Review
Of
Related literature
CHAPTER-II

REVIEW OF RELATED LITERATURE

The review of research study pertaining to the problem under investigation is of fundamental importance to provide insight into the problem, broaden the general concepts and principles, and sharpen understanding. Besides, keeping abreast the work being done in this field, the review also gets corroborative evidences. It definitely helps the researcher to imbibe his awareness and understanding of the various techniques available for conducting such an investigation and formulating ideas that profoundly contribute to the overall rational and interpretation of the data gleaned and complied with great effort. The review is based on various sources like journals, periodicals, unpublished thesis, internet etc. The review also helped to develop the understanding and concept that contributed to the overall rationale interpretation of data. A thorough investigation was made into the various sources containing educational review. A brief summary of the some has been attempted below in ascending order:-

Gray (1936) investigated the body build in football players (n=1179) in relation to the field positions. They varied vary slightly in their age. The weight increased in successive positions and significantly, so, except the guard versus the tackle, the latter being only 1.1 kg heavier. These men were the heaviest of all groups studied. Stature was also found to increase in successive positions, but not in the same order as weight, the main shift had been for the ends that were lighter than the centers and guards. But taller than both; it was margin of 3 mm. If weight and height together be taken as a rough criterion of mere physical power, these measurements game the two tackles a very special characterization of the latest weight for their height.

Cureton (1941) investigated the Body Build as a Framework of reference of interpreting physical fitness and athletic performance. Cureton stated that in general, people with long legs and long arms and relatively short trunks were physically weak in long sustained heavy work, but they might show great speed and endurance at high levels of athletic activity. The sprinter and the long distance runners were almost identical in height, but the former being
heavier and stouter than the later, 400 and 100 m. hurdlers were taller and heavier than the sprinters and long distance runners.

An investigation 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).

Carter (1968) summarized Sheldon’s (1954) colourful 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.

Sidhu (1971) conducted a comparative study of some Anthropometric Variables and subcutaneous tissue folds in athlete and non-athlete Punjabi adults. The purpose of the study to find out the differences in body built of athlete and non-athlete individuals of adult Punjabi population. Anthropometric and skinfold variable have been chosen for a better understanding of the body built of these groups. The number of subjects was forty two and age ranged between 18-28 years taken in the present investigation. Nine anthropometric measurements were taken in this research. The findings of the research shows that athletes are taller and heavier in relation to the non-athletes. Both the groups have equal lower extremity. The non-athletes are seen to possess higher amount of subcutaneous facts at all sites of the body taken into account in this study. The athletes are also found differing significantly from their counterparts and also in sitting height vertex.

Bullen (1971) studied the overweight: encyclopedia of sports sciences and medicine. He said that the muscles, fat and bones were the three major components of the body of a man. The ratio of these components varies in subjects of different occupations. But it is a matter of great concern if an athlete or sportsman carries larger quantity of muscles or fat in the body. For the athlete who is very lean but heavy because of a well developed muscular
component, excessive weight and muscularity can be conductive to superior performance in certain competitive sport activities such as football, weight-lifting and shot-put. On the other hand, there is evidence that the individual who derives his overweight from excessive fat accumulation is not only at a disadvantage in most type of physical performance but may also avoid physical activity as well.

Venkateshwarlu (1973) identify the anthropometric characteristics and physical fitness of contact, semi-contact and non-contact athletes and non-athletes (n=320) from different games i.e. Kabaddi, Basketball and track and field and (n=100) non-athletes were taken in the present investigation. The findings of the research shows that kabaddi players and Throwers were heavier, Basketball and Throwers were taller than other athletes. Throwers and Kabaddi players had greater circumferences and diameters of the upper and fore arms and also greater body fat % than other athletes.

Sidhu and Wadhan (1974) compare the anthropometric variables in throwers and football players and found to be of average height, with larger trunks and smaller lower extremities than the controls. They also had more of lean tissue in the extremities them the latter.

Wickkiser, John D. and Kelly, John M. (1975) focuses on the body composition and anthropometric measurements of (n=65) college football players. Body composition was determined by underwater weighing with an accurate assessment of residual volume. The anthropometric measurements included height, weight, seven skinfolds, waist circumference, and wrist diameter. The estimated optimal playing weights of each player were determined by densitometry, and each player and the coach estimated their optimal weights through personal experience. It was found that the players and the coach estimated the players optimal mean weight to be six and nine pounds heavier, respectively, than the densitometric analysis indicated as optimal.

Amuso (1979) conducted an extensive study on relationship of soccer playing ability selected measure of structure and physical physiological performance of college men. He studied on 46 selected subjects who were well conditioned soccer players are at-least two years playing experience of 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 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.

**Marshall et al. (1980)** conducted a longitudinally study on algometric growth in boys of ages seven to sixteen years. In the present investigation differential growth in boys is of ages 7 to 16 years. Although the changes are anatomical and physiological in nature. The present results would be age wise in any attempt to dissociate differential structural from functional change. Perhaps further analysis of such algometric relations will facilitate assemblage of a set of assumptions to produce a theoretical model that more closely approximates empirical results and thus will contribute to an increased understanding of the driving force or forces of differential growth.

**Meszaros (1980)** performed a comparative study on body dimensions between athletic and non-athletic young and adult subjects. The investigation was conducted on athlete and non-athlete. The non-athletic adults were university students and the young subjects were school children. All athletic subjects were engaged in track and field events. The result of the present study indicates that some of the differences in physique that discriminate adults according to involvement in intense regular athlete activity could also be shown in adolescence. Functional superiority of the athletes is a direct consequence of regular training and not necessarily of a relatively better state of structural development.

**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 et al. (1984) conducted a study to determine the introspect differences in the physique of Indian University Football Players. A total of 151 football players of 12 Indian University teams including the champion teams of the four zones. Only 16 anthropometric measurements were considered in this study. All the measurements were taken on the left side of the subject. Results show that the physical status of each introspect categories of footballers was also compared with the average status of the total sample of footballers. Findings show that the backs and goalkeepers have generally higher mean values than the mean values of the total sample and that many of these differences are statistically significant.

Sodhi (1984) compare the level of physical growth and performance of punjabi males aged 13 to 16 years. A cross sectional study on 234 males of Punjab, age 13-16 years. The anthropometric measurements, the tests of performance and jumping ability and the maturity status were recorded for each individual. The main objective of the study is to understand the role of maturity and physical growth in performance. The result shows that the physical performance, maturity and tests of performance all showed a general increase from 13 to 16 years in all the performance groups. The occurrence of the adolescent spurt is quite clear in all the physical characteristics examined. The onset of the adolescent spurt in most of the physical characteristics as well as the tests of performance ranges from 13-14 years of age.

Dey (1984) evaluated the body composition and sports performance. He discussed with the body composition, Energy release process, Energy source, Psychological factors, Physical fitness assessments etc. The physique of the sportsmen for top notch performance gives also a valuable reference point in relating human structure or composition, to function. The influence of body composition in terms of body density, specific gravity, anthropometric
assessments, surface area and body shape on different characteristics of parameters of human performance. Body composition has also been studied within different parameters in the field of human biology, physical anthropology, medicine, psychology and many general overall researches. Body composition has been related to disease susceptibility, cardiovascular conditions and biochemical body constituents. Health related fitness components such as strength, speed, agility, power, endurance and co-ordination are the product of the working of our machine with different modes and intensities of work. Hence, body composition is always significantly related to physical fitness of an individual.

Stini, (1984) investigate the kinanthropometry: an anthropological focus and found that the secular trend in increased body size and earlier sexual maturation has provided evidence that environmental factors until now had prevented large number of people over many generations from achieving their genetically determined growth potential (Damon, 1965; Frisancho, Sanchez, Pallardel and Yanez 1973). Thus the smaller body size of the Japanese population prior to 1950 could be viewed as a developed acclimatization to a diet low in protein and calories. The rapid increase in stature and weight in the contemporary Japanese population and the slower increase that has taken place in the populations of North America and Europe over the past 100 years might look very much like the replacement of one population by another to a native human paleontologist at some future date.

Carter and Yuhasz (1984) assess body composition and skinfolds Olympic athletes. They found that the athletes who were lean or less fatty but heavy because of a well developed musculature were superior in performance in certain competitive sports. Similarly, Sargent, was the first scientist to point out that athletes did run two types. He reported the sprinters typically light-boned with relatively long bone and full chested bodies. Kohlrauch (1929) measured the male athletes taking part in 1928 Amsterdam Olympic Games. Krakower (1935) investigated on 16 high jumpers and found that the type of individual who succeeded in high jump and long jump had long legs, a short body and broad feet, respectively.

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 get 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.

*Amusa et al. (1985)* studied the effects of soccer training on muscular performance cardiovascular efficiency and body composition. The study was conducted on 20 undergraduate soccer players. They compared with the 16 control subjects. The results shows that the primary training affects for soccer players were an increase in muscular endurance and cardio respiratory endurance, rather than either an increase in muscular strength or muscular power and changes in body composition and structural measure accompany endurance training.

*Burke, L.M. et al. (1985)* confined the anthropometric measurements and personal data were collected (n=119) Australian Rules footballers from Victoria. The profile of physical features of these athletes at the beginning of the season is presented. A gradation of body size was observed between teams. The players in the top level team were slightly taller and heavier than those in the other teams. They had less body fat, as shown by lesser skinfold thickness, a smaller percentage body fat as determined by prediction equations, and a greater fat-free mass. The intermediate level team showed an intermediate level of body fat and the lower level team had the highest proportion of fat.

*Chaudhary, G.S. et al. (1985)* investigate the body composition and its review. The measurement of skinfold is based on the knowledge that approximately 50% of depot fat is accumulated in specialized cells within the subcutaneous areas. A fold consisting of two
layers of skin and subcutaneous structures can be picked up with the thumb and index finger. This fold depends upon the fat measured by the skinfold caliper instrument. It is therefore real difference between structural and functional measurements of active and non-active individuals. The research studies have shown that the effect of acute exercise can differentiate between obese and non-obese subjects. It was found that the body fat was inversely related to the extent of participation in physical activity. There is the effect of six week period of physical fitness for underwater trainees, Cureton (1963) found significant reduction in abdominal fat, total index, and abdominal girth. Among middle-aged men, Cureton and Phillips (1964) found significant reduction in abdominal girth, body weight, body surface area and total fat due to a continuous conditioning programmed.

Mathur et al. (1985) reported the somatotype rating and percentage body fat of 131 Nigerian male athletes, averaging 24.2 years of age and belonging to badminton (n=18), basketball (n=30), field hockey (n=24), handball (n=16), judo (n=18) and soccer (n=25) teams, field hockey players were found to be shorter and lighter than basketball, hockey and soccer players.

Tripathy et al., (1986) examined 309 sportsmen and athletes using the facilities of the Andhra Pradesh sports council (APSC) Hyderabad, formed the subject, (n=157) 16-20 years, (n=131) 20-25 years, while 21 subjects were belong to 25 years age group. Total nine anthropometric measurements including age of different games were taken in the present investigation. The results show that the mean values for bi-acromial and bitronchanteric diameters were highest among the volleyball players compared to their counterparts. No differences were observed in the mean bi-iliac diameter among the different sports specialties.

Sharma et al. (1986) studied on the sports in India through a physical anthropological approach. They find out that the anthropology is a science of man. It has two branches, cultural and physical anthropology. The physical anthropology contributes in identifying through these studies; biological, morphological, somatological, population variation, growth, family and psychological studies in understanding the ‘man’ in totality. Anthropologist, human biologists, sports scientists, physiologists, social scientists and
researchers in the field of sports medicine have indicated various factors which affect performance of a sportsman.

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.

Singh et al. (1987) compare the somatotypes of some categories of sportsmen (n=152) taking part in various games and sports events. All the subjects were in the age range of 17-25 years somatotypes were estimated from the anthropometric measurements with the help of Heath-Carter (1967) method. The result shows that the average somatotypes of hockey, football and basketball groups are almost similar to each other. All the sports categories have shown significantly higher rating of mesomorphy associated with lower ratings of ectomorphy as compared to the control group. Compared to the Olympic level players, those of the present study are much below in the development of musculo-skeletal system.

Carter & Heath (1990) investigate the somatotyping development and Application. The present study was based on somatotypes of eight offensive and six defensive linemen from the San Diego (California) professional football team. The means were similar but the offensive lineman was more mesomorphic than the defensive specialists. The San Diego means were closer to the Edmonton players than to other 45 players. In the former two samples almost all linemen were extreme endomesomorphic. The lower mesomorphy and higher endomorphy in Wilmore’s study may be due to differences in method or subject selection. Somatoplats of the means by playing position for the three studies showed the similarities between the pairs of offensive and defensive linemen, running backs and linebackers, and defensive backs and wide receivers. Although the techniques of the paired positions differ, the physical attributes needed by position are similar. They are also similar in height and body weight.

Abdelwahab (1990) compare the various anthropometric measurements of top sportsmen playing soccer, basketball, volleyball, handball, swimming, and track and field, and to
analyze chronological and sports age’s effects. Subjects were 84 first class Saudi players. Total variables were 29, in which 16 circumferences and 10 lengths of body parts, in addition to chronological and sports ages and the sport played. Results showed that chronological age is more related to lengths, while sports age is more related to circumferences. Handball players were superior to soccer, volleyball, track and field, and swimming players in circumferences. Basketball players were superior to soccer, volleyball, track and field, and swimming players in some circumferences and some lengths.

**E. Cacciari et al. (1990)** studied the relationship between sporting activities, endocrine levels and changes in anthropometric measurements during growth (n=175) boys, aged 10–16 years, who have played football at a competitive level and (n=224) boys, severing as controls, who have never performed sporting activities regularly. The results showed no significant differences in the growth indices between prepubertal athletes and controls, but the plasma level of DHEA-S was significantly higher (P<0.05) in the athletes. Pubertal football players, however, were significantly taller than the control subjects, particularly at 14–16 years chronological age. There were no such significant differences when bone age was considered.

**Sodhi et al. (1990)** investigated on a sample of players and non-players, who have represented the school District & State Championships including the reserved. Twenty Anthropometric measurements were taken in the present investigation. The results indicate that there are significant differences on eight out of nine height measurements. The players have significant height muscles & strength, comparatively the Non-players.

**Radha (1994)** determine the anthropometry and soccer performance of University players in Tamil Nadu. One hundred University soccer players from six Universities in Tamilnadu were taken who at least participated in the inter University. Anthropometric variables height, leg length and thigh girth were measured in the present research. A finding shows that the height and thigh girth are having significant relationship with the soccer playing ability of the University players. Height and thigh girth, the former is having a positive relationship and the later has negative relationship with soccer playing ability.
Mussiger 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.

Singal, et al. (1994) evaluated the morphological profile and body composition in various sports of National level men. A total of 100 sportsmen and 100 non-sportsman i.e. control group. Each subject had measured 17 anthropometric measurements. Anthropometric measurements and body composition of sportsmen of National level are the focus of the present research and their comparison with controls. The findings of the investigation shows that the players of all games are taller, bigger trunk, broader shoulder, wider elbow, wrists, knees and ankles as compared to non-sportsmen. Various girths, total lean body mass and present body mass were larger whereas body fat and present lean body fat were smaller in all sportsmen.

Sidhu and Sangeeta (1995) investigate the body composition and skinfold change in sports boys and controls from age 13 to 18 years. A sample of 150 sports boys and 182 controls, between the age group of 13-18 years. The variables to be measured in the present investigation was weight, five skinfolds, percent body fat and lean body mass were calculated for each subject. The findings of the study indicate that skinfolds become thicker with age in both the groups. Sports boys show less skinfold at all the ages and differences 13-16 years in sports boys and from 13-18 years in control boys. Sportsmen have more percent of lean body mass at all the age levels.

Sidhu et al. (1996) studied the morphological characteristics of sports boys ranging in age from 11-19 years (n=444) sports boys and (n=401) non-sports boys ranging in age from 10.5 to 19.499 years. The boys were selected who participated at least in the district level competitions. Various anthropometric measurements were taken using standard techniques.
The results of the research show that sports boys are significantly taller and heavier with longer trunk, wider diameters as shoulder and hip as compared to the controls. Generally in skinfold thickness of triceps and sub scapular, the two groups do not differ from each other.

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.

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 mid-fielder as compared to other groups.

Mansoldo (1999) studied the positive & negative social influence physical activity in order adults. The purpose of the study was the Anthropometric profile of collegiate soccer players and high performance players and found that soccer player were heavier, taller and the skinfold adding identical to the soccer players with no significant difference in the skinfold. Anthropometric and work rate profile of elite South American International Soccer players were examined by Rienzi et al., (2000) segmental lengths, limbs and body compositions were involved in anthropometric variables. No significant correlation has been observed for any other relationship between the anthropometric variables and work rate profile.

Rienzi et al. (2000) examined an anthropometric and work rate profile of elite South American International Soccer players. Segmental lengths, limbs and body compositions
were involved in anthropometric variables. The player's mean height and body weight were 1.77 ± 0.4m and 75.4 ± 4.41kg, respectively. The sum of skinfolds were found to be 23.6 ± 6mm and 62 ± 6mm. Estimated percentage adiposity of the players was 11.6% but no significant correlation has been observed for any of the other relationship between the anthropometric variables and work rate profile.

**Kaur et al. (2001)** determine possible anthropometric and fitness profile of Asian gold medalist male kabaddi players (n=45). National male kabaddi players aged about 20 to 34 years were taken. Total 22 anthropometric measurements, somatotype and body composition were used. To assess the physical fitness level standing broad jump, pull ups, 30m run, 6x10m shuttle run and 2.4km run motor performance tests were conducted on selected 17 players. The result shows that height and weight ration also indicates that the players are overweight with respect to height. There are significant improvement has been find out in pull ups, 6x10m shuttle run and 2.4kg run and the physical fitness tests were indicated overall improvement in their fitness.

**Wittich et al. (2001)** assessed the body Composition of Professional Football (Soccer) Players Determined by Dual X-Ray Absorptiometry. The present study was based on a three-compartment body composition analysis of (n=42) professional football (soccer) players and 33 age and body mass index-matched control subjects was determined by dual X-ray absorptiometry (DXA). The equipment provided a direct measurement of fat, lean, and bone mass. Fat mass was significantly higher in the control subjects whereas lean mass and bone mass were markedly higher in the players. The percentage of body weight fat varied from 6.1 to 19.5% in the football players and from 9.1 to 29.9% in the control subjects. The midfielders had a significantly higher percentage of fat (13.6 ± 3.3%) than backs or forwards (11.1 ± 2.8 and 11.0 ± 2.3%, p < 0.05 and p < 0.06, respectively). In the football players, the correlation between the age in the control subjects (r = 0.13, p > 0.1). The results should be of interest to coaches because they will help improve athletes' performance.

**Strudwick et al. (2002)** compared the anthropometric and fitness profiles of elite players in two football codes (n=19) professional soccer players and (n=33) inter-country Gaelic
football players. The finding shows that the variability in stature was significantly greater in the soccer players compared to the Gaelic footballers. Performances in the 10-m and 30-m sprints and in vertical jump were superior in the soccer group compared to the Gaelic footballers. The intra-group variability on the anthropometric and performance measures of the soccer players is likely to be due to the specificity of positional roles. The combined groups could be described as lean and muscular with a reasonably high level of capacity in all areas of physical performance. Anaerobic characteristics of the professional soccer players were superior to those of Gaelic football players.

**Chauhan (2003)** Correlated between selected Anthropometric variables and middle distance running performance (n=56), middle distance runners between the age range of 18-30 years. 32 anthropometric measurements were taken in this study. The result shows that the multiple correlation of a selected combination of variables (i.e. height, thigh girth, biacromial diameter and thigh skinfold) with middle distance running performance have been found significant but the multiple correlation is not of sufficient size, so the regression equation developed cannot be put in the prediction of middle distance 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.

**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). The measurements were taken in respect of weight, height, four skinfold thicknesses, and two circumferences; and calculated body mass index, total body fat percentage, fat free mass, arm fat percentage, and arm muscle area. 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
Filiz Can et al. (2004) describes certain morphological characteristics of women soccer players and to examine aspects of training and performance. Twenty-two anthropometric measurements of somatotype and body composition; flexibility, agility, anaerobic power, leg muscle power, and dynamic pulmonary functions were used as performance variables. Measurements were made on (n=17) professional athletes and (n=17) age-matched sedentary women who acted as controls. The women soccer players showed less fat content and less lean body mass than did the sedentary women. Anaerobic power, leg muscle power, and agility in the athletes were higher than in the nonathletes, whereas no differences were found in flexibility and pulmonary functions. The women soccer players showed more significantly mesomorphic, less endomorphic, least ectomorphic components and higher performance level than did the sedentary women.

D.B. Pyneab et al. (2005) evaluates the utility of fitness assessment and trends in drafting of players in the Australian Football League. Height, mass, skinfolds, 20-m sprint, vertical jump, agility run and endurance assessed on the 495 players. Compared with midfield players, ruckmen, tall forwards and tall defenders were decisively taller and heavier, but had poorer sprint speed, aerobic ability and agility. The only substantial changes in fitness scores over the 5-year period were an increase in height and an increase in 20-m sprint time. We conclude that fitness assessment is useful for differentiating between player positions and identifying some annual trends in recruitment in Australian football, and that players with a second half birth month have been disadvantaged with lower representation at the national draft camp.

Silvestre et al. (2006) examine the relationship between body composition (BC) and physical performance (PP) in male collegiate soccer players and differences among positions and between starters and non-starters (n=27), (age = 19.9 ± 1.3 years, height = 177.6 ± 6.3 cm, body mass = 77.5 ± 9.2 kg, body fat (BF) = 10.6 ± 5.8 kg, and %BF = 13.9 ± 5.8%). BC, vertical jump, speed, lower-body and total body power production (TPW), and estimated O2max were measured. Significant correlations were found between BC and PP.
ranging from 0.38 to 0.61 for weight, VJ, S, TPW, and O2max. BF showed a positive correlation with S (r = 0.60) and a negative correlation with O2max (r = -0.67). The values for BC and PP were similar in starters and non-starters with only TPW showing a significantly greater value in starters.

Sergej (2006) determine the effects on body composition and exercise performance in soccer players. The main aim of this study was to determine the effects of yohimbine supplementation on body composition and exercise performance in professional soccer players. The athletes (20 top-level male soccer players) were allocated to two randomly assigned trials. Subjects in the yohimbine group orally ingested tablets that contain yohimbine at a dose of 20 milligrams per day in two equal doses for 21 days. Subjects in the placebo group ingested an equal number of identical-looking pills that contained cellulose. There were no statistically significant changes in body mass and muscle mass within or between trials after the supplementation protocol. Percentage of body fat significantly decreased in the yohimbine group after the supplementation protocol (9.3 ± 1.1 vs. 7.1 ± 2.2%; p < 0.05). Furthermore, fat mass was significantly lower in the yohimbine versus placebo trial at postsupplementation assessment (7.1 ± 2.2 vs. 9.2 ± 1.9%; p < 0.05). There were no changes in exercise performance indicators (bench and leg press, vertical jump, dribble and power test results, shuttle run) within or between trials (p > 0.05). The results of the current study indicate that supplementation with yohimbine combined with resistance training does not significantly alter the body mass, muscle mass, or performance indicators in professional soccer players. Nonetheless, yohimbine supplementation appears to be suitable as a fat loss strategy in elite athletes.

Hencken (2006) investigate the anthropometric assessment of premiership soccer players in relation to playing position. A squad of Premiership soccer players (n=24) provided informed consent to participate in this study. A total of 39 measurements (skinfolds, girths, lengths, and breadths) were made for each player. A multivariate analysis of variance revealed no differences between positions ($F_{15,41.810} = 0.783$, $P = 0.688$). However, in this study, stature and body mass were not different among strikers, midfielders, defenders, and goalkeepers. Research has suggested that a soccer player’s anthropometric dimensions can be a major determinant for success within a playing position. In this study, within-position
variation was quite large in some cases, which could indicate that a team that does not have the opportunity to hand-pick players, based on anthropometric characteristics, may be at a disadvantage.

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.

Duthie et al. (2006) determine the anthropometry profiles of elite rugby players. The present study was conducted between 1999 and 2003 body mass and sum of seven skinfolds were recorded for 40 forwards and 32 backs from one Super 12 rugby union franchise. Players were assessed on 13 (7) occasions (mean (SD)) over 1.9 (1.3) years. The result shows that the exponent x was 0.13 for forwards and 0.14 for backs (90% confidence limits ±0.03). The forwards had a small decrease in skinfolds (5.3%, 90% confidence limits ±2.2%) between preseason and competition phases, and a small increase (7.8%, 90% confidence limits ±3.1%) during the club season. A small decrease in LMI (1.5%) occurred after one year in the programme for forwards and backs, whereas increases in skinfolds for forwards became substantial (4.3%, 90% confidence limits ±2.2%) after three years.

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.

**Gil et al. (2007)** determine the selection of young soccer players in terms of anthropometric and physiological factors. Young soccer players 14-17 years old were taken in this research. Somatotype and body composition was calculated by measuring skinfolds, limb circumferences and joint diameters. VO2max was estimated by the Astrand's Test. Sprint, jump and endurance tests were also performed. Result shows that the most relevant differences were obtained between selected and non-selected players belonging to the 14-year-old team. Selected players were taller, heavier, leaner and faster and they had higher absolute or relative VO2max. In addition, a higher % of selected players were found among those born during the first 6 months of the year. In the rest of the teams, the agility was better in selected than in non-selected players. At later ages, there was also a predominance of players born during the first 6 months of the year. Results shows that around the time of puberty, parameters associated with physical maturity such as height, size, speed, VO2max, or chronological age are important to determine the success of a soccer player. At older ages, other factors such as agility seem to be more important. Nevertheless, players born in the 1st semester of the year are also more frequent in the older teams.

**Gil et al. (2007)** compare the physiological and anthropometric characteristics of young soccer players according to their playing position forwards (n=56), midfielders (n=79), defenders (n=77), and goalkeepers (n=29). Anthropometric variables of participants (height, weight, body mass index, 6 skinfolds, 4 diameters, and 3 perimeters) were measured result shows that forwards were the leanest, presenting the highest percentage of muscle. They were the best performers in all the physiological tests, including endurance, velocity, agility, and power. In contrast, goalkeepers were found to be the tallest and the heaviest players. They also had the largest fat skinfolds and the highest fat percentage, but their aerobic capacity was the lowest. In the selection process, agility and the jump tests were the most discriminating for forwards. In contrast, agility, height, and endurance were the key factors for midfielders. The defenders group was characterized by a lower quantity of fat.
Raschka and Wolthausen (2007) compared the somatotype differences of soccer and handball players based on the methods of German and Anglo-American schools of constitutional biology (n=39) soccer players of the third division as well as (n=22) handball players of the second division and (n=17) handball players of fourth division (average age 24 years) were examined kinanthropometrically. The group differences are highly significant for the endomorphy. In the somatogramm of Heath & Carter (1967) both ballplayer collectives are settled in the ectomorph mesomorph area. The group differences are here for the endomorphy and mesomorphy highly significant, for the ectomorphy significant. The proportional fat portion (calipermetry) is high-significantly lower for the soccer players with 6.6 +/- 1.6% than for the handball players (8.4 +/- 2.5%). All height and longitudinal dimensions as well as the circumferences with exception of the thigh girth were for the larger handball players (body height: 189.1 +/- 7.9 cm) very to highly significantly higher than for the smaller soccer players (body height: 178.6 +/- 5.8 cm), whereby no important proportional difference.

Roy et al. (2007) evaluated the analysis of body composition, strength and endurance of elite female soccer players (n=30) elite female soccer players of Manipur. Age, height, weight, Fat % and FFM etc. variables were measured in the present investigation. The results showed that the physical profile of the Manipuri female soccer players were found shorter and lighter than those of international female soccer players and the VO2 max value among the Manipuri soccer female players was found much higher than others.

Rahmawati et al. (2007) determine the specific morphological characteristics of young male athletes (19 badminton players, 96 soccer players, 74 volleyball players) and compared with non-athlete students (51) in Indonesia. The badminton players were shorter and lighter with greater skinfold values among the athlete groups; the soccer players were relatively shorter and with smaller skinfold values and greater arm and leg girths; and the volleyball players were taller and heavier with smaller elbow and knee breadths and very small skinfold values. The non-athlete students were characterized by greater arm girth, elbow breadths, knee breadths, and back and leg skinfolds. In mean somatotype category, the badminton players were ‘central’ (3.3-3.7-3.7), the soccer players were ‘balanced
mesomorph (2.7-4.9-3.0), the volleyball players were 'mesomorph-ectomorph' (2.4-3.5-3.7), and the non-athlete students were 'ectomorphic mesomorph' (2.7-5.2-3.8).

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.

James et al. (2008) conducted a case study on performance and anthropometric characteristics of prospective elite junior Australian footballers (n=54). Prior to the selection of the final training squad, Multivariate analysis (MANOVA) showed significant (p<0.05) differences between selected and non-selected players when height, mass, 20-m sprint, agility and vertical jump height were considered collectively. Univariate analysis revealed that the vertical jump was the only significant (p<0.05) individual test and a near significant trend (p=0.07) for height differentiating between selected and non-selected players with medium effect sizes for all other tests except endurance. In this elite junior football squad, physical characteristics can be observed that discriminate between players selected and non-selected, and demonstrates the value of physical fitness testing within the talent identification process of junior (16-18 years) players for squad and/or team selection. Based on MANOVA results, the findings from this study suggest that team selection appeared to be related to a generally higher performance across the range of tests. Further, age was not a confounding variable as players selected tended to be younger than those non-selected. These findings reflect the general consensus that in state-based junior competition, there is evidence of promoting overall player development, selecting those who are generally able to fulfill a range of positions and selecting players on their potential.

Marta et al. (2008) evaluated the body composition and body image of a group of top flight soccer players and compare the results with those of a group of university students used as
controls subjects. A total of 56 individuals took part in the study; half of them were soccer players and half university students. They did not find significant differences in body image satisfaction between the soccer players and the control subject. However, “the university students perceived their image much more precisely than the soccer players. The body composition study revealed that the soccer’s had more muscle mass and less fat than the control subjects; that is, they were thinner and more defined than the volunteer group. While the control subject tended to want a more muscular body with the same amount of fat and less than they had, the soccer players expressed that they wanted more muscle mass, but also more body fat.

Maughan et al. (2008) studied healthy young male football players who were either fasting (n= 59) or not fasting (n= 36) during the month of Ramadan. Body mass, body composition, and dietary intake were assessed at each time point. Energy intake was relatively stable in the fasting participants, but there was a small decrease of approximately 0.7 kg in body mass during Ramadan. Mean daily energy intake increased from 14.8 MJ (s= 2.9) to 18.1 MJ (s= 3.2) during Ramadan in non-fasting participants, with concomitant increases in body mass and body fat content of about 1.4 kg and 1% respectively over the month. These data suggest that Ramadan fasting had some effects on diet composition, but the effects were generally small even though the pattern of eating was very different. After Ramadan, the dietary variables reverted to the pre-Ramadan values.

Gall et al. (2008) examined 161 soccer players according to the standard whether they achieved international or professional status or remained amateur. Measures were taken across three age categories (under 14, 15 and 16 years of age). The skeletal age of players was also measured to determine maturity status. Multivariate analysis (MANCOVA) identified a significant (p < 0.001) effect for playing status. Univariate analysis revealed a significant difference in maturity status in amateurs and professionals versus internationals (p < 0.05), in body mass in professionals versus amateurs (d = 0.56, p < 0.05), in height (d = 0.85, p < 0.01) and maximal anaerobic power (d = 0.79, p < 0.01) in both professionals and internationals versus amateurs. There was also a significant difference in counter-movement jump (d = 0.53, p < 0.05) and 40-m sprint time (d = 0.50, p < 0.05) in internationals versus amateurs, as well as a significant main effect for age and playing
position ($p < 0.001$). Significant differences were reported for maturity status; body mass, height, peak concentric torque, maximal anaerobic power, and sprint and jump performance with results dependent on age category and playing position. These results suggest that anthropometric and fitness assessments of elite youth soccer players can play a part in determining their chances of proceeding to higher achievement levels.

Chiara et al. (2008) compared the body composition in soccer players of different competitive level ($n=48$) male subjects were investigated over three months. They were aged $23.2 \pm 3.24$ y, weighted $73.6 \pm 9.08$ kg, and their mean height was $1.79 \pm 0.054$ m; the mean BMI (kg/m$^2$) was $22.9 \pm 4.16$. Skin fold measurement was performed with a Harpenden caliper (Gima, Modena, Italy) according to standard procedures. The findings of the research show that the sum of skin folds, as well as several individual skin folds, body density, and percent body fat were significantly different in the three groups and these parameters were significantly different between agonist and control subjects, non-agonists showing intermediate, not statistically different values.

Carling et al. (2009) studied the anthropometric and fitness characteristics vary according to birth date distribution in elite youth academy soccer players. This investigation was confined according to birth date distribution in elite, under-14 youth academy soccer players. The selection year was divided into four quarters, with 160 male players grouped according to individual birth date. Players had their skeletal age determined and were assessed using a battery of standard anthropometric and physical performance tests. Players born across all quarters of the year were investigated for differences in the various performance characteristics using multi- and univariate analyses. An uneven birth distribution was observed, with players born early in the selection year. They highly represented at $P<0.01$ level. A significant difference in height was observed across quarters ($P<0.01$) with higher values reported in the earlier-born players. No significant differences were observed across any of the fitness measures, although the trend was for players born in the first quarter to out-perform players born in the later quarters. These findings suggest that the relative age of the performer may not always be linked to a significant advantage in physical components. The selection criteria for entry into the academy may explain the present results.
S.A. Adeniran et al. (2009) assess to determine the patterns of body fat distribution among Nigerian university soccer players and the possible effect of fat pattern on playing positions. Skinfold measurements were taken on (n=20) soccer players. Results showed that the midfielders had the least, while the goalkeepers had the highest percentage body fat. Skinfold values were found to vary by playing positions. Goalkeepers had the highest biceps skinfold thickness. Supra-iliac skinfold thickness was least in the defenders. But highest in the midfielders. Chest and waist girths were least in the midfielders. It was concluded that the differences in anthropometric variables among soccer players could be due to the demands of the playing positions.

Veale et al. (2009) assess the performance and anthropometric characteristics of prospective elite junior Australian footballers. Multivariate analysis (MANOVA) showed significant (p<0.05) differences between selected and non-selected players when height, mass, 20-m sprint, agility and vertical jump height were considered collectively. Univariate analysis revealed that the vertical jump was the only significant (p<0.05) individual test and a near significant trend (p=0.07) for height differentiating between selected and non-selected players with medium effect sizes for all other tests except endurance. Based on MANOVA results, the findings from this study suggest team selection appeared to be related to a generally higher performance across the range of tests. Further, age was not a confounding variable as players selected tended to be younger than those non-selected. These findings reflect the general consensus that, in state-based junior competition, there is evidence of promoting overall player development, selecting those who are generally able to fulfill a range of positions and selecting players on their potential.

Esteban M. Gorostiaga et al. (2009) compared anthropometric (body height, body mass, percent body fat, fat-free body mass) and physical fitness characteristics (vertical jump height, power-load curve of the leg, 5 and 15 m sprint running time and blood lactate concentrations at submaximal running velocities) among (n=15) elite male indoor soccer and (n=25) elite male outdoor soccer players. Indoor soccer players had similar values in body height; body mass, fat-free body mass and endurance running than outdoor soccer players. However, the IS group showed higher (P < 0.05–0.01) values in percent body fat (28%) and sprint running time (2%) but lower values in vertical jump (15%) and half-squat
power (20%) than the outdoor soccer group. The present results show that compared to elite outdoor soccer players, elite indoor soccer players present clearly lower physical fitness (lower maximal leg extension power production) characteristics associated with higher values of percent body fat. This should give indoor soccer players a disadvantage during soccer game actions.

Wong et al. (2009) studied the relationship between anthropometric and physiological characteristics in youth soccer players (goalkeeper: 10, defender: 20, midfielder: 25, and forward: 15). Body mass was significantly correlated with ball shooting speed and 30 m sprint time. Body height was significantly correlated with vertical jump height, 10 m and 30 m sprint times, Yo-Yo intermittent endurance run (YYIER) distance and running time during maximal oxygen uptake (Vo2max). Body mass index (BMI) was significantly correlated with ball shooting speed, 30 m sprint time, Hoff test dribble distance, YYIER distance, sub maximal running cost, Vo2max, and the corresponding running time. Significant positional differences were observed in anthropometry (body mass, height, and BMI) but not in physiological performances.

António J. Figueiredo et al. (2009) studied a compared variation in size, function, sport-specific skill and goal orientation associated with differences in biological maturity status of youth soccer players within (n= 159) male soccer players in two competitive age groups, 11–12 years (n=87) and 13–14 years (n=72). Weight, height, sitting height and four skinfolds, four functional capacities, four soccer skills and goal orientation were measured. Players in each age group advanced in maturity are taller and heavier than those on time and late in skeletal maturity, but players of contrasting maturity status do not differ, with few exceptions, in functional capacities, soccer-specific skills and goal orientation. Variation in body size associated with maturity status in youth soccer players is similar to that for adolescent males in general, but soccer players who vary in maturity status do not differ in functional capacities, soccer-specific skills and goal orientation.