Chapter 2

Review of the Related Literature

The study of related literature was a crucial step of the planning. Time spent in such a survey invariably was considered as an investment. Review of literature was an enacting task calling for the deep insight and clear perspective of the overall field. It was important step which minimizes the risk of dead ends, rejected topics, wasted efforts, trial and error actively oriented toward approaches already discarded by previous investigator and even more important erroneous findings based on faulty research design. The review of literature promoted a greater understanding of the problem and its crucial aspects and ensured the avoidance of unnecessary duplications. Review of literature in the concerned field helped researcher to locate the research problem as well as to guide and support the research work in hand.

A review of the related literature has brought forward certain aspects related to the research topic. For collecting reviews, researcher had great help of library of Chandrashekhar Agashe College of Physical Education, Pune and Physical Education Department of University of Pune, Pune. Also LNIPE, Gwalior library was helpful. Reviews taken were from books and scientific journals. Attempt has been made to report few studies related to the problem. These were as follows.
2.1 Reviews Related to the Physical Fitness

Many researcher in this physical education field studied physical fitness as an important factor with the help of longitudinal analysis. There were number of studies related to different factors of physical fitness such as strength, flexibility, body composition and endurance. The longitudinal analysis includes the period from three years to eight years. In most of the study, there was a particular training program and its effect was examined on selected fitness factors. Also ANOVA was used to assess the significant difference. Data collection tool was fitness test and the test was taken periodically. In some study, frequency of test was twice to thrice in a year. Some of the reviews were stated as follows.

Geithner, C.A. and Malina, R.M. (Geithner, 1995) studied somatic growth, maturation and sub maximal power output of Polish adolescents differing in activity status. Sample of one hundred and five Polish adolescents were followed from approximately 11 to 19 years of age. Body dimensions were measured quarterly for each individual from ages 11 to 14. Sub maximal power was assessed using Cycle Argo Meter twice in a year. Adolescents participating in sports more than three years were considered active and those students who participated less than three years were considered not active. ANOVA was applied. Mean of both groups were increased but as per statistics it was not significant. Significant difference was recorded in the heights of children from active group. Also no significant growth was seen in body growth.

They evaluated effects that the implementation of a mandatory physical fitness testing program had on selected measures of physical fitness in hundred sheriff deputies from 1990 to 1992. All subjects completed six physical fitness assessments including one and half mile run or one mile walk, three-site skin folds, sit and reach, one minute sit-ups, one repetition max for bench press and leg press during the study years. ANOVA was used to analyze the data. Results indicated that the all subjects significantly improved VO$_2$ Max, number of sit-ups, sit and reach, and leg press for year one vs. two and years one vs. three. The results of this study show that the implementation of a mandatory physical fitness testing program for law enforcement officers can produce significant improvement in physical fitness variables over time.

Grestov, G. (Grestov, 1990) studied the anthropometric and physical fitness parameters for high jumpers of different age groups. This study was conducted on the leading high jumpers throughout the world. Result of this study showed that only tall sportspersons with less weight are capable of achieving high results. These abilities should be kept in mind while searching the talent.

Trudeau, F; Laurencelle, L.; Tremblay, J.; Rajic, Mi. And Shephard, R. J. (Trudeau, Laurencelle, Tremblay, & Rajic, 1999) studied daily primary school physical education: effects on physical activity during adult life. The purpose of this investigation was to study the influence of a daily primary school physical education program on physical activity (PA) level, attitudes toward physical activity, and perceptions of barriers to physical activity during adulthood. They compared two groups: 1) an experimental group of men and women ($N = 147$)
who had received five physical education sessions per week throughout their 6 yr of primary school education in the early 1970s; and 2) a control group, drawn from the data bank of the Québec Health Survey, and matched for age, gender, and socioeconomic profile \((N = 720)\). Experimental and control subjects filled out an identical questionnaire about their current physical activity level, their attitudes toward physical activity, and their perceptions of barriers to physical activity. The control group was stratified to obtain the same socio demographic profile as the experimental group. The principal results were: 1) a frequency distribution that showed a higher rate of physical activity in experimental women than in control women; 2) similar intentions to exercise and attitudes toward exercise in the experimental and control groups, with no differences in opportunities for exercising or in the support received from their family and friends; and 3) a lower prevalence of regular smokers in experimental men than in control men. There were also some differences in the types and frequency of physical activities selected between experimental and control subjects. The results strongly suggest that daily physical education at the primary school level has had a significant long-term positive effect on the exercise habits on women, despite similar perceived barriers, attitudes, and intention to exercise in the two groups. The program has also had a significant health effect in men, substantially reducing the risk of becoming a regular smoker. Because the program was not specifically designed to promote health, we hypothesize that a health-oriented physical education program could have an even stronger effect.
Renfrow, N.E. (Renfrow, 1982) undertook a study of the effects of a twelve minute aerobic training program on second and fourth grade students. Sample was 2332 students from second and fourth grade of E.L.E school. Pre test of height, weight, fifty yard dash, vertical jump, shuttle run, nine minute run was taken. Two groups were formed, Group of second grade and other of fourth grade. Group of second grade was experimental, got daily twelve minutes of aerobic training program for 21 weeks. Post test was taken. Group of fourth grade was control group, evaluated by a standardized academic achievement test. After analyzing the data, experimental group’s speed, vertical jump and flexibility got developed. No development was seen in cardio vascular endurance.

Das, S. S. and Banerjee, A.K. (Das, 1992) studied the effect of variation duration of training period on the performance variables on young soccer players. To find the answer to the question – what should be the exact and accurate duration of training which affects performance variables, this study was done. Sample was twenty nine school soccer players of ten to twelve years age group. Pre test for speed, strength, endurance, agility, flexibility and soccer skills were taken. Subjects were given eight week training. During training, after 4th week, 6th week and 8th weeks training above tests were taken. There was development in agility, endurance, shooting, juggling and kicking abilities. But significant difference was seen only after 6th week training. All other abilities were developed after 8th week training. For significant difference, training should be minimum of six weeks.
Das, S. S. and Banerjee, A.K. (Das, 1999) undertook a study of influence of maintenance program following eight weeks strength and endurance training on young soccer players. Sample was thirty young soccer players. They were divided into two groups A and B by convenient method. Both groups got program of weight and endurance training. After eight weeks group A undergone a special maintenance program. Group B was control group. Physical fitness and soccer skills test were taken. There was significant difference recorded in physical fitness of group A. Skills of both groups got significant difference. But development of group A was more significant than group B. Physical fitness and skills of Group A was more significant than group B.

Sodhi, H.S. and Saini, K. (Sodhi, 1984) conducted a study of physical growth and performance of Punjabi males aged 13 to 16 years. The purpose of the study was to understand the role of maturity and physical growth in performance. A cross sectional data of 234 males of Punjab age 13 to 16 years have been collected. The anthropometric measurements, the test of performance and jumping ability with maturity status were recorded for each individual. The body mass and height showed a general increase from 13 to 16 years of age. The different anthropometric measurements also showed a general increase. Thus it was concluded that the maturity status of the children plays a dominant role in determining their performance and physical growth. The early matures have been found to perform better than the late matures.
Roy, J. (Roy, 1992) performed a study which investigates the reaction ability in children of different age groups selected under National Sports Training Centre scheme of Sports Authority of India. It studies the developmental pattern of simple and choice reaction times among boys and girls of the age group nine to fourteen years. A total of 327 children were tested for visual reaction time – both simple and choice. The results of the study revealed significant difference in reaction ability among different age groups of boys and girls. The boys were found to be less variable than girls. It was also noted that simple reaction time showed development during earlier stages, while choice reaction time progressed towards later stages of development of children.

2.2 Reviews Related to Intelligence and Sports

There were many studies in the field of physical education and sports which included intelligence as one of the important contributory factor. Intelligence was independent variable. In some cases, intelligence was measured as academic achievement. Researcher examined the relation between intelligence and sports. Some of these were stated below.

O’Callaghan, F., O’Callaghan, M., Williams, G., Bor, W. and Najman, J. (O'Callaghan, 2012) study Physical Activity and Intelligence: A Causal Exploration. Studies involving animals and older adults suggest that physical activity (PA) might lead to improved cognitive ability in general and enhanced Intelligent Quotient (IQ) in particular. However there are few studies involving young persons and none controlling for the possibility that those with better cognitive skill are more likely to engage in PA. Method use was as follows. Data
are from the Master-University of Queensland Study of Pregnancy. Researchers measured IQ at the 14 year follow-up and IQ and PA at 21 year. IQ test was conducted by Raven’s SPM. This test measures of ‘core’ intelligence. Conclusion was while there was an association between some indicators of PA and IQ, there was no consistent evidence that higher PA levels might lead to increased IQ score.

Singh and Saini (Saini, 20-23, March, 1993) conducted a study in which he measured various psychological characteristics including intelligence of hockey players playing at different levels of participation viz. school, district and state levels. The study was designed to know as to how the intelligence levels differed among male and female school hockey players playing at three levels. With this aim in view, two hundred and forty male and female school hockey players were selected out of which eighty were of school level, eighty inter zone and eighty inter district level players. They were administered Raven’s Progressive Matrices Test for intelligence. The result of study revealed that there were significant difference on intelligence between inter district and inter zone level players.

Binet and Simon (Simon, 1905) have studied the academic differences between athletes and non-athletes, they find that athletes are physically and mentally superior to non-athletes. There are genetic variations in physical and mental ability, but they prefer to take a social behavioural approach in tracing the linkages between sports participation and academic achievement.
Terman, L. (Terman, 1926) has studied geniuses intensively from childhood to adulthood during a good portion of this century. His gifted subjects, as reported in Volume one of the Genetic Studies of Genius, were children with I.Q. of 140+. These children, when compared to normal children, displayed a greater interest in games that required intellectual ability (thinking) and less for competitive activities. There was little variation between the groups in the amount of experience in the play and games studied. The gifted group did prefer activities popular with older children and played alone more than was the case with normal children.

Lorenz (Lorenz, 1958) conducted a study on a comparison of the academic grades and intelligence scores of participants and non-participants in intramural athletics at the University of Kentucky. The average academic rank and intelligence test scores of 322 students were used in their study. The results of the study suggest

- The freshman participation in intramural athletics does not have a marked effect upon the students' academic grade.
- That participant in intramural athletics, as a whole, has a higher mean intelligence sigma ranking than those who do not participate.
- The sophomore participant show a slightly higher mean academic grade and that junior and senior intramural participants demonstrate a definitely higher mean academic grade than do non-participants of the same class.

Krant and Tabin (Tabin, 1954) warns the limitations of motor measurement tools and methodologies in investigations that have attempted to compare
motor and intellectual functioning. Considering experimental drawbacks, it appears from the research that intelligence is only slightly, if at all, related to proficiency in physical activities, at least within the scope of the 'normal' range of elementary, junior high school, high school, and college students.

Sanford (Sanford, 1965) investigated the effect of mental practice on skill performance after exposing subjects to real performance of a novel motor skill. Thirty five school boys practiced a wand juggling task for one week prior to being divided into control, mental practice, and physical groups; subjects then practiced in treatment groups for three weeks. Results indicated mental practice to be effective in facilitating juggling performance in subjects having experienced controlled actual practice.

Cratley (Cratley B., 1972) carried out an investigative research using a world class high jumper as a subject, in which it was the intent to clock duration of the time the athlete engaged in some kind of pre-jump thought. Collected prior to numerous jumps, these times were then compared with the actual efforts achieved. It was found that there seemed to be an optimum amount of time spent in this kind of reflective activity which, if not reached or exceeded, resulted in less than optimum effort. In another study, a number of triple jumpers were encouraged for several months to spend numerous periods a week thinking through the mechanics of the relatively complicated event in which they participated. They were asked to think through and verbalize about the actual leg and arm movement in the correct order when carrying out the jump. A control group with similar abilities was not exposed to this mental
practice. It was noted that the jumping efforts of the mental practice group was superior to that of the controls.

Cratley also found that most superior athletes in Olympic competitions in Eastern Europe possessed at least average intelligence and often their IQ scores were well above average. But a clear division existed between the intelligence quotient of sportsmen practicing activities to which they had been exposed in college and the intelligence test scores of men practicing sports usually not associated with a college. It has been found that athletes in the team sports, such as basketball, ice hockey will score higher on standardized measures of I.Q. than others participating in activities requiring more force and power than team strategy (i.e. shot putting, boxing). Case studies of athletes in various European countries indicate that those with more academic backgrounds and with higher scores on I.Q. tests, are better equipped to engage in self-assessment of the psychological and physiological data collected about themselves than are their less well educated team mates. After competitions, understanding the reasons for success or failure seems more difficult for those athletes who have lower I.Q. scores.

Hackensmith and Miller (Hackensmith C, 1935) showed more positive conclusions as related to the athletic beings more intelligent than non-participants.

Digiovanna (Digiovanna, 1937) conducted a study of the intelligence and athletic ability of college men. Two hundred and ninety five men between the age of eighteen and twenty. One of the required physical education classes of
the southern Illinois. State Teachers College acted as subjects for the study. Intelligence quotients were determined through the medium of Otis self-administering tests of mental ability, higher examination (Form B). The subjects were divided into classes for fairness in athletic competition by means of Me Cloy method of classification athletic achievement scores were secured by obtaining individual records in eight events namely: standing broad jump, running broad jump, 100 yard dash, 400 yard dash, 12 pound shot-put, javelin throw, baseball throw for distance push ups; and by transporting them to single percentage score. He concluded that:

(i) There was no definite correlation between intelligence and athletic ability in college men.

(ii) There was small but definite correlation (0.31) between motor ability and athletic achievement which substantiated the findings of other. Thompson (Thompson, 1939) compared the intelligence of school athletes with non-athletes of Washington high schools. He found athletes as a group were more intelligent.

Johnson (Johnson, 1942) studied the relationship that existed between physical skill as measured and the general intelligence of college students. The test results of the study indicated that:

- There was no significant relation between physical skill as measured and mental power or general intelligence as measured.
- There was no significant relationship between physical skill and academic grades.
- There was a hint of relationship between skill and grades in physical education activity.
- There was just a meagre relationship between intelligence as measured and academic grades.

Biddulph (1954) tested the athletic skills of 461 high school boys. It was concluded that the high athletic group did significantly better in grade point average, although there was no significant difference in Intelligence Quotient.

Burley and Anderson (Anderson, 1955) conducted a study to find the relation of jump and reach - measures of power to intelligence and athletic performance. The study aimed to find the relation of jump and reach test scores and intelligence test scores of one thousand and thirteen school boys, the relation between the jump and reach test scores of athletics and non-athletics, and the relation between jump and reach test scores of seven sport groups. The correlation between jump and reach test scores and intelligence test scores was 0.37 which was too low to be predictive. Athletes were found to be more superior to non-athletes in jump and reach test performance. The jump and reach test scores of seven athlete groups indicated that power was more closely related to performance in some sports than in others.

Weschler (1958) has explained the role for physical activity within individual and groups, within the normal intelligence range, within gifted children, and within feeble-minded children. It has been found that more intelligent students seem to have greater activity interests than individuals with lower intelligence.
Bond (Bond, 1959) analyzed the inter-relationships among rhythmic perception, intelligence, and various measures of motor performance and obtained correlations ranging from 0.24 to 0.36 between intelligence and rhythmic perception and essentially zero correlations between intelligence and various measures of motor performance.

Start (Start, 1960) studied relationship between intelligence and effect of mental practice on the performance of motor skill. He selected thirty five subjects as his sample. He concluded that in motor test, there was a significant improvement in the mean average of final score than on the mean average of initial score of the group after mental practice (t = 2.61 significant at .05 percent level). The improvement was not significantly related to initial score in the test or to the intelligence of the individual performing the test. It was felt that the level of difficulty for the sample of the skill used in the test was too high to give a wide spread of performance and thereby discrimination.

Start (Start, 1962) conducted a study in stratified sample of one hundred and eighty boys in a large English Grammar School. He found no statistically significant relation between games performance and either intelligence or streaming. Each boy was in one of the five 'streams' based on his academic achievement within the school. There were a number of boys from each stream on the school athletic intelligence scores between the team players and other students.
Ruffer (Ruffer, 1965) compared highly active with physically inactive boys and noted a statistically significant difference in intelligence and academic average in favour of the active groups.

Smith (Smith, 1965) conducted a study on academic achievement and athletic participation. The subjects for the study were Kent University freshmen and university Football Team and matched non-athletes. Football players and non-athletes were matched individually on the basis of A.G.T. composite score, major fields and matriculation rates. Grade point averages and scores on the Brown Haltgman survey of study habits and attitudes were tested for significance at the 0.05 level through the application of a two tailed 't' test. Significant differences were not found. Similarly, the chi-square test demonstrated no relationship between 'athletes' and 'non-athletes'. The following conclusions were drawn from his study:

- Participation in inter-collegiate football has no adverse affect upon academic progress over a long period of time.
- Participation in inter-collegiate football appears to have a slightly adverse affect upon academic achievement at the immediate level. In other words, adverse affects may be apparent when isolated quarters are considered, though such differences are compensated for airing the off season by increased academic achievement.

Malumphy (Malumphy, 1966) noted that reports from athletes at major universities suggest that "winning football players are winning students". This is often not the case. Anecdotal evidence indicates that "brain coaches" and
tutors are not primarily interested in the education of the players (though they might hope for this); rather, their primary concern is to keep them eligible. This may include scheduling courses that are not particularly beneficial to the "scholar athlete" but provide an easy grade. "Free Grade" courses, get-bins copies of examinations and hiring graduate students to take examinations or write term papers for them are other techniques.

Thorpe (Thorpe, 1967) investigated the intelligence and skill of three hundred and seventy five college women in relation to their success in round-robin singles competition in Badminton or Tennis. Intelligence was measured by the Otis quick-scoring mental ability test; skill was determined by the subject's combined t-score on two standardized tests of badminton or tennis skill; and success in tournament play was expressed by the percentage of points won out of the number possible during tournament play. An analysis of variance employing success as the dependent variable and involving two levels of skill and intelligence (high and low) and two levels of span (badminton and tennis) resulted in a highly significant F-ratio for intelligence and sports. Correlation coefficients between skill and success in badminton and tennis were 0.65 and 0.60 respectively and coefficient between intelligence and success were essentially zero.

Stebbins (Stebbins, 1968) conducted a study with the purpose to determine the relative effectiveness of mental and physical practice upon the learning of a selected motor skill and the possible differential effects of mental practice during different stages of the learning period. Ninety three male volunteers
were used as subjects. They were randomly assigned the following five
treatment conditions: control, mental practice, physical practice, mental
physical practice, and physical mental practice. Practice consisted of throwing
rubber balls at a target from a distance of fifteen feet. The practice period
lasted for eighteen days initial and final tests were administered to determine
the increase in skill. Data which consisted of a gain scores, were analyzed using
analysis of variance. The results indicated that the only significant
improvement occurred in combination type treatment conditions. Trend
analysis was used to evaluate the changes in the daily practice scores. The
results showed that either mental or physical practice was equally effective
during the first half of skill development period.

Hart (Hart, 1970) carried out studies on relation between physical fitness test
scores, intelligence quotients and grade point average for selected one
hundred and ninety two high school students, he found no significant
correlation between physical fitness and intelligence quotient.

Charles (Charles, April, 1978) conducted a study on the relationship of
intelligence, bio-rhythm and high school students’ mental ability scores. The
purpose of this study was to investigate the possible relationship of three day
intelligence (bio-rhythm) cycle in humans as postulated by Alfred Tellscher and
high school student’s mental ability test. Specifically the test was designed to
test for a relationship between high school students scores on the Otis-Lennon
mental ability test and the students intelligence bio-system phases their sex,
the parallel test forms and resulting two and three way interactions of bio-
rhythm, sex of the subject and the test form. Each of the seven hypotheses was tested at 0.05 level of significance. In each case there was a failure to reject the null hypothesis. No effect was found for bio-rhythm phase and sex of subjects, parallel test forms, the interaction of sex of the subject and parallel test form the interaction of bio-rhythm phase, sex of the subject and parallel test form.

2.3 Reviews Related to Retrospective Cohort Study and Longitudinal Analysis

Researches in physical education and sports field measuring effect of training on various fitness variables use retrospective cohort study and longitudinal method. Period of some studies were from six weeks to six years. Some of the reviews were as follows.

Bailey (Bailey, 1970) made a longitudinal analysis on 111 days from ages 12 to 17 years. Data were collected on the individual muscles groups’ dynamometric strength, grass and relative strength batteries, muscular endurance and motor ability elements. Ten of the fourteen variables studied had a moderate degree of inter age consistency, especially when the correlation was between adjacent ages. As the boys advances in age, the mean of an all the measures increases. The longitudinal changes in an absolute variability were not consistent. Differences between high and low skeletal age groups and high and low cable tension strength groups formed at age 12 years maintained significance on most other tests through 17 years of age.

Day (Day, 1970) analyzed the maturity and physical growth of boys ages seven through twelve years. He found that maturity and physical growth test showed
high levels of inter-age consistency especially between adjacent ages. As the boys advanced in age, their means and all measures of three induces increased and decreased of different ages. The mean of sitting height or standing height when it was constant through the ages. His opinion was that the difference between high and low skeletal age groups gross strength groups, weight groups, formed at age nine years, maintained significant mean difference on the other tests.

For over a half century, (Sandra, 1997) over arm throwing of elementary aged and pubescent children has been a popular research subject. The purpose of this study was to describe throwing patterns and velocity performances of boys and girls across the elementary years. Specifically analyzed were the rates of change in performance for each six on throwing velocity and four aspects of as the differences between the sexes over time. In addition, relationship between specific throwing from variables and throwing velocity were examined for each sex across time. Finally, the longitudinal stability of the qualitative throwing variables and velocity of throwing for each sex was determined. Results indicated year by gains in throwing velocity around boys at each test interval, boys displayed more throwing from earlier and in large proportion than did girls. However, annual gains in throwing techniques were greater for girls who improved substantially throughout the elementary years, stability or throwing from variables was not detected best one year interval for either sex. Incorrect stability of velocity performance measures was evident for both sexes although throwing velocity was not stable when two years interval
was exceeded mild stability was present in the intervals from grade 1 to 2 and grade 1 to 3 girls. Moderate stability was fond for boys on all first grade to sixth grade intervals of throwing velocity.

David (David, 1968) conducted a longitudinal analysis of the rate and pattern of growth of selected maturity, structural strength and motor ability measures of boys ten to sixteen years of age. The yearly velocity rates of skeletal age and most of the functional variables of hundred boys were relatively consists of the six year; the structural variable shows less consistency. Most of the variables displayed a near linear growth pattern. The highest correlation between velocity rates and the experimental variables were for the structural measures. The correlation between the velocity rates and standing height and leg length increasing from 0.44 and 11 years to 0.81 at 16 years of age.

Rasmussen (Rasmussen, 1979) conducted a study to determine the effects of physical activity on structural and functional growth of boys followed longitudinally from age 7 through 16 years. From the boys who were part of the Saskatchewan child growth and development study, a group of hundred and five boys tested annually for ten years was used to develop standard growth curve for standing height, body weight, vital capacity, elbow extension strength, knee extension strength, standing broad jump, absolute maximal oxygen uptake and maximal oxygen uptake expressed per kilogram of body weight. It was conducted that lack of physical activity may have resulted in significant gains in body weight in the inactive group and that physical activity may have enhanced the active boys’ relation maximal oxygen uptake. Being
physically active and inactive, within the normal range of activity for boys seven through sixteen years of age, does not appear to affect the decline the relative oxygen uptake which occurs in both groups. Standing broad jump appears to improve more than would be expected due to increasing size whether one is physically active or inactive.

Buckellew (Buckellwe, 1969) collected data at each grade, level; subjects were evaluated in physical fitness (AAHPER Youth Fitness Test), physical growth (Welzel Grid) educational achievement (IOWA Basic Skill Test), and mental capacity (California Mental Maturity Test). Differences in physical fitness, physical growth, and intelligence of boys classified into high, middle and how achievement academically at each grade level was analyzed. There was no apparent relationship between physical fitness and academic achievement or intelligence. There was no relationship between developmental levels. Physical growth and academic achievement or intelligence grade five, six, seven and eight were progressively (although not necessarily significantly) better in physical performance.

Santamaria (Santamraria, 1970) made a longitudinal analysis of maturity and physical growth of boys ages twelve through seventeen years. The subjects were tested for maturity, boys linearly, boys bulk, and indexes; reflecting body proportions. Analysis employed were inter-age correlation's among all ages for each variables, means, standard deviations, and co-efficient of variation, construction of mean velocity curves, differences in growth pattern, high and low maturity growth strength, relative strength, weight and height groups.
Except for lung capacity between 0.64 and 0.97, with the height correlations between adjacent ages and the lowest when five years intervened. As the boys advanced in age, their mean in all measures but the indexes increased gradually, standard deviation also increased with age. Difference between high and low maturity groups, gross strength groups, weight groups and height groups formed at twelve years of age maintained significant mean difference on the other tests for the six years of the study.

Jordon (Jordon, 1967) conducted the study on ninety three boys which were studied longitudinally from age nine to twelve years and data from forty seven subjects were available from age seven to twelve years. A moderate degree or inter age consistency was found over the six years period for bar push ups, standing broad jump, 60 yards shuttle run, cable tension strength, average, strength index, and physical fitness index. The highest of these were for bar push ups, 886 between ages 10 to 11 years. The comparison of the strength and motor ability means for advance and retarded maturity groups revealed. Continuous significant differences for the two gross strength test batteries, cable tension strength average, and strength index when the growth pattern of high and low PFI groups were compared, continuous significant differences were obtained for bar push ups and strength index over the four year period.

Bischoff, J.A. and Lewis, K.A. (Bischoff, 1987) undertook a Cross – Sectional study of fitness levels in a movement education program. The purpose of this study was to compare fitness levels of children participating in a movement education program to Illinois fitness norms (control group). The AAHPERD
Health Related Fitness test was administered to children ages seven through twelve during May in each of the three years, 1980-83. The skin fold measures showed that the movement education children had more skin fold thickness regardless of age and gender. Scores for sit-ups and sit and reach over the three years for movement education children showed that the nine and eleven year old movement education males had more abdominal strength and eleven and twelve year old movement education females, less flexibility. Time in the mile run indicated that movement education children were slower than the control group. Data indicated that movement education children need remediation in cardiovascular activity and reduction in subcutaneous fat.

Johnson, L.C. (Johnson L. , 1969) conducted the study of the effects of five days a week, two and three days a week physical education class on fitness, skill, adipose tissue and growth. The sample of this study was 743 standard 8th boys. 284 students were given regular exercise for two years. Other 460 students exercised for two or three days in a week. Physical education program was same for these two groups. After two years, six fitness tests of boys and two fitness tests of girls were conducted. Daily exercise doing group has more physical fitness than the group doing exercise two or three days a week, but the growth curve was much different.

activity (PA) declines during adolescence. There has been little research describing this decline or examining participation and nonparticipation in specific activities. Objective of this study was to describe the pattern of change in the number of physical activities, the time spent on specific activities, and the stability of participation and nonparticipation in specific activities during adolescence. Design and setting of this study was a population based four year longitudinal study of adolescents recruited from a single suburban school district near Pittsburgh, Pa. Total participants were 782 adolescents, aged between 12 to 15 years at baseline. Physical activity was measured annually via questionnaire. Outcome measures include hours per week of PA, number of reported activities, and participation (yes or no) in specific activities. Results of this study were physical activity declined during the four years by 26%. The decline in physical activity was primarily due to a decrease in the number of reported activities. Adolescents who continued to report an activity during the 4 years of the study maintained or increased the time spent on that specific activity. Female adolescents were more likely to report individual activities, while male adolescents were more likely to report team activities. The probability of maintaining participation in a specific activity during the 4 years was low to moderate, 0.02 to 0.47 for female adolescents and 0.04 to 0.71 for male adolescents. The probability of not participating in a specific activity during the 4 years was extremely high and consistent for male and female adolescents, 0.70 to 1.00. Conclusions of this study was the decline in physical activity during adolescence is primarily due to
a decrease in the number of activities in which the adolescent is participating, and there is only a moderate probability that an adolescent will continue to participate in an activity during the 4-year period from junior to senior high. Future efforts should be directed at identifying factors associated with initiating and maintaining participation in specific activities.

Kuh, D. J. and Cooper, C. (Kuh, n.d.) undertook Physical Activity at 36 years: patterns and childhood predictors in a longitudinal study. Objective was to describe the sex and socioeconomic differences in patterns of physical activity at work and in leisure time of men and women aged 36 years, and to investigate factors in childhood and adolescence which predict high rates of participation in sports and recreational activities in later life. Design of the study was data collected in childhood, adolescence, and at 36 years on members of a national prospective birth cohort study were used. The population sample was resident in England, Scotland, and Wales. A stratified sample of about 3500 men and women was studied regularly from birth until 43 years. Results of this study were more men than women reported high rates of sports and recreational activities, gardening, and do-it-yourself. In contrast women reported higher rates of bicycling and walking. Higher levels of education were associated with frequent participation in sports. Individuals often engaged in one type of activity without necessarily engaging in other types. Those who were most active in sport had been above average at sports in school, more outgoing socially in adolescence, had fewer health problems in childhood, were better educated, and had more mothers with a secondary
education than those who were less active. Conclusions were studies that examine the relationship between physical activity and chronic disease should consider a broad range of pursuits rather than extrapolating from only one area of physical activity, and in their explanations should take account of the possible role of childhood characteristics. The findings suggest the importance of developing skills and habits in childhood as well as of encouraging healthier exercise habits in adults who may have had few opportunities or low motivation previously.

Beunen, G. P.; Malina, R. M.; Renson, R.; Simons, J.; Ostyn, M.; Lefevre, J. (Beunen, Malina, Renson, Simons, Ostyn, & Lefevre, 2005) conducted physical activity and growth, maturation and performance: a longitudinal study. The effects of increased physical activity upon physical growth, maturation and performance were investigated in samples of 32 active and 32 non active Belgian boys followed longitudinally from 13 to 18 yr of age. Active boys participated in sports activities for more than five hours in one week, yearly during each of the first three year of the study, in addition to compulsory physical education. Non active boys participated in less than 1.5 hours in one week, yearly during the first three year of the study, but did participate in required school physical education. Anthropometric dimensions included lengths, breadths, circumferences, and skin folds. A physical fitness test battery was administered at each observation including nine health- and performance-related tests. Skeletal maturation was assessed; socio cultural determinants and sports participation were obtained through written
questionnaires verified by a control interview. No significant effects of increased physical activity were observed on growth in somatic dimensions, including skin folds, age at peak height velocity, skeletal maturation, and most of the physical fitness components. More active boys obtained better results from 14 year onward only for pulse recuperation and for bent arm hang. These results can be generalized to the average population but do not necessarily apply for highly trained and selected elite athletes.

Telama, R., Yang, X., Viikari, J., Välimäki, I., Wanne, O., and Raitakari, O. (Risto Telama, 2008) conducted physical activity from childhood to adulthood: A 21-year tracking study. The aim of this study was to look into stability of physical activity from childhood and adolescence to adulthood in multiple age cohorts, and analyze how fine adult physical activity can be predicted by various physical activity variables measured in childhood and adolescence. The data were derived from the Cardiovascular Risk in Young Finns Study. The study was started in 1980, when cohorts of randomly sampled boys and girls aged 3, 6, 9, 12, 15, and 18 years (total of 2309 subjects) were examined for the first time. The measurements were repeated in 1983, 1986, 1989, 1992, and 2001. In 2001, the subjects (n =1563, 68%) were aged 24, 27, 30, 33, 36, and 39 years, respectively. Physical activity was measured by means of a short self-report questionnaire that was administered independently in connection with a medical examination. On the basis of a questionnaire, a physical activity index (PAI) was calculated. There were no considerable differences in the 1980 PAI between participants and dropouts in 2001. Results were Spearman’s rank
order correlation coefficients for the 21-year tracking period varied from 0.33 to 0.44 in males, and from 0.14 to 0.26 in females. At shorter time intervals the correlation was higher. On average, the tracking correlation was lower in females than in males. Persistent physical activity, defined as a score in the most active third of the PAI in two or three consecutive measurements, increased the odds that an individual would be active in adulthood. Odds ratios for 3-year continuous activity versus continuous inactivity varied from 4.30 to 7.10 in males and 2.90 to 5.60 in females. The corresponding odds ratios for 6-year persistence were 8.70 to 10.80 and 5.90 to 9.40. It was concluded that a high level of physical activity at ages 9 to 18, especially when continuous, significantly predicted a high level of adult physical activity. Although the correlations were low or moderate, we consider it important that school-age physical activity appears to influence adult physical activity, and through it, the public health of the general population.

Susan A. Ca., Janet E. F., Sarah M. L., Maynard, L.M., David R. B., Harold W. K. and William H. D. (Susan A. Ca., 2003) undertook Physical Education and Academic Achievement in Elementary School: Data from the Early Childhood Longitudinal Study. They examined the association between time spent in physical education and academic achievement in a longitudinal study of students in kindergarten through fifth grade. Methods used were data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998 to 1999, which employed a multistage probability design to select a nationally representative sample of students in kindergarten (analytic sample =
Time spent in physical education (minutes per week) was collected from classroom teachers and academic achievement (mathematics and reading) was scored on. Results were a small but significant benefit for academic achievement in mathematics and reading was observed for girls enrolled in higher amounts (70–300 minutes per week) of physical education (referent: 0–35 minutes per week). Higher amounts of physical education were not positively or negatively associated with academic achievement among boys. Conclusions were among girls, higher amounts of physical education may be associated with an academic benefit. Physical education did not appear to negatively affect academic achievement in elementary school students. Concerns about adverse effects on achievement may not be legitimate reasons to limit physical education programs.

Tuija, T. Simo, N. Andrew P., Marjo-Riitta J., (Tuija, 2003) studied adolescent participation in sports and adult physical activity. Background of this study was physical activity in adolescence has been reported to improve physical activity in adulthood, but exhaustive information on the enhancing effect of different types of adolescent sports is lacking. They evaluated the association between participation in different types of adolescent sports and physical activity in adulthood. Methods was the sample comprised 7794 males and females who responded to the mailed questions on physical activity status at age 14 years and at age 31 years in follow-up surveys of the Northern Finland 1966 birth cohort. The associations between adolescent participation in different sports and adult physical activity were examined by multinomial logistic regression.
Results were frequent participation in sports after school hours in adolescence were associated with a high level of physical activity in adulthood. In males, adolescent participation in ball games, intensive endurance sports, track and field, and combat sports was associated with a high or very high level of adult activity. In females, the same applied to adolescent participation in running, orienteering, track and field, cycling, gymnastics, and riding. Adolescent participation in ball games increased participation in ball games in adulthood, especially in males, while participation in cross-country skiing, running and orienteering provided the greatest stimulation to carry over of some endurance sport to adulthood. Conclusions of this study were participation in sports at least once a week among females and twice a week among males was associated with high level of physical activity in later life. Adolescent participation in the intensive endurance sports, and some sports that require and encourage diversified sports skills, appeared to be most beneficial with respect to the enhancement of adult physical activity.

Frank J.G. Backx, Hein J.M. Beijer, Eduard Bol and Wietze B.M. Erich (Frank J.G. Backx) undertook injuries in high-risk persons and high-risk sports: A longitudinal study of 1818 school children. In this Dutch population-based study they attempted to determine the incidence and severity of sports injuries occurring during different kind of sports in a longitudinal way. The study included 1818 school children aged 8 to 17 years. Over a period of 7 months, 399 sports injuries were reported in 324 youngsters. The most common types of injuries were contusions (43%) and sprains (21%). Medical
attention was needed in 25% of all cases. Young basketball, handball and korfball players had a nearly 100% chance of suffering one sports injury per year. Volleyball especially had a high incidence rate in practice (6.7 in 1000 hours). Although physical education classes had a low incidence rate, there were significantly more fractures on the upper limb. Etiologically, sports-related factors were much more important than personal-bound factors. The injured youths spent more time in practice than the non injured ones, both in organized and non organized sports (P < 0.001). High-risk sports were characterized by contact, a high jump rate, and indoor activities. These three factors explained 78% of the total variance. The contact versus noncontact factor accounted for 48% of the medically treated injuries. An additional goal of this study was to explore the seasonal influence as an extrinsic environmental factor. We found that the duration of injury was increased in the spring (P < 0.05). Specific preventive measures were formulated in order to reduce the number of new and recurring injuries and a proposal was made to implement injury prevention in school curriculums.

Kodgire, U.J. (Kodgire, 1998) undertook a study of the effect of selective lezim exercises training program on selective physical fitness of boys age group 12 to 14 years for submitting her M.Phil. Thesis. Sample was sixty boys who were divided equally into two groups of thirty boys. One was control group and other was experimental. Experimental group had selective lezim exercises training program. AAHPERD test was applied. Pre test and post test was taken. After every 15 days training, 30 days training and 45 days training test was
conducted. Mean, standard deviation, mean difference, standard error and t value was calculated. After 45 days training speed, abdominal strength, explosive strength of leg muscles, agility, hand and shoulder muscular endurance were developed.

Morrow, J.R., Zhu, W., Frants, D., Marilu, D. M. and Spain, C. (Morrow, 2009) conducted a 50 years study (1958-2008) of Youth Fitness Tests in the United States. The AAHPER Youth Fitness Test, the first U.S. national fitness test was published fifty years ago. Important youth fitness test initiatives in the last half century are summarized. Key elements leading to continued interest in youth fitness testing at the start of the twentieth century includes (a) concerns about children and youth fitness levels, (b) AAHPER (D) led Youth Fitness battery development, (c) demarcation between performance related and health related fitness testing, (d) the numerous youth fitness test developed, (e) computerization of youth fitness test results and (f) concerns about youth fitness levels. This article summarizes the key youth fitness tests in the second half of the twentieth century and projects future consideration.

Breuer, C. and Wicker, P. (Breuer, 2009) undertook a study named ‘Decreasing Sports Activity with Increasing Age? Finding from a twenty year longitudinal and cohort sequence analysis. According to cross-sectional studies in sport science literature, decreasing sports activity with increasing age is generally assumed. In this paper, the validity of this assumption is checked by applying more effective methods of analysis, such as longitudinal and cohort sequence analysis. With the help of 20 years’ worth of data records from the German
Socio-Economic Panel, the development of sports activity over a lifespan is analyzed. According to inadequate cross-sectional analysis, sports activity decreases with increasing age. In contrast, longitudinal analysis shows that sports activity increases with increasing age. Cohort sequence analyses indicate that not only age but also cohort and period effects influence sports activity. Thus different methods of analysis revealed opposite results.

2.4 Reviews Related to Statistical Analysis

Researches which included longitudinal analysis as the method of study used ANOVA and repeated measures ANOVA as statistical tool. Some reviews were stated below.

Cohen, C.J. (Cohen, 1995) conducted a study about the effect of a three year physical fitness program on the body composition and life style behaviours of middle school students. A total of 393 children studied for 3 years from 6th to 8th grade. Body composition was estimated using the regression equations of Slaughter et al. (1988). Physical activity and dietary habits were assessed using a questionnaire and follow-up interview. All the children in this study received the physical education curriculum including fitness testing, a wide variety of fitness-based activities, plus instructions in fitness concepts. ANOVA was used to analyze the data. Results show that there was no significant change in either the body composition or the physical activity and dietary habits.

Slaughter, M.H., Christ, C.B. Stillman, R.J. and Boileau, R.A. (Slaughter, 1994) conducted a four year longitudinal study to see the effects of gender, physical activity level, age group and test year on select parameters of physique in
The one hundred and three subjects were categorized into 16 groups. Measures of height, weight, total body water and body density were obtained at one year intervals for four consecutive years. Design used was $2 \times 2 \times 4 \times 4$ repeated measures. ANOVA was used. Rigorous physical activity does not alter body fat content; however consideration of gender and age group is essential in assessing the magnitude and pattern of change in body composition over time in children.

Kerr, M. (Kerr, 1982) studied the effects of a circuit training or slow stretching program on the fitness development of selected fifth and sixth grade students. Sample was divided into experimental and controlled group. Researcher took pre and post AAHPERD fitness test of both groups. Experimental group had 20 minutes circuit training along with traditional exercises in 35 minutes training program. Control group undergone with only 35 minutes traditional program thrice in a week, eight weeks program was conducted. Data of pre and post training program was collected by correlated A.T. test. ANOVA was applied. Results showed that there was no significant difference in experimental group.

Rajni, Negi, S.C. and Singh, H. (Rajni, 1994) studied the development of motor abilities of trained and untrained girls aged ten to fourteen years. This study has been conducted on trained (N=75) and untrained (N=75) girls of aged ten to fourteen years. The trained subjects were selected students of sports hostel and sports schools, untrained girls were the students of senior secondary school in Patiala. Five age groups of one year interval were formed by converting the present age into decimal age. Motor abilities were measured by
standard field test like Standing Broad Jump, Ball Throw, Sit ups for sixty seconds, 6 X 10 meter shuttle run, bend and reach forty meter dash and eight hundred meter running. Results revealed that there are significant differences in body height and weight between trained and untrained girls. The pattern of development of height and weight indicate an earlier growth spurt in case of untrained girls. Significant difference observed in average performance of motor ability test, the trained subjects showing higher values than their untrained counter parts. ANOVA and results of Post - Hoc test showed significant differences in body height and weight, leg strength, sit-ups, arm strength, speed among the various age groups of trained subjects. In untrained girls, significant age groups differences were found only in body height and weight and arm strength.

Kumbhar, L.B. (Kumbhar, 1998) submitted her M.Phil. Dissertation. Her study was the effect of suryanamaskar on physical fitness of girls’ age group 12 to 14 years. Sample was sixty girls who were divided equally into two groups of thirty girls. One was control group and other was experimental. Experimental group had suryanamaskar. AAHPERD test was applied. Pre test and post test was taken. After every 15 days training, 30 days training and 45 days training test was conducted. ANOVA was used. After 45 days training, hand and shoulder strength were developed.

2.5 Reviews Related to the Sports School Program

To prepare an international athlete who will achieve high performance, sports talent has to be hunt in early stage. For top level performance, it is very
important to spot, select and nurture a budding sportsmen as it is recognized by that entire athlete must possess some inherent qualities which can be developed by means of systematized and scientific training. The program utilizes information across all disciplines of sports sciences to identify young athletes with characteristics associated with elite performance.

After talent hunting for sports, next important step would be to nurture the identified talent. It depends upon National Sports Policy of the particular country. Top countries with reference to the Olympics Medals such as China, U.S.A., Australia, Germany and many other countries have their own specialized sports training programs which depends on their National Sports Policy. Based on these Sports Policy, Sports Schools were started like Singapore Sports School (Singapore Sports School, 2011), The National Sports School, Canada (National Sports School, 1994) and Malaysian School of Sports (Malaysian School of Sports, 2012). In India there were few examples of sports schools like Sports Authority of India (Sports Authority of India, 2012), Army Boys Sports Company Scheme (ABSC), Army Sports School (Army Sports Institute, 2012) and Krida Prabodhini of Maharashtra State (Directorate of Sports and Youth Services Maharashtra State., 2008) (all program from Government Agencies), Andhra Pradesh Sports School (Andhra Pradesh Sports School, 2006), Pimpri Chinchwad Municipal Corporation Krida Prabodhini and Pune Municipal Corporation Krida Niketan.(all program from Public Sector Agencies) and Usha School of Athletics. (Usha School of Athletics, 2008) (Program from Private Sector Agencies). After reviewing all the above
programs, researcher found that there were some drawbacks like less integrity of sports sciences, no coordination of sports and education, red tape bureaucracy and less holistic view.

**Finding from the Reviews of Related Literature**

A. Review of related literature showed that retrospective study and longitudinal approach related to physical education and sports could be conducted for minimum two years to maximum 60 years.

B. Review of related literature showed that using the research design of retrospective cohort study, data collection tool was questionnaire for qualitative data.

C. Review of related literature revealed that in longitudinal study and which includes two or more variables, statistical measures used was ANOVA and repeated measures ANOVA.

D. Review of related literature also revealed that variables like physical fitness, intelligence and sports achievement were very rarely studied simultaneously.

E. Very less research work was done for secondary school level children and their variables like physical fitness, intelligence and sports achievement.

F. In the field of physical education and sports, test for general intelligence was sufficient and SPM was the standardized test for measuring general intelligence.
G. After reviewing the related literature, researcher revealed that there was very less work has been done on the sports school and especially in the context of Indian sports school scenario.

H. Review of related literature motivated researcher to take study which includes sports school program, variables like physical fitness, intelligence and sports achievement and secondary school level children. Also longitudinal approach would be helpful regarding this type of study.
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