CHAPTER - II

REVIEW OF RELATED LITERATURE

There cannot be two opinions about the need for review of the related literature in the very beginning it helps in a careful and methodical perusal of the study at hand. It not only serves to solve the problem but also enormously helps in broadening and deepening our understanding of the published research work in the related field. A review of the concerned literature helps to ascertain that the same has not been put to scrutiny before.

The review, cited in this chapter has definitely helped the researcher to imbibe his awareness and understanding of the various techniques available for conducting such a study and formulating ideas that profoundly contributed to the overall rational and interpretation of the data gleaned and compiled with great effort. In the process of conducting the study, the researcher was bound to be Zealous and meticulous which, in turn, brought about awareness of the peripheral issues that undoubtedly helped his study in the frame of scientific reference.

The review enlisted in this chapter was based on various sources vis-à-vis journals, periodicals, encyclopedia, newspaper and internet etc. which were available in various libraries. The libraries which the scholar consulted were Panjab University, Chandigarh, Punjabi University, Patiala. The relevant literature pertaining to the present study has been abstracted in this chapter to provide the background material to evaluate the significance of this study as well as to interpret its findings.
STUDIES ON ANTHROPOMETRIC MEASUREMENTS

**Metheny (1939)** studied the difference between Negro and White athletes in respect of their body measurements, forty seven direct and derived anthropometric measurement on fifty one American Negroes and fifty one White male college students were analysed and compared with findings of other investigator in this field. The Negroes were found to exceed the White in weight, arm length, elbow width, leg length, lower leg length, knee width, shoulder width, chest depth and hip width, neck girth all related stature. While the White exceeded Negroes in sitting height, total fat, hip width and illium width. Certain differences in foot proportions, chest circumference and pelvic proportions were also noted.

**Steggerda and Petty (1940)** conducted study on Anthropometric measurement of White and Negroes college women. The Negroes’ data were obtained from education classes at college level and selected at random. White girls’ data were obtained from a published paper on one hundred Smith College students. This study was of particular interest since, it was compared two racially different gauges, which were alike in vocation, age, height, weight and chest measurement. In all other body proportion there is some significant difference between two races. In many of the proportion the Negroes were larger than Whites; in fact the reverse was true, the most obvious of these differences as found in this study are as follows:

(a) All linear measurement of appendages are happed to be larger in the Negroes than in Whites.

(b) The span in Negroes happened to be nearly 105 percent of the stature and in the Whites it is only 99.4 percent.
The Negroes a lower forearm in relation to the upper arm than whites.

The trunk length in White happened to be greater than Negroes, on other hand the Negroes trunk happened to be more V-shaped then the white, because of larger bi-acromial and small inter-crystal breadths.

**Digiovanna (1943)** substantially the common claim by many coaches is that body structure is associated with athletics success. The study of further indicated of associated of muscular strength, explosive power and athletic success. The difference between a male athletic group and a normal group in vertical jump had critical ratios of 7:12 for basketball players and 8:15 for gymnasts.

**Cureton (1951)** examined, twenty two track and field champion athletes of the United States and reported typical that the track men were light in skeletal frame work are relatively longer upper leg ratio and along leg trunk relationship. Be also noted that most good sprinters have narrow hips, and that the more ponderous men with longer and larger trunks, but with relatively short limbs, are mostly to succeed in weight lifting, wrestling, gymnastics and diving. The shot-put throwers were greater in arm span/height and greater in upper arm/fore-arm length. Curetor stated, ‘The success of athletic champions is not fully explained by inherent anthropological body type measurement because among men or approximately the same physical type, there are great differences in performance. Developing the proper skill takes many years of patient training of the muscular system.
Morris (1960) one hundred and fifty women athletes were compared with one hundred sixty four college women on specific and overall body strength, anthropometric measurements and the somatotype. The somatotype ratings were made by Sheldon and his associates at Columbia University. The comparisons within the athletic group were since according to sports in which the subjects specialized. The analysis of variance and ratios were used to determine significant differences. The women athletes scored higher on all measures of strength than the unselected sample. The athletic group was more mesomorphic and less endomorphic. The total strength was not as important in athletic performance as the ratio between strength and weight. The significant differences in anatomical proportion which existed among the performance in particular sports including limbs length, hip width and ratio of the shoulders to the hip.

Tanner (1964) also studied track and field athletic at the Rome Olympics. His analysis was presented in terms of body, size, height, growth, pattern and amount of tissue in limbs. There were outstanding differences among the means of different events.

Johnson (1968) investigated two hundred eight collegiate wrestlers. The subjects were classified as successful and unsuccessful according to their win of loss percentages. A second classification was by weight, light, middle and heavy category. All subjects were measured for height, weight or the length, and leg length. The unsuccessful wrestlers had longer legs than average and successful wrestlers. The analysis of multiple regression equation showed that no combination of the independent values was successful in predicating success.
Brozak (1972) maintained that the ratio of height and weight may serve as a first, very rough estimate of the amount of soft tissue in relation to size of skeleton. However, he pointed out that this and other weight and height indices suffer from the basic limitation of all procedure which consider only height as the reference point. Thus neglecting the vertical proportion of the body the lateral dimensions and size of the skeletal musculature.

Brangdon (1973) conducted a comparative study of physical fitness and anthropometric measure of Mexican and Anglo American males. Thirteen anthropometric measurements were taken and AAPHER Youth Fitness Test Battery was used. The results indicated that the Anglo-American males are larger in gross body size and they are more physically fit than Mexican males.

Muthiah and Venkateshwarlu (1973) studied the Indian track and field athletes and noticed the throwers to be heavier, taller and older than other athletes. Among runner’s the age increased and the height and weight decrease with the increase in the distance they run, the jumpers and the hurdlers were taller and heavier than sprinters but were starter and lighter than throwers. The decathletes were the second heaviest as they were all rounders.

Hirata (1979) collected data on age, height, weight and panderal index of 711 female of Montreal Olympic players of basketball (N=81), volleyball (N=104), handball (N=81) and athletics (N=445). All the players were in the age group of twenty two to thirty five years. He reported that the average basketball players and high jumpers were the tallest (182.4
among all the other categories of the players of the gold medalist team.

**Ward et. al. (1979)** conducted a study on Masters and first class weight lifters and reported that human motor performance is a composite of many variables, one of which encompassas the size and shape of the performer ‘s body. The specific measurement of limb lengths, circumferences and breadth suggest a relationship between the anthropometric of the athletic group and the motor performance.

**Sodhi (1980)** studied the top ranking Indian National basketballers and found that with the increasing standard of the participants the average height was greater. The top class teams in the world had a greater average height than teams of lower standard, A significant correlation was seen between height and performance in competitions. The value of correlation was very high with the field basketballer, the better his performance.

**Sidhu and Grewal (1982)** studied the physique and body composition of seventy eight Indian Basketball player, playing at different level of competition. The state level player, who were at the highest level of competition, were taller, heavier with bigger trunks, longer upper extremities and broader as compared to the players of lower levels though the difference was not statistically significant.

**Carter (1982)** compared the body size among athletes of Montreal and Mexico Olympic and the Canadian students in terms of percentiles. Male and female Athletes of Montreal were larger than those of the Mexico Olympic in length, breadth and girth but were smaller in shoulder breadth.
The male Athletes were older than the students but the narrower hips, whereas the female’s athletes were lighter than the students.

**Khamdram (1984)** investigated the relationship of related physical variables with the performance in shot put. The strength, speed, agility, and flexibility variables were studied. The anthropometric variables were included height, weight, arm length, leg length, four leg length, thigh girth, ponderal index and crural index. It was found that there exists a significant correlation between arm strength and shot put performance ($r=0.45$), leg strength and shot put performance ($r=0.42$), flexibility and shot put performance ($r=0.47$), and speed and shot put performance ($r=0.42$). He concluded that there exists a significant correlation of arm strength, leg strength, speed

**Sodhi and Sindhu (1984)** They possessed a longer lower extremity in relation to the length of the trunk. The hurdlers, in both the events had better developed bicondylar diameters. Thought the degree of this developed bicondylar diameters. Thought the degree of this development was greater in the lower extremity than that in the case of all other track athletes. Among the hurdlers, the 110m, men were found to dominate the 400m. Man in the length of trunk and the breath of shoulders, but were more slender in the chest, narrower in the hip width and lighters in weight than the later 400m. Hurdlers had a greater amount of lean body mass like sprinters. The 110m. hurdlers, on the other hand, were less muscular than the sprinters. They also had relatively a small chest and light weight as compared with all track event athletes.
Chauhan (1986) studied the relationship between selected anthropometric variables and endurance running performance. He concluded that height, leg length, thigh and calf skin fold and lean body mass had significant and negative correlation with 1500 meter endurance running performance, whereas 10,000 meters running performance had statistically insignificant correlations with linear segments, girths and diameter measurement, except with skin fold measurements (triceps, supra iliac. Midaxillary, thigh and calf skin folds) and body composition variables (i.e. body density, fat percentage, far weight and lean body mass).

Luthra and Shaw (1990) lead an investigation on thirty female runners nine jumpers and ten throwers, who had participated in Delhi Inter college Athletic Meet, were considered as subjects. Twenty anthropometric measurements were taken such as height, weight, femur width, bi-acromial width, upper arm girth, hip girth, foot length, hand length, upper arm length, total arm length, total arm length, fore arm length. ANOVA one way test was computed to compare the three groups on the selected anthropometric variables. Results shows that runners, jumpers and throwers are significantly different in height, weight foot length, bi-acromial width at 0.01 level of significance whereas arm length ,upper arm length, leg length bi-cristal ratio was not found to be statistically significant.

Kaur (1990) discovered the characteristics of the physique and body composition of Indian National Female Cyclists. This study had conducted on eighteen female cyclists ranging in age from sixty to twenty years and the forty six anthropometric measurement studied were, height, weight, upper arm, calf circumference, thigh circumference, bi-acrominal
diameter, humerus, bi-condylar diameter, wrist diameter and skinfold of biceps, triceps, sub-scapular, supra-illiac and calf. The statistically mean, standard error of means and ‘t’ value had employed on cyclist and control group. The results had the cyclists were observed to possess slightly narrow shoulders. The skeletal width of upper arm were slightly less than cyclists as compared to controls group.

**Ghuman (1990)** the study conducted on 140 gymnastic championship, All India Inter-university Championship, National School Games of India. The study had conducted on following variables of motor fitness, speed, agility, strength, endurance, power, flexibility, dynamic balance, speed of movement. For the anthropometric measurement the variables were taken as age, weight, height, sitting height, leg length, arm length, shoulder width, chest width, hip width, circumferences of arm, chest, hip, thigh, calf. This study found the relationship of motor fitness and anthropometric variable to gymnastic performance, partial co-relation, results shows that significance relationship between selected motor fitness and gymnastic performance at various levels. There had been significant difference in anthropometric measurements of gymnasts at different levels. The analysis of data further proved that there were significant difference in the senior National and National School games gymnasts on the anthropometric measurement of weight, height, sitting height, shoulder width, chest width, circumferences of arm, chest, hip, thigh, calf except arm length and leg length.

Inter university gymnasts on all the anthropometric measurement except arm length but no difference observed between the senior level and all India Inter- university level gymnasts.
Sodhi (1990) study shows that kianthropometric characteristics of the Northern Indian Junior volleyball players ranging in age between sixteen to eighteen years. The results are based on the cross-sectional data on ninety volleyball players and ninety four control subjects examined during February-March 1987. The data were collected on male of volleyball players (N=90) and the control (N=94) and eighteen anthropometric measurements were taken of each subjects, age, weight, height, hand span, upper arm circumference, thigh circumference, chest circumference, skinfold of biceps, triceps, calf, sub-scapular, supra-illlic etc. The results of the study proved that the volleyball players in each group are significantly taller and heavier than the control group. Amongst volleyball players the difference in height were found to be statistically non-significant between the three age groups (16-18 years).

Sullivan (1994) Anthropometric characteristic of skilled adolescent pole vaulters were examined by Sullivan. The heights of the subjects ranged from 1.98 to 4.72 m.(mean 3.58 = S.D. 0.536m). The vaulters have somatotype of 1.6-4.2-3.5. One way analysis of variance showed that while stature, physical performance and vault performance significantly increased across age groups, somatotype and sum of skinfolds remained stable. It was concluded that the somatotype of skilled young pole valuters of the study is similar to that to Junior Olympic s and adult Olympics valuters and that this somatotype is a selective factor for this event as early as thirteen years of age. The valuters in the study tended to be leaner and stronger than the average adolescent of corresponding age.

Vaz (1994) Investigated some of the selected anthropometric characteristics and physical fitness components as predictors of
performance in judo. He found in his study that anthropometric variables namely height, weight, calf-girth, arm girth and Pondera index were related to judo performance in various weight categories, but leg length, thigh girth and crural ratio were not seen significantly related to judo performance. Combined contribution of anthropometric and physical fitness variables to judo performance in various weight categories were showing significant relations. Multiple regression analysis indicated that predictions regarding judo performance, on the basis of anthropometric and physical fitness variables, can be made with reasonable degree of accuracy.

Kumar (1995) conducted a study to establish the relationship between selected anthropometric variables and performance in athletics programme of high and senior secondary school students. Three hundred eighteen male athletes of Haryana State studying in High and Senior Secondary classes, during academic sessions 1993-94 and 1994-1995 were chosen as subjects for this study. The age of the subjects ranged from 16.5 to 19.5 years. Anthropometric variables (independent variables), which seemed to be related to performance in athletics, were selected age, body weight, height, leg length, thigh length, fore-leg length, trunk length, total arm length, upper arm length, fore arm length, foot length, foot width, sitting height, shoulder circumference, chest circumference, adbminal circumference, hip circumference, upper arm circumference, thigh circumference, calf circumference, femure diameter, ankle diameter, humeres diameter, wrist diameter, triceps skinfold, biceps skinfold, subscapular skinfold, calf skinfold, thigh skinfold, body density, percent fat, fat weight and lean body mass. Performance in Athletic events (Dependent variables). Mean, Standard deviation, Pearson’s Product
Moment coefficient of correlation, Multiple correlations and multiple regression equations were computed, using Wherry Doolittle method. Anthropometric variables and performance in athletic events has been partially accepted and partially rejected as some of the selected anthropometric variables are significantly related to performance in athletic events and some of them are not found to be significantly related.

Sodhi (1996) Study has been conducted on five hundred eighty-three subjects who included three hundred eighty-seven volley balers and one hundred ninety-six won sports persons. The measurements of stature, sitting height and hand span of each subject were taken by using standard technique. It was concluded that the stature, hand span and trunk length increase gradually, advancing age wise as well as level wise with increase in age in volley balers that hand size gradually advance not only in size as depicted by hand span.

Sinha (1997) studied that basketball players had significantly higher value in height (187.03) and weight (81.02) as compared to handball players. No significance difference was observed for somatotype writing and fat percentage between basketball players and handball players through the mean age of both handball and basketball players was the same. It was carried out on twenty three basketball players (male) who were attending the coaching camp prior to their participation in Asian Championship, Year 1993 at Sports Authority of India, Eastern Center Calcutta, Height, Weight and skinfold were taken according to standard procedure.

Dhillon (1998) Examined the influence of training break in selected motor abilities and skills of 15 hockey players, age ranged between 13-18
year. Eight physical fitness and skill tests. All the tests were conducted before a training break of three weeks. These tests were conducted again at the end of the first and second week after the beginning of the training. It was found that the training break of three weeks leads to a significant deterioration. The deterioration of technical skills was much higher in push, hit and shooting. Deterioration was observed much less in dribble and role skills. In the tests of physical fitness significant deterioration was found in flexibility and speed, leg length ability did not show any type of deterioration due to the break. It was concluded that after three weeks of training break, two weeks of training was enough to achieve the previous level of performance except flexibility. They further added that the rate of recovery was higher in the first week as compared to the second.

**Debnath and Bawa (2000)** Studied the physique, become position & somatotype of Indian elite female 100m. swimmers and concluded that elite swimmers posses low fat percentage lesser skin fold thickness and greater strength, height and greater biacromial diameters.

**Rienzi (2000)** Investigated anthropometrics and work rate profiles of elite south American international soccer players anthropometric profile were obtained on 11 of the South American players. The anthropometric variables included segmental lengths, limb girth, body composition, muscle mass and somatotype. No significant correlation was observed for any of the relationships between the anthropometric variables and work rate profiles.

**Mokha (2000)** in the present study an attempt has been made to study the physique and physical performance of 30 national female
basketball players and 30 controls. The following tests were, conducted on the players and the controls.

(a) Anthropometric measurements
(b) Somatotyping

The results of the study showed that the basketballers are significantly taller and heavier with broader shoulder wider elbows and knees with well developed extremities as well as in the trunk. They have less amount of subcutaneous fat in the upper and lower extremities as well as in the trunk. The basketballers are more endomorphic and more ectomorphic than the controls.

Neetu (2000) conducted a study to establish the relationship between selected Anthropometric measurements and performance of women cricket players. The Anthropometric variables were weight, height, sitting height, upper by length, lower by length, arm length, upper arm length and power. 35 women cricket players were selected from Delhi University. The age ranged between 17 to 25 years. Mean, standard deviation and Pearson’s product moment correlation were employed. The level of significance was .01 and .05 at 33 degree of freedom. The results indicated that there exist significant correlation between cricket performance and selected anthropometric measurements.

Kaur (2001) investigated the predicting excellence in junior elite Indian Basketball players. In the contribution of anthropometric attributes found that our players were still smaller in height and lighter in their body mass and requires somatotype development to the best of successful basketball players.
Singal (2002) studied anthropometrically 697 athletes and 699 controls to assess their body fat and lean body mass. All the body components increase from 10 to 18 years in both boys and girls of sports group and controls. The body fat is lesser in athlete’s boys and girls. The lean body mass is large in athlete boys only after 14 years of age. While studying sex differences it has been noticed that athletes as well as control girls have significantly fatter and had lesser lean body mass as compared to male athletes and male controls. The magnitude of increase in fat as well as lean body mass is more in boys as compared to girls.

Kaur (2002) reviewed somatotype of Indian and Olympic male athlete. They reviewed track and field players, boxers wrestlers, weightlifters, cyclists, gymnasts, basketballers, footballers, swimmers and hockey players, it was found that almost all of the Indian players belonging to different events studied were found out of desired circle.

Chauhan (2003) conducted a study on relationship of anthropometric variables and middle running performance and concluded that age, linear measurement i.e. height, leg length, thigh length, total arm length, shoulder, chest, abdomen, hip, thigh, knee girth, ankle diameter and calf skin fold have positive and significant co-relation with middle distance running performance. Lean body mass also has positive and significant co-relation. The multiple co-relation of combination of anthropometric variables i.e. height, thigh girth, bi cranial, thigh skin folds with middle distance running performance is significant at 1% level, but multiple co-relation is not of sufficient size, so the regression equation cannot be put into prediction of the running performance.
The purpose of the study was to develop the regression equation for the prediction performance of University Throwers in relation to their anthropometrics measurements. To achieve the objectives of the study, thirty throwers were selected as subjects from the University athletic meet of Kurukshetra University, Kurukshetra. Thirty two body measurements were taken with the help of anthropometer, steel tape, Vernier caliper and skin fold caliper according to the instruction of Weiner and Lourie (1969). The throwing performance of the subjects was measured in terms of performance in putting the shot. Product moment method for inter correlation and wnerry do little method for calculating multiple correlation and development of regression equation for the prediction of performance were applied. The linear measurements i.e. height, leg length, fore leg length, total arm length, upper and fore arm length, circumference i.e. shoulders, chest abdomen, hip and arm, body diameters i.e. biacromial, bicristal and elbow diameters, and skin fold measurements i.e. biceps, sub-scapular, supra-iliac and calf skin fold have been found to possess positive and significant correlation with throwing performance at 1% and 55 levels respectively. Among body composition variables i.e., fat percentage, fat weight and lean body mass have positive and significant correlations, but body density has negative and significant correlation with throwing performance at 5% level. The multiple correlation of body weight, height and total arm length with throwing performance is positive and highly significant (R=.935). The size of the multiple correlation is quite sufficient and the regression equation developed can be used for the prediction of throwing performance of the athletes.
Chauhan and Chauhan (2005) The purpose of the study was to explore the possible ingredients of anthropometric variables which are essential for the execution of explosive arm strength for volleyball players. Since the game of volleyball involves explosive strength for the execution of importance skills, i.e., smashing, blocking, serving and receiving and receiving the ball, in the playing situations, hence arm strength is essential ingredient which determines the efficiency of players. To achieve the objectives of this study, various body measurement on forty volleyball players selected as subjects were taken. Product moment method for correlations, and developing Regression Equation, were used. Linear measurements, i.e., height, sitting height, Trunk length, leg length, lower leg length, total arm length, upper and forearm length, foot length, body girths, i.e., shoulder, Chest, Abdomen, hip. Thigh, body diameter, i.e., Biacromial, Bitrochantric, femur Bicodylar and skinfolds, i.e. Biceps, Triceps, Subscapular, suorailliar mid auxiliary, sum of four skin folds and body composition variables, i.e., fat percentage, fat weight and lean body mass have positive and significant correlations which explosive arm strength of volleyball players. Multiple correlation of height, biacromial and elbow diameter, lean body mass taken together with explosive arm strength has been found significant 1% level. The size of the multiple correlation is sufficiently large hence regression equation developed is useful for the prediction of the explosive arm strength of volleyball players.

Monsma and Malina (2005) conducted a study on anthropometric and somato type of competitive female figure skates (11-22 years) by level of competition and discipline. The results suggest that figure skating favors lightness, high anesomorphy and lower endomorphy at elite level.
Bayios and Bergeles (2006) conducted a study on anthropometric, body composition and somatotype differences of Greek elite female basketball, volleyball and handball players. Their mean scores were compared and it was found that elite female players varied among sports.

Bayios (2006) conducted a study to (1) determine the anthropometric profile body composition and somatotype of elite Greek female Basketball (H) players. (2) to compare the mean scores among sports and (3) to detect possible differences in relation to competition level. A total of 518 female athletes, all members of the Greek first National League (A1 and A2 division) in B,V and H sport teams participated in the present study. Twelve anthropometric measure required for the calculation of body composition indexes and somatotype components were obtained according to the establishment literature. They concluded that five athletes who were the tallest (P<0.001) among the three groups of athletes had the define the anthropometric profile of B,V and H female athletes internationally.

Gabbett and Georgieff (2007) also investigated the Physiological and anthropometric characteristics of junior volleyball players competing at the elite, semi-elite, and novice levels and to establish performance standards for these athletes. One hundred and fifty three junior national (N=27 males; N = 34 females) volleyball players participated in this study. Subjects underwent measurements of standard anthropometry (body mass, height, standing reach height, and sum of 7 skin folds), lower body muscular power (vertical jump and spike jump), upper-body muscular power (overhead medicine ball throw), speed (5-m and 10-m sprint, agility (7-test), and estimated maximal aerobic power (multistage fitness test) during the competitive phase of the season after obtaining a degree of
match fitness. Significant differences of match fitness. Significant differences (P < 0.05) were detected among junior national, state and novice volleyball players for height, standing reach height, skin fold thickness, lower body muscular power, agility and estimated maximal aerobic power, with the physiological and anthropometric characteristics of players typically improving with increases in playing level. Male players were taller, heavier, leaner and had greater standing reach height, speed, agility, muscular power and estimated maximal aerobic power than female players. These findings provide normative data and performance standards for junior volleyball players competing at the elite, semi-elite and novice levels. Given the improvements in lower body muscular power, agility and estimated maximal aerobic power with increased playing level and given the importance of these qualities to competitive performance, conditioning coaches should train these qualities to improve the playing performance of junior volleyball players.

Sheppard (2008) conducted on investigation to examine the potential strength, power, and anthropometric contributors to vertical jump performance that are considered specific to volleyball success: the spike jump (SPJ) and counter-movement vertical jump (CMVJ). To assess the relationship among strength, power and anthropometric variables with CMVJ and SPJ a correlation and regression analysis was performed in addition comparison of strength, power and anthropometric differences among the seven best subjects on the performed. When expressed as body mass relative measures, moderate correlations (0.53-0.65; P) were observed between the IRM measures and both relative CMVJ and relative SPJ very strong correlations were observed between relative (absolute height-
standing reach height) depth jump performance and relative SPJ (0.85) and relative CMVJ (0.93; P). The single best regression model component for relative CMVJ was the relative depth jump performance, explaining 84% of performance. The single best predictors for relative depth jump performance (72% of performance) with the three components models of relative depth jump, relative CMVJ, spike jump contribution (percent difference between SPJ and CMVJ), and relative CMVJ,spike jump contribution and peak force, accounting for 96% and 70%, respectively. The results of this study clearly demonstrate that in an elite population of volleyball players, stretch shortening cycle performance and the ability to tolerate high stretch loads, as in the depth jump, is critical to performance in the jumps associated with volleyball performance.

Nikos, Karolina and Elissavet (2009) examined and compared of performance in attack in relationship with performance in set between Olympic level volleyball male (M) and female (F) players. A 3 members group of expert coaches assessed the players actions in set and attack in 16 volleyball games (M=8, F=8) of teams competing in the final phase of the 2004 Olympic Games Assessment was based on a 5-point rating (Eom and Schutz, lowest values of body fat (P<0.001) and their somatotype was characterized as balanced emdomorph (3.4-2.7-2.9). B athlete were taller (P<0.01) and leaner (P<0.001) than H players with a somatotype characterized as mesomorph- endomorph (3.7-3.2 -2.4). H athletes were the shortest of all (P<0.001), had the highest percentage of body fat (P<0.001) and their somatotype was mesomorph- endomorph (4.2-4.7-1.8). In comparison with their A2 counterpart the A1 division heavier (P<0.01), but at the same time learner (P<0.001), and exhibited higher homogeneity in
somatotype characteristics (P<0.005). Anthropometric, body composition and somatotype variables of Greek female elite team ball players varied among sports; selection criteria, hours of training and sport-specific physiological demands during the game could explain the observed differences. They suggested that more data were needed to 1992 and included actions that composed a set of 2 contacts in complex 1 (M= 1007, F= 1248). A cross tabulation statistical procedure with level 4x5 calculated performance percentage and frequencies; $X^2$ criterion was used to examine possible differences in the distribution of performance assessment in attack for every performance assessment in set and $Z$ criterion was used to compare percentages of performance assessment between genders. Result showed that the higher the performance of settsels the higher the performance of attackers in both gender. Significantly (P, 0.005) lower percentage of male compared to female attacker's average and very good performance was found after receiving good and excellent quality sets, whereas significantly (P< 0.05) higher percentages of good performance were shown in favour of male attackers after receiving excellent quality sets.

Bandyopadhyya (2009) undertook a project to complete anthropometric and body composition variable of volley ball and soccer players. For this, he selected 50 sedentary males and 128 sports persons (valley ball-82, soccer-46) between 20-24 years from West Bengal, India. He concluded skin folds, girth measurements body fat percentage (% fat) and endomorphy were significantly higher among sedentary individuals, but lean body mass (LBM) and mesomorphy were significantly (P<0.001) higher among the sports persons. Soccer and volley ball 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. % fat exhibited a significant correlation with body mass index (BMI) and thus prediction equations for % fat from BMI were computed in each group.

**Singh (2010)** conducted a study on fifty male and fifty female players who participated at the intercool agitate tournament of the Punjab University, Chandigarh. The anthropometric variable were age, weight, height, sitting height, shoulders width, arm length, Upper arm circumference, elbow width, forearm circumference, hip width, leg length, knee width circumference. The physical variables where speed, power, flexibility, agility, reaction time, endurance, muscular strength and the physiological variables were peak expiratory flow rate, resting pulse Rate, Blood Pressure, Vital Capacity. The results show that a few variables showed significant correlation to volleyball playing ability but the regression yielded only one or two mainly height in case of men and arm length in case of women. The prediction equation revealed that height alone or height combined with endurance was a good predictor of volleyball playing ability in case of men. In case women arm length alone or combined with measure of endurance or lung
capacity and grip strength proved to be better predictors of volleyball playing ability.

**Koley, Khajuria and Melton (2010)** The purpose of this cross-sectional study was of two-fold: firstly, to evaluate the back strength of Indian inter-university male cricketers and secondly, to study its relation to leg strength, along with selected anthropometric characteristics. Thirteen anthropometric characteristics were from 98 Indian inter-university male cricketers aged 16–25 (mean age 21.03, ± 1.72), all students at nine Indian universities, and the competition was held in Guru Nanak Dev University, Amritsar, Punjab, India. An adequate number of control participants (n = 99, mean age 21.50, ± 1.13) were also collected from students at the host university for comparison. The findings of the present study indicated statistically significant differences (p ≤ 0.05) in weight, BMI, thigh length, total leg length, biceps, triceps, subscapular and calf skinfolds, percentage of body fat and back strength between the cricketers and control participants. The striking findings of the present study were that back strength showed significant positive correlations only with leg strength but not with any of the other studied anthropometric characteristics.

**Koley and Kanupriya (2010)** The purpose of this study was of two-folds, firstly, to evaluate the anthropometric profile of Indian inter-university female cricketers and, secondly, to search the correlations of these anthropometric characteristics among themselves. To serve this purpose, fifteen anthropometric characteristics, were measured on purposively selected 56 Indian inter-university female cricketers aged 18–22 years (mean age 19.23 years, ±1.87) collected from six Indian universities and the competition was held in Guru Nanak Dev University, Amritsar, Punjab, India. An adequate number of controls (n = 101, 19.31 years, ± 1.12) were also collected from the same place for comparisons. The
findings of the present study indicated significant differences (p≤ .05 - .000) between Indian inter-university female cricketers and controls in subscapular skinfold, suprailiac skinfold, calf skinfold and thigh circumference. Weight has significantly positive correlations (p≤ .01) with all the variables studied (except height and biceps skinfold), For all the five skinfold measurements, significant positive correlations (p≤ .05 - .01) were found with all the variable studied except height and humerus bi-epicondylar diameter. Similarly, for all the six circumferential measurements, significantly positive correlations (p≤ .05 - .01) were noted with all the variables studied except height. Skinfold measurements have strong correlations with the circumferential measurements in the Indian inter-university female cricketers, affecting the body weight greatly.

**Shyamal (2011)** The purpose of this study was threefold: first, to evaluate the arm anthropometric profile of Indian inter-university basketball players; secondly to search for the correlations among these arm anthropometric characteristics; and thirdly, to search for the association of handgirth with arm anthropometric characteristics in Indian inter-university basketball players. Three anthropometric characteristics, nine arm anthropometric characteristics, and grip strength of both right and left hand were measured on randomly selected 60 Indian inter-university basketball players (35 male and 25 female, aged 18-25 years) of six university, who participated in the inter-university championship organized at Guru Nanak University, Amritsar, Punjab, India. An adequate number of control subjects were also taken from the same place for comparisons. The results indicated statistically significant difference between the male basketball players and the control in Height, right handgrip strength, upper arm, Forearm and total arm length, whereas no significant difference was found between the female basketball players and the controls. Highly
significant sex differences were found in the basketball players in almost all the variables studied (except BMI and arm fat area). Significant positive correlations were noted among the arm anthropometric characteristics studied (except arm fat area and arm fat index) and with right and left handgrip strength.

**Mark (2011)** This study investigated the anthropometric and performance characteristics of 43 soccer players, who represented a UK-based championship club in teams classified according to chronological age (i.e., under 14, under 16 or under 18 years of age). Anthropometric and physical performance (countermovement jump: CMJ, 15m and 30m sprint, multistage fitness test) were measured. The under 18 age group were taller, heavier, jumped higher, sprinted faster and possessed a greater maximal aerobic capacity than the under 14 players. However, players from the two youngest age group were similar in all measurement. Additionally, high or low CMJ performance were able to differentiate between sprint times over 15m and 30m. These results characterise the anthropometric and performance of UK-based soccer players of varying ages while high lighting the discriminative ability of certain tests to differentiate between sprint performance.

**Chahal, Ghildyal and Chahal (2012)** Talent indentification, selection, training and improvement (TISTI) programs were scanty in team sports especially in consideration of Indian female basketball. This study tasted the hypothesis that predicting excellence in junior Indian female basketball players in relation to anthropometric, physiological variables and then helpful to determine the squads of other level. The regression and factorial analysis to predict the excellence were applied. The study
measured anthropometric measures (height, weight, arm length, palm length, leg length and girths of the upper arm, wrist, thigh and calf) and physiological variables (anaerobic power, peak flow rate, vital capacity and four skin folds for body fat percentage) of ninety six female players competing at junior national basketball championship. To collect the data of selected variables were taken on each subject individually during rest hours with the help of standard scientific instruments and techniques. Significant relationship were found between performance in relation to palm length, leg length, upper arm circumference, anaerobic power, peak flow rate, vital capacity and body fat percentage. The performance in junior female basketball players could be attributed to selected anthropometric and physiological variables followed by prediction equation. Factor analysis of data showed four prominent factor. Application of the finding may prove more beneficial and effective TISTI program to optimize playing ability at appropriate chronological and competitive age.

**STUDIES ON PHYSICAL FITNESS**

**Mehta (1980)** compared the fitness of 75 girls from tribal and equal number from non-tribal students of age group 12 to 17 years. AAHPER Youth Fitness Test revealed significant differences in the physical fitness levels. The performance of tribal girls was significantly greater in flexed are hang, sit-ups and shuttle run. But in the overall physical fitness level the non-tribal girls were significantly better than the tribal girls.

**Shirda (1981)** compared the physical fitness level of Iraqi children with AAPHER Youth Fitness Test norms. Data was called by administering the Youth Physical Fitness Test to 545 children between 10-17 years of age
in Basrah. The findings revealed that the performance of Iraqi children in Bajrah in an absolute sense exceeded the American norms by 15 items. At an early age (10-12) performance of both boys and girls of both the countries were similar.

**Johnson and Nelson (1982)** developed three Physical Fitness Test Batteries for different categories. First is the Elementary School Physical Fitness Test, second is the Junior High School Physical Fitness, and third is the High School and College Students Physical Fitness Test. These batteries covered five components of physical fitness test. The Elementary School Physical Fitness Test items are: - Overhead pull test, modified push-ups modified sit and reach and 600 yard run/walk. The Junior High School Physical Fitness Test items are: - Spring Scale Press Test for boys and girls, chin up for boys and flexed arm hang free girls, modified sit and reach and 600 yard run/walk. The high school and college student physical fitness test items are: - two-hand push ups modified sit and reach chin-ups for men and flexed arm test for women and, 2 minute run walk test.

**Singh (1986)** undertook a study on four thousand college students of Panjab University, Chandigarh. Fleishman’s Test Battery was used on 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.

**Ignico (1990)** Evaluated Physical Fitness level of children enrolled in daily (five classes per week) and weekly (one class per week) physical education programme. The APPHER test was administrated to 218 elementary school children from two school of similar size.
An inspection of mean indicates that daily physical education school participation were superior on all four test items.

Anija (1990) purpose of the study was to study 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 revealed that urban girls were slightly higher in height. Further the results shows that rural girls were better in 100 meters, 200 meters run, vertical jump, but urban were better than rural in shot put.

Moore (1992) have suggested that Tibetan are better adapted to live at high altitude compared with Andeans because of enhanced oxygen transport leading tom exceptional exercise performance at altitude.

Singh (1993) conducted a study of Physical fitness status of students of department of Physical Education Panjab University. He collected data of males and females by using AAPHER Physical Fitness Test. The subjects of Kurushetra University were found superior on all physical fitness status, where as girls of Panjab University were significantly better than Kurushetra University were found superior on all physical fitness status, where as girls of Panjab University were significantly better than Kurushetra University.

Sangral (1994) administered a study on motor fitness components as predictor of talent in hockey. Thirty nine \((N=39)\) male students were selected as the sample of study. Ten ball shooting rolling for 25 meter and dribble and roll for 20 seconds tests were used to evaluate the hockey performance. Motor fitness test i.e. coordination ability, standing broad
jump, 30 meter fly sort vertical jump, 10 x 6 meter shuttle run, sitting ball throw, 800 meter run and 20 meter backward run were used. The analysis of data showed that 10 ball shooting had significant relationship with co-ordination ability and backward run for 20 meter. Similarly rolling of 20 meter had significant relationship with standing broad jump, 30 meter fly start, vertical jump, 10 x 6 meter shuttle run, sitting ball throw, 800 meter run and backward run for 20 meter dribble and roll for 20 seconds (distance). The regression equation for prediction showed different contribution of motor abilities to hockey performance.

**Sharma (1997)** conducted a study to construct and standardize motor fitness for elementary school children of Delhi. His sample included fine hundred boys and girls. The study was conducted in two phases in the first phase he developed motor fitness battery by using factor analysis technique. The battery consisted of five motor fitness test namely soft ball throw, toe touching, double foot balance 50 meters dash, 300 meter run/walk for girls and boys. In the second phase he developed percentile scale on all the five components of motor fitness for future use.

**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 subjects selected from high altitude. Fleishmen fitness test battery was used for the purpose, She concluded that the tribal boys and girls were superior in explosive strength and agility than the non-tribal boys and girls.

**Maia el. al. (2001)** to investigate the tracking in physical fitness vivid as a whole a multidimensional trait of the subject and to establish the
stability of each factor of physical fitness in adolescence of 454 number of boys age 12 to 18 years physical fitness was evaluated by means of a battery composite of the following test plate tapping sit and reach, vertical jump are pull leg lift, bent arm hang and shuttle run. Rescued shows stability estimated of physical fitness as a whole.

Brar (2004) conducted a study on motor development of school children of Union Territory of Chandigarh. A cross sectional analysis 12 to 14 years. Measurement tools used for the said purpose were speed, agility, endurance, strength power, flexibility and movement time on the students of Shivalik Public School (N=300) of Chandigarh. The results indicates that:-

1. No difference in performance was observed between 12 years boys and girls. However the 13-14 years boys had better performance than girls in corresponding age.

2. Boys and girls didn’t have any difference in abdominal strength at each corresponding age from 12 to 14 years.

3. No development was visible among boys and girls in flexibility 12 to 14 year’s group.

4. No development in leg strength was evident among boys in standing broad jump in each year, but girls developed the same.

5. No development was seen in grip strength in boys, but girls have more development is 14 years than 13 years.

6. Development of shoulder strength in boys and girls was evident.

7. No development was seen in speed among girls and boys.
**Kumar (2006)** conducted a survey type normative study which was designed to assess the physical fitness of Himachal Pradesh College students and subsequently develop norms to be used in the future to assess the physical fitness status of the Himachal Pradesh male college students. He collected a sample of 2715 subjects from various colleges affiliated to Himachal Pradesh University, Shimla for the above said purpose. A special case was taken so that the data should be evenly distributed covering three altitudes i.e. high, medium and low, in all the districts of H.P. For the collection of data, a revised AAPHER Youth Fitness test battery was used in addition to height, weight of the subjects the AAPHER Fitness battery comprised of pull ups, sit ups, 50 mtrs sprint, standing broad jump, shuttle run and 600 mtrs run/walk was administrated. From the results of the study he concluded that the boys living at high altitude were significantly taller than the boys living at low and medium altitude. Therefore, in the games like basketball, volleyball where height is a matter of concern for better performance, the boys of high altitude may be selected for there sports.

**Ahmet (2007)** contends, that even though different sports have unique physical requirements to be successful in given sports, yet the most important component in all sports is body fat, because many performance factors have high relation with body fat; Like agility, strength, speed, flexibility, explosive strength, jumping ability. Generally, low body fat is desirable for high physical performance. He thus, undertook a project to study body composition of Turkish Volley Ball players, selecting 60 male and 60 female Volley Ball players. Forty three of them were playing in national teams in different categories. Body composition was
assesed using bioelectrical impedance method. Because this method is more rapid and cheaper than others. Tantia BMC-148 Body Results showed that there was a significant difference between Turkish male and female volley ball players (P<0.05). And there was a significant difference between the categories. In addition the Turkish Volley Ball players had similar body compositions compared to data of volley ball players from other countries.

**Superlak (2008)** Proper multi-level selection of talented youth is one of the fundamental aspects of qualified sport. The common auto telic approach to selection in sport, based on the measurement of individual traits and abilities and excluding any programmatic aspects of different sports seems highly insufficient today. Each specific sport features has its own factors affecting athletes development and constituting important selection criteria. Thus, a heterotelic approach accounting for the specificity of different sports allows on to genetic profiling of young talented athletes in view of their dispositions to act under varying circumstances. Thus he presented and verified a theoretical modal of holistic perception of playing dispositions by way of inter dispositions and identification of candidates for the polish national team, who after a two years training won the European Championship in cadet Volley Ball. According to him the data obtained showed that each player featured a specific structure of traits and abilities understood as volley ball playing dispositions can be under different extent-combined into more complex structures called inter dispositions. The exemplification of the theoretical modal showed that playing dispositions could and should be studied in an interdisciplinary, manner. The holistic approach to the player's individual traits makes his
or her profiling more comprehensive which affects the development of skills and performance assessment methods.

Disch and James (2009) examined the relationship between a battery of motor performance tests and a set of Volley Ball Skill Test designed to discriminate among levels of volley ball players were tested on skill, serve pass, spike and volley, motor performance; vertical jump, triple hop, agility run, twenty yard dash, and basketball throw. They concluded that the motor performance test battery was concurrently valid with the selected skill tests.

Masques (2009) indicates that significant anthropometric and strength differences exist among playing positions in elite male volleyball players. In addition these findings provide normative data for elite male volleyball players competing in specific individual playing positions. According to them sport scientists and conditioning professionals should take the strength and anthropometric characteristics of volleyball players into account when.

Ortega (2009) conducted a study on physical fitness levels among European adolescents. A sample of 3456 adolescents aged 12.5 to 17.49 years from ten European cities in Austria, Belgium, France, Germany, Greece (an inland city and an island city), Hungary, Italy, Spain and Sweden, was assessed in the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study between 2006 and 2008. Muscular fitness, speed, agility, flexibility and cardio-respiratory fitness were assessed using a different fitness tests of sex and age, specific normative values for physical fitness in the European adolescents were derived using the LMS
A statistical method and expressed as tabulated percentiles from 10 to 100 and as smoothed percentile curves ($P_{5}$, $P_{25}$, $P_{50}$, $P_{75}$ and $P_{95}$). The figures showed greater physical fitness in the boys, except for the flexibility test, and a trend toward increased physical fitness in the boys as their age increased, whereas the fitness levels in the girls were more stable across ages. The normative values hereby provided will enable evaluation and correct interpretation of European adolescents fitness status.

Gentona (2010) conducted a study on energy and macronutrient requirements for physical fitness in exercising, subjects like optimal nutritional intakes are critical for health and skill-related physical fitness. The effect of energy restriction and supplementation on physical fitness, discusses the optimal chronic macronutrient intakes for physical fitness in exercising subjects and finally overviews the impact of short term intakes of carbohydrate and protein, before, during and after exercise, on physical fitness of athletes. The present study was highlight that it is essential that health care gives personalize nutritional advice to meet the specific needs of exercising individual while applying the described recommendations. It reminds the difficulty of providing straight nutritional recommendations for physical fitness on the basis of evidence based medicine.

Cowley (2010) this study was conducted to examine the relationship between timed performance on functional tasks of daily living and age, knee isometric strength, and peak aerobic capacity in a group of individual with down syndrome- Samples were taken 35 men ($27 \pm 7.5$ years) participants completed an isometric test of knee extensions and flexor strength, an individualized exercise test to measure peak aerobic capacity and three timed functional tasks of daily living. Which included
chair rise, gait speed, and stair ascent and descent. Multiple regression analysis were performed to examine the relationship between timed task performance and age. Knee isometric strength, and peak aerobic capacity. The multiple regression models explained 11-29% of the variance in timed task performance. Knee extensions strength was the most influential variable in predicting timed task performance (3 quard semi partial correlation) coefficient $[S_{r^2} = 0.11 - 0.20]$, followed by aerobic capacity $[S_{r^2} = 0.10-0.14]$. Age was not a significant predictor of timed task performance. These findings suggest that physical fitness limits the ability of adults with DS to perform functional tasks of daily living. Randomized controlled trails should be performed to test the probable causal relationship between exercise designed to improve physical fitness and functional tasks of daily living.

Kumar (2011) prepared physical fitness norms for the assessment of Government and non-Government school of Chandigarh. Data were collected on 4000 subjects from the Government and non-Government school Chandigarh. The administered consisted of six items i.e. pull up, sit-up, shuttle run, standing broad jump, 50yard dash and 600 yard run/walk. The percentile norms of the physical fitness test were found to be valid and suitable to assess the physical fitness level of the Government and non-Government schools boys in the age group of 13 to 16 years.

Khare el. al. (2012) the study was to find the relationship of Physical variables with the performance of Squash Racket Players. For the purpose of the study, Twenty Squash Racquet Players were selected as subject from Lakshmibai National University of Physical Education, Gwalior, Banaras Hindu University, Varanasi and from Jiwaji club, Gwalior.
There are different Physical variables were selected for achieving the purpose of this study like arm strength, leg strength, agility and flexibility. For this study the arm strength was measured by the Roger’s formula, the leg strength was measured by leg dynamometer, the agility was measured by shuttle run and flexibility i.e. spine flexibility was measured by Modified sit and reach test. For shoulder-wrist flexibility, Shoulder and wrist elevation test was applied and the Squash Racquet performance was evaluated and graded by a panel of experts on the basis of their skills, techniques and match results. Zero order correlation was used to compute correlation between Squash Racquet Performance with the selected variables at 0.05 level of significance. The result of the study indicates that the shoulder - wrist flexibility and agility were found significant at 0.05 level of significance. And on the basis of the findings of the study, the following conclusion drawn that the shoulder – wrist flexibility and agility of the subjects were important variables for better performance in Squash Racquet game.

Thakur el. al. (2012) an attempt has been made to compare physical fitness components namely explosive strength, speed, endurance, agility, flexibility between table tennis and badminton male players belonging to various institutes of Maharishi Markendeshwar University, Mullana. The study was carried out on 50 male players, 25 from table tennis and 25 from badminton. The data was collected by using the measurements of age, height, and weight as well as by application of tests like standing broad jump, 50 yards dash, 600 yard run/walk, shuttle run and sit ups. The data was analyzed and compared with the help of statistical procedures in which arithmetic Mean, Standard deviation,
Standard error deviation (SED) and t-test were employed. The results found significant difference in speed, and agility and no significant difference in strength, endurance and flexibility components between table tennis and badminton male players. There was no difference between badminton and table tennis players with reference to their explosive strength, endurance and flexibility components. With reference to speed, table tennis male players were much stronger than badminton male players, and with reference to agility, table tennis male players were much better than badminton male players. On the basis of results we concluded that null hypothesis is accepted in case of explosive strength, endurance and flexibility and rejected in case of speed and agility components.

**Mahendiran and Balamurugan (2012)** The present study aims to investigate the alteration in sprinters temporal patterns on selected fitness components during normal and disturbed sleep state. To achieve the purpose ten (10) male sprinters were selected from the Department of Physical Education and Sports Sciences, Annamalai University. These subjects age ranged between 18 to 25 years. The ten sprinters were examined on Speed, Explosive power, Flexibility and Strength endurance on two occasions for 24 hours (00:00, 04:00, 08:00, 12:00, 16:00, 20:00 and 24:00), one during normal nocturnal sleep and the other during disturbed nocturnal sleep. The characteristics of temporal rhythm such as acrophase, amplitude, MESOR and r-values of selected fitness variables were measured by using cosinor win software. The overall mean differences were calculated using paired sample t-test (SPSS 17 version). The result of the study showed a significant MESOR difference on speed (p < .0001), explosive power (p < .0001), flexibility (p < .0001) and strength endurance
(p < .0001). The rhythmometric analysis showed a significant phase advanced in Speed 15:39 hours, Explosive power 9:56 hours, Flexibility 7:54 hours and Strength endurance 7:54 hours. It can be concluded that disturb sleep during nocturnal can impair sprinting performance in male sprinters. However, sprinters with good nocturnal sleep showed better sprinting performance during daytime.