CHAPTER II

REVIEW OF RELATED LITERATURE

Efforts have been made by the researcher to locate literature pertaining to this study. It was found after reviewing the literature in Dissertation Abstracts International, Research Quarterlies, various journals and unpublished research work done on physical fitness.

A brief review of literature is presented under four sub divisions:

1. Physical fitness tests
2. Women physical fitness studies
3. Physical fitness studies related to age
4. Some general studies

Physical fitness tests

Stephens (1970) investigated the effects of the additions of an obstacle course on the physical fitness of fifth grade children of two Clark County (Georgia) schools. The instrument used for measuring the physical fitness was the basic fitness tests as modified by Edwin A. Fleishman. The statistical analysis revealed that a significant difference existed between the control and experimental groups at the time of the post-test. The experimental group scored significantly higher on six of the ten physical fitness variables measured. Of the remaining
four tests there were no statistically significant differences for either group. The pre-test in each of the ten criteria was variables - the most significant predictor for success on the post-test. Each of the pre-test variables was significant at the .01 level of confidence as a predictor of post-test success. Age and sex were not factors on the ten tests with the exception of the softball throw. On this variable the males scored significantly higher than the females.

Dahl (1971) administered the AAHPER Youth Fitness Test on 400 Negro and white boys from the same Texas school district. All test data were collected during the spring semester of the 1969-70 school year. It was found that the Negro boys obtained higher mean scores than white boys on gross body coordination. The difference was significantly higher than white boys as on muscular explosiveness (.01 level of confidence).

Zuidema (1971) conducted a study to examine the influence of certain measurement factors on the reliability and efficacy of the performance scores in selected tests of physical efficiency. The factors were: (1) Selection of criterion score (2) Option of scoring precision (3) Choice of statistical procedure for estimating reliability and use of partners scoring. 58 college and 49 elementary school boys were given multitrials in the standing broad jump, shuttle run, and 50-yard dash tests on two different occasions. The findings of this study offered evidence, to question the use of the recommended methods for scoring performance in physical efficiency tests and the use
of Pearson Product Moment, interclass correlation procedure to evaluate the measurement schedule in physical efficiency measurement. The findings also suggested the choice of the most appropriate measurement schedule. The selection of scoring unit precision and the use of partner scoring, appeared to be most suited to the test being given.

Miller (1971) made an investigation to determine the value of 300-yard run as a measure of endurance. The effects of administering the test on a short, tight course on the quarter mile running track were also studied. The validity of 300-yard run test was established by correlating the results of two tests with 12 minute run-walk test and Harvard Step-test. The circumference and the surface of the test administration sites used in this study had no significant influence on the value of 300-yard run as endurance test.

A study was undertaken by Shore (1972) to construct motor fitness test battery for lower elementary grade boys. In all thirty test items, considered as valid and reliable measures of motor fitness, were administered to 230 boys. Two different test batteries each containing seven items were developed after statistical analysis of the data.

Andrews (1976) undertook a study to establish physical fitness norms for South African boys and to compare their physical fitness level with those of Canadian boys. AAHPER physical fitness Battery (1966) consisting of one minute
speed sit-ups, the standing broad jump, the shuttle run, flexed arm hang, 50-yard dash and 300-yard run were administered. A t-test was applied to compare the mean scores of the South African and Canadian students. The results were found to be significantly in favour of the South African boys. Zuti and Corbin (1977) established physical fitness norms for college freshmen. They took 3,000 freshmen of Kansas State University from the age of 17.6 to 19.5 years. The tests were conducted for strength, flexibility, body composition and cardiovascular fitness. The results appeared to indicate that college freshmen at Kansas State University were of a standard similar to the average American.

Anyanwu, Samuel Uwazuruonye (1977) attempted to establish physical fitness norms for Nigerian boys and girls in the age group 11 years to 18 years. The study included the following test items: Shuttle run; push-ups for boys; Chair push-ups for girls; flexed knee sit-ups; 45 meter dash; standing long jump; pull-ups for boys; flexed arm hang for girls; a minute run for subjects 11 to 12 years; and 12 minute run for subjects 13 to 18 years. The results of the study show (1) the high correlations were obtained on the test-retest method. The test items were considered objective. (2) The activities can be accepted as true test item for the components of physical fitness which they purport to measure. (3) In most of the test items the
performance of the boys improved from the lower to upper age levels. (4) The boys performed better than the girls in all the test activities. (5) The mean scores revealed that the girls of lower age level tend to possess better physical fitness status than the girls of the upper levels.

Romain (1977) conducted a study to identify the factors when selected motor fitness measures were administered to 213 male and female pupils between 77 and 99 months of age. 17 motor fitness tests were administered. The intercorrelation matrix was subjected to an image analysis. Factor 1 received high substantial loadings on the four variables, six second run -0.953; shuttle run -0.951; toe touch -0.945; and modified beam walking -0.885. Factor 2 received high loadings on five variables, modified side step -0.630; 50-yard dash -0.603; standing broad jump -0.599; one minute lateral jump -0.509; base ball throw -0.448. Factor 3 received high loadings on four variables, weight -0.766; height -0.745; Grip strength -0.764; base ball throw -0.462.

Ted, Baumgartner (1978) undertook research to develop a modified pull-up test that would be valid, reliable, quick and easy to administer with a minimum of inexpensive equipment, and discriminatory among subjects low in strength and endurance. Results of this study indicate that the modified pull-up test is valid. The results reported seem to indicate that the test is reliable for college subjects if not for a wide range of age groups. The test discriminates
ability levels and is economical to administer in terms of time and equipment.

Paris and Charles Gregory (1978) evaluated the student fitness for life program. This study would determine the extended effects of the fitness for life program. 380 subjects were randomly selected. A questionnaire was constructed using the objectives of fitness for life as formal criteria. After the data were collected and analyzed, tables of descriptive statistics, frequency distributions and cross tabulations were made. The questionnaire proved to be reliable and valid and successfully determined positive changes in attitude and lifestyle patterns with their relation to the fitness for life program.

Young (1979) compared the effects of an experimental programme of physical education and the present curriculum of physical education on the physical fitness of 213 boys and girls. Pre and post-tests were administered to each subject in the 1.5 mile run for aerobic endurance, the 440-yard run for anaerobic endurance, the sit-up and push-up tests for strength and sit and reach test for flexibility. The comparison of means within each treatment were statistically analyzed by a correlated t-test and the comparison of means between treatments were statistically analysed by an analysis of variance. The results showed that there were no significant differences between treatments for any of the five tests.
Veera Swamy (1984) conducted a study of youth physical fitness for the boys of Gwalior. AAHPER Youth Fitness Test was used on 212 subjects, randomly selected from different schools of Gwalior. She found that physical fitness was related to the degree of regularity in physical activities and was independent of the economic status of the subjects.

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

A study was undertaken by Johnson (1985) to determine the relationship between power output as measured by the Margaria-Kalamen (Mg.K) power test, in a selected number of power events in track & field and basketball. The test was conducted on male college athletes and basketball players.
Three such problems were also investigated: (1) The determination of objectivity and validity of the Mg. K power test (2) Validity of the Sargent Jump Test and 50-yard dash as measures of power and (3) Validity of the Lewis Normogram as a measure of lower extremity power. The test results indicated no significant relationship between power output as measured by Mg. K. power test and selected power events. Other findings indicated that the sargent jump test, fifty-yard dash and Lewis Normogram were valid power tests.

Goslin and Stephen (1986) conducted physical fitness field testbattery on 98 white coloured and 32 black senior high school pupils. White subjects scored higher on tests of aerobic and anaerobic power, and speed sit-ups. Black subjects were stronger than the other two groups. There was no difference between the subject groups on tests of balance, upper body endurance, agility or flexibility. Male results were higher than female results in all tests except flexibility where the trend was reversed. It was felt that social and economic factors, and the intensity of habitual physical activity played a significant role in the results of this study.

Singh (1986) prepared physical fitness norms for high school boys of Punjab State. Data were collected on five thousand subjects from the various schools in the state. The test administered consisted of eight items i.e. standing broad jump, sit and reach test, Agility run, sit-ups bent
knee, 50 metres dash, push-ups (Chairs), cricket ball throw and 600 metres run-walk. The percentile norms for physical fitness tests were found to be valid and suitable to assess the physical fitness level of the high school boys in the age group of 12 to 15 years.

Singh (1936) 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 performances on different items.

Women Physical Fitness Studies

Busch (1970) made a normative study of the AAHPER Youth Fitness Test in grade seven through ten in the State of South Dakota. He found that the medium scores of South Dakota girls were higher than those of national girls in all items except the flexed arm hang.

Robinson (1970) conducted a test with a view to find out the relationship between physical fitness, scholastic achievement and sports participation with 248 selected secondary school girls. She obtained significant correlations at the .01 level of confidence between achievement and participation in intramurals.
Patrick Ross Cobb (1972) had constructed a motor fitness test battery for girls in lower elementary grades. The items included in this test were Clarke's strength composite, Micloy's endurance ratio, leg extension and flexion, Well's sit and reach, Dodging run, Bass length and stick balance, and vertical jump. The scholar was of the opinion that these tests will measure the essential components of motor fitness such as muscular strength, cardiovascular endurance, flexibility, agility, balance and power.

Frank, Katch and Gwynne Domelson (1976) conducted a study, to evaluate the extent of individual differences (minute-by-minute) in a cycling endurance performance by women, keeping in view the factors of maximal leg force and body composition. In conclusion, for a 6 min. Constant load test performed at an initial rate of 900 kgm, where the objective was to try to maintain the prescribed work rate throughout, the amount of decrement was approximately 14% after 3 minutes and 28% at the end of 6 minutes. (2) With the exception of minutes 4 and 6, there was a significant improvement of 27% at each minute of performance on test two compared to test one. (3) There were substantial individual differences in endurance performance, as reliability of minute by minute and cumulative endurance scores was high (r = .90 min one). (4) The factor of MLF, as measured during
a cycling test, correlated highest with performance during
minutes 2 and 3 \((r = .74)\). For the other minutes, the
correlations averaged at \(.54\). (5) Using the cumulative
endurance of shorter duration on the other test average
prediction after 2 minutes was \(r = .76\); \(r = .87\) after 3
minutes and \(r = .90\) after 4 minutes.

Mason (1979) investigated the relationship between
the self-concept and physical fitness performance of white,
American, Indian and black women college students. 60
subjects were given the tests. Lindsay physical fitness
test battery was used. Correlations were determined on the
basis of nine self-concept factors and fitness performances
separately for each of the three groups. The study reveals
that (1) There was no significant relationship between the
students. (2) There were no significant relationships between
the self-concept and fitness performances of the black
women and the American Indian women college students.
(3) The black women were significantly better in endurance
than the white and the Indian women college students.
(4) College women felt good about themselves and were above
average in physical fitness.

Margret (1981) selected parameters of college female
lacrosse athletes before and after a competitive season. In
addition the investigation endeavoured to compare the responses
of these subjects with data reported for female athletes in
related research. The study was conducted on 17 members of
a women's intercollegiate lacrosse team with mean age 20.6 and trained for fifteen weeks. Tests were conducted before and after this conditioning period and a multivariate analysis of variance with two factors (treatment by subjects) was employed in order to detect significant changes. The value (P < .05) was used for all tests of statistical significance. Results of the analysis indicated that over the conditioning period there was a significant improvement in means for % body. There was a significant improvement in push ups but no noticeable change in other tests assumed to measure muscular endurance or flexibility.

Young (1935) undertook a study on 193 female students of grade 7-10. He used: (1) a background information form (2) a physical education questionnaire (3) the Tennesse self-concept scale and (4) two items of physical performance: sit-ups and 600-yard run. Results indicated a significant, positive relationship between both items of physical performance and overall self-esteem for grade 10 female and 600-yard run for grade 7 females. No significant relationship between these items was found for those in grade nine. As expected, estimation of physical fitness were significantly related for females in all three grades with correlation for estimation of fitness and the stamina item higher in each instance.

Some female studies have been discussed under physical fitness studies related to age.

Physical fitness studies related to age

Elmer William Yoest (1973) conducted a study on the relationship between cardiovascular fitness and related
body measurements of 51 grade eight boys and 43 college male subjects who were selected from physical education classes. The measurements determining each group were age, weight; height; skinfold at the triceps, mid-axillary and nipple area; body density; present body fat; lean body mass and body surface area. A cardiovascular step test was administered to both groups to determine cardiovascular fitness. The Ohio State University test was administered to the college men and a modified version of the same test was used for the younger subjects. Pearson's Product Moment Correlations were used to determine the relationship between the body measurement performance on the step test. The factors of age, height, lean body mass and body surface area did not significantly limit the college men's step test performance, but it did affect the 13 to 15 years old boys. The study suggests that the subjects, adolescents or adults who possessed high percentage of lean body tissues registered higher score on the step test.

An attempt was made by Bissonette (1974) to identify the nature of physical fitness possessed by elementary school boys through factor analysis. Twenty four physical fitness evaluation items were administered to 112 boys, seven and eight years of age. The data collected were correlated to maximize 3 loadings on each factor. Five similar physical fitness factors were identified for all ages. They were named body fat, body dimensions, static strength, hip flexibility
Recovery pulse, and muscular endurance.

Remi (1974) put forward factor analysis of physical fitness in 11 and 12 years old elementary school boys enrolled in the Springfield School System, Ohio, 1973. Twenty four physical fitness evaluation items were selected based on their relationship to one or more physical fitness components. The test items were: cardio-respiratory, efficiency, strength, muscular endurance, flexibility, and body fat. The findings clearly indicated a well defined factor structure of physical fitness for elementary school boys. The factor structure was almost similar for both the age groups and was also similar to adult physical fitness components. Tests were more specific at ages seven and eight years as they were loaded on only one factor. This confirmed the belief that physical fitness tests were not necessarily specific to one factor.

Hunt (1975) studied the relationship between height, weight and age and the ability of Junior High School students to perform Manitoba's physical and motor fitness performance test. He concluded that (i) chronological age, standing height and weight are of little value when classified in the compulsory items of the Manitoba's Physical and Motor performance test. (ii) Until better predictions are available, chronological age, standing height and weight are useful to present a picture of the students' future goal, and possibilities in the performance of the compulsory items of the Manitoba's physical and motor fitness test.
Mall et al. (1976) investigated and analysed physical fitness of high school students and found out the relationship (if any) of their physical fitness to socio-psychological variable. The result was that physical characteristics of height and weight of three selected groups (13, 14 and 15) with high academic achievement did not show any significant difference.

Willee (1976) attended the Clarke symposium in June, 1976 and presented a paper entitled "Fitness Australia?" This paper showed the results of a fitness survey of Australian boys and girls, 13 to 17 years of age in Government (Public) Schools by the use of AAHPER Youth Fitness Test. This survey was compared with a similar study in the United States by Hunsticler and Reiff in 1953 and 1965. According to the U.S. data of 1958 the Australian girls were superior in circulatory endurance, leg power speed, agility, and abdominal endurance, but weak in the arm and the shoulder girdle. U.S. data of 1965 revealed that the Australian girls were markedly inferior in the arms and the shoulder strength, static muscular endurance, leg power, abdominal endurance, and agility. One area in which Australian girls showed superiority was circulatory endurance (600 yards run walk). U.S. data of 1953 showed that Australian boys were almost equal in pull-ups and sit-ups and superior in all other tests except for the softball throw for distance.
According to the U.S. data of 1967, the American boys were superior in all respects, they were stronger and more powerful in arms and shoulder girdle, had a better development of the abdominal region, jumped further, ran faster, were more agile, and had better circulatory endurance.

Judy (1982) presented an account of clinical judgements made during the performance of the basic motor ability test by seven-year old children. The sex difference examined led to the view that boys were slower in movements when performing tasks requiring fine-hand-eye co-ordination, while girls were slower in gross skills requiring strength and maturity of movement pattern.

Arlene (1982) examined the relationship of age and sex to the performance of 3, 4, 5 and 6 year olds children on seven motor performance test items. Although significant age and sex differences were found in most of the motor tests, overall change with age was fairly linear for balancing and a general tapering in improvement in the 5 to 6 year old category. In the tests of throwing and balancing gender was as important as age, or more so, in its relationship to performance. Boys were superior to girls at all age levels in the throwing tests, girls were superior to boys at age 6 in the balance test. Gender differences of a lesser magnitude were found in the speed run and standing long jump tests with the performance of boys generally being superior to that of girls. Thus, it appears that gender differences in motor performance occur as early as the preschool
years. Interestingly, except for the balance test, in all the tests the 3 and 4 year old boys performed similarly. For the girls there were significant differences from year to year in performance. The data indicated at least three distinct skill groups for girls from age 3 to 6.

A survey was conducted by Summers (1934) to assess the motor performance of three and four year old children. A test-retest evaluation was conducted with a sample population of 30 subjects to determine the validity and reliability of the instruments. The data collected by the survey was then tested by use of correlations on t-test. The findings revealed that majority of the 24 test items selected for the instrument were valid and reliable measures for three and four years old children.

Harris (1985) investigated the effects of two types of goal-setting conferences on self-efficacy and physical fitness of seventh and eighth grade boys and girls. Of the 175 subjects who participated, 58 were assigned to a proximal sub-goal groups, 60 to a distal goal group and 57 to a control group. Data were generated from subjects' responses to a physical fitness self-efficacy scale and from performance on a four-item physical fitness test. Both instruments were administered under pre and post test conditions. ANCOVA statistical technique was used to analyse the data. The primary findings were, (a) subjects in the two goal setting groups sufficiently increased their physical fitness efficiency whereas subjects in the control group did not, (b) subjects
in the proximal sub-goal group had significantly higher level of physical fitness self-efficacy than in the other groups. (c) the mean scores of the three groups improved in post-test conditions. ANOVA statistical technique was used to analyse the data. The primary findings were, (a) subjects in the two goal-setting groups sufficiently increased their physical fitness efficiency whereas subjects in the control group did not, (b) subjects in the proximal sub-goal group had significantly higher level of physical fitness self-efficacy as compared to the other groups, (c) the three groups improved their mean post-test fitness level upon their pre-test level.

Gail (1985) undertook a study on 73 female swimmers aged 24 to 71 years. Each subject was assessed on measure of body size, grip strength, peak isokinetic torque of shoulder, knee flexion and extension, and endurance of shoulder and knee movements. Although swimming training appears to have resulted in higher strength values for these swimmers than for less active women, an age related decline in muscular strength values was nevertheless apparent. The results fail to reveal a similar age related trend for muscular endurance, suggesting that swim training influences muscular endurance more than muscular strength among adult women.

Yound (1970) tested 56 middle class and 56 lower class, 5 and 6 years old children for height, weight, and performance in six motor skills. The results indicated no significant
difference between classes or sexes in body, weight, shuttle run, balance beam and broad jump. However, middle class students were significantly taller than the lower class. Also, middle class boys scored better on the distance throw than the girls of either class. Lastly middle class girls and lower class boys were faster than middle class boys in running.

Some general studies

Hopper (1971) tried to determine that Negro and Caucasian disadvantaged children could be differentiated on the bases of strength and physical fitness scores. The Clarke-schopt strength test and the Fleishman Basic fitness tests were administered on eighty four Negro and Caucasian disadvantaged, sixth grade children of elementary schools in the four North part, Alabama. The results showed that Negro, disadvantaged children were superior in cardiovascular endurance, dynamic strength, static strength and dynamic flexibility, whereas Caucasian, disadvantaged children were superior in explosive strength.

A study was undertaken by Dowell and Landiss (1971) to determine the physical fitness trends of entering college freshmen. Entering male fresh students were tested on the Texas A & M Physical Fitness Test. The test included pull-ups, sit-ups and 300-yard shuttle-run. A total of 5,496 subjects were used in this 20 year study. ANOVA between year's was computed for each physical fitness item. It was concluded that muscular endurance as measured by sit-ups
had improved over the past 20 years. Arm strength increased from 1948 till about 1963, and since then it decreased. No definite trend was seen concerning the running speed and agility.

A study was undertaken by Robertson (1974) to compare the physical proficiency of the 1972 five year old and seven year old boys and girls, with the raw scores of the 1954, seven year old boys and girls as set-up by the Peacock Achievement Scale in Physical Education Activities. The data showed that the 1972 seven-year-olds excelled the other two groups. 1954 seven-year-olds differed significantly at or beyond the .05 level of confidence from the 1972 five-year-olds on all but one test item - the side step test.

Brar (1975) conducted a study to compare the physical fitness of two different socio-economic groups. The AAHPER Youth Fitness Test was administered to the subjects - thirty in each group, taken from Central School, Gwalior and Railway Colony School, Gwalior. The data was compared by converting the raw score into standard score using 't' scores. It was concluded that the socio-economic difference did not have any effect on physical fitness of an individual. The subjects belonging to the lower socio-economic group were as good as subjects belonging to the higher socio-economic group.

Bittner, Linda Laraine (1977) structured a study to examine the relationship between selected measures of physical fitness, self-concept, and student teaching performance
to facilitate the administration of professional preparation programs in physical education. The subjects included 23 males and 34 females. Little correlation was found between the self-concept measures and the actual physical fitness levels of the subjects, suggesting that there are other factors which influence the perception of self in the physical realm.

Derenne (1977) conducted the study to assess in areas of the N.P. Neilson score card. The status of the physical education program for boys in selected private high schools, in the state of Hawaii during the 1974-75 school year. This assessment was necessary to provide the schools with data about their existing program conditions and practices. Descriptive percentages were computed to determine the strength and weaknesses of the physical education program of the schools under investigation. A rating scale was devised by the investigator to evaluate the program's strengths and weaknesses in each school. After evaluating the collected data, the investigator made recommendations to the selected private high schools and to the Hawaii Association of independent schools.

Borg (1977) compared the strength and endurance capacity between American and Swedish male athletes. Intermittent work capacity was assessed by the cycling strength and endurance test on a specially constructed bicycle ergometer.
The CSET proved highly reliable for the American sample. The validity of CSET measurements as predictors of continuous physical working capacity, seems quite adequate. The maximal strength components of the CSET correlated to a fairly high degree with the maximal work rate on the bicycle ergometer test.

M. Robson, A. Uppal (1978) undertook a comparative study on 150 boys and girls belonging to both defence and non-defence personnel in the correct perspective. The test battery composed of six items (Viz.: 50 dash, 4x10 mts shuttle run, sit-ups, modified push-ups, vertical jump, 600 m. run and walk) was administered to both boys and girls. In conclusion they found that Elementary school girls and boys studying in grades one to five, and belonging to defence personnel performed significantly better in physical fitness as compared to girls and boys belonging to non-defence personnel.

An investigation was made by Johnson (1978) to determine the relationship between motor creativity and motor performance of young children. The Wyriex test of motor creativity and a motor performance test battery consisting of the standing broad jump, 40-yard dash, tennis ball throw for distance, side-stepping, and a bass stick test were administered on 48 boys and girls whose age ranged from 3 years 6 months to 6 years 10 months. The results of the
investigation indicated that there was a significant positive relationship between motor creativity and motor performance.

Watson (1978) undertook a study to measure physique and physical performance of 31 students beginning a specialist course of physical education. The subjects were compared with a reference group of final year school boys of the same age. Hand grip and back strengths were measured. Standing long-jump, agility run, sitting basketball throw, alternate hand wall toss, were administered. Physical work capacity 170 was determined from the steady state heart rate, at three submaximal work loads, on a bicycle ergometer. Height and weight were measured and somato-type determined photoscopically. The students scored highly on all tests with the single exception of hand grip strength. Height was constant but heavier students had higher ratings for mesomorphy and lower ratings for ectomorphy. The differences in strength and PWC 170 remained after allowance for the difference in body weight, but the differences in strength can be accounted for in terms of difference in body size and shape physique appears to influence performance in 5 out of 7 tests conducted.

Ghose (1979) undertook a study to compare the relationship of an academic achievement with physical fitness, motor ability and general ability of high school athletes and non-athletes. One hundred subjects were involved in the study: 50 male and 50 female athletes. AAHPER Youth Fitness, Barrow Motor ability tests were administered to measure
fitness and general motor ability. The results of the study revealed that the academic achievement does not have significant relationship with physical fitness, motor ability and general motor ability in the case of subjects studying in classes ninth, tenth and eleventh of the Kendriya Vidyalaya, Gwalior. The scope of academic achievement and physical fitness, motor ability and general motor ability were separately compared for athletes and non-athletes. In none of the cases the value of coefficient of correlation was found significant. All the values of coefficient of correlation for athletes and non-athletes were positive except in the case of correlation of academic achievement and physical fitness of athlete where negative value of "r" was obtained.

Malik (1980) compared the physical fitness of students of different socio-economic groups from selected schools of Delhi. He concluded that:

1. The male school students belonging to upper-middle and lower-middle status did not differ significantly in physical fitness as revealed by the AAHPER Youth Fitness Test.

2. The male school students belonging to upper-middle status were found to possess better abdominal strength and endurance as compared to school students belonging to lower middle status.

Saha (1980) conducted a study on selected Anthropometric measurements and physical fitness variables of tribal and
non-tribal students of Tripura. AAHPER fitness test was used. The study did not show any significant difference between physical fitness of tribal and non-tribal school students.

Chandrashekar (1931) compared the physical fitness components of football and basketball players. He used Fleishman's test battery for physical fitness. Results showed that the basketball players were superior to football players in flexibility and dynamic flexibility. The football players were significantly better in leg explosive strength, abdominal strength and Gross body Coordination.

Crowley (1931) examined the five dimensions of human fitness: physical, intellectual, social, emotional and spiritual, in relation to two teaching styles in physical education program. Cooperative games, initiative tests, and group activities were incorporated under an all-inclusive concept contributed to the development of the human fitness dimensions. (2) A physical activity program taught in traditional, direct and teacher demonstrated methods indicated positive but limited improvement for each of the dimensions. (3) The teaching style employed for the two treatments should be considered a major factor in the development of the physical, intellectual, social, emotional, and spiritual dimensions. (4) Physical fitness levels improved a comparable amount for the traditional and the cooperative, games group. (5) It was indicated that since the cooperative games group
was constantly working together, the subjects' attitude about themselves and others changed. This implies that this approach particularly affected the social, emotional, and spiritual dimensions.

Shirda (1981) compared the physical fitness level of Iraqi children with AAHPER Youth Fitness Test norms. Data was collected 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 Basrah in an absolute sense exceeded the American norms by 15 items. At an early age (10-12) performances of both boys and girls of both the countries were similar.

Pizarro (1982) investigated the use of the Health Related Physical Fitness tests and the modified pull-up with mainstreamed EMR/IMR children to normal children was a secondary aspect of the study. Modified sit-ups, sit and reach, skinfold fat measurement and modified pull-ups were found to be reliable and suitable for use with mainstreamed EMR/IMR children. The 880 yard run was inappropriate for IMR's and acceptable for EMR's provided they were adequately prepared beforehand. Comparison between sexes indicated that fitness trends in retarded populations are similar to normal populations. Males demonstrated much more strength, and better cardiorespiratory endurance than females. Females were significantly more flexible than males and tended to have greater amounts of body fat.
Barbanti (1983) conducted a study on 2,342 boys and girls enrolled in a public school system in Brazil, during 1982 school year. A trained team collected two Anthropometric measurements, administered the Health related physical fitness test battery and two tests of athletic ability. It was revealed that: (1) For selected Brazilian school populations, age 6 to 14 years, height and weight of both sexes increased at approximately same rate. (2) Brazilian girls had higher values than boys for triceps, sub-scapular skinfold measurements and in sit-and-reach test. (3) Brazilian boys performed better than Brazilian girls in modified sit-up-test, nine-minute run test, 50 meter dash test, and standing long jump test. (4) The comparison between norms for Brazilian and American boys and girls showed that American boys and girls, in general, were taller and heavier, and had higher scores in sit-and-reach test, modified sit-up test, 50 meter dash test, and standing long-jump test.

Vernon (1985) conducted a study to compare untrained men with trained women body builders in terms of absolute and relative upper and lower body strength. Relative strength was expressed per unit of height, weight, iliac crest and iliac width. Analysis of the data by a one way ANOVA indicated that upper body strength in untrained men is significantly stronger than in trained women in absolute terms. A difference was found in lower body strength between the contrasted groups. When body characteristics were controlled by using an ANOVA there were no significant differences in upper and lower body
strength between the groups, although a trend appeared in which the men were stronger on the upper body and the women were stronger on the leg flexors with little difference on the leg extensors.

Vivian (1986) examined gender differences in upper and lower body strength as a function of lean body weight and the distribution of muscle and subcutaneous fat in the upper and lower limbs. 103 physically active men (N=48) and women (N=55) were the subjects. The peak torques produced during shoulder flexion (SF) and knee extension (KE) were used as measures of upper body and lower body strength, respectively. Flexed arm girth, thigh girth, triceps skinfold, and thigh skinfold were used to estimate the distribution of muscle and subcutaneous fat in the limbs. Results of MACOVA indicated that the SF and KE strength of women and men did not differ significantly when differences in lean body weight, arm girth, thigh girth, triceps skinfold and thigh skinfold were statistically controlled. High levels of SF and KE strength were associated with a high lean body weight and a large arm girth. Results of the multiple regression analysis indicated that for men a substantial portion of the variance in both SF and KE strength was explained by lean body weight; whereas strength variations in women were adequately explained by including limb variables along with lean body weight, within the limitations of this study. It was concluded that gender differences in upper and lower body strength in lean body weight and the distribution of muscle and subcutaneous fat.
in the body segments. Upper body strength is relatively more important than lower body strength in characterizing the gender difference in strength.

Hardy, Jones (1936) described the two experiments to find out whether the results obtained in studies of static flexibility could be transferred to dynamic flexibility. In experiment 1, 24 female subjects were randomly assigned to one of the three treatment groups or a control group. The three treatment groups received seven daily training sessions either using proprioceptive neuromuscular facilitation (PNF), or one of the two ballistic stretching techniques, the first emphasizing speed and the second range. All subjects were presented for dynamic range of hip flexion on day one and they protested on day seven. A single factor ANOVA revealed a significant difference in improvements between the experimental groups ($F_{3.20} = 5.825$, $P = 0.005$). Subsequent follow up tests indicated that this happened because the PNF and ballistic group emphasizing range had improved much more than the control group. No other differences were significant.

The design of experiment 2 was similar to that of experiment 1, but used only two different training regimes: PNF and the ballistic technique which emphasized range. Here the criterion task was a measure of the dynamic range of shoulder extension. A single factor ANOVA again indicated
significant differences between the experimental groups $(F(2,15) = 41.74, p = 0.001)$, which, as revealed by the follow up tests were due to both treatment groups improving significantly more than the control group. The results suggest that, in short term improvements of dynamic range of motion, approximately chosen ballistic stretching techniques can be just as effective as PNF-based techniques. These findings contrast markedly with previous results obtained in studies of static range of motion.

The review shows that physical fitness components have been identified and tests developed to assess physical fitness. However, the Indian researchers have used the physical fitness test batteries in absence of the norms of the physical fitness batteries. This is a major drawback in research.

Some attempts have been made to construct norms of Indian populations e.g. by Reetmoninder Singh (1986) and Ajmer Singh (1986). These researchers have not used the tests being used by the investigator and have also not covered the girls of the age group 12 to 15 years. The attempt was to cover the girls population of Punjab for which no notable physical fitness study has been made.

There have also been some studies with cross-sectional design which have highlighted the relationship of physical fitness components with age. However, the results of these studies appear to be dissimilar and contradictory. The girls have been left out in the studies, where age has been cross-
sectionally studied with regard to physical fitness.

In this study attention has been focussed on the selected physical fitness variables in a more composite way. Apart from the development of norms of physical fitness which include the components of strength, cardiovascular endurance, speed, agility, flexibility, coordination, balance effort has been made to investigate the relationship of age from 12 to 15 years with these components. In addition the interaction effects residence, urban and rural along with the interaction effects of age have been studied.