CHAPTER II
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A careful study and exploration of the selected literature for the present study is essential to have some insight into the works already done in this field. In India, very little research work has already been done in this field. From whatever studies are available, the scholar has gained valuable methodological hints that were of great importance in the formulation of physical fitness programme. A brief review of related studies in the field of health related physical fitness programming and testing are presented in this chapter.

Adams (2003) conducted a study to examine the effects of an individualized instructional fitness program, taught in conjunction with the regular physical education curriculum, upon selected health-related fitness test scores of fifth grade children. The subject group in this investigation was comprised of 61 fifth grade students from Slippery Rock Area Elementary School. Thirty-four participants comprised the experimental group, who participated in an individualized fitness-training programme in addition to their regular physical education and twenty-seven participants comprised the control group, who
participated only in the regular physical education curriculum. Both groups were tested at baseline and after 12-weeks on push-ups, sit-ups, and the sit-and-reach. The post-test mean score for each fitness test was calculated. Mean test scores were compared between the experimental and control groups after pre- and post-testing. Data were analysed using an independent t-test (alpha<0.05) for push-ups and sit-and-reach. Analysis of covariance (ANCOVA) was used to analyse the sit-up test, since the mean scores for the control and experimental groups were significantly different on the pre-test. The mean scores for the total number of push-ups performed was significantly greater (p<0.05) for the experimental group when compared to the control group on the post-test. The mean scores for the total number of sit-ups performed and sum of distance for the sit-and-reach showed no significant difference (p<0.05) between the experimental and control groups on the post-test. Therefore, it appears that the individualized training program only significantly improved the push-up scores.

Perry et. al (2002) conducted a study to compare physical characteristics, health and fitness-related variables, and nutrient intake between children of Japanese ancestry living in the
United States as well as in Japan. A cross-sectional study was conducted at Miami, Florida and Tsukuba, Japan. Fourteen children of Japanese descent living in the United States and 14 sex- and age-matched children living in Japan were subjected to study. The Japanese resident groups and U.S. were compared on physical characteristics, health and fitness-related variables, and nutrient intake using the 't' test for paired samples. To assess differences between groups in variables not statistically significant, effect sizes were calculated using the Cohen d test of standardized differences. The following significant differences were found between US and Japanese resident groups, respectively: body mass index, 19.3 and 16.9, P = .02; percentage of body fat, 22.0% and 14.3%, P = .002; diastolic blood pressure, 65.8 and 58.9 mm Hg, P = .01; total cholesterol, 169.8 and 138.7 mg/dL (4.39 and 3.59 mmol/L, P = .001); low-density lipoprotein cholesterol, 108.2 and 88.0 mg/dL (2.80 and 2.28 mmol/L, P = .01); triglycerides, 92.5 and 59.0 mg/dL (1.04 and 0.67 mmol/L, P = .02); percentage of fat intake, 26.1% and 20.3%, P = .001; percentage of saturated fat intake, 7.9% and 6.1%, P < .002; percentage of carbohydrate intake, 57.9% and 63.9% (P = .004); vertical jump, 28.9 and 34.4 cm, P = .02; and flexibility, 58.2 and 42.6 cm, P = .002. Using the Cohen d test,
US residents showed a moderately greater systolic blood pressure (107.5 vs 101.9 mm Hg, P = .10) and leg strength (81.5 vs 55.8 kg, P = .11) than did Japanese residents. A small sample (n = 14) of children of Japanese descent living in Florida showed more adverse health-related characteristics than did a comparable group of their peers living in Japan. The results are probably related to differences in their diets. It remains to be seen whether the differences in diets are related to the place of domicile.

Guerra et. al (2002) conducted a comparative and correlation cross-sectional study to describe the associations between cardio respiratory fitness, blood pressure and body composition in Portuguese school children. The sample comprised 529 children (246 males and 283 females) aged 8 to 15. Body height and body mass were determined by standard anthropometric equipment, blood pressures of the children were measured after at least 5 min rest. The maximal multistage 20-minute shuttle run test was carried-out to predict maximal aerobic power. The present study shows that boys were more fit (p= or <0.05) and less fat than girls (p= or <0.05). Multiple regression analysis reveals that weight and age explained significantly (p= or <0.01)
the amounts of systolic blood pressure (SBP) and diastolic blood pressure (DBP). In girls, percentage of fat (%F) showed an influence on the variance in SBP (4.9%, \( p < 0.05 \)). In addition, weight (14.5%) and age (9.8%) account significantly (\( p < 0.01 \)) for the amount of variance to DBP in males. For girls, age (11.4%) and BMI (2.4%) account significantly to the variance found in DBP. However, the independent variables, for both sexes, account less than 50% of the overall variance found in blood pressures values. In conclusion, the study shows that boys were more fit and had less fat than girls. The level of cardio respiratory fitness does not seem to be an important correlate of blood pressure variation across age groups and gender.

Huang and Malina (2002) studied the relationship between physical activity and health-related physical fitness of 282 Taiwanese adolescents of 12 to 14 years of age. The subjects were randomly selected from the 7th, 8th and 9th grades in two junior high schools in Taiwan. Physical activity was estimated as total daily energy expenditure and energy expenditure in moderate-to-vigorous physical activity from 24-hour activity records for three days, two week days and one weekend day. Health-related fitness was assessed as the one-mile run
(cardiorespiratory endurance), timed sit-ups (abdominal strength and endurance), sit-and-reach (lower back flexibility), and subcutaneous fatness (sum of the triceps, subscapular, suprailliac, and medial calf skinfolds). The study recorded that physical activity is significantly and positively correlated with one-mile run performance and the sit-and-reach, but not with sit-ups and subcutaneous fatness. Overall, the result showed that strength of the relationships between estimated energy expenditure and specific fitness items in the total sample varied from low to moderate, with only 1 percent to 12 percent of the variance in fitness variables being explained by estimated energy expenditure. Comparisons of active versus inactive and fit versus unfit adolescents provide additional insights. The more active (highest quartile) are also more fit in cardiorespiratory endurance and in the sit-and-reach than the less active (lowest quartile), and the more fit in the one-mile run (better time, lowest quartile) and the sit-and-reach (highest quartile) are more active than the less fit in each item, respectively.

Al-Hazzaa (2002) states that during recent years, the Kingdom of Saudi Arabia has witnessed a tremendous development at an astounding rate. He told that the raise in standard of
living and mechanization are apparent in all aspects of people's life. As industrialization and modernization progress, a number of changes in physical activity and eating habits are likely to occur. Indeed, physical inactivity and sedentary living with associated low level of physical fitness are increasingly becoming prevalent in the Saudi society. These lifestyle changes undoubtedly carry unfavourable consequences on health outcomes of the Saudi population. This paper reviews the status of physical activity among Saudi children and adolescents and discusses its implications to cardiovascular health and fitness. From the available evidences, it appears that most Saudi children and adolescents do not meet the minimal weekly requirement of moderate to vigorous physical activity necessary for effectively functioning cardio respiratory system. Furthermore, active Saudi boys tend to have favourable levels of serum triglycerides and high-density lipoproteins-cholesterol compared with inactive boys. Sixteen percent of Saudi schoolboys are considered obese (fat content is above 25% of body mass). Body fat percent of Saudi boys seems to have increased over the past decade. Body fatness correlated significantly with several coronary artery disease risk factors. The study results warrant promotion of physical activity among Saudi children and
adolescents and to a national policy, encouraging active living is also to be formulated for having a healthy population.

Sukhareva et. al (2002) conducted the clinical and epidemiological studies at the Research Institute of Hygiene and Care of Children and Adolescents, Health Research Centre, Russian Academy of Medical Sciences, is indicative of a substantial deterioration of health in adolescents in the late 20th century. Inactivity typical for young people of today has been found to be a major risk factor of cardiovascular functional disorders and metabolic osteopathies whose prevalence has increased among adolescents. There is evidence for association of low activity with the occurrence of calcium homeostatic disorders that result in osteomuscular diseases, cardiovascular functional disorders, deteriorated physical development, decreased functional (force) capacities of the growing organism in adolescents. In addition to inactivity, excessive exercise experienced by young athletes also causes marked disorders, girls in particular.

Eliakim et. al (2002) assessed the effect of a weight management programme on body weight, body mass index (BMI), and fitness in obese children and adolescents. The study
was designed as a longitudinal, non-randomised, clinical experience of a 3 and 6 month combined dietary-behavioural-exercise intervention. A total of 177 obese children (age 6-16 years) participated in the 3-month programme, of which 65 completed the 6-month intervention. A group of 25 age- and maturity-matched obese children who did not participate in the structured programme served as controls. Body weight, BMI, and fitness were evaluated at baseline, and after the 3 and 6 months intervention. Body weight and BMI were significantly reduced (P<0.05), and endurance time significantly increased (P<0.0005) following the 3 months intervention. Obese children who continued the programme for 6 months maintained the decrease in BMI and further improved endurance time. In contrast, obese children who did not participate in the structured programme gained weight, increased their BMI, and improved fitness less significantly. Gender, pubertal status, and the degree of obesity had no influence on BMI changes. Children without parental overweight had significantly greater decreases in BMI compared to children of obese parents. The study concluded that, a combined, structured multidisciplinary intervention for childhood obesity results in decreased body weight, decreased body mass index and improved fitness.
Chen et. al. (2002) state that, the current body mass index (BMI) norms for children and adolescents are developed from a reference population that includes obese and slim subjects. The validity of these norms is influenced by the observed secular increase in body weight and BMI. They hypothesized that the performance of children in health-related physical fitness tests would be negatively related to increased BMIs, and therefore fitness tests might be used as criteria for developing a more appropriate set of BMI norms. The study evaluated the existing data from a nation-wide fitness survey for students in Taiwan (444652 boys and 433555 girls) to examine the relationship between BMI and fitness tests. The fitness tests used included: an 800/1600-m run/walk; a standing long jump; bent-leg curl-ups; and a sit-and-reach test. The BMI percentiles developed from the subgroup whose test scores were better than the 'poor' quartile in all four tests were compared with those of the whole population and linked to the adult criteria for overweight and obesity. The BMIs were significantly related to the results of fitness testing. A total of 43 percent of students had scores better than the poorest quartile in all of their tests. The upper BMI percentile curves of this fitter subgroup were lower than those of the total population. The 85th and 95th BMI percentile
values of the fitter 18-year-old-students (23.7 and 25.5 kg m\(^{-2}\) for boys; 22.6 and 24.6 kg m\(^{-2}\) for girls) linked well with the adult cut-off points of 23 and 25 kg m\(^{-2}\), which was recommended as the Asian criteria for adult overweight and obesity. Hence, the BMI norms for children and adolescents could be created from selected subgroups that have better physical fitness. The study concluded that the new norms based on this approach will be used not only to assess the current status of obesity or overweight, but also to encourage activity and exercise.

Babin, Ropoc and Bonacin (2001) conducted a study to find out the efficacy of specially programmed physical and health education on the motor development of first-grade pupils by analysing in a sample of 633 children aged 7 years. Pupils have been divided into two groups, viz; control group and experimental group consisted of 140 boys and 137 girls attending standard programme of physical and health education, and in experimental group consisted of 184 boys and 172 girls attending specially programmed physical and health education. A battery of 12 motor tests were conducted on two occasions with nine-month interval. Analysis of time-changes (by using the model of differences) pointed to the significantly greater
quantitative changes in experimental group compared with control group. In boys, the changes are obtained for the tests of aerobic endurance, static strength, flexibility, speed, explosive strength of sprint and throw type, and equilibrium, and in girls, they are for aerobic endurance, static strength, explosive strength of throw and sprint type, flexibility, repetitive strength, speed, and equilibrium.

Das and Dhundasi (2001) studied the aerobic capacity or maximum oxygen uptake capacity (VO2 max). VO2 is widely considered as a reliable and valid measure of cardio respiratory fitness. Persons possessing higher values of VO2 and have the capacity to yield larger amounts of energy are capable of performing better in athletic and other field activities. Seventy school going children from the Muslim community of Bijapur (Karnataka) aged between 12 and 16 (means +/- SEM = 14.33 +/- 0.94), volunteered for this study. Their height (cm) and weight (kg) were measured as physical anthropometry and Body mass index (BMI) was calculated (kg/m2). VO2max (ml.kg-1.min-1) was determined by applying the step test study of Margaria et al. The Physical fitness index (PFI) of the subjects was assessed by Harvard Step Test. The physiological endurance measured as VO2 max (ml.kg-1.min-1) was found to be 34.31 +/-
2.44 S.E.M, which is lower in comparison to their Caucasian counterparts but nearly similar when compared with their Indian counterparts. The present study reveals that VO2max significantly correlates with BMI and PFI score. The present study also reveals that 27.2%, 20.07%, 15.77%, 14.37% and 22.87% of the subjects are in excellent, very good, good, average and poor classifications of fitness level respectively.

Baquet et. al. (2001) analysed the effects of a high-intensity aerobic training program on different components of physical fitness in adolescents aged 11 to 16 years. The subjects were divided into a high intensity (HI) group (243 girls and 260 boys) and a control (C) group (21 girls and 27 boys). HI and C completed a weekly 3 hour physical education (PE) session. Before and after a 10-week period, the two groups performed the European physical fitness test battery (EUROFIT). During these 10 weeks HI spent one hour out of three at a specific PE session. These specific sessions consisted of short intermittent exercises (10 seconds) at 100 to 120 percent of maximal aerobic speed. They showed a significant influence on standing broad jump (2.9 %, P<0.05, F=4.85), 20 minutes shuttle run (3.8%, p0.001, F=23.21) and on the maximal distance covered over 7 min
(7.6 %, P< 0.001, F= 14.48). For C there was no improvement in EUROFIT performances. It was concluded that training at high intensity improves not only children's aerobic fitness but also performance of standing broad jump. Well-monitored, adequate intensive training is necessary for a more desirable functional development.

Trost et.al., (2001) compared the physical activity (PA) patterns and the hypothesized psychosocial and environmental determinants of PA in an ethnically diverse sample of obese and non-obese middle school children. One-hundred and thirty-three non-obese and 54 obese sixth grade children (mean age of 11.4+/-0.6). Obesity status determined using the age-, race- and gender-specific 95th percentile for BMI from NHANES-1. The objective measurements were collected of PA over a 7-day period using the CSA 7164 accelerometer: total daily counts; daily moderate (3-5.9 METs) physical activity (MPA); daily vigorous physical activity (> or = 6 METs; VPA); and weekly number of 5, 10 and 20 min bouts of moderate-to-vigorous physical activity (> or =3 METs, MVPA). Self-report measures were collected of PA self-efficacy; social influences regarding PA, beliefs about PA outcomes; perceived PA levels of parents and peers, access to
sporting and/or fitness equipment at home, involvement in community-based PA organizations; participation in community sports teams; and hours spent watching television or playing video games. RESULTS: Compared to their non-obese counterparts, obese children exhibited significantly lower daily accumulations of total counts, MPA and VPA as well as significantly fewer 5, 10 and 20 min bouts of MVPA. Obese children reported significantly lower levels of PA self-efficacy, were involved in significantly fewer community organizations promoting PA and were significantly less likely to report their father or male guardian as physically active. The results are consistent with the hypothesis that physical inactivity is an important contributing factor in the maintenance of childhood obesity. Interventions to promote PA in obese children should endeavour to boost self-efficacy perceptions regarding exercise, increase awareness of, access to, community PA outlets, and increase parental modelling of PA.

Boreham and Riddoch (2001) state that, despite their natural tendencies, children have become less physically active in recent decades, with children today expending approximately 600 Kcal/days less than their counterparts 50 years ago.
Although the health consequences of reduced energy expenditure in adults is well documented, there is little direct evidence linking sedentariness with health in children. However, three main benefits arising from adequate childhood physical activity have been postulated. The first is direct improvements in childhood health status; evidence is accumulating that children that are more active generally display healthier cardiovascular profiles, are leaner and develop higher peak bone masses than their less active counterparts. Secondly, there is a biological carry-over effect into adulthood, whereby improved adult health status results from childhood physical activity. In particular, childhood obesity may be a precursor for a range of adverse health effects in adulthood, while higher bone masses in young people reduce the risk of osteoporosis in old age. Finally, there may be a behavioural carry-over into adulthood, whereby active children are more likely to become more active (healthy) adults. However, supporting evidence for this assertion is weak. Given this background, recent health guidelines suggesting that children should accumulate 60 minutes of moderate-intensity physical activity every day-supplemented by regular activities that promote strength flexibility and bone strength-appear to be justified. Future developments should include implementation of
large-scale, longitudinal studies spanning childhood and young adulthood, the further refinement of tools for measuring physical activity accurately in young people, and research into the relative strength of association between fitness-as well as activity-and health in children.

Kemper et al. (2001) conducted a study to test the hypothesis that daily physical activity over a period of 15 years has been beneficial to aerobic fitness in young male and female participants (13-27 years) in the Amsterdam Growth and Health Longitudinal Study. Only subjects with the maximal data of six sets of measurements were included (83 male and 98 female participants). Daily physical activity was assessed using a standardized interview on activity and expressed as a weighted activity score. Aerobic fitness was assessed using a maximal running test on a treadmill and measuring the maximal oxygen uptake (VO2max) and the maximal slope of the track (Smax). To assess the longitudinal relationship between daily physical activity and aerobic fitness a real longitudinal analysis was carried out with generalized estimating equations, adjusting for differences in initial aerobic fitness at age 13, and for other lifestyle (dietary intake, smoking and alcohol consumption) and
biological parameters (biological age, body fat, blood pressure and concentration of serum cholesterol). A significant relationship ($P < 0.01$) was observed between daily physical activity and both VO2max and maximal slope of the track. It can be concluded that the development of aerobic fitness between the age of 13 and 27 years is independently and positively related to daily physical activity in this group of male and female participants in the study. The functional implications, however, are small: a relatively high increase in the weighted physical activity score of 30 percent over a period of 15 years results in a 2 percent to 5 percent increase in aerobic fitness.

Malina (2001) states that, the contemporary thinking in public health posits that childhood and adolescent physical activity and physical fitness may influence health status during childhood and adolescence, as well as throughout adulthood. On this paper she addresses the evidence dealing with potential associations of physical activity and physical fitness in childhood and adolescence to health status during childhood, adolescence, and adulthood. There are generally low to moderate relationships between childhood and adolescent physical activity and health
(operationalized largely in terms of health-related physical fitness) and adult physical activity and health. A large part of the variability in health-related fitness is not accounted for by physical activity as assessed in the available studies. Nevertheless, the trends emphasize the importance of a lifestyle of regular physical activity during childhood and adolescence, which continues into and throughout adulthood, for the health and well-being of the individuals and populations.

Gharote (2000) selected and tested two hundred and fifty schoolboys from Lonavla with Kraus-Weber tests for their minimum muscular fitness. The results revealed that 20.8 percent boys failed in the tests. Multiple failures were 4.8 percent while flexibility failures alone were 11.6 percent. Boys at the age of 15 years failed more in flexibility test. Boys at the age of 10 years had the maximum percentage of failures to the extent of 38.5. Inclusion of Yogasanas in the programme of physical activities of the school is suggested for the improvement of the status of the failures.

Rasmussen et. al.(2000) states that the intense physical activity in children may either improve fitness and protect against asthma, or may trigger symptoms. The aim of this study was to determine whether physical fitness in childhood has an impact on the development of asthma. In this prospective, community-based study,
757 (84%) asymptomatic children with an average age at inclusion of 9.7 years were followed for 10.5 years. In both surveys, a maximal progressive exercise test on a bicycle ergometer was used to measure physical fitness (maximal workload) and to induce airway narrowing. A methacholine provocation test was performed in the subjects as follow-up. During the 10-year study period, 51 (6.7%) of the previously asymptomatic children developed asthma. These subjects had a lower mean physical fitness in 1985 than their peers: (3.63 versus 3.89 W x kg\(^{-1}\); p=0.02) in boys and (3.17 versus 3.33 W x kg\(^{-1}\); p=0.02) in girls. A weak correlation was found between physical fitness in childhood and airway responsiveness to methacholine at follow-up when adjusted for body mass index, age and sex (r=0.11; p<0.01). In a multiple regression analysis, physical fitness was inversely related to the development of physician diagnosed asthma, odds ratio=0.93 (0.87-0.99). Thus, the risk for the development of asthma during adolescence is reduced 7 percent by increasing the maximal workload 1 W x kg\(^{-1}\). In conclusion, this study showed that physical fitness in childhood is weakly correlated with the development of asthma during adolescence and that high physical fitness seems to be associated with a reduced risk for the development of asthma.

Telama (2000) conducted a study to analyse age-related decline of physical activity among Finnish young people. The number of subjects at the beginning of the study in 1980 was
2309, representing both genders and ages 9, 12, 15, and 18. The follow-up measurements were repeated in 1983, 1986, and 1989. Thus, the data cover ages from 9 to 27. To measure physical activity, a short self-report questionnaire was administrated in connection with medical examination. The questionnaire consisted of items concerning frequency and intensity of physical activity, way of spending leisure-time, and participation in organized sports. Using five items, an index of physical activity was calculated. The results showed a remarkable decline after the age of 12 in frequency of physical activity and sport participation, in particular. The self-reported intensity of physical activity increased with age. In younger age groups, the boys were more active than girls according to all variables but the decline of activity was steeper among male than female subjects, and after the age of 15 the female subjects participated in physical activity more frequently than male subjects. Reasons for the decline need to be further studied, and interventions are needed to assist young people in maintaining healthful levels of physical activity.

Grund et. al (2000) conducted a study to assess different aspects of physical activity and fitness in order to develop a
basis for sport programmes for overweight and obese children. Eighty-eight pre pubertal children (49 boys, 39 girls, 4.8-11.4 years old, 61% obese, 14% overweight and 25% normal weight) were examined. Body composition was assessed by combined use of anthropometrics and bioelectrical impedance analysis. Resting energy expenditure (REE) and total energy expenditure (TEE) were measured by indirect calorimetry (IC) and individually calibrated 24-h heart rate (HR) monitoring, respectively. Activity-related energy expenditure (AEE) and physical activity level (PAL) were calculated from TEE and REE. Fitness [assessed by O2-pulse, respiratory exchange ratio (RER) at submaximal work intensities] was determined by ergometry. The maximal isometric muscle strength of the legs (m. quadriceps, Fa max, m. ischiocruralis, Fb max) was measured by computer tensiometry. Children were grouped according to their nutritional state, AEE, O2-pulse and muscle strength. When compared with normal weight children, obese and overweight children had increased fat mass (FM), fat-free mass (FFM), waist-to-hip ratio and REE, but no group differences were observed for TEE, AEE, and PAL. Obese and overweight children spent more hours per day watching television. After correction for body weight and FFM, no group differences in REE were observed, but
normal weight children had a higher O2-pulse than overweight and obese children. By contrast, RER was increased in the latter group. The fittest group had the lowest body weight, BMI, FM and FFM. Children with a low O2-pulse spent more hours per day watching television. Grouping children according to their degree of muscle strength, younger children (4-7.5 years) did not show group differences in nutritional state, energy expenditure, physical activity and fitness. However, in the group of 7.6- to 11-year-old children, those with the greatest muscle strength and FFM had reduced BMI, skin folds, FM and FFM. FM correlated inversely with O2-pulse, but was not associated with TEE, AEE, PAL or muscle strength. By contrast, television consumption was positively associated with FM. To summarize, overweight and obese children were less fit and watched more TV than their normal weight counterparts. FM did not correspond to TEE, AEE or PAL. Muscle strength was not associated with FM in young children, but was inversely associated with FM in older children. Our cross-sectional data are consistent with the idea that increased fitness and reduced physical inactivity may prevent children from being overweight.
Pratt, Macera and Blanton (1999) describe the current levels of physical activity and inactivity among adults and young people in the United States. Estimates of participation in regular physical activity were derived from three national surveys for adults (National Health Interview Survey, National Health and Nutrition Examination Survey, and the Behavioural Risk Factor Surveillance System) and from the Youth Risk Behaviour Survey for high school students. Overall, 63.8 percent of high school students surveyed on the 1997 YRBS reported participating in vigorous physical activity for at least 20 minutes on 3 or more days per week. Participation in vigorous activity was higher for boys (72.3%) than girls (53.5%), whites (66.8%) compared with blacks (53.9%) and Hispanics (60.4%), and decreased with advancing grade. Among adults, 27.7 percent meet recommended levels of either moderate or vigorous physical activity, whereas 29.2 percent report no regular physical activity outside of their work. Gender differences in participation in physical activity are less pronounced than in youth, and age-related patterns were complex. Whites are more active than blacks and Hispanics, and persons with higher family incomes and more education report being more physically active. There have been only minor changes in reported participation in
leisure time physical activity over the past 15 years. National
estimates of physical activity appear to be reliable and valid for
adults but may be less so for adolescents and are poor measures
for children. Research is needed to determine the role that
objective monitoring with accelerometers may play in
surveillance. Reliable and valid measures of occupational,
household, and transportation-related physical activity and
sedentary behaviours are needed to better characterize the range
of activity that is associated with health.

Walton et. al. (1999) studied the Stage of Change (SC)
paradigm was adapted to assess readiness to be or stay
physically active among fifth and sixth graders. Students
completed a four-item SC survey, the Past Year Leisure Time
Physical Activity Questionnaire, and the Modifiable Physical
Activity Questionnaire for Adolescents. Pre contemplation,
contemplation, and preparation stages were grouped as "pre-
action" (PRE), and action and maintenance as "post-action" (AX)
stages. Nearly 40 percent of all students were in PRE, compared
to 60 percent of students in AX stages. Twenty-two percent of all
students were in the sedentary pre contemplation or
contemplation stages. Significantly, more boys were in
maintenance than girls, and more girls than boys were in contemplation. Students averaged 14-21 hours/week of television, video, or computer work, and 1.6 hours/week of physical activity outside of school. Interventions may be targeted at a specific SC to enable a child to move forward along the SC continuum toward an active lifestyle.

Klepper (1999) investigated the effects of an 8-week, 24-session weight-bearing physical conditioning programme on disease signs and symptoms in children with chronic arthritis. In a within-subjects, repeated measures design, 25 subjects, ages 8-17 years, with chronic polyarticular juvenile rheumatoid arthritis (JRA), were assessed at study entry, after an 8-week control period, and after an 8-week exercise period, for 1) disease status, based on joint count (JC) and articular severity index (ASI) (sum of scores for joint swelling, pain on motion, tenderness, and limitations of motion); 2) worst pain during the past week, using a 10-cm visual analog scale (VAS), and 3) aerobic endurance, using the 9-minute run-walk test of the Health Related Physical Fitness Test battery. The 60-minute conditioning program included warm-up (10 minutes), low-impact aerobics (25 minutes), strengthening (15 minutes), and
cool-down and flexibility exercises (10 minutes). Subjects exercised twice a week at their rheumatology center and once a week at home, using a commercial exercise video-tape supplied by the investigator. RESULTS: Significant improvement was found in the ASI (Friedman analysis of variance [ANOVA]), JC, and 9-minute run-walk test (repeated measures ANOVA) from the pre- to post-exercise tests. Mean VAS pain scores decreased 16 percent from study entry to the post-exercise test. Statistically significant improvement (reliable change index > 1.96) occurred in 80 percent of subjects on the ASI and 72 percent on the JC. Children and adolescents with chronic polyarticular JRA can improve their aerobic endurance through participation in weight-bearing physical conditioning programs without disease exacerbation or increased pain, and may achieve decreased joint signs and symptoms through increased physical activity.

Rowland et. al. (1999) administered endurance run tests in schools to assess cardiovascular fitness, defined in the laboratory as maximum oxygen consumption. To examine the validity of this concept, assessing the influences of body fat and maximum values of oxygen consumption per unit time, stroke
volume, heart rate, and arteriovenous oxygen difference on 1-mile (1.6-km) run time in healthy sixth-grade boys. Subjects were 36 boys with a mean (SD) age of 12.2 (0.5) years. The relationship was examined between body fat content (estimated by skinfold measurements) and maximum oxygen consumption per kilogram and cardiac variables (during maximum cycle testing) with 1-mile run velocity. Body fat content and maximum oxygen consumption per kilogram (independent of body fat) accounted for 31 percent and 28 percent of the variance in run velocity, respectively. Stroke volume was the only component of maximum oxygen consumption that related to run performance. These findings suggest that cardiovascular fitness and body fat content contribute equally to 1-mile run time in healthy boys and together account for only 60 percent of the variance in performance on this endurance fitness test. Consequently, 1-mile run performance in children may not serve as a strong indicator of cardiovascular fitness.

Michaud, Narring Cauderay and Cavadini (1999) studied the protective effects of physical activity and fitness on cardiovascular health has clearly been shown among adults and, to a lesser extent, among children and adolescents. However,
data are currently lacking pertaining to children and adolescents living in Switzerland. To gather data on the physical fitness and physical/sports activity of children and adolescents aged 9 to 19 years. From September 1996 until March 1997, 3540 subjects (1778 girls, 1762 boys) from the canton of Vaud were enrolled in a multifaceted study which included a battery of 7 tests measuring different components of fitness, anthropometric measures and a self-administered questionnaire assessing physical activity, health and lifestyles. Most of the respondents practise sports on a regular basis but boys engage in physical and sports activities much more often than girls: 75 percent of boys versus 56 percent of girls spent at least one hour a day in activities inducing sweating, an index of moderate to vigorous physical activity (p < 0.001). Depending on the grade, 56 to 74 percent of girls and 62 to 88 percent of boys reported participation in sports clubs (p < 0.01); current participation ranges from 33 to 46 percent among girls and 64 to 69 percent among boys (p < 0.001). Participation in physical and sports activities were lower after age 15 than before, and lower among girls than among boys. As far as fitness is concerned, girls exhibit greater flexibility than boys, while the latter exhibit greater strength and endurance, especially after age 15.
Calculated values for the BMI and VO2max are within the ranges published in the international literature for both sexes. Programmes and strategies, which aim to increase physical activities, should be gender-specific and should especially target adolescents aged over 15. Physical/sports activities and fitness could and should be monitored using both a battery of tests and self-administered questionnaires.

Manios, Kafatos and Codrington (1999) assessed physical activity and physiological fitness parameters among six year old children and to determine whether there were any significant gender differences. Comparative study of a representative sample of boys and girls in school and at home. Participants: 569 children (305 boys and 264 girls) selected randomly from a total of 6153 registered in the 1st grade in 1992 on the island of Crete. Assessment of physical activity was based on observational methods involving teachers and parents. Cardiorespiratory fitness was estimated by performance on the 20 minutes Shuttle Run Test (20mSRT). BMI, skinfold thickness, Midarm Muscle Circumference (MMC) and haemoglobin were also measured. Both sexes were found to spend a very small proportion of their leisure time in Moderate to Vigorous Physical
Activities (MVPA). More boys engaged in MVPA than girls at school and at home, but more girls were involved in physical activity-related lessons and classes out of school. Among the physiological fitness parameters, significant gender differences were found only for MMC. No significant gender difference was found in performance on the 20mSRT. The results indicate that in this culture stereotypic sex preferences in physical activity begin at a very young age, and that this differentiation cannot be attributed to gender differences in cardiorespiratory fitness. The social, environmental and possibly psychological parameters involved have implications for Health Educators and Physical Education Instructors in the appropriate targeting of physical activity promotion programs among young children.

Rowlands, Eston and Ingledew (1999) studied the relationships between children's activity, aerobic fitness, and fatness is unclear. Indirect estimates of activity, example., heart rate (HR) and recall, may mask any associations. The purpose of this study was to assess these relationships by using the Tritrac-R3D, a pedometer, and heart rate. Thirty-four children, ages 8-10 years, participated in the study. The Tritrac and pedometer were worn for up to 6 days. HR was measured for 1 day. Activity
measured by Tritrac or pedometer correlated positively to fitness in the whole group (Tritrac, $r = 0.66$; pedometer, $r = 0.59$; $P < 0.01$) and in boys and girls separately ($P < 0.05$) and correlated negatively to fatness in the whole group ($r = -0.42$, $P < 0.05$). In contrast, HR did not correlate significantly to fitness, and HR of $>139$ beats/min correlated positively to fatness in girls ($r = 0.64$, $P < 0.05$). This suggests that HR is misleading as a measure of activity. This study supports a positive relationship between activity and fitness and suggests a negative relationship between fatness and activity.

Chad, Humbert and Jackson (1999) studied the effectiveness of the Canadian Quality Daily Physical Education (QDPE) program in creating awareness, support, and influencing school based physical education programs was determined using quantitative and qualitative methodologies. Participants included teachers, principals and vice principals, school board officials and trustees, professional agencies and association, and provincial ministry of education officials. Findings showed this national initiative increased awareness and support of QDPE among all participants. Although the influence of this increased awareness and support on school physical education
programming was limited, the greatest impact was in time committed to instruction, development of curricula, and instruction of classes, delivery of intramural programs, professional development, and student response to physical education. The least impact was on hiring of physical education specialists, the number of staff, and funding for physical education.

Truden et. al., (1999) investigated the influence of a daily physical education programme in primary school 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 years of primary school education in the early 1970s; and 2) a control group, drawn from the data bank of the Quebec Health Survey, and matched for age, gender, and socio-economic profile (N = 720). Experimental and control subjects filled out an identical questionnaire about their current physical activity level, their attitudes toward PA, and their perceptions of barriers to PA. The control group was stratified to obtain the same socio-demographic profile as the
experimental group. Results show that 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. Results of the study 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 programme had significant health effect in men, substantially reducing the risk of becoming a regular smoker.

Marshall et. al (1998) examined the tracking of multiple health-related fitness components in children from fourth to sixth grade. A battery of fitness tests was used to measure 414 children (213 boys, 201 girls, mean = 9.48 yr, +/- 0.41) from three elementary schools in Southern California. Children were
assessed during the fall and spring of each grade. Baseline scores were correlated (Spearman) with each subsequent time point. For boys 3-yr correlations of body mass index (BMI) (0.89), skinfold thickness (0.80), sit-and-reach test (0.67), and the pull-up test (0.66) indicated high levels of tracking. Mile run (0.56), sit-up test (0.46), and waist-to-hip ratio (0.30) tracked moderately. For girls BMI (0.83), sum of skinfolds (0.75), sit-and-reach test (0.72), and the pull-up test (0.63) tracked highly, while mile run (0.42), sit-up test (0.47), and waist-to-hip ratio (0.42) tracked moderately. Results suggest that relative rankings of BMI, skinfold thickness, and sit-and-reach test performance are more likely to track during early adolescence. Measures of cardiovascular fitness, muscular strength, and endurance and fat distribution may be less likely to track into adolescence, possibly because they are more influenced by changes in physical activity or because tracking may be reduced by measurement error.

Katzmarzyk et. al (1998) evaluated the relationship between indicators of physical activity and health-related fitness in youth aged 9-18 years. A cross-sectional sample of 356 boys and 284 girls 9-18 years of age from phase I of the “Quebec
Family Study was studied. The sample was divided into three age groups by gender aged 9-12, 13-15, and 16-18 years of age. Physical activity variables included two estimates of activity, estimated daily energy expenditure (EE) and estimated moderate-to-vigorous physical activity (MVPA), and one estimate of inactivity, time spent watching television per day (TVTIME). Health-related fitness variables were the sum of six skin folds (SUM), number of sit-ups in 1 minute (SITUP), physical work capacity at 150 beats x min(-1) (PWC150), and static strength of the leg (LMS). Partial canonical correlation was used to quantify the relationship between standardized (z-transformed) activity variables and health-related fitness items, controlling for age. There is a weak to moderate association between physical activity and fitness in youth. The first activity canonical variate is a function of positive loadings for EE and MVPA, with a smaller, negative loading for TVTIME. The first fitness variate generally includes positive loadings for PWC150 and SITUP, with a small negative loading for the SUM and a small positive loading for LMS. The first canonical correlations indicate that the variance shared by the fitness and activity variates ranges from 11 to 21 percent. There is a significant relationship between activity and health-related physical fitness, but a large part of
the variability (80-90%) in fitness is not accounted for by physical activity as measured in this study.

Stephens (1998) states that the physical activity levels of US children are declining. Opportunities for physical activity within city schools are constrained by time and space limits. This study determined whether a supplemental programme of physical activity would significantly alter the fitness levels of low-income, minority, urban elementary schoolchildren. Ninety-nine students from two Cleveland Public Schools served as subjects. One school received a 15-week intervention programme where teams of two medical students met with urban elementary schoolchildren three times a week for physical activity sessions. The other school served as a control group and received no supplemental activity other than a regularly scheduled physical education class held once a week. We obtained field measurements of skinfold thickness, heart rate response to submaximal exercise, and sit and reach flexibility. The supplemental activity group showed significant improvements in flexibility, body composition, and heart rate response to submaximal exercise. This investigation indicates that a programme of fitness activities conducted within the classroom
can significantly improve levels of fitness in urban elementary schoolchildren.

Sallis et al (1998) evaluated a health-related physical education programme for fourth- and fifth-grade students designed to increase physical activity during physical education classes and outside of school. Seven schools were assigned to three conditions in a quasi-experimental design. Health-related physical education was taught by physical education specialists or trained classroom teachers. Students from these classes were compared with those in control classes. Analyses were conducted on 955 students with complete data. Students spent more minutes per week being physically active in specialist-led (40 min) and teacher-led (33 min) physical education classes than in control classes (18 min; P < .001). After 2 years, girls in the specialist-led condition were superior to girls in the control condition on abdominal strength and endurance (P < .001) and cardiorespiratory endurance (P < .001). There were no effects on physical activity outside of school. A health-related physical education curriculum can provide students with substantially more physical activity during physical education classes.
Improved physical education classes can potentially benefit 97 percent of elementary school students.

Burke (1996) examined associations between children's responses to nutrition and fitness programmes and their baseline levels of cardiovascular risk factors. A randomised controlled trial was set at Primary schools in Perth, Western Australia. 1147 children aged 10-12 years were participated in the study. Fitness, fitness + school nutrition, school +home nutrition or home nutrition programmes and a control group was assigned. Blood pressure (BP), cholesterol, nutrient intake, fitness, and body fat were analysed. Results showed that fall in systolic BP was significantly greater in the higher risk groups with the fitness intervention for boys and the home nutrition intervention for girls. Overall, diastolic BP fell for girls in the fitness intervention with no differences related to cluster membership. Higher risk boys in the fitness intervention showed greater improvement in fitness than the lower risk boys. Fitness improved in girls in the fitness programme but responses did not differ significantly according to cluster membership. Decrease in triceps skinfolds was significantly greater for higher risk boys in the home nutrition group and in higher risk girls except for
those receiving the school + home nutrition intervention. Home nutrition programmes were associated with decreased intake of fat and greater intake of fibre in girls in the higher risk group and of sugar in higher risk boys. The greatest improvements in the higher risk children were associated with fitness and home nutrition programmes. Health education programmes aiming to include higher risk children should focus on these areas.

Schmidt (1995) examined the muscular endurance and flexibility components of the Singapore National Physical Fitness Award (NAPFA) Scheme and compared the results with other similar fitness test protocols. A total of 286 subjects (149 males, 137 females) voluntarily participated and were divided into six age and gender groups. Significant correlations and no statistical differences (p < .05) were found between abdominal endurance using different protocols indicating that any of the alternative tests could be substituted for the NAPFA sit up test which has been classified as a contraindicated exercise (MacFarlane, 1993). In upper body muscular endurance tests, secondary age boys and all adults showed a high correlation (p < .01) with alternative test protocols. Replacement of the pull up test with the Vermont modified pull up test was recommended for primary
and secondary boys because of the low number and many zero scores from the present NAPFA test. From this study it was concluded that the sit-and-reach test measured using a zero reference point from the floor could replace the present sit-and-reach test because the alternative protocol accounted for arm and leg differences. These findings provide safer and relevant alternative protocols for a national battery of field fitness assessments.

Greene and Ignico (1995) conducted a study to determine effects of a 10-week after school physical fitness program on fitness profiles, levels of self-concept, and body-esteem in 3rd and 4th grade low-fit children. Participants were 17 children (9 boys, 8 girls) who failed to meet AAHPERD Physical Best fitness standards in at least two of three fitness profile components, including cardiovascular endurance (one mile run/walk), muscular strength and endurance (sit-ups/min.), and flexibility (sit and reach). All participants were pre- and post-tested in each of these three fitness profile components. Self-concept and body-esteem were also pre- and post-tested using a shortened version of Harter’s Self-Perception Profile for Children and the Body Esteem Scale for Children. The treatment group (n=10)
participated three days/week for 60 min./day in a vigorous physical activity program designed to maintain heart rates corresponding to 60-80 percent of each individual's VO2max. An analysis of covariance revealed the treatment group scored significantly higher on the post-test than the control group on two of the three fitness profile components (muscular strength and endurance, and flexibility), and on two of the four self-concept dimensions (athletic competence, and global self-worth). In light of problems associated with increasing children's physical activity levels, offering after school programs such as this one appear to be an effective strategy.

Riddoch and Boreham (1995) state that the fitness and physical activity levels of children and youth are commonly questioned, but the evidence cited is both equivocal and methodologically diverse. The amount and type of physical activity undertaken during childhood that is appropriate for optimal health is unknown, although it has been suggested that, in the absence of such criteria, activity levels known to confer health benefits in adults are also appropriate for children. The measurement of activity in children is problematical, and there is currently no valid method of assessing activity levels that is feasible for use in large studies. Therefore, studies may lack
either internal validity or wider applicability. Studies using self-report methods indicate relatively high levels of activity with 60 to 70 percent of children taking sufficient 'appropriate' physical activity. However, a variety of activity thresholds has been used. Studies that use more objective methods report much lower levels of activity, especially when cardiovascular fitness criteria are applied. The use of less stringent health-related thresholds results in higher levels of 'appropriate' activity. Nearly all studies of teenagers report a decline in activity with age during this period. Data from the large population studies indicate that activity levels peak in children at around 13 to 14 years of age, and then markedly decline. Boys are normally reported to be more active than girls, but this difference is greatly reduced when moderate activity alone is compared, indicating that boys participate in more vigorous exercise than girls. The health effects of low levels of vigorous activity in children are unclear.

Kikuchi, Rona and Chinn (1995) examined the influence of social factors, passive smoking, and other parental health related factors, as well as anthropometric and other measurements on children's cardiorespiratory fitness. This was a cross sectional study. The analysis was based on 22 health areas
in England. The subjects were 299 boys and 282 girls of 8 to 9 years. Parents did not give positive consent for 15 percent of the eligible sample. A further 25 percent of the eligible sample did not participate because the cycle-ergometer broke down, study time was insufficient, or they were excluded from the analysis because they were from ethnic minority groups or had missing data on one continuous variable. Cardio respiratory fitness was determined using the cycle-ergometer test. It was measured in terms of PWC85%-that is, power output per body weight (watt/kg) assessed at 85 percent of maximum heart rate. The association between children's fitness and biological and social factors was analysed in two stages. Firstly, multiple logistic analyses were used to examine the factors associated with the children's ability to complete the test for at least four minutes. Secondly, multiple linear regression analysis was used to examine the independent association of the factors with PWC85%. In the logistic analysis, shorter children, children with higher blood pressure, and boys with a larger sib ship size had poorer fitness. In the multiple regression analysis, only height (p < 0.001) was positively associated, and the sum of skinfold thickness at four sites (p = 0.001) was negatively associated with fitness in both sexes. In girls, a positive association was found
with pre-exercise peak expiratory flow rate (p < 0.05), and there were negative associations with systolic blood pressure (p < 0.05) and family history of heart attack (p < 0.05). In boys, an association was found with skinfold distribution and fitness (p < 0.05), so that children with relatively less body fat were fitter. Social and health behaviour factors such as parent's social class, parent's employment status, or parents' smoking habits were unrelated to child's fitness. Height and obesity are strongly associated and systolic blood pressure to a small extent, with children's fitness, but social factors are unrelated.

Marsh (1993) investigation extends the factor analytic approach pioneered by Fleishman (1964) by incorporating subsequent developments in the application of confirmatory factor analysis and the physical fitness literature. Specifically, it tests the ability of a prior factor structure of physical fitness to fit (i.e., account for) data based on 25 indicators of fitness (field exercises, technical measures, and laboratory measures) for 2,817 boys and girls aged 9, 12, and 15. An eight-factor (Cardiovascular Endurance, Explosive/Dynamic Strength, Static Strength, Flexibility/Joint Mobility, Blood Pressure, Lung Function, Body Girth, and Skinfold) model derived from previous
research fit the data well for each of the six age/gender groups, considered separately. Based on tests of factorial invariance, factor loadings and factor correlations were reasonably invariant across the six groups. This important finding indicates that all 25 indicators are equally valid for boys and girls aged 9, 12, and 15 and that the multidimensional structure of physical fitness generalizes over gender and age.

Chatterjee, Mandal and Das (1993) conducted a cross-sectional study of physical and motor fitness measurements on 629 healthy Indian (Bengalee) school-going boys of 9-18 years. The study brought to light gradual increase in physical and motor fitness measurements with the advancement of age except physical fitness score. Major increments were recorded between 13 and 15 years of age. All the fitness test scores showed significant positive correlations with age, height and weight but Dash, Shuttle Run and PFI showed significantly negative relationship. Indian boys of the present study were superior in Sit and Reach and inferior in Vertical Jump to the Belgian boys of comparable ages. These boys showed higher values in Vertical Jump than American boys after the age of 13. Dash and Shuttle Run test scores of Indian boys fall between 15th to 25th and
30th to 45th percentiles of American Standard respectively. Besides, American boys are superior in Grip Strength to Indian boys. Percentile values of physical and motor fitness test scores of Indian (Bengalee) boys are, therefore, useful for determining their present fitness status and potentiality in that particular community for specific sports activity.

Kim (1993) states that excess body fat has generally been considered to be an influential factor to physical fitness and motor ability in obese boys. However, little information is available on the physical fitness and motor ability in obese boys. The purpose of this study was to clarify characteristics of physical fitness and motor ability in obese boys. The subjects were three hundred and five boys aged 12 to 14 years. Nineteen physical fitness and motor ability items were tested and skinfold thickness was measured at six sites. Bioelectrical impedance was measured using a tetrapolar impedance plethysmograph (Selco SIF-891). Body density was calculated from the formula of Kim et al. The results of comparison clearly indicated that the obese group was significantly poorer in 1,500 meters run, 5 minute run, 50 meter run, running long jump and many other variables, but was superior only in back strength. To analyse the
factorial structure in boys, principal factor analysis was applied to the correlation matrix, which was calculated with 19 variables, and then five factors were extracted. The obese group was significantly poorer in total body endurance and muscular endurance than the non-obese group. From these results, it was confirmed that the excess body fat could be one of the most important factors that affects the state of many physical fitness and motor ability elements in obese boys. However, the relationships between physical fitness, motor ability and the degree of fatness seem to be rather complicated. A great deal of data should be accumulated for more detailed analysis on the influence of the excess body fat in obese boys.

Lehnhard (1992) assessed current fitness levels in the state of Maine, more than 8,000 public school students, aged five through nine, were assessed using a nationally known (American Alliance for Health, Physical Education, Recreation and Dance) health-related physical fitness test. Maine students were then compared with a national norm group on (1) the one-mile walk/run (minutes: seconds), (2) skinfold thickness (centimetres), (3) one-minute timed sit-ups (number performed correctly), and (4) the sit and reach test for flexibility
(centimetres). Generally, Maine boys and girls scored higher than the norms on the sit-up, sit and reach, and one-mile walk/run; however, they had significantly larger skinfold thickness. Implications for assessment of health-related fitness in this age group were discussed.