correlations of anthropometric characteristics with isotonic strength (handgrip strength), lower limb power, aerobic
strength, and skill tests in purposely selected 60 Indian professional male hockey players of different levels. Results indicated statistically significant (p<0.05) differences only in lower limb power between Indian national and state level male hockey players. In Indian professional male hockey players, height has significantly positive correlations with weight, right and left handgrip strength, lower limb power and negative correlations with % body fat and dribble test, and body weight has significantly positive correlations with % body fat, right and left handgrip strength, lower limb power and negative correlations with slalom sprint. Significantly positive correlations were noted among the fitness component variables too.