Chapter II

REVIEW OF LITERATURE

To get a clear-cut idea of Assessment of Health Related Physical Fitness of School going boys ample of literature has been reviewed in this chapter. The detailed review is as follow,

Chung, Joanne WY; Chung, Louisa MY; Chen, Bob\(^1\) (2009) performed a survey titled ‘To Compare the Physical Fitness Levels of Hong Kong and Mainland Chinese School Children and to Study the Association Between any Differences and their Respective Life-style’. The study was conducted on Primary school children (n=522). Demographic data was collected by questionnaire. Physical fitness tests (height, body weight, sit and reach, long jump, running 50m and lung capacity) were carried out. Significant differences were found in height, body weight, sit and reach, long jump, running 50m and lung capacity. Hong Kong children were found to be taller and heavier at ages 6 and 7, but heavier with similar height to that of mainland children at ages 8-12. Other results showed better physical fitness on the part of mainland children. The Hong Kong children differ greatly. The findings in terms of physical fitness revealed variations in flexibility, cardiovascular function, body build and muscle power between the two groups. Life-style could possibly be a key factor and predictor of physical fitness, providing strong evidence to support the interaction between life-style and genes in their impact on our health. Relevance to clinical practice life-style could possibly be a key factor and predictor of physical fitness and health outcomes. The finding of this study may enhance the identification of healthy life-style which may improve health outcomes in children.

Guerin, Pauline B, Elmi, Fatuma Hussein, Corrigan, Callie\(^2\) (2008) performed the study with the purpose to compare the body composition and cardio respiratory fitness Refugee Somali women were invited to participate in sessions to assess physical fitness.


and body measurements. Height, bodyweight and waist and hip circumference were measured. The Rockport Fitness Walk Test was used to estimate the women's cardio respiratory fitness levels. Thirty-one women between 12 and 66 years old participated in this study. There was a significantly greater proportion (71.4%) of participants with a BMI in the overweight or obese range (>or=25 kg/m²) compared to normative New Zealand women's data (49.3%; p = 0.015). The proportion of Somali women (42%) with a waist-to-hip ratio in excess of 0.8 was higher than that of New Zealand women (35.6%), but not statistically so. All women over 30 years of age (n = 12) had an estimated VO2max below the 50th percentile with eight participants below the 10th percentile. The extent of overweight and obesity and low fitness levels, particularly among the older Somali women in this study, suggests that Somali women are at increased risk of developing life-style related diseases.

K.D. Monyeki, M.A. Monyeki, S.J. Brits, H.C.G. Kemper, and P.J. Makgae (2008), performed an observational prospective cohort study with the purpose to investigate the development and tracking of body mass index (BMI) of Ellisras Rural children from pre-school age into late adolescence from the Ellisras Longitudinal Growth and Health Study. Heights and weights of children were measured according to the standard procedures recommended by the International Society for the Advancement of Kinanthropometry twice a year from 1996 to 2003. In total, 2,225 children—550 pre-school and 1,675 primary school aged 3-10 years (birth cohorts 1993 to 1986) were enrolled at base-line in 1996 and followed throughout the eight-year periodic surveys. In 2003, 1,771 children 489 pre-school and 1,282 primary schools were still in the study. The prevalence of overweight was significantly higher among girls (range 1.6-15.5%) compared to boys (range 0.3-4.9%) from age 9.1 years to 14.9 years. The prevalence of thinness (severe, moderate, and mild) ranged from 7.1% to 53.7% for pre-school children and from 8.0% to 47.6% for primary school children. Both pre-school and primary school children showed a significant association between the first measurements of BMI and the subsequent measurement which ranged from B=0.2 (95% confidence interval [CI] 0.1-

0.4) to B=0.8 (95% CI 0.6 -0.9) for pre-school and B=0.2 (95% CI 0.1-0.3) to B=0.7 (95% CI 0.6-0.8) for primary children. A significant tracking of BMI during 4-12 years of life was more consistent for pre-school children (B=0.6 (95% CI 0.6-0.7) and for primary school children (B=0.6 (95%CI 0.5-0.6). Investigation of nutritional intake and physical activity patterns will shed light on how healthy these children are and their lifestyle.

Mastrangelo, M. Alysia; Chaloupka, C. Edward, Rattigan, Peter\(^4\) (2008) performed a study titled ‘To Compare Cardiovascular Fitness between Obese and Non-obese Children’. Based on body mass index, 118 were classified as obese (boys [OB] = 62, girls [OG] = 56), while 421 were non-obese (boys [NOB] = 196, girls [NOG] = 225). Cardiovascular fitness was determined by a 1-mile [1.6 km] run/walk (MRW), estimated peak oxygen uptake and analyzed using two-way analyses of variance (Gender x Obese/Non-obese). MRW times were significantly faster (p < .05) for the NOB (10 min 34 s) compared to the OB (13 min 8 s) and the NOG (13 min 15 s.) compared to the OG (14 min 44 s.). Predicted [VO.sub.2] peak values (ml x [kg.sup.-1] x [min.sup.-1]) were significantly higher (p < .05) for the NOB (48.29) compared to the OB (41.56) and the NOG (45. 99) compared to the OG (42.13). MRW was compared between obese and non-obese participants on the President's Challenge (2005), the National Children and Youth Fitness Study, and FITNESS- GRAM[R] HFZ standards. The non-obese boys and girls scored higher on all three, exhibiting better cardiovascular fitness as compared to obese counterparts.

Bovet, Pascal; Auguste, Robert, Burdette, Hillary\(^5\) (2008) examined the relationship between physical fitness and obesity in children have had mixed results despite their interrelationship making intuitive sense. We examined the relationship between physical fitness and overweight and obesity in a large sample of adolescents in the Republic of

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Seychelles (Indian Ocean, African region). All students of four grades of all secondary schools performed nine physical fitness tests. These tests assessed agility, strength and endurance, and included the multi-stage shuttle run, a validated measure of maximal oxygen uptake. Weight and height were measured, body mass index (BMI) calculated. Data was available for 2203 boys and 2143 girls from a total of 4599 eligible students aged 12-15 years. The prevalence of overweight (including obesity) was 11.2% (95% confidence interval: 9.9-12.4) in boys and 17.5% (15.9-19.1) in girls. For 7 of the 9 tests, the relationship between BMI and fitness score, as assessed by locally weighted regression, was characterized by a marked inverse J shape. Students with normal body weight achieved "good" performance markedly more often than overweight or obese students on 7 of the 9 tests of fitness and more often than lean children. For example, good performance for the multi-stage shuttle run was achieved by 25.6% (SE: 2.1) of lean students, 29.6% (0.8) of normal weight students, 7.9% (1.3) of overweight students and 1.2% (0.9) of obese students. This cross-sectional study shows a strong inverse relationship between fitness and excess body weight in adolescents. Improving fitness in adolescents, likely through increasing physical activity, might need special interventions that are responsive to the ability and needs of overweight children.

Photiou, J H Anning, J. Mészáros, I .Vajda, Mészáros, Sziva, Prókai (2008) compared some selected morphological and functional parameters of 7-14 year-old Hungarian schoolboys living in the middle of the 1970s and at the beginning of the new millennium. It was hypothesized that there would be significant differences in morphological and functional characteristics of the Hungarian schoolboy population, because they were assessed 30 years apart. Means of height, body mass, body mass index (BMI), the sum of five skin-fold tests, percentage of body fat, and two running performance times (400 m and 1,200 m) of the boys (N = 3,672) studied in 1975 were compared to those of the boys (N = 3,758) in 2005. Data was analyzed using two-tailed independent samples t tests (p < .05). A significant secular changes in body mass and height was observed. In addition, boys in 2005 had significantly more subcutaneous fat

compared to 1975. The running times for the two distances were significantly poor at the
time of the second investigation. The remarkable and unfavorable changes in body
composition and cardio respiratory performance were attributed to the continuously
decreasing intensity of habitual physical exercise and a life-style that had become more
sedentary (watching TV playing computer games, etc.). Radical interventions are
necessary to reduce these risks associated with the high prevalence of cardiovascular
disease in Hungary and the challenge to resolve the problem requires combined efforts at
the educational, societal, corporate, and governmental levels.

Huang, Yi-Ching, Malina, Robert M 7(2007) evaluated the cross-sectional relationship
between BMI and a physical fitness index (PFI) based on four indicators of fitness in a
national sample of Taiwanese youth. Height, weight, and four measures of physical
fitness (sit-ups completed in 60 s, standing long jump, sit and reach, and 800- or 1600-m
run/walk) were measured in a national sample of 102,765 Taiwanese youth 9-18 yr of
age: 50,940 girls and 51,825 boys. BMI was calculated for each subject. Within each sex-
specific half-year age group, students were classified into five BMI categories based on
national percentiles: very low, BMI < 5th percentile; low, BMI >or= 5th but < 15th
percentiles; normal, BMI >or= 15th but < 85th percentiles; high, BMI >or= 85th but <
95th percentiles; and very high, BMI >or= 95th percentiles. Z-scores based on sex- and
age-specific means and standard deviations were calculated, and the sum of z-scores for
the four fitness tests was used as a PFI. Differences in PFI between BMI categories
within each sex-specific half-year age group were compared with ANOVA with
Bonferroni adjustments. Sex-specific regressions of PFI on BMI, using a nonlinear
quadratic model, were done in four broader age categories. Relationships between BMI
and PFI are nonlinear and vary with age from late childhood through adolescence. With
increasing age during adolescence, the relationship becomes parabolic and the peaks of
the parabola are sharper in adolescent boys than girls. PFI declines in a curvilinear
manner with increasing BMI among youth 9-18 yr of age, but the slope of the
relationship varies with age

7 Huang, Yi-Ching, Malina, M. Robert, (2007). BMI and health-related physical fitness in Taiwanese
youth 9-18 years. Retrieved on April 16, 2009 from http://www.find-health-
articles.com/rec_pub_17414809-bmi-health-related-physical-fitness-taiwanese-youth-9-18-
years.htm
Vanderburgh, M. Paul 8(2007) conducted a study on defense personnel. Recent research findings combined with the theoretical laws of biological similarity make the compelling case that all physical fitness test items for the Army, Air Force, and Navy impose a 15 to 20% physiological bias against heavier, not fatter, men and women. Using the published findings that actual scores of muscle and aerobic endurance scale by body mass raised to the 1/3 power, correction factor tables were developed. This correction factor can be multiplied by one's actual score (e.g., push-ups, sit-ups, abdominal crunches, or curl-up repetitions or distance run time) to yield adjusted scores that are free of body mass bias. These adjusted scores eliminate this bias, become better overall indicators of physical fitness relevant to military tasks, are easily applied to the scoring tables used in the present physical fitness tests, and do not reward body fatness. Use of these correction factors should be explored by all military services to contribute to more relevant fitness tests.

Fogelholm, S. Stigman, T. HUsiman, J. Metsamuuronen 9(2007) studied the associations of overweight (OW, BMI) and physical activity (PA) with physical fitness in adolescents. The national representative sample was 1120 boys and 1146 girls, aged 15-16 years. Height and weight were self-reported. The level of PA was based on self reported frequency and duration of sweating during organized and non-organized activity. Fitness was measured by Sit-ups, sit-and reach, five–jump, back and forth jumping, ball skills, and coordination and endurance shuttle run tests. The fitness index calculated as the mean of z-scores for individual tests. The prevalence of OW was 17.3% in boys and 11.8% in girls. The main effect PA on all fitness tests was significant (P<0.005). The main effect of OW was significant (P<0.002) for all tests, except for sit and reach. According to linear regression models, the association between PA and fitness was stronger than that between OW and fitness. Sit-ups, endurance shuttle run and fitness index showed the strongest association with PA (standardized B coefficients 0.31-0.49). OW was not associated with sit and reach test (coefficient 0.04) and only weakly with the

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ball skills test (coefficients-o.10 to 0.12). In conclusion, OW had the most negative association with cardio respiratory and muscle endurance, and explosive power tests.

Leonardo Nhantumbo, Mala Jose, Silvio Saranga, Rogerio Fermin, Antony Prista\(^\text{10}\) (2007) conducted a study with the following objectives: 1) assess aspects of somatic growth and functional ability (Aptf) in children and young people from Rural Calanga 2) to examine the influence of chronological age, sex and geographical area (GA) in the variability of somatic growth and physical fitness (PF) of children and youth from Calanga, Mozambique 2) to differentiate their values to those of Urban areas (UA) of the same age cohort, as well as with those from international references. Sample size consisted of 3172 subjects of both genders from seven to 16 years old; 818 subjects were from Rural area (RA) and 2354 from UA. Height and weight were measured according to LOHMAN et al. (1988) procedures. PF was evaluated with 1) AAHPERD (1980) test battery which includes mile run and grip; 2) EUROFIT (1988) including tests such as sit and reach, standing long jump, flexed arm hang and 10*5 meters run; 3) FITNESSGRAM (1994) assessing curl up. Data analysis consisted of ANOVA 2 and ANOCOVA, as well as descriptive statistics’ done in SPSS 14.0. An increase pattern of mean values in PF was found in both genders, with greater values in boys; a significant effect as well as an interaction of age, sex and GA in the majority of somatic and PF variables. Body mass index in boys and coefficient of total physical activity in girls have proved covariates significant in most tests. 

Conclusions: 1) the average height and weight of the subject HR of both sexes were below the 25\(^\text{th}\) percentile (P25) percentile of the distribution of reference the CDC/NCHS/WHO (2000), 2) is a striking sexual dimorphism in physical fitness for the boys and elderly with exception of proof of flexibilities in stress better than girls results 3) it is clear the effect of AG, with the clear advantage in most subjects of the AU of evidence, 4) the median values of the physical fitness of boys and girls of Calanga are higher than the references in the American and Belgian proof of miles and flexibility, respectively, and favorably comparable to reference values in most other Belgian evidence.

D. J. Macfarlane, G. R. Tomkinson (2007) aimed to summarize existing literature reporting explicitly on secular changes in the fitness test performance of Asian children and adolescents, and where possible, comment on the geographical variability of such performances. Using a meta-analytical strategy, this study summarizes the secular changes in power, speed and cardiovascular endurance test performance of over 23.5 million 6- to 19-year-olds from seven Asian countries, tested between 1917 and 2003. In addition, it summarizes the geographic variability in fitness test performance of Asian children and adolescents within, and outside Asia. There has been very little change in the power and speed test performances of Asian children and adolescents in recent decades, yet alarmingly, there have been consistent declines in cardiovascular endurance fitness performance across all studied Asian nations over the past 10-15 years. Given the association between cardiovascular endurance fitness and numerous degenerative conditions (e.g. diabetes, obesity and metabolic syndrome), recent declines in cardiovascular endurance fitness performance of Asian children and adolescents should be an issue of major concern for public health authorities throughout Asia.

Johnston, Delva and O’Malley (2007) conducted a study to determine the current levels of physical education (PE) and sports participation among American secondary school students, and to establish the extent to which they vary by grade level, racial/ethnic background, and socioeconomic status (SES) of the students. Methods: Nationally, representative data was used from over 500 schools and 54,000 students surveyed in 2003, 2004, and 2005 as part of the Youth, Education, and Society (YES) study and the Monitoring the Future (MTF) study. As part of YES, school administrators completed questionnaires on physical activity (including rates of sports and PE participation) of students in their schools. Students in the same schools completed self-administered questionnaires in the same year as part of MTF, providing individual


background data, including their gender, racial/ethnic identification, and parents' education level. Data was analyzed in 2006. Results: Physical education requirements, and actual student participation rates, decline substantially between 8th and 12th grades. About 87% of 8th graders were in schools that required them to take PE, compared to only 20% of 12th graders. Principals estimate that over 90% of 8th graders actually take PE, compared to 34% of 12th graders. Subgroup differences in PE participation rates were small. Only a fraction of all students participate in varsity sports during the school year, with girls participating only slightly less than boys (33% vs. 37%). Participation correlates negatively with SES and was lower among black and Hispanic students than white students, even after controlling for other variables. Participation rates in intramural sports were even lower, declined in higher grades, and were lower among low-SES and Hispanic students (after controlling for other variables). Conclusions: Physical education is noticeably lacking in American high schools for all groups. Racial/ethnic minorities and low-SES youth, who are at higher than average risk of being overweight in adolescence, are getting less exercise due to their lower participation in school sports. Disparities in resources available to minorities and lower-SES youth may help explain the differences in participation rates.

Volbekiene, Vida, Griciute, Ausra, (2007) performed a study on Socio-economic transformation over the previous decade which may have created a less active life-style and a decline in fitness among Lithuanian children. The aim of this study was to analyze the differences in health-related fitness among 12, 14 and 16-year-old Lithuanian boys and girls from 1992 to 2002. The height and weight of the children were measured, and the Euro fit test battery was used to analyse the children's fitness. For the analysis of differences, 2,009 children aged 12 (n = 697), 14 (n = 733), and 16 (n = 579) years were tested. Boys and girls of all three age groups performed better in the sit and reach test (12.4-19.8%, p<0.001) and in the 20 m shuttle run test (30.0-46.0%, p<0.001) but did fewer sit-ups (3.5-7.3%, p<0.05) in 1992 compared with the results in 2002. The girls' performance was better in the long broad jump test (4.9-5.5%, p<0.001) in 1992 than in

2002. These differences were not significantly influenced by weight, body mass index (BMI), and "height+BMI". There was a marked decrease in aerobic fitness and flexibility and a slight increase in abdominal muscle endurance among Lithuanian schoolchildren. Leg muscular power decreased slightly in girls but remained unchanged in boys. A decrease in daily physical activity is the most likely contributing factor to the decrease in aerobic fitness and flexibility and PE reform has not been able to compensate for this effect.

**Dursun Guler, S. Balci, Filiz Colakoglu, Selma Karacan**¹⁴ (2007) aimed to develop the health-related physical fitness norms and to evaluate the health-related physical fitness of 8 to 10 yea-old Turkish girls. The number of the subjects who participated in the study was 602 volunteer girls, of which 225 were 8-year-olds, 196 were 9-year-olds and 181 were 10-year-olds from the state schools and private schools. The measurements and tests of this study were as follows, respectively: sit-and-reach test, Skin-fold measurement, sit-up, pull-up, and one mile (1600 m) run-and-walk and in statistical Analysis mean, standard deviation, docile and quartile norm values of skin-fold measurements and totals, sit and reach, bent-knee Sit-ups, pull-ups and one mile walk-run tests results of the subjects were obtained and evaluated. As a result, components of health-related physical fitness, applied to female children from 8 to 10 showed that fatness ratio, and the values of cardiovascular endurance were better than international norms; the values of abdominal strength, of upper body strength and of flexibility were below international norms. In addition, the norms which were developed would be referred to nationally representative health-related physical fitness of 8 to 10 years old Turkish Girls.

Mergul Colak, Metin Kaya\textsuperscript{15} (2007) in their study put forward the sex and age difference of 12-14 years of students educating in Erzincan and in its districts by determining the body composition concerning to health related physical fitness characteristics. A total of 1019 students, 476 girls and 543 boys living in Erzincan and its districts (Kemah, Uzumlu, Tercan) voluntarily participated in this study. Anthropometric tests including height, body weight and skin fold measurements were applied to calculate body composition of students. A 3x2x2 (age-sex-settlement) variance analysis was used to analyze data. The Tukey and Tamhane’s statistical techniques were used when differences were significant between age groups. When comparisons were done in the viewpoint of sex differences, it was reported that body weight and body fat percentage of girls were higher than those of boys (p<0.01) whereas boy had higher lean body mass than girls (p<0.05). It was found that all anthropometric measurements, body fat percentage and lean body mass of students living in city center were higher than the students living in districts (p<0.001). The height and body weight and lean body mass of girls and boys increased by age (p<0.001). At the end of this study, it was determined that all values of girls increased by age. On the other hand, it was reported that some values of boys remained almost the same except height body weight and lean body mass.

Jones, B. Sarah, Knapik, J. Joseph, Sharp, A. Marilyn Darakjy, Salima, Jones, H. Bruce\textsuperscript{16} (2007) investigated to determine the validity of self-reported Army Physical Fitness Test (APFT) scores. The APFT is administered to all soldiers in the U.S. Army twice a year and consists of the maximum number of push-ups completed in 2 minutes, the maximum number of sit-ups completed in 2 minutes, and a 2-mile run for time. Army mechanics responded to a questionnaire in March and June 2004 asking them to report the exact scores of each event on their most recent APFT. Actual APFT scores were obtained from the soldier's military unit. The mean +/- standard deviation (SD) of actual and self-reported numbers of push-ups was 61 +/- 14 and 65 +/- 13, respectively. The


mean +/- SD of actual and self-reported numbers of sit-ups were 66 +/- 10 and 68 +/- 10, respectively. The mean +/- SD of actual and self-reported run times (minutes) were 14.8 +/- 1.4 and 14.6 +/- 1.4, respectively. Correlations between actual and self-reported push-ups, sit-ups, and run were 0.83, 0.71, and 0.85, respectively. On average, soldiers tended to slightly over-report performance on all APFT events and individual self-reported scores could vary widely from actual scores based on Bland-Altman plots. Despite this, the close correlations between the actual and self-reported scores suggest that self-reported values are adequate for most epidemiological military studies involving larger sample sizes.

Garver, N. Julie, Jankovitz, Z. Kristine, Danks, M. Jane, Fittz, A. Ashley, Smith, S. Heather, Davis, C. Steven (2006), performed a study on firefighters. Both industrial and municipal firefighters need to maintain high levels of physical fitness and minimize cardiovascular risk factors. The nature of firefighter responsibilities in industrial and municipal settings may vary, affecting the ability to sustain high levels of physical fitness. They compared the working conditions, physical fitness, and exercise training practices of an industrial fire department (n = 17) to those of a nearby municipal fire department (n = 55). After informed consent, aerobic capacity, muscular strength, muscular endurance, body composition, flexibility, blood lipid concentrations, and blood pressure levels were measured. Exercise training practices and related factors were assessed using a questionnaire. Despite programmatic differences, these departments demonstrated similar, relatively high degrees of physical fitness and similar blood lipid concentrations, blood pressure levels, and cardiac risk factors. It is recommended that fire departments involve appropriately trained staff, schedule on-duty times for exercise, offer well-equipped exercise facilities, and follow National Strength and Conditioning Association (NSCA) and American College of Sports Medicine (ACSM) guidelines for exercise conditioning in order to maintain a high degree of physical fitness.

D. S. Yang (2006) studied the Korean law of ministry. According to Article 442 of the Korean Law of Ministry of Education, the physical education requirements were increased in 1981 from 78 hours to 102 hours per academic year in the junior and high schools. Scores on the Korean Student Physical Fitness Test (KSPFT) are now also used as part of college entrance requirements. Thus, there has been much concern and action in Korea to help children develop and maintain fitness. The research compares the 1979 and 1986 KSPFT results to see if change has occurred. The following conclusions were drawn: (1) a significant difference between grade levels was found between the boys. With the girls, there was a mixed performance between 9th and 12th graders. Superior to the girls. (3) A significant difference in year was found between the 1979 group and the 1986 group. The 1986 group performed significantly better than the 1979 group in the 100m run, standing broad jump, sit-ups and flexed-arm hang. In contrast, the 1986 group was significantly poorer than the 1979 group in the distance throwing and pull-ups for boys. The 1986 group was significantly poorer than the 1978 group in the 800m run for girls and 1000m run for boys. (4) A significant grade by gender interaction was found in sit-ups, standing broad jump, 100m run and distance throwing. (5) A significant grade by year interaction was found in the distance throwing and 800m run/walk. (6) A significant gender by year interaction was found in the standing broad jump and sit-ups. (7) No significant grade by gender by year interaction was found in the KSPFT items.

Goon Daniel Ter (2006) studied the Nigerian school children. Little information exists regarding health-related physical fitness and body composition profiles of Nigerian school children, specifically concerning gender differences and compared to normative data among school-going children from other countries. Body composition was assessed using several anthropometric variables while physical fitness was evaluated using the Prudential FITNESSGRAM test battery on a random sample of 2015 children aged nine to 12 years from schools in Makurdi, Nigeria. The parametric t-test assessed the significance level between genders while the F-test tested the significance level of the variables across age groups. A two way Analysis of Variance (ANOVA) examined

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gender and age differences in fitness tests. Significance was set at a 95% confidence level. Statistically, the girls at all ages had significantly higher stature, body mass, sum of skin-folds and percentage body fat compared to boys. In comparison to their peers from other countries, this sample had a lower level of adiposity as assessed by all variables. Although the boys observed significantly higher push-ups and maximal oxygen uptake values than the girls, no significant differences were found in flexibility. In comparison with their peers from other countries, this sample demonstrated poor physical fitness performance. As such, the Benue State Primary Education Board, Makurdi, Nigeria will be advised to streamline physical education and sports practice in schools. Comparison with physical fitness of Nigerian children from developed and other developing countries is subject to caution because of the distinct nature of the educational curriculum in Nigeria, which tends to pay lip service to physical education and sports. It is possible that the Nigerian children were completely unfamiliar with some of the physical fitness tests, likely due to the lack of institutionalized physical education in the Nigerian school system. Therefore, the apparent low scoring on sit-ups, push-up and sit-and-reach tests may be attributed to a learning effect. Contemporary children from other developed and developing countries may be more “practiced” in performing for instance, push-ups, than Nigerian children, for whom this was a strange movement.

The literature has to be interpreted with some caution since the majority of epidemiological studies examining health, fitness, and obesity rely on self-reported data rather than measurements. A further limitation is that most studies examine either physical activity or nutrition, only few deals with both aspects simultaneously. In the present study Leyk, Rohde, Gorges, Ridder, Wunderlich, Dinklage, Sievert, Rüther, Essfeld, 20(2006) analyzed both aspects in more than 58,000 persons aged between 17 and 26 years. All of them were applicants for the German Bundeswehr, which accepts only volunteers with school leaving certificates and a body mass index (BMI) below 30 kg. M (-2). The admitted subjects performed a Physical-Fitness-Test (PFT) consisting of 5

simple sport tests (shuttle run, sit-ups, push-ups, standing jump, Cooper test). For 23000 subjects’ additional measurements of body height and body weights as well as information about their education level were available. This data was combined with the PFT results. It revealed large deficits in the physical fitness of young adults: More than 37 % of the participants failed to pass the PFT, with failure rates of the male volunteers increasing significantly since 2001. While the female volunteers showed virtually constant body weight and BMI, the corresponding values of men increased monotonously between the age of 17 and 26 years. Physical fitness was positively, BMI negatively correlated with education level. The present findings suggest that body weight increases and fitness decreases in non-obese young adults in Germany. Despite the correlations between BMI and physical fitness the terms "overweight" and "physically unfit" should not be regarded as synonyms.

Mikkelsson, Lasse, Kaprio, Jaakko, Kautiainen, Hannu, Kujala, Urho, Mikkelsson, Marja, Nupponen, Heimo,21 (2006) found out the relationship between adolescent physical fitness and adult health-related fitness. Forty-five subjects (20 males, 25 females) participated in physical fitness tests in 1976 and again in 2001. The adolescent physical fitness tests were distance running (2,000 m for boys or 1,500 m for girls), 50 m run, pull-ups (boys) or flexed arm hangs (girls), shuttle run, a 30-sec sit-up test, standing broad jump, hand grip-test, and sit-and-reach test. The adult health-related physical fitness index (APFI), stratified by sex, was formed by summing the z-scores of a bicycle ergometer test, sit-up test, hand-grip test, and sit-and-reach test. Height- and weight-adjusted correlations between adolescence and adulthood for exactly similar tests for men and women were, respectively, 0.74 (95% CI, 0.44-0.89) and 0.53 (95% CI, 0.17-0.76) in sit-and-reach tests, 0.41 (95% CI, -0.04 to 0.72) and 0.55 (95% CI, 0.20-0.78) in sit-up tests, and 0.53 (95% CI, 0.11-0.44) and 0.44 (95% CI, 0.05-0.71) in hand-grip tests. When all adolescent tests were put in regression analysis together with BMI in 2001, the significant explanatory factors for APFI were distance running ability and the sit-and-reach test for men and sit-up test, flexed arm hang, and BMI in 2001 for women.

Tsimeas et al., (2005) investigated physical fitness in relation to fatness in Urban and Rural Greek children by means of algometric scaling. The sample for this study consisted of 360 (189 Urban and 171 Rural; age 12.3±0.42 years) boys and 247 (125 Urban and 122 Rural; age 12.3±0.43 years) girls. The sample was highly representative (32-64%) of all 12 year old children registered in the prefecture of Trikala, Greece. All volunteers were assessed for BMI and % body fat, as well as sit and reach, basketball throw (BT), vertical jump (VJ), handgrip strength (HG), 40 m sprint, agility run, and 20 m shuttle run. To correct for possible associations between fatness and fitness, a single cause algometric scaling was employed using the natural logarithms (ln) of fitness parameters that were significantly correlated with the in body fat. Results: Independent-samples t tests revealed that VJ (p<0.05) was significantly higher in boys living in Urban settings compared to their Rural counterparts. Similarly, BT was found to be significantly better (p<0.05) in Urban girls, whereas HG was significantly higher (p<0.05) in Rural girls. Conclusion: Considering that (a) only three out of the 14 possible cases (seven fitness parameters for boys and seven for girls) were significantly different between Urban and Rural children, and (b) these differences were not uniformly distributed in children living in either Urban or Rural environments, it is concluded that the place of residence has no clear impact on physical fitness as studied herein.

Monyeki, Koppes, Kemper, Monyeki, Toriola, Pienaar, Twisk (2005) determined the relationships between the body composition characteristics, body mass index (BMI), sum of skin folds (SSF), % body fat (%BF), fat-free mass (FFM) and waist-to-hip ratio (WHR), and nine physical fitness test items in undernourished Rural primary school children in Ellisras, South Africa. DESIGN: A cross-sectional study. The study consisted of 462 boys and 393 girls who were aged 7-14 y. Five body composition measures were assessed: BMI, SSF, %BF, FFM and WHR. Nine physical fitness test items were assessed: standing long jump, bent arm hang, sit-ups, 10 x 5 m shuttle run, 50 m sprint, 1600 m run, flamingo balance, sit and reach, plate tapping. BMI was highly correlated

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with FFM (r = 0.7, P < 0.001). In line with findings from Western countries, regression coefficients (B) showed that children with higher BMI or SSF performed worse in bent arm hang and in 1600m run. BMI was significantly associated with flamingo balance. WHR was positively associated with bent arm hang, and inversely with sit and reach. In contrast, significant relationships were found between BMI and standing long jump, sit and reach, flamingo balance and plate tapping was significantly associated with sit and reach. Significant inverse associations were found between FFM and bent arm hang, 1600 m run) and 50 m run. FFM was significantly associated with standing long jump, flamingo balance and with sit and reach. The present study concludes that in undernourished children, body composition was significantly related to physical fitness, but not always in the expected direction. It is therefore important to note that in this population, BMI should not be interpreted as a measure of fatness/overweight, but rather as an indicator of muscle mass.

Dollman and Pilgrim (2005) conducted a study with the objective to compare rates of change in South Australian children's body composition between 1997 and 2002 in sub-samples based on location of residence and socio-economic status. Six year aged children from randomly selected South Australian schools in 1997 (32 schools, n=1,423) and 2002 (29 schools, n=992) were compared on: body mass index (BMI), sum of triceps and abdominal skin folds (skin fold sum) and waist girth. Samples were divided into Urban (population >20,000) and Rural (<10,000) sub-samples, and low, medium and high SES. ANCOVA, controlling for boys' decimal age and girls' predicted menorrheal age, was conducted for the whole sample, and where interactions were significant, separately in socio-demographic strata. Results: Between surveys, there were significant increases in boys' waist girth (p=0.004) and skin fold sum (p=0.007), and girls' BMI (p=0.0005) and skin fold sum (p<0.0001). There were significant interactions of survey year and sociodemographic variables among girls only. While there were no significant changes in anthropometric variables among Rural and high SES girls, Urban girls increased in skin fold sum (p<0.0001), waist girth (p=0.033) and BMI (p=0.0007). Low (p<0.0001) and

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medium (p=0.001) SES girls' skin fold sum increased between surveys. Conclusions: Secular trends in Australian children's body fatness are continuing. Further, the rates of change in girls are affected by the socio-demographic milieu. Implications: The development of targeted interventions to combat child obesity will depend on a clearer understanding of how environmental influences on weight status are distributed across the sociodemographic landscape.

One role of Army Reserve Officers Training Corps (ROTC) programs is to physically prepare cadets for the demands of military carrier. Cadets participate in physical training 3 days per week as part of their military science curriculum. Limited research has been conducted on the fitness level of ROTC cadets.

David Thomas, Samantha Lumpp, Jamee Schreiber and James Keith\(^{25}\) (2004) therefore profiled the physical fitness status of a cadre of ROTC cadets. Forty three cadets (30 men and 13 women) performed Army Physical test (APFT) assessments (2-mile run, 2-minute maximum pushups and Sit-ups) and clinical assessments of fitness (Bruce protocol Vo2 max, underwater weighing, and 1repetition maximum (1RM) bench press test). Mean, standard deviations were calculated to provide the physical fitness profile for each parameter. The mean scores were above the 83\(^{rd}\) percentile on all APFT items and average (percent fat) to above average (Vo2 max and men’s bench press scores) when compared with peer-age and sex-corrected norms. Only the women’s bench press score was below average. With the exception of the women’s bench press, these ROTC cadets possessed average to above average levels of fitness.

Mehmet Gunay, Kemal Tamer, Gul baltaci, Kadir Godemir\(^{26}\) (2004) developed the health-related physical fitness norms of 8 to 10 years old Turkish boys. The number of the subjects participated in the study were 670 students, which 227 were 8-year-olds, 217 were 9-year-olds and 226 were 10-year-olds from the state schools and private schools. The order of the measurements and tests was as follows: sit-and-reach test, skin-fold measurement, sit-up, pull-up, and one mile run-and-walk. In statistical analyses, mean, standard deviation, deciles and quartile norm values of skin-fold measurements and totals


sit and reach, bent-knee sit-ups, pull-ups and one mile walk-run tests results of the subjects were obtained and evaluated. As a result, the norms which were developed would be reference to nationally representative health-related physical fitness of 8 to 10 years old Turkish boys.

**Y. Koutedakis and C. Bouziotas** (2003) assessed the current national physical education (PE) curriculum in relation to selected motor and cardiovascular health related fitness parameters. A sample of 84 Greek schoolboys (mean (SD) age 13.6 (0.3) years, height 160.7 (8.6) cm, weight 50 (10.8) kg) volunteered. Forty-three indicated participation only in school PE classes and habitual free play (PE group). The remaining 41 were involved in extracurricular organized physical activities in addition to school PE and habitual free play (PE+ group). The subjects underwent anthropometric, motor (flexibility, balance, standing broad jump, hand grip, sit-ups, and plate tapping), and cardiovascular health related (percentage body fat, aerobic fitness, and physical activity) fitness assessments. Children in the PE group had inferior motor and cardiovascular health related fitness profiles compared with those in the PE+ group. Body fat (20.3 (8.8) v 13.9 (3.5); p<0.001), aerobic fitness (34.7 (3.7) v 43.9 (4.2); p<0.001), and time spent in intensive physical activity (0.2 (0.2) v 0.7 (0.3); p<0.001) showed the greatest differences between the two groups. In the pupils in the PE group, these were lower than the levels proposed to be necessary to combat future health risks. Adjustments for confounding variables showed a decrease in the significance of motor fitness, but not in cardiovascular health related parameters. The national PE curriculum for Greek secondary schools does not achieve the required levels of motor and cardiovascular health related fitness and should be reconsidered.

**Pena Reyes, Tan, Malina** (2003) studied the physical fitness of school children resident in an Urban Colonia and in a Rural indigenous community in Oaxaca, southern Mexico, was compared. Two measures of performance-related fitness (standing long jump, 35-yard dash [32 m]) and four measures of health-related fitness (grip strength, sit and reach, timed sit-ups, distance run) were taken on 355 Rural (175 boys, 184 girls) and 324 Urban

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(163 boys, 161 girls) school children, 6-13 years of age. Urban children were significantly taller and heavier than Rural children. Absolute grip strength did not consistently differ between Rural and Urban children, but when adjusted for age and body size, strength was greater in Rural children. Explosive power (standing long jump) and abdominal strength and endurance (timed sit-ups) were better in Urban than in Rural children without and with adjustment for age and body size. Urban-Rural differences in running speed (dash) and flexibility (sit and reach) varied by age group and sex. Younger Rural children and older Urban girls performed better in the distance run, whereas older Rural and Urban boys did not differ in endurance. The size advantage of Urban children does not necessarily translate into better levels of performance and health-related physical fitness. The observed differences may be related to activity habits associated with school physical education and lifestyle in the respective communities.

Li-Yu Chen (2003) performed a research with the purpose to understand the effects of exercise, combined with dietary control on body composition and health-related physical fitness of obese children (weight-for-length index). The health-related physical fitness items include 800-m run (cardio respiratory fitness), sit-ups (muscular fitness), sit and reach (flexibility), percentage of body fat (body composition) and BMI. Ten children (6 boys and 4 girls), were included in this study. Subjects were given dietary control guidelines before the experiment, and were asked to record and change in dietary habits everyday during the experiment. Meanwhile, subjects exercised 3 times a week, 50 min. each. The study lasted for 12 weeks. The blood biochemical readings like TC (total cholesterol), TG (triglycerides), HDL (high-density lipoprotein), LDL (low-density lipoprotein), and together with the health-related physical fitness items and body composition variables of the subjects were recorded both before and after the experimental period. Here are the results: 1. The average height of the subjects increased significantly (p-value<0.05). The average weight dropped by 1 kg but was not significant. 2. In the body composition, the average percentage of body fat dropped significantly and the average net weight increased significantly. 3. In the health-related physical fitness, significant progresses were observed in every item. 4. In the blood biochemical readings,

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none of them changed significantly. But the HDL readings of the subjects were all below
the normal level both before and after experiment.

**Pen, Tan and Malina (2003)**\(^{30}\) compared the physical fitness of school children resident
in an Urban Colonia and in a Rural indigenous community in Oaxaca, southern Mexico.
Two measures of performance-related fitness (standing long jump, 35-yard dash [32 m])
and four measures of health-related fitness (grip strength, sit and reach, timed sit-ups,
distance run) were taken on 355 Rural (175 boys, 184 girls) and 324 Urban (163 boys,
161 girls) school children, 6-13 years of age. Urban children were significantly taller and
heavier than Rural children. Absolute grip strength did not consistently differ between
Rural and Urban children, but when adjusted for age and body size, strength was greater
in Rural children. Explosive power (standing long jump) and abdominal strength and
endurance (timed sit-ups) were better in Urban than in Rural children without and with
adjustment for age and body size. Urban-Rural differences in running speed (dash) and
flexibility (sit and reach) varied by age group and sex. Younger Rural children and older
Urban girls performed better in the distance run, whereas older Rural and Urban boys did
not differ in endurance. The size advantage of Urban children does not necessarily
translate into better levels of performance and health-related physical fitness. From the
results authors of this study concluded that the observed differences may be related to
activity habits associated with school physical education and lifestyle in the respective
communities. Childhood obesity is the result of a long lasting imbalance between energy
intake and energy expenditure. A major contributing factor is physical inactivity which is
closely linked to bone health, cardiovascular disease risk, fitness and psychological
factors. The school seems to provide an excellent setting to enhance levels of physical
activity (PA). However, there is insufficient data from previous school-based intervention
trials on how to enhance overall PA. It is also unknown whether an intervention aimed at
increasing PA is effective in improving the children's health.

school children in Oaxaca, Mexico*. American Journal of Human Biology, 15, 6, P. 800-813.
Mansukh Wagh (2002)\(^{31}\) conducted a research of normative study of Athletics ability of C.P.Ed students of Gujarat state. They took 327 boys and girls C.P.Ed students. Age groups of 18 to 22 years in the various Physical Fitness test item for boys and girls.
1) Bent knee Sit-ups
2) Shuttle run
3) Standing broad jump
4) 50 meter yard dash
5) Scoot obstacle race test
6) Harvard step test
7) Pull ups
The result of the study the physical fitness test battery and prepared norms evaluated the performance of the C.P.Ed students on the basis of evaluation rank and grade can be marked.

Yi Ching Huang and Robert M. Malina\(^{32}\) (2002) in their study found out the relationship between physical activity and health-related physical fitness. They evaluated in all 282 Taiwanese adolescents 12-14 years of age. The subjects were randomly selected from the 7\(^{th}\), 8\(^{th}\) and 9\(^{th}\) 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 (cardio respiratory endurance), timed sit-ups (abdominal strength and endurance), sit-and-reach (lower back flexibility), and subcutaneous fatness (sum of the triceps, sub scapular, suprailiac, and medial calf skin folds). 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 strength of the relationships between estimated energy expenditure and specific fitness items in the total sample vary from low to moderate, with only 1% to 12% 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 cardio respiratory 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.

Falk, Cohen, Lustig, Lander, Yaaron, Ayalon33 (2001), examined the tracking of field-assessed fitness components in boys and girls from the second to sixth grades. A total of 857 children (448 boys and 409 girls) from 11 Urban schools were tested in grade 2; 565 children (297 boys and 268 girls) were tested again in grade 6. Only subjects who had completed all fitness tests on the two occasions were included in the analysis (n = 319: 203 boys and 116 girls). Fitness tests included a 600-m run, a flying-start sprint, the standing long jump, and a medicine ball throw. Additionally, subjects performed a skill task that involved slalom dribbling of a basketball. Baseline scores in grade 2 were correlated (Spearman Rank Order) with scores attained in grade 6. Boys had significantly (P < 0.05) better scores in all fitness tests compared with girls in both grades. Tracking of fitness components over the 4-year period in both sexes varied between 0.36 and 0.66. Tracking was consistently lower in girls than in boys, perhaps reflecting their earlier maturation.

Lohman et al.,34 (1999) evaluated body composition in 81 boys (aged 11.2+/0.6 y) and 75 girls (aged 11.0+/0.4 y) attending public schools in 6 American Indian communities: White Mountain Apache, Pima, and Tohono O'Odham in Arizona; Oglala Lakota and Sicangu Lakota in South Dakota; and Navajo in New Mexico and Arizona. These communities participated in the feasibility phase of Pathways, a multicenter intervention for the primary prevention of obesity. Body composition was estimated by using a combination of skin fold thickness and bioelectrical impedance measurements, with a prediction equation validated previously in this same population. The mean BMI was 20.4+/4.2 for boys and 21.1+/5.0 for girls. The sum of the triceps plus sub scapular skin fold thickness averaged 28.6+/7.0 mm in boys and 34.0+/8.0 mm in girls. Mean

percentage body fat was 35.6+/-6.9 in boys and 38.8+/-8.5 in girls. The results from this study confirmed the high prevalence of excess body fatness in school-age American Indian children and permitted the development of procedures, training, and quality control for measurement of the main outcome variable in the full-scale Pathways study.

**Pargaonkar (2002)**[^35] established the norms of health related physical fitness and athletic events of school students, aged 13-16 years, from the region of Mumbai district. The norms are gradable and found the same are reliable and valid. However, this study did not inform comparative norms of Rural and Urban students.

**Cooley and McNaughton (1999)**[^36] conducted a study with the aim to determine the aerobic fitness of Tasmanian secondary school children aged 11 to 16 years. A random sample of Tasmanian secondary schools was undertaken and then all children within each grade in the school were tested. In all, 6061 children undertook the test, 2981 boys and 3080 girls. The test consisted of a 20m shuttle run in time to a pre recorded timing sequence. Each child had to complete as many shuttles as possible while staying in time with the beep. The test ceased for each child when they could no longer reach the marker at the same time or prior to the generated sound. The analyses indicated that there was a significant main effect of grade and sex. Children in lower grades completed fewer shuttles than the children in higher grades, and boys completed more shuttles than girls within each grade. Students in government-run schools completed significantly fewer shuttles than their non-government school counterparts (p < .0001). On a regional basis, there were no differences between children in the north and south of Tasmania as each completed 5.7 +/- 0.1 shuttles but children in the northwestern region of the state completed a significantly greater number of shuttles. An estimation of mean VO2max based upon shuttle stages completed indicated that these values ranged from a low of 40.6 ml.kg-1.min-1 in 13-, 14-, and 15-yr-old girls to a high of 50.4 ml.kg-1.min.-1 in 16-yr-old boys. Comparisons between this and similar data suggest that Tasmanian school children are less fit than their counterparts around the world. In conclusion, normative


data for Tasmanian school children were developed and distributed to schools throughout Tasmania for use by teachers in evaluating the fitness of their students.

**Marshall, Simon, Sarkin, Sallis, McKenzie** (1998) examined the tracking of multiple health-related fitness components in children from fourth to sixth grade. Methods: 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. Results: For boys’ 3yr correlations of body mass index (BMI) (0.89), skin-fold 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 skin-folds (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, skin-fold 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.

**G. L. Khanna, P. Mujumdar, M. Saha, M. Mandal** (1998) performed a cross sectional analysis of 777 children involved in training for high level performance and a further 209 schoolchildren of 10-16 years of age. Children comprising the training group were selected by the coaches and scientists on the basis of their performance and motor qualities from all over India. The untrained reference group was composed of children from various schools. Subjects were weighted with minimum of clothing and stature was measured with stediometer. Skin-folds measured using a Harpenden skin-fold caliper at four sites. Body fat was calculated from body density. The body weight of trained children in the present study was comparatively higher than that of untrained Indian children. The result is indicative of the positive training effect on muscle mass. The

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trained Indian children were taller when compared with Dutch, German, and American children at 10-11 year age. While still comparable at 12-13 years international counterparts were taller. Indian children are less developed in physical and physiological components compared to children from various developed countries. This may be due to lower socio-economic status, poor nutritional habit and genetic reasons.

A cross-sectional study was conducted by **Chatterjee, Mandal, Das** (1993) to find out physical and motor fitness and measurements was undertaken 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.

**Sallis, McKenzie, Alcaraz** (1993) performed a Cross-sectional survey with co relational analysis and examined the relationship between habitual physical activity and components of health-related physical fitness in children. Seven public elementary schools in a subUrban southern California city were the subjects for study. Five hundred and twenty eight healthy fourth-grade children (274 boys and 254 girls), 85 % of who were non-Hispanic whites were samples of the study. Ninety-eight percent of eligible students participated. Results of six measures of physical activity in children (monitoring

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by accelerometer, parent report, and child self-reports of weekday activity, weekend activity, and summer involvement in activity classes and youth sports) were combined in a physical activity index. This index of habitual physical activity was examined in relation to measures of five components of health-related fitness: the mile run, skin-fold tests, pull-ups, sit-ups, and the sit-and-reach test. The physical activity index was significantly associated with all five fitness components. The canonical correlation was (conclusion) active children appear to engage in a sufficient variety of activities to enhance multiple components of health-related fitness.

C. B. Corbin, R. P. Pangrazi \(^{41}\) (1992) analyzed data from the National School Population Fitness Survey (Reiff et al., 1986) and data collected by the authors of the original study to assess the fitness of American children and youth based on the results of additional analyses. We then compared the numbers of children and youth meeting norm-referenced standards were compared to numbers meeting recently adopted criterion-referenced health (CRH) standards for individual test items in the FITNESSGRAM (Institute for Aerobics Research, 1987) and AAHPERD Physical Best (AAHPERD, 1988) test batteries. The number of children and youth meeting CRH standards for multiple items in a test battery was also determined. Finally, data was analyzed to determine if changes in fitness have occurred among American children and youth over recent decades. The results suggest that, with the exception of measures of arm and shoulder girdle strength/endurance, more children and youth meet criterion-referenced health standards than norm-referenced standards (50th percentile) and the majority of American children and youth meet CRH standards for individual test items. However, the majority of American children and youth cannot meet the CRH standards for a battery of items for either of the two batteries studied. A second look at decade to decade comparisons of fitness produced evidence that questions the idea that youth are less fit now than in previous years.

Athchia Pillai \(^{42}\) (1991) conducted a study on computation of norms for 12-minute run and walk among school boys. In his study he described cardio-vascular endurance is one

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of the basic and important components of physical fitness, a state level norm will be useful for boys to understand their present status compared with other boys of the same age, for the teacher and the coach either to understand or to prescribe a programme to improve the student ability and to compare it with other states. Since 15000 subjects are involved in the study, 12 minutes walk test has been considered as the more appropriate test for assessing cardio-vascular endurance. For this study, data were collected from 20 districts except the Nigeria district. Data collected from 250 subjects in each age category of 13, 14 and 15 years school boys. Tests were conducted on 12 minutes run/walk and the distance covered the nearest 50th meter were recorded as their performance. Two-way analysis of variance was applied to find out whether there was any significant difference between the district and age group in 12 minutes run/walk performance. It was found that significant difference was noticed only among different age groups. Hence, norms were constructed throughout the state for different age groups by using Hull scale.

**M. A. Looney, S. A. Plowman** (1990) performed a twofold study: (1) to determine the percentage of 6-18-year-old students who passed the FITNESSGRAM criterion scores for percent body fat (%BF), body mass index (BMI), mile run (MR), sit-ups (SU), pull-ups (PU), and sit and reach (S&R), and (2) to suggest and illustrate the instructed-uninstructed/mastery-non-mastery technique for the validation of criterion-referenced cut-off scores. The data base consisted of the NCYFS I and II national probability samples of students. Results showed that the most frequently passed item was the S&R (M = 90%; F = 97%), followed by the two body composition items (%BF: M = 89%; F = 91%) (BMI: M = 88%; F = 85%), the MR (M = 77%; F = 60%), SU (M = 65%, F = 57%), and finally the PU (M = 73%; F = 32%). It is recommended that the criterion cut-off scores be statistically validated using the illustrated technique when the active (instructed) group has been trained with documented levels of frequency, intensity, and duration and the inactive (uninstructed) group is truly sedentary.

Robins (1985)\textsuperscript{44} undertook a normative study for high school boys in the State of Alabama. He selected 2545 boys and girls studying in grades one to nine and of 6 through 14 years of age. The APPHER Youth Fitness Test and APPHERD Health Related fitness Test were administered. Percentile tables were constructed for each test item based on age and sex. Alabama and National means were compared. It was found that Alabama students scored better on events measuring ability speed and cardiovascular endurance but the National scores in abdominal muscular endurance and flexi­bility were better.

Malley (1985)\textsuperscript{45} studied the effect of age on physical performance. He took 180 elementary school boys from grades one to six. Approximately 30 subjects from each class were randomly selected. The age of the subjects ranged from 5 to 12 years. Twelve tests of different physical fitness items were conducted to judge the motor performance of the subjects. It was concluded that the motor performance of the subjects increased with the age but flexibility decreased with the age.

A. M. Elnashar, J. L. Mayhew\textsuperscript{46}(1984) performed a study on Male (\(n = 399\)) and female (\(n = 311\)) Egyptian school children, aged 9-18 yrs, had their fitness evaluated using the 6-item AAHPER test. Comparisons of the 50\textsuperscript{th} percentiles of the AAHPER norms with the median scores for the Egyptian sample revealed that the latter were substantially below average fitness levels. Egyptian boys performed significantly better than girls on all comparable test items, even when the effects of age, height, and weight were held constant by covariance. Eight weeks of twice weekly intensifed physical education instruction produced significant improvements in all test items for both sexes.

Humphrey (1983)\textsuperscript{47} conducted a study to investigate the physical fitness level of third grade pupils taught by specialists and 100 non-specialists were randomly selected from 20 schools in generally consisting of following items

1) Sit-ups


\textsuperscript{47} M. A. Humphrey, (1983). \textit{A comparison of fitness level in elementary children as taught by specialists and as taught by non-specialists}. Dissertation abstracts international, 44. P. 6
2) Sit and reach  
3) skin fold measurement  
4) one mile run and walks  

Comparison was made with the test results between all subjects taught by specialists and between females taught by specialist and non-specialists. The two groups T-test was used to make the comparison. Analysis revealed that the specialists group had significantly higher scores. The specialists males scored significantly higher on Sit-ups, sit and reach skin-fold measurement and one mile run and walk when compared with non-specialists females.  

Das (1980)\textsuperscript{48} prepared norms for finding the performances in physical fitness for class 9\textsuperscript{th}, 10\textsuperscript{th}, and 11\textsuperscript{th}. These classes were selected from the Government High Secondary School of the Union Territory of Delhi. This study was conducted on twenty percent of schools in Rural and Urban areas and the population was taken up for this study was same. Ten percent of students from each school were tested on the tests of AAHPERD Youth fitness tests and NPFP Battery ‘A’. The tests included in NPFP were the same as in the syllabus of central board of secondary education. The norms which are prepared for the boys of 9\textsuperscript{th}, 10\textsuperscript{th}, and 11\textsuperscript{th} classes were statically analyzed and it was compared with data of American students. This comparison shows that the Indian student of 9th, 10\textsuperscript{th}, and 11\textsuperscript{th} standard seen to be very poor in abdominal strength. It is seen that the performance of 9\textsuperscript{th} standard students in all tests of Youth fitness tests was poor and there was remarkable part of performance in class 10 and 11 though still lower than that of students in the United States of America expect in pull ups measuring shoulder girdle strength.  

Falls (1979)\textsuperscript{49} established norms on the AAHPHERD youth physical fitness. The norms were computed for more than 10,000 young subjects. Those who fall below the 50\textsuperscript{th} percentile in any area were advised to participate in a fitness-developed programme.  

Shoenfeld \textit{et al.}, (1977)\textsuperscript{50} predicted maximal oxygen uptake (Vo2max) in 1,951 high school students aged 14 to 19 years--1,061 girls and 890 boys--from five different types

\textsuperscript{48} Das, (1980). \textit{Prepared norms for finding the performances in physical fitness for classes 9\textsuperscript{th}, 10\textsuperscript{th}, and 11\textsuperscript{th}} Government high school union territory. Unpublished Doctoral thesis, Delhi University, New Delhi  
of high school. The schools represented most of the ethnic groups. The mean Vo2max in the boys was 41.3 +/- 9.4 (SD), and in the girls, 34.7 +/- 10.1 ml - kg-1 - min-1; it was highest at the age of 16 in the boys, and at ages 14 and 15 in the girls. Significant ethnic differences in Vo2max were recorded; Vo2max was highest in students of Middle Eastern and North African origin [boys 42.7 +/- 9.3 (SD), girls 35.9 +/- 14.5], and lowest in the subjects of European and North American origin (boys 39.8 +/- 9.2, girls 33.2 +/- 9.3). Israel-born students showed average values (boys 40.7 +/- 9.6, girls 35.2 +/- 10.9).

Significant differences in mean Vo2max values were observed in the general and agricultural high schools, and the lowest values in boys were observed in the yeshiva (parochial) high school and in girls in the state religious high school. The differences in Vo2max in the various subpopulations in Israel can be attributed mainly to different patterns of physical activity and in part to ethnic origin.

Andrews (1976) prepared the physical fitness norms for South African boys and compared their Physical fitness level with the Canadian boys. He administered AAHPER Physical fitness battery (1966). The mean scores of both the boys – South African and Canadian were compared. It was found that South African boys performed better than the Canadian boys. Difference was significant.

Mervin (1974) and his associate defined physical fitness into four factors in this previous study, which are cited in this chapter. In this second study, 13 fitness items were administered to 109 college women and 97 college men. Data was analyzed using 8 derived factor solutions. This present study was proposed and conducted to serve as a partial replica of the initial study and to serve as comparative investigation of the component and tests of physical fitness. Six testing sessions were used to administer the 13 tests. As in the initial study, data were analyzed using four models and eight derived factor solutions. Findings of this study suggested for men test component are chin-up, pull-up, push-up; half hold sit-ups, leg raises; standing board jump, jump and reach; 12 minutes run, 880 yard run. For college women, modified push up, overhand straight arm

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hang, modified chin ups; bent knee sit up; standing board jump, jump and reach, 50 yard dash, 12 minutes run.

**Busch (1970)**\(^{53}\) conducted a normative study on APPHER Youth fitness test for girls in grade 7 through 10 in the state of South Dakota. One school was selected to represent each region or section of the South Dakota high school activities association. The number selected from each school was in proportion to school enrollment. The APPHER youth fitness test was administered to 1000 South Dakota girls in grade 7 through 10. Norms were established by computing every fifth percentile. The score of South Dakota were compared with those of national girls, using age only. The medians of national girls on each test items. The medians of South Dakota girls on all items, except the flexed arms hang. The scores of South Dakota girls tended to show improvement as age increased where as the scores for national girls to level off or drop.

**Rasmussen (1970)**\(^{54}\) did a comparative study. He tested the physical fitness of South Dakorta boys of all ages. Their physical fitness level was compared with national norms. It was found that median scores of South Dakorta boys at all ages were higher than the national score in all the items except shuttle run and pull ups.

**Harman (1967)**\(^{55}\) compared physical fitness level of the Urban and Rural boys. He selected 100 Urban and 100 Rural boys and administered the APPHER Youth Fitness Test. In conclusion he stated that the Urban boys’ superior to Rural boys and difference was significant at the .01 level.

**Hunsiker and Reiff (1966)**\(^{56}\) compared the physical fitness of American boys and girls studied during the years 1958 and 1965. They used APPHER Youth Fitness Test. They found that level of Physical fitness of boys and girls of 1965 years was better and higher than that of 1958 years boys and girls.

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\(^{53}\) J.G.A. Busch, (1970). *A normative study of APPHER Youth Fitness Test of girls in Grade 7 through 10 in the state of South Dakota*. Complete research in Health, Physical Education and Recreation,9: P.204

\(^{54}\) Glen L. Rasmussen, (1970). *A normative study of the APPHER Youth Fitness Test for boys in Grades Seven through Ten in the state South Dakota*. Completed Research in Health, Physical Education and Recreation,9: P.207

\(^{55}\) Boone Herman, (1967). *A Comparison of Physical Fitness Level of Urban and Rural Boys*. Completed Research in Health Physical Education and Recreation,10: P.86

Alston (1965) \(^{57}\) compared the physical performance of girls in three different tests  
1) The Vargenia physical fitness test  
2) The APPHER Youth Fitness Test  
3) North Carolina Physical Fitness Test  
He computed the correlation between the Vargenia and AAHPER Test which was .89 and between the AAHPER test and the North Carolina Test which was 80.  
Fleishman(1963)\(^{58}\) conducted a study on thirteen tests measuring eight physical fitness factors, which were administered to over 20,000 students between the ages of 12-18 in 45 cites, distributed throughout the United States. The results of this provided (a) normative table by which individual programme can be evaluated by test, age, sex and (b) growth curves which show the development of the different physical proficiency components during the adolescent and sub-adult period. Finally, the recommendations were made for batteries of tests, which provided more comprehensive and efficient coverage of physical factors.  
The APPHER (1962)\(^{59}\) YOUTH Fitness test project represented the first attempt by the physical education profession to establish national norms. The test battery was originally developed in 1957 by special committee of the AAPHER’s recreational council. The youth fitness tests now consists of six item’s for boys and girls age groups 10 to 17 and college men and women. The norms were revised up to date it and make more scientific after comparing the achievements of the youth of Great Britain, Japan etc. with American norms of youth fitness tests consists of the following.  
1) Pull-ups (modified pull-ups for girls)  
2) Sit-ups  
3) Shuttle run  
4) Standing broad jump  
5) 50 yards run  
6) 60 foot ball throw and

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7) 600 yards run walk

The norms were revised to update it and make it more specific after comparing the achievement of the youth of Great Britain, Japan etc. with the American norms.

Namiko Ikeada (1962) conducted a study to compare the physical fitness of Iowa-U. S. A. children with that of Tokyo-Japan children. He selected 395 Tokyo children and 355 Iowa children of 9 to 12 years of age. The test battery included the following test item.

1) Sit-Ups  
2) Shuttle Run  
3) Dash  
4) Standing Broad Jump  
5) Forward Bend  
6) Grasshopper  
7) Pull-Ups for Boys and  
8) Bent Arms Hang For Girls

Some Anthropometric Measurement also was taken.

The result indicated that Iowa children were heavier, taller and had longer legs than Tokyo children, but Tokyo children scored better marks in all motor performance tests except one-sit up. A comparison of physical education programmes in these schools also was made and it was found that Tokyo children had more opportunities to improve physical fitness through their physical education programme.

J. P. Verma in his study found out a new method for constructing norms of any test item based on difficulty ratings. The technique so discussed has been used to develop the norms for the school boys of Gwalior in two age categories viz. 13-14 years and 15-16 years on the five test items i.e. sit-ups for abdominal strength, balance, standing broad jump for power, 50 meter performance for speed and 600 meter performance for endurance. 480 boys in the age group of 13-16 years from the central schools of Gwalior were selected randomly as the subjects in the study. The norms so developed were distinct in both the age categories on all the test items. The important finding of the study is that in each of the test items for a given increase in the performance at the lower level a subject is rewarded less but at the higher level the reward is more. It is because that the improvement in the performance at the top level has larger difficulty ratings in comparison to that of at the lower level.

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H. Harrison Clarke and Theodore G. Schopf (1962)\textsuperscript{62} constructed a strength test for boys of 9 through 12 years of age studying in 4\textsuperscript{th}, 5\textsuperscript{th} and 6\textsuperscript{th} standards. They used cable Tension method and prepared norms for age and weight utilizing Roger’s physical fitness Index.

Cromwell\textsuperscript{63} (1960) completed a study on the growth of school children for ages eight to eighteen and discovered that boys were shorter and higher than girls during the approximate ages of eleven to fourteen. He noted that after fourteen the boys became taller and heavier and continued their growth longer than girls.

Anna\textsuperscript{64} (1958), studied the children’s performance on Krause Webber Test and found that the children, who failed in one or two items, scored poor marks in running, jumping, throwing and sit- ups items, whereas other children scored good marks.

Peng Chia-Li\textsuperscript{65} investigated the effects of the physical fitness curriculum on health-related physical fitness and blood lipids among obese elementary school children. The subjects were 40 male/female obese children, who were chosen by body mass index (BMI), divided into an experimental group and a control group. The subjects participated 50 minutes every time and twice per week through 15 weeks.

The health-related physical fitness examination and blood sampling were taken before and after curriculum. The health-related physical fitness testing events included height, body weight (convert into body mass index), sit and bend forward, one-minute sit-ups with bended knees, and 800 meter running race. The blood sampling included TC, HDL-C, LDL-C, TG, UA, and FPG. All collected data were analyzed by ANCOVA to see the health-related physical fitness and blood lipids differences between the experimental group and the control group. The level was set at .05. Following is my finding: (1) After the 15-week physical fitness curriculum, the body composition, flexibility, muscular endurance and cardiovascular fitness between the experimental group and the control

\textsuperscript{64} Expenschade Anna, (1958). \textit{Fitness of Fourth Grade Children}, Research Quarterly. P.274-278
\textsuperscript{65} Peng Chia-Li (n.d.). \textit{The Effects of Physical Fitness Curriculum on Health-related Physical Fitness and Blood Lipids among Obese Elementary School Children}. Retrieved on April 10, 2009 from www.ceps.com
group reach the significant difference ($p < .05$). (2) After the 15-week physical fitness curriculum, the TC, HDL-C, LDL-C, TG, UA, and FPG between the experimental group and the control group reach the significant difference ($p < .05$). The conclusion of this study is that the physical fitness curriculum intervention improves on the obese elementary school children’s health-related physical fitness and blood lipids. The finding of these studies may enhance the identification of healthy lifestyle which may improve health outcomes in children. The purpose of these studies was to compare the body composition and physical fitness levels of sample. The investigators applied various physical fitness tests on children and adolescent. These tests assessed body composition, C. V. Endurance, muscular strength, and muscular endurance, and flexibility. Fitness was measured by pushups, Sit-ups, sit-and reach, five –jump, back and forth jumping, ball skills, sit-and-reach test, Skin-fold measurement, sit-up, pull-up, and one mile (1600 m) run-and-walk and coordination and endurance shuttle run tests. Body composition was assessed using several anthropometric variables. The fitness index calculated as statistical Analysis mean, standard deviation, decile and quartile norm values of skin-fold measurements, the mean of z-scores for individual tests and totals, sit and reach, bent-knee Sit-ups, pull ups and one mile walk-run tests results of the subjects were obtained and evaluated. The parametric t-test assessed the significance level between genders while the F-test tested the significance level of the variables across age groups. A two way Analysis of Variance (ANOVA) examined gender and age differences in fitness tests. Investigator examined the influence of chronological age, sex and geographical area (GA) in the variability of somatic growth and physical fitness (PF) of children and youth.

The study was to develop the health-related physical fitness norms and to evaluate the health-related physical fitness. The physical fitness of any subject affects socioeconomic status, nutritional habit and genetic reasons also. Lifestyle could possibly be a key factor and predictor of physical fitness, providing strong evidence to support the interaction between lifestyle and genes in their impact on our health.