CHAPTER II
REVIEW
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RELATED LITERATURE
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The research scholar has made a sincere efforts to locate literature related to this study. The relevant studies found from various sources, which the research scholar came across are included in this chapter. Some of the studies cited in this chapter do not have direct relevance to the present study but are indirectly related. The review of literature collected from different sources has been classified into two sections namely Section A and Section B.

Section-A

Clarke and others (1961) analysed the relation of maturity, structural and strength measures to the somatotypes of boys of 9 to 15 years of age. The purpose of the study was to relate the somatotypes of boys to their skeletal maturity, structural characteristics and muscular strength. Five somatotype categories were formed endomorphs, mesomorphs, endomesomorphs, ectomorphs, and mid-types. The subjects were 259 boys, 37 at each age group. It was concluded that endomorphs and endomesomorphs were largest in such body measures as body weight, chest girth, upper arm girth, calf girth and hip width.

Wear and Miller (1962) studied the relationship of physique and development levels, as determined by the wetzelqril to performance in fitness test of junior high school boys. They found subjects who were medium in physique and normal in development to be the best performers and the subjects of heavy physique to be the poorest performers.

Rerick and Cyster (1964) studied the relationship between physical maturity, muscular strength and motor performance of young school age boys. They examined the relationship of skeletal age and other maturity indicators to measure strength and motor performance of second grade boys. In addition to four maturity indicators, the data on each subject, included measurement of strength of eight muscle groups, performances on standing broad jump, 30 yard dash, and over arm throw.
The results showed that the skeletal maturity was a factor of little consequence in explaining individual difference in strength and motor proficiency. Although none of the maturity indicators were separately accounted for more than 15 percent of the variance in strength and motor performance.

Richard (1965) made a study of relationship in somatotype components, maturity, structural strength, muscular endurance and motor ability measures of 207, twelve year old boys. He found that endomorphy, mesomorphy and ectomorphy was positively associated with skeletal age. Single anthropometric measures lacked significantly high correlation with somatotype components to warrant their prediction but the ponderal index correlated 0.964 with ectomorphy. Endomorphy correlated highly with body bulk when linear measure, were partialled out. Mesomorphy was related especially to large trunk and short legs. The partial correlations also indicated that the strength of mesomorphy was independent of body size. Ectomorphy generally lacked strength. But gross strength and muscular endurance were not highly related to somatotype. Regression equations were computed from 'r' s or R's had significant magnitude for prediction.

Luce (1976) did a comparative study of body size, body structure and physical performance between Mexican, American and Anglo American adolescent boys at ages eleven, twelve, thirteen, fourteen, fifteen, sixteen and seventeen. 440 male subjects were selected i.e. 125 Mexican American and 315 Anglo-American. The Mexican American and Anglo American Subjects were compared on body size, body structure and physical performance and body measurements. It was found that the Anglo American Subject had significantly higher mean standing heights at eleven, fourteen, fifteen, sixteen and seventeen year old age levels.

Craig (1976) Compared the Physical fitness level of Canadian and South African boys. He used AAHPER Physical fitness test battery. The result showed that the physical fitness levels of South Africa high school boys are higher than those of Canadian high school boys.
Pal (1978) analysed the relationship between physical fitness and selected anthropometric measurements on 100 male of 16 to 34 years. AAHPER Youth Fitness Test was used and six anthropometric measurements such as chest girth, upper arm girth, thigh girth calf girth height and weight were obtained.

It was concluded that height was the most reliable single anthropometric measurement in prediction of physical fitness of men students. The other measurements were not so reliable. The most valid combination of anthropometric measurements in predicting physical fitness consisted of calf, height, weight and chest girth.

Ray (1979) conducted a study on 60 male students of tribal group and 60 male students of urban group from 18-20 years. All students were day scholars and they had different environmental influence outside the college. AAHPER Youth Fitness test was administered to obtain the physical fitness level of the subjects. The males in particular were able to reach similar values of maximum ventilation, cardiac frequency, and aerobic power output when standardized for body size and composition (m·kg⁻¹·m⁻¹·min⁻¹) the VO₂ max for each paired group (Caucasian yoruba; and kurd Yemenite) was identical. It was concluded that if difference in aerobic power output exist between ethnic group, they must be small and there fore of doubtful biological significance. They are certainly less than the large inter subject variations which exist between members of the same race.

Brar and Srivastava (1985) conducted a cross sectional study of motor fitness components of 100 school children of Gwalior whose average age was 10 to 12 years studying from VI, VII and VIII classes. The following AAHPER Motor Fitness tests were administered : (1) 50m Run for Speed (2) Bent Knee Sit Ups for Abdominal strength (3) Pull ups for Arm and shoulder girdle strength (4) Standing Broad Jump for Leg Power (5) Shuttle Run (4x10) for agility and (6) 9 Min. Walk/Run for cardio Respiratory Endurance in the procedure described in the AAHPER Test Manual. It was concluded from the study that the students studying
in grades VI and VII vary in their motor fitness, therefore, they should have different physical education programme and different evaluation procedure.

**Simpson** (1989) studied the effect of activity participation upon health related physical fitness component of 132 students engaged in various physical activities. The significant changes were observed in body composition flexibility and dynamic strength among weight training and aerobic dance group. The racket ball groups experienced significant positive changes in flexibility and dynamic strength, whereas the control group experienced significant negative changes in cardio-respiratory endurance.

**Pokhriyal** (1991) compared the physical fitness component of boys and girls belonging to different region of India. The total number of subjects were 1080 (540 boys and 540 girls) sixty boys and sixty girls in each of the nine age groups of 10 to 18 years were selected randomly from east, west, north and south zones. Selected health related physical fitness components were measured. The data pertaining to height weight fat percentage, shoulder flexibility, ankle flexibility, knee flexibility, right grip strength, left grip strength, 9/12 minute run/walk test were analysed by three way analysis of variance. Fisher's post hoc significant test was used to assess the significant differences between the means of different groups. The F ratio obtained by three way analysis of variance was tested for significance at .05 level.

The result of the study indicated that there are significant differences in boys and girls in mean height, weight, fat percentage, shoulder flexibility knee flexibility, right grip strength, left grip strength and 9/12 minute run/walk in 10 to 18 years age groups of east, west, north, south zones of India.

**Thomas** (1992) investigated the health related fitness of school students of first through fourth grade. 348 students were assessed in AAHPER Health related fitness test. Boys performed significantly well in
skin fold measurements and sit ups, girls performed significantly well on sit and reach, sit ups and body composition.

Hatano (1994) administered the Asia youth health related fitness test proposed by the Asian board of ICHPER S.D. to assess the health related physical fitness of 2149 Japanese boys and girls of ages 10-17 years. The reliability and validity of the proposed test were examined. The mean performance of 11 and 12 years old boys in 600 mt. were 218.0 and 214.2 seconds respectively. 27 and 34 numbers for sit ups, 9.0 and 10, for pull ups and 6.12 and 6.98 centimetres for sit and reach test and 25.0 and 22.0 millimeters for total skinfold respectively.

Hue et al (1994) administered the Asia youth health related fitness test consisting of an endurance run, sit and reach test for flexibility and skinfolds to 3168 students of 10-17 years of age attending public school in China. The mean values of endurance performance of 11 and 12 years boys were 190.5 and 114.58 seconds respectively. Scores for 60 seconds situps were 35.7 and 39.1, pull up scores were 9.3 and 6.6 respectively, sit and reach performance were 10.7 and 7.00 centimeter respectively and the total skin folds were 26.6 and 28.2 millimeters respectively.

Fu (1994) administered the ICHPER S.D. Asia Health Related fitness to 20304 primary and secondary school student. The feedback from participants were considered in preparing the final test manual. The five studies investigating the relationship of fitness with selected personal attributes and characteristics of Hongkong secondary school students during 1991-92 using the new test manual was considered for comparison and for developing norms for primary and secondary school boys and girls of various age groups.

Bandhyopadhyay (1998) studied the physical and physiological profiles of 20 female Indian classical dancers and 20 female physical educators of an average age of 22 years. The physical and physiological variables chosen for the study were cardio respiratory endurance, abdominal strength, endurance, agility, flexibility, resting heart rate, resting systolic and diastolic blood pressure, vital capacity, body
composition and haemoglobin concentration. The responses of the classical dancers and physical educators to the selected variables in terms of recorded scores were analysed by one-way ANOVA and it was found that Indian classical dancers' group had significantly superior ankle flexibility (Plantar); While the physical educators' group had significantly lower diastolic blood pressure and percentage of body fat; higher lean body mass and abdominal strength-endurance. In the variables of cardio-respiratory endurance; vital capacity; resting heart rate; resting systolic blood pressure; haemoglobin concentration; agility; and flexibility of hip and back; trunk and neck as well as shoulder and wrist, both the groups showed no significant difference.

Kukoj et al (1999) studies anthropometric strength and power predictors of sprinting performance. Twenty four male students of physical education served as the subjects for the study. The purpose of the study was to examine relations between sprinting performance and some standard anthropometric strength and power test. The maximum isometric force of knee extensors, hip extensors and hip flexors were measured by a strain gauge dynamometer. The power testing consisted of a jumping test battery, including counter movement jump, and 155 of continuous jumping on the Ergo jump apparatus (Bosco system). Standard anthropometric measures were also taken. The result obtained demonstrated that except for weight of the counter movement jump, all correlation, coefficient between the selected variables and sprinting performance were low and therefore, insignificant. As a consequence, multiple correlation coefficients were also low.

The body composition of athletes has extensively been studied by various scientists. Leasy et al concluded that physical performance in which whole body moves, primarily depends on lean body mass (LBM). They developed regression equation for calculating body composition from performance in various tests (pull ups, standing broad jump). Parizkova pointed out that the proportion of lean body mass to fat is an indicator of degree of fitness for performance.
McArdle et al. (1999) pointed out that athletes generally have physique characteristics unique to their specific sports. For example field event athlete have relatively large quantities of lean tissues and a high percentage of body fat whereas long distance runners have the least amount of lean tissue and fatness. He also pointed out that players are amongst the heaviest and leanest of all sportsmen. Lohman pointed out the errors involved in determining the body composition in children and youth prior to their age of clinical maturity (age 15 to 18 years foremost). The fat free mass (FFM) is not stable in growing children and youths because water content decrease and body solids (bone density) increases in concentration until maturity.
SECTION - B

Latehew (1954) concluded that in boy's strength test there is a rapid increase in the amount added in strength for each year from 13 to 16 years of age and sharp decline after 17 and after eighteen, there is no further increase. This period corresponds to the period of active pubescent changes in the male. In case of girls, this period of rapid increase comes from 12 to 14 years of age and corresponds to the earlier onset of puberty in the female and it declines abruptly at 15. The fact presented by the author would lead to the conclusion that there is a high probability that the relationship between age and athletics or their motor performance is not a linear one.

Espenschede (1956) conducted a comparative study of motor fitness of boys and girls for age ten and a half through fifteen and one half years. She found that before thirteen and a half years there were only slight difference between boys and girls in the agility, strength and static balance elements of the brace test. After that boy's scores increased up to 17 years, but girls scores tended to decrease.

Borley, Dobell and Farell (1961) conducted a study to determine the differences among the 7th, 8th and 9th grade girls in power, speed and flexibility and to determine the relationship between power and flexibility, speed and flexibility, and certain anthropometric measures. They found that 7th grade girls were faster than 8th and 9th grade girls in the 50 yard dash. No significant relationship was found in other items studied.

Fleishman (1963) has conducted the study of physical proficiency in relation to age and sex development. For each test the mean score of boys and girls of different ages were obtained. The scores were plated in curves. Some notable differences were observed in the development curves of the girls, especially in explosive strength. In speed running test decreases in performance was observed up to age 15 and thus some improvement. In contrast to the curves of boys the girls curves reflects definite developmental stages during which there is no improvement or
decrease in performance. It is likely that the maturational phases of female development are more apt to interact with physical performance. Interest pattern also changes with age and girls are more likely to show marked shifts away from athletic interests at given stages in their adolescent period as compare to the boys.

**Smoll** (1967) collected the data from the grade 4 and 11. 24 boys and 24 girls participating in a longitudinal growth study. Static strength measures of the ankle extensor's, hip flexors and extensors, and knee extensors were measured with a cable tensiometer. Motor performance was represented by standing broad jump and 30 yard dash. The analysis depended primarily on zero order and multiple correlations. Height and weight, were poor predictors of performance with in the age and sex groups. The aggregate lower limb strength had a moderate positive relation with performance. Performance in the broad jump during adolescence can be predicted more accurately than in the dash on the basis of growth strength, and performance taken during middle childhood.

**Espenschade** (1968) has observed that girl's scores in the cross test of general motor ability did not improve after the age of 14, while boy's score showed steady improvement from 8 to 18 years of age. She concluded that all studies agree in showing increase with age in running, jumping and throwing for boys from the earliest measures made in the childhood through the last years in school. Girls showed improvement through the early school years but reached their maximum in running and jumping as early as 13 years of age and showed little changes after 13 in distance throwing. She has also stated that since physical size and strength continue to increase after this age level, the discontinued growth in motor ability could not be attributed to the attainment of physical maturity. She further found that girls improve in agility up to 14 years, but then decline.

**Neumour** (1971) did a comparative study of anthropometric measurements of Cavasian and Negro boys and girls to find out the differences in anthropometric measurements and at the same time
differences in standing broad jump, medicine ball put, and zig zag run performance of the boys and girls of both races. A total of 900 subjects were taken. Subjects were of different age groups of six to ten years. Anthropometric measurements were standing height, sitting height, weight, length of arm, length of fore arm, length of the hand, length of the upper extremity, length of the thigh, length of the leg and length of the lower extremity. He found that at the age of six to eight and ten years, boys differed from girls in most anthropometric measurements. However, there were no differences in standing height, leg and lower extremity length. Negro boys and girls had longer appendages and were taller than Caucasians. Negro boys and girls were no superior in the events of power and agility.

Barry (1974) studied to determine selected differences occur in neuro-muscular power development in boys and girls ranging from five through seventeen. The test included a vertical jump test, standing broad jump test, power ratio test, shuttle run test, medicine ball put test, and shot put test. In analysing the test results the boys and girls were found to follow a parallel progression in power performance, with the girls only slightly below the boys until the early teenage years. At thirteen years of age the female tended to level in power development while the males continued to advance through age seventeen. A comparison of yearly developmental rates noted significant differences between ages six and seven, nine and ten, and fifteen and sixteen failed to register significance at the .05 level of confidence.

Singh conducted a remarkable study of assessment of motor abilities of untrained Indian school boys of 10-16 years age belonging to different regions of India. The total number of subjects were 3384. Following test of motor abilities were administered to assess the subjects: 4x9m. Shuttle run, 50 m sprint, standing shot put (4kg), Standing broad jump, bent knee sit ups (30sec) and 800m run and walk. In addition to these tests the standing height and body weight was also taken. The data was statistically analysed age-wise. The results indicated that there are
statistically significant interstate differences in height, weight motor abilities of the subjects.

Klafs and Loyn (1978) has reported that constant setting of new records and top level performance by young girls indicated that exercise physiologists supported by many reputed studies have long maintained that 12-15 years old girls are at their physiological peak and are both, socially and psychologically, more trainable than at any other time.

Kansal and Sidhu conducted a study entitled physical growth patterns and prediction of Adult physical status with special reference to selection of sports probable. Keeping in view the specificity physical status of sportsman and women, it is concluded that at the age 10 and 11 children should be provided a test of those sportive activities in which their physique will be best suited when they achieve the adult physical status. Thus the sports counsellors could divert the interests of sports probable at young age whose chances of achieving the required physique for the sport of their choice is slender. This is possible only if appropriate prediction criteria are available to the sports coaches and physical educators for the prediction of adult physical status at a young age. Therefore, it is highly recommended that sufficient research efforts be made in this direction to make available such prediction criteria for large number of endogamous groups in India.

Bhatnagar, Singal and Grover ( ) conducted a study entitled Somatometric variables and Body components in relation to socio-economic status the investigation was based on the cross sectional sample of 155 normal female children ranging in age 6 to 16 years. Out of this 80 children belong to higher socio economic group in whose case their parental income is more than Rs. 2000/- p.m. and remaining 75 children are from lower socio-economic group with their parental income less than Rs. 1000/- p.m. The former are studying in modern schools. Each subjects has been measured for ten somatometric variables - weight, height, four diameters (humerus, bicondylar femur, bicondylar, ankle and wrist) and four skin and subcutaneous tissue folds (biceps, triceps, suprailliac and
subscapular). In body component percentage of fat, absolute fat and lean body mass has been calculated from fat, absolute fat and lean body mass has been calculated from skin and subcutaneous tissue folds and body weight. It was found that in all the somatometric variables and body composition the upper socio economic groups were higher when compared with lower socio economic group. From the result it was also concluded that females belonging to upper socio-economic group are having better physical development than that of lower socio-economic group.

Eiben Barabas and Panto (1980) has conducted first Hungarian National Growth and Physical Fitness study of Hungarian Children and Youth from 3-18 years of age, taking into consideration all the ecological factors of 1980s. 39035 Hungarian boys and girls were investigated and basic anthropometric measurements were taken to study the growth status, proportional changes, body composition, physique, maturation status and past skeletal age. The physical fitness programme was arranged from a battery of seven tests of hand grip strength, medicine ball push, standing broad jump, burpee test, sit-up test, 60 m. dash and 12 minutes endurance run. The results showed the differences of mean between the age groups. Boys usually have larger body dimensions and they produce remarkably better performance in motor tests than girls do. The short period in which girls exceed boys in height and weight in 11-13 years of age period. On the motor performance tests the values for both sexes and for each age groups are given in percentiles of boys and girls in each age group and each test. The differences among the girls age group decreases as this age advances.

Robson, Uppal and Bose (1981) conducted a study to determine the selected physical fitness component of boys and girls at different stages of elementary school level. Twenty boys and girls at different stages of elementary school level. Twenty boys and 20 girls were selected at random from each grade, from one through five. Their ages ranged from five to eleven years. The components tested were speed, shoulder strength, explosive power and agility. It was found from the analysis of the data that boys has more shoulder strength than girls in all grades. In
standing broad jump there was no significant difference in performance between boys and girls of grades one and two. Boys of grade three and four were significantly superior to girls of grade three and four in standing broad jump. It was also found that boys of grade five were significantly superior to girls of same grade in 50 meter run and shuttle run.

**Slaughter, Lohman and Boileau** (1982) studied the relationship of anthropometric dimensions to physical performance in children. This study was designed to determine whether anthropometric dimensions account for a significant amount of variation in physical performance in 7-12 year old children (N=159). The physical performance measures consisted of three tests of running (mile run, 600 yard dash, and 50 yard dash) and two test of jumping (standing board jump and vertical jump). Anthropometric dimension consists of skin fold and circumference along with height and age improved the prediction of performance than age on height. It was concluded that physical performance measures in children can be estimated with moderate success from a combination of skinfolds and circumferences along with age and height and that anthropometry may provide additional information to body size and age with respect to performance expectation of children.

**Sodhi and Kulwant** (1984) conducted a study entitled physical Growth and performance of Punjabi Males aged 13 to 16 years. It has been found that the maturity status of children plays a dominant role in determining their performance and physical growth. The early maturers have been found to perform better than the late maturers. It is important to mention here that the late maturers might also do better after attaining the degree of maturity equal to that of early maturers. The implications of this phenomenon might be considerable interest to a coach while training a sportsman. However the standards for evaluating the maturity status for Indians can be based only on the secondary sex characteristics for time being.

**Sodhi and Chopra** (1985) conducted a study on the menarcheal maturity and physical performance of 12 to 18 year girls of Punjab. Data
on 236 girls have been collected from Patiala and its surroundings. Each girl was examined for body weight, stature, standing broad jump, standing vertical jump, dynamic flexibility, flexed arm hang, sit-ups, Shuttle run, sitting basketball throw, 50 meter dash and 60 meter run. The menarcheal age was determined on the basis of memory recall method. The data of birth of each child was obtained from the school records. The data have been classified into seven age groups. On the basis of menarcheal maturity in each age groups the data has been further sub-divided into two. The results indicated that the earlier maturity in girls perform better in most of the performance tests up to 14 years.

However, at 16 and 17 years the difference between the performance of early and late maturing girls is considerably reduced.

Sohi and Singh (1985) compared the Indian and Nigerian children of 10 to 14 years age. In this study physical growth (Height and body weight) and motor abilities test (Standing broad jump and 50m sprint) were conducted to assess the motor development of boys from both countries and were compared. The results indicated that the Nigerian boys had a higher rate of growth as compared to Indian boys and in motor performance the Nigerian boys out performed the Indian boys.

Mathur and Salokn (1985) studied the body composition of successful Nigerian female athletes. A total of 150 female subjects were taken for the study. They included non athletes (n=33), university level athletes (n=69). Subjects anthropometric measurements and body composition were measured. Insignificant differences (p>.05) between the anthropometric variables and body composition of university and national level athletes were observed. The measurement were significantly different (p<.05) between athletes and non athletes and between the athletes of different sports (volley ball, basketball, throw, sprinters and distance runners) differences in various measurements within the athletic group have been attributed to physical demand of each sport.

Tiwari (1997) conducted a study on the dimensions and causes of child malnutrition and health status of Brhamin, Rawat, and Teli pre-
school children of Raipur, M.P. A total of 121 Brahmin, 97 Rawat, and 97 Teli pre-school children were studied using nutritioned anthropometry and clinical signs of malnutrition. A cross-sectional data were collected on these children to evaluate growth pattern during pre-school age. The measurement like body weight, stature, sitting height, circumference of head, chest, mid upper arm, thigh, calf skinfold of tricep, bicep and subscapula, and different nutritional indices were calculated. The evaluation of nutritional status reveal variety of nutritional problems that affect pre-school children of all the three populations. It was found that there are multiple forms of malnutrition. The pattern of protein energy malnutrition observed in the sample children is primarily of mild to moderate intensity in Brahmin and moderate to severe intensity in Rawat and Teli pre-school children.

**Classeuns et al (1999)** studied the contribution of anthropometric characteristics to performance scores in elite female gymnasts. An anthropometric study was conducted during the 24th World Championship Artistic Gymnastic in Rotterdam, Netherlands in 1987. Total 168 female gymnasts aged between 13 to 23 years of age worked as subjects. An anthropometric battery of 18 dimensions were taken on each subject. Somatotype was estimated with Heath-Carter anthropometric protocol. Performance scores were based on the final ranking obtained during the competition on the four apparatus. It was concluded that the performance scores are associated primarily with the degree of fatness or endomorphy of the athlete. Fatter or more endomorphic gymnasts tend to have lower performances correlations between skinfolds and endomorphy and competition scores ranged from $-0.38$ to $-0.68$ and showed about 14% to 36% of the variance in competition scores.

**Manna et al (2002)** conducted a study on anthropometric and physiological profiles for the selection of under 14 years football players in DDA scheme. This study was conducted on 32 football players for selection in Delhi Development Authority (DDA) scheme. Anthropometric measurements viz., height, weight, skinfolds, back and grip strength and flexibility were taken following standard procedures to evaluate
anthropometric paramaters. A treadmill test was conducted to evaluate the cardio-vascular adaptation to submaximal and maximal exercise as well as recovery. This study also identifies few anthropometric and physiological parameters that may help in the selection of players at young age. The cardio-vascular adaptation to submaximal exercise was evaluated by the treadmill test. It was found that at sub-maximal exercise the heart rate was at higher level, which indicated a low level of fitness among the players. It was concluded that anthropometrical and physiological profanity is best viewed as an objective means of selecting young players.

Mitra et al (2002) studied on growth pattern of the Kamars – A primitive tribe of Chhattisgarh. A cross sectional study of the physical growth was made on 655 Kamar children (314 boys and 314 girls) aged 5 to 18 years, in the Raipur district of Chhattisgarh. The anthropometric measurements of height, weight, sitting height, biacromial diameter, biliocristal diameter, upper arm circumference and calf circumference, head length, head breadth bizygomatic height and skinfold thickness of subscalpular and tricep of Kamar boys and girls were taken as per the IBP recommendation. The percentile were calculated as referred by WHO, 1995. Descriptive statistics like mean and standard deviation were used and t-test was used to find the differences between the mean sample.

Analysis of various body dimension and nature of the distance curves reveals that the mean value of different body measurements were representing more or less increasing trend with advancement in age. It was observed that most of the body measure show age group differences which extend between 11-14 years in girls and 14-16 years in boys which suggests that adolescent period last for about two to three years and it occurred generally two years earlier in girls than boys. It was also observed from the growth gradient values of various measures that more than 90% of total growth took place by 14 years except in body weight, total arm length and upper arm circumference.