Chapter II

Review of Related Literature

One of the most important early steps in a research project is conducting of the literature review. In fact, the processes of reviewing the literature is a thoughtful one. Review of the literature provides insight into the research work researchers. It can also reveal investigations similar to your own and it can show you how the collateral researchers handled those situations.

A literature review is a description of the literature relevant to a particular field or topic. It gives an overview of what has been said, who the key writers are, what are the prevailing theories and hypothesis, what questions are being asked, and what methods and methodologies are appropriate and useful. It can reveal to you sources of data you may not have known existed. In other words, review of literature can provide you with new ideas and approaches that may not have occurred to you. It also helps you evaluate your own research efforts by comparing them with the similar efforts of others.

Keeping the previous references as guideline, efforts made to find out the researches to complete retake the present study. In order to do, any study which used the Eurofit or provisional Eurofit test batteries to assess the physical fitness of children and adolescent was considered as a candidate study.

Studies were located from the extensive review of literature by searching online journals and CD. Rom bibliographic database using the key word “Eurofit” and the modifiers “child” “adolescent” “boy” “girl” “youth”. Attempts were also made to personally contact the authors of some of the studies to request raw data to clarify details of their own study and to ask if they knew of further studies.
In order to complete the research, investigator has also visited the following libraries:
1- Jaykar library of University of Pune.
3- Library of Chandershakar Agashi College of physical education. Pune
4- Library of college of physical education of Tehran University. Iran
5- Library of national Olympic academy of sports. Tehran-Iran.

It was found that some scholars have taken the studies of comparing the physical fitness of different people with Eurofit test or have evaluated the fitness level of different people along with other factors with this test. Almost none of them have done similar research, but in this present study, the researcher has taken the study of physical fitness level of high school students and its relation to quality of physical education programs. Therefore, some of these studies are briefly reviewed because of its relevance to the present study.

In a study conducted by Antonis, et al. (2004) entitled “Fitness levels alteration of primary school Greek children in relation to curricular and extracurricular physical activity” they have tested 155 primary school pupils Aged 8.1 year at the beginning of a school year and one year later in order to find weather parameters related to physical fitness and health are affected from curricular and extracurricular physical activity levels. They subdivided the subjects into “athletes & non-athletes” group, where athletes participated in extracurricular activity and non-athletes involved only in school physical education classes. It was found that higher physical activity levels have positive effects on selected health- and skill related fitness parameters and also P.E classes are not sufficient to bring about appropriate physiological adaptation and promote health.

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In another study conducted by Baquet, et al. (2003), they have tested 39 children (15 boys & 24 girls) in order to find the “relations between physical fitness and habitual physical activity levels in children 8 to 12 years old”. Their findings showed that there wasn’t no significant difference between boys and girls in anthropometric measurements, performance in SBJ, SHR and SUP for school days, as for free days. Only relationship between SBJ and MVPA time (r=0.36, p<0.05) during school days, and between body mass index and MVPA time (r=0.34, p<0.05) during free days were found. They concluded that the habitual physical activity level of children is significantly higher during school days but was not related to the different components of physical fitness.

Jurimae, T and Jurisson, A, (1997), in their research entitled “The relationship between physical fitness and physical activity in children” investigate the relationships between health related fitness and physical activity in 10, 12, 13-year-old boys and girls. They have found that in 10 and 13-year-old boys the results of the 7 tests were significantly related with physical activity. The regression analysis indicated that total and vigorous physical activity accounted for 15-50% of variance of the endurance shuttle run. The relationships with other components of fitness were not so clear.

In another study conducted by, Gokebl, H and Uzuncan, H, (1992) they have tested 60 male primary school students age 10-12 years old with Eurofit test. The results of their study showed that mean height, weight, right hand grip, standing broad jump and 10*5 meters shuttle run values of present subjects were worse than other nation norms, while the subjects had higher mean flexibility values than other nation norms. Trained subjects had higher mean hand grip; PWC 170, standing broad jump, sit-ups, bent arm hands, and 10*5 meters shuttle run values than untrained subjects.

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Toivo, J and Vida, V. (1998) in their comparative study, have examined the “Eurofit test results in Estonia & Lithuania 11 to 17 – year-old children”. They measured the motor abilities of 4766 children (3165 Estonian & 1601 Lithuanians) from both countries with eurofit tests and present possible differences between these two countries. They have found that there were only a few significant differences in the anthropometrical parameters between the children of the two countries. In 20 meter endurance shuttle run test, Estonian boys & girls had significant higher scores (p<0.05-0.01) compared to Lithuanian children of the same age and sex. In hand grip & 10*5 m shuttle run tests results were significantly higher in Estonian children in most cases(p<0.05-0.01) Balance scores were significantly higher (0.05-0.01) in Estonian girls, while the difference was not significant in boys(p<0.05). Generally, there were no significant differences in the results of standing broad jump, bent arm hang and plate tapping between the children of both countries. It was concluded that the motor ability of the children of both countries was comparable with children of other European countries. In some tests, the results were significantly better in Estonian children when compared with Lithuanian children of the same age and sex.

In 12th Annual Congress of the ECSS, which held on 11-14 July 2007 in Finland, Tinazci, C. (2007) had presented his research entitled the: “Physical fitness in rural children compared with urban children in North Cyprus “ He examined the 3955 Euro it test results of 9-11 years old school children from 90 schools of 5 different districts. Analysis of obtained points has shown that children with 90th percentile of their test result and above were fit enough to be successfully engaged in sport activities, which vary with age 43 and district, whereas those children with data below 23rd percentile had risk of facing with health problems in the future.

Assessment of age differences of test results also indicated different impact of this factor on health and fitness levels of children. The results

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showed that body mass index and skinfolds thickness were higher in the urban children (p<0.05). Flexibility and muscle endurance of the rural children were significantly higher than urban children. The children living in urban areas were more inactive and obsess, which resulted in a decrease in their flexibility and muscle fitness.

In another study conducted by Wieslaw, O. & Jacek, B. (1991), they have compared the results of physical fitness of 600 boys and 560 girls aged 11 to 15 years old from selected European countries with the children from Poznan in Poland with Euro fit test. 416 of boys were from non-sports grades and 184 from sports grades. In girls, 388 of them attended non-sport grades and 172 were students of sports grades. It is found that youngster from Poznan had rather average body weight and height compared to their peers from the selected European countries. It also found that youngster from Poznan had an extremely high percentage of body fat. This clearly indicates that a systematic monitoring of the changes going on in the fat tissue is absolutely necessary. Generally, in the sphere of their motorial development (the non-sports standard) of the children from Poznan considerable trunk strength has been observed, good explosive strength of the legs and low functional and static strength of the arms. Regarding the trunk flexibility and agility and speed of movement, the Poznan young people were not worse, compared with their peers from other countries. The boys & girls from the sports standards usually achieve much better results compared with general level of the young people in Poznan.

Mehtap O. et al. (2003) compared the physical fitness of children who are living in rural area with urban children in Turkey. In their cross-sectional observational study, they have studied 98 children from rural and 74 children from urban area aged 9-11 with Eurofit test. It was found that rural children preferred to play football and volleyball while urban children had tendency to prefer indoor sport. The percent of urban children not involved in any sports activity was 35%, while this rate was 30.6 % for rural children. The results

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showed that body mass index and skinfold thickness were higher in urban children (p<0.05). It is also found that there were no significant differences in the hip-waist ratio between two groups. There were no difference between the two groups regarding cardiopulmonary and motor fitness, but in contrast, flexibility and muscle endurance in rural children were significantly higher than urban children.

Ziaee, V et al. (2007) examined the relationship between the body mass index (BMI) on the selected group of first-year medical students and their personal physical fitness with Eurofit test. In this cross-sectional study, they evaluated 513 first-year medical students. The group was 67.8% female and 32.2% male. The results showed that underweight status (BMI<20) was in 27.1% of the subjects, 16.1% were overweight (25<BMI>30) and 3.7% were obese (BMI>30). Overweight and obesity in males was higher than in females. The total physical fitness score in female students was better than that of male students. It also found that there is negative correlation between physical fitness and weight, BMI, body fat, and wrist to hip ratio in both genders. In addition to that, they have found the positive correlation between hip circumference and physical fitness in both groups. They concluded that medical student should be encouraged to maintain a good BMI and perform physical exercise.

Taylor, Suzan R, et al. (2002) assessed the health and skill related fitness of children from Liverpool and compare the findings to those reported in the other literatures. A total of 719 children (413 boys & 306 girls) aged 9-10 performed a series of Eurofit test. The results demonstrate that compared with children in Northern Ireland (Mahoney et al 1991) Liverpool boys were 3% taller, 10% heavier, and 6% stronger. A similar trend was evident in the girls who were 3% taller, 14% heavier and 9% stronger. The test showed that the children of Liverpool scored below average on many of the health and skill related tests. The only exceptions were 20-MST and SBJ, were both groups of boys performed 46 laps and jumped 132 cm. The children from Liverpool

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were 9% slower than those recorded in Belfast in agility and speed test. In endurance test, there was 9.5% difference between the girls data, with 33 laps compare to 36 laps for the children from Liverpool and Belfast respectively. When the results of this research compared with a study conducted in America shows that the upper body strength of children from Liverpool was 44% (Boys) and 63% (Girls) of their American counterparts (Rose et al 1987). They concluded that children of Liverpool had below average performance on some of the Eurofit test when compared to children of the same age in different countries.

**Vida, I. & Leonas, M.** (2003)\(^\text{11}\) investigated the changes in Physical fitness of girls from the 11th grades promoting their self-education and training their least developed physical qualities with Eurofit test. In this experimental study, they have examined 48 female in two equal groups of 24 girls. It was found that physical fitness of girls from the 11th grades was low. According to the Lithuanian Eurofit Reference scales, the test score in standing broad jump was 3, in sit-and-reach and shuttle run 10*5 was 4, and in bent arm hang was 5. The program designed to promote the need for self-development and to train strength and suppleness purposefully had a positive effect on the changes in the girls’ physical fitness, the results of the experimental group in standing broad jump, sit-up, sit-and reach and shuttle run 10*5m tests increased significantly (p<0.05) while in the control group only a slight increase of physical fitness was observed.

In another study, **Sheikh, M. et al.** (2006)\(^\text{12}\) investigated the possible relationship between motor abilities, anthropometry and physical activity in 12-15 years old Iranian children. They have tested 277 student aged 12-15 years with Eurofit test. The results showed that the relationship between anthropometry and Eurofit tests results was moderate and in some weight-bearing test, the relationship were significant. Physical activity of the children did not depend on the anthropometrical parameters but the endurance

\(^{11}\) Ivaskiene, V. Meidus, L. (2007). Physical fitness changes in girls from the 11th grades promoting their physical self-development and training their least developed physical qualities. *Sportas*, Nr.3(66), p.11-18

shuttle run test results in all age and sex groups correlated significantly with physical activity.

**Tomkinson, G. R, et al.** (2007)\(^{13}\) Meta analyzed 67 studies reporting on the Eurofit test performance of healthy European children and adolescents. Performances on each fitness test were expressed as z-scores relative total children of the same age and sex from all countries. They have collected 1,185,655 Euro fit test performance by 7-18 years old Europeans from 23 countries. The findings showed that there was considerable variability in the mean z-scores among countries, with the variability among countries differing by test. Overall, the best performance children came from northern and central European countries. (0.3-0.4 SD above the overall European average). They concluded that performance was related to socio-cultural factors, such as the place of exercise and sport in the national psyche.

**Nikolas, T. et al.** (2002)\(^{14}\) examined the test-retest reliability of the Eurofit motor fitness tests performed by University students. A total 98 undergraduate students (29 men aged 19.5 +/- 2.7 yr and 66 women aged 19.7 +/- 2.7 yr). Intraclass correlation coefficient indicates satisfactory coefficient above 0.70 for most tests. The only exception was the plate-tapping test, which yielded a low value (R=.57). They have founded that the majority of the Eurofit test battery fitted well within the 96% confidence interval, and only three Eurofit test motor fitness test items (flamingo balance, plate tapping, and sit-ups) presented a confidence limit below the value of 0.70. They concluded that the Eurofit test battery yielded reliable data for undergraduate students, however, in order to improve the reliability of certain test items, for application to undergraduate students, modification should be considered.

**Freitas, Durate Luis, et al.** (1999)\(^{15}\) investigated the association between socioeconomic status and physical fitness levels in children and youth from Madeira, in Portuguese with Eurofit tests. Five hundred seven

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students (251 girls, 256 boys) aged 8 to 18, including 5 cohorts (8, 10, 12, 14, and 16) have been chosen with stratified sampling and followed up during three consecutive years (1996, 1997, and 1998). Their SES was assessed by Portuguese Institute of Statics. The results showed that boys from the low SES group were more proficient than the high SES group in sit-reach, bent arm hang, standing long jump, and endurance test. They also have found that high SES group presented better results than the low SES group in sit-up, shuttle run and hand grip. The results of girls showed that differences are virtually non-existent. For standing long jump, sit-ups and shuttle run the results were better for high SES group. They have concluded that 1) SES correlations are more pronounced in boys than in girls, 2) physical fitness levels are not always different between the SES groups; therefore there is no clear trend favoring high SES.

In another study, Moreno Duarte & Vasconcelos Olga, (2002) evaluated the level of motor performance of children and adolescents living in different context, rural and urban area, according to sex and maturation status. Their sample comprised 204 subjects of both sexes, aged 11-15 years old which were belonging to different areas. One group (N=100) was from an urban area and the other one (N=104) from rural area. In order to evaluate the maturational statue, two different inquiries were used: one was menarcheal age for girls, and the other one was genital development for boys. The comparison of results revealed the superiority of physical fitness levels in children and adolescents of both sexes of rural environment than their counterparts of urban environment. There were significant statistical differences in the tests of hand grip (p=0.024) and shuttle run (p=0.000).

The comparison of the boys’ results verified that the boys’ level of physical fitness was higher in the rural environment than in the urban areas; however, only the shuttle run test presented a significant statistical difference (p=0.000). The girls’ results also verified higher level of physical fitness in the rural environment, with significant statistical differences in the shuttle run (p=0.035) and manual dynamometry (p=0.000) tests. According

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to maturational status, concerning physical fitness, the results indicated that globally, boys evidence an improvement in the following components: static strength, (hand grip), agility and running speed (shuttle run 10*5) and cardiovascular endurance. With respect to girls, the results suggested a physical fitness level improvement along the maturational development and those post-menarcheal girls, had superior physical fitness levels in almost tests when compared to their counterpart.

**Benedict, D. et al. (2001)** assessed the different aspects of physical fitness and physical activity in obese and nonobese Flemish youth. They have selected 3214 school children with random sampling and divided them into an “obese” and nonobese” group based on body mass index and sum of skinfolds. Their Physical fitness assessed by Eurofit test battery and physical activity estimated by modified Baecke Questionnaire. The results showed that obese children had inferior performances on all tests requiring propulsion or lifting of the body mass (standing – broad jump, sit-ups, bent arm hang, speed shuttle run and endurance shuttle run) when compared with their nonobese counterpart (p<0.001).

**Ozsvath, Karoly, et al. (2006)** investigated the characterize of the fitness level of students in P.E. teacher training in Hungarian University of physical Education (TF) with Eurofit test. They have tested 122 trained students (66 male, 56 female) in 30 branches of sports. After the data sorted out and checked, the results showed that the students of TF had better results than the reference scores of other Hungarian students (p<0.001) in every items of Eurofit test. They also found that BMI of student were comparatively high. The discriminate Analysis showed significant difference (p<0.001) between the results of males and females. The main caused of this difference was due to strength tests (HGR, BAH, SBJ).

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Craig.M and Dr.Colin .B.(1991) in their investigation entitled “Eurofit in Belfast primary schools” organized two-year study in order to assess the feasibility of Eurofit test with primary school children and also conducting a field survey of the physical fitness of these children. One hundred thirteen children (56 boys, 55 girls) aged, 7, 9, and 11 years have completed the first test. In the second year they have tested 587 children (294 boys, 293 girls) in the same schools. The results showed that the test have adequate test-retest reliability. It also showed that body fat for both sexes remains constant during primary years, though girls have significant more body fat than boys. Boys tend to be stronger than girls at all ages, with abdominal strength of girls in the lower age, seen as particular problem. Girls have a more consistent flexibility than male counterparts. It has been shown that with increasing age the development of strength and co-ordination allow better results to be obtained. Endurance test show significant increase with age and difference between sexes. They have also compared their results with Australian survey, and found that Belfast children are shorter in all age and sex and their weight is lower by 2-3 kg than Australian children. In other test items, Belfast children were better in SBJ, but their flexibility was closest comparative results.

Regular evaluating of physical development and sport performance of school population offers important information about the level of fitness, total physical regiment and general state of health as well. In this regard, Julius, K. & Maria, M , (1996) have conducted a study in order to testing area of physical fitness and motor profile of children in Slovak republic. They have tested 197 boys and 172 girls aged 11,12,13,14. The results show that girls are taller than boys at 12 and 13 year, while boys become taller at 14 years. In body weight, girls are heavier than boys at 12 years, while in other years body weight is greater in boys. No significant differences were found between boys and girls in the thickness, skinfolds. From total number of 9 test items, 6 of them registered better results reached by boys (motor ability),

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showed a comparative efficiency and in one case girls were better (coordination ability). When they compared their results with Slovakian population, it showed that their selected group had lower values in body weight, height and skin folds.

Wilezewski, A. et al. (1996)\textsuperscript{21} in their investigation, examined polish children from two different areas in order to find the physical fitness and body build of those children and compare with other countries. In their cross-sectional study, they have tested 494 boys and 494 girls aged 11-15 from rural and metropolitan area. The results show that children of urban area are taller and heavier than their peers living in rural region and had a higher relative fat content. The rural children had better results in balance, plate tapping, hand grip and running velocity whereas the urban children was superior in agility, trunk strength, and physical capacity.

In another investigation, conducted by Raudsepp L, & Jurimae T, (1996)\textsuperscript{22} they have tried to find the relationship between somatic growth, fatness and physical activity and fitness and fundamental motor skills in prepubertal boys. Two hundred three boys, ages 7 to 10 years old divided into four groups were studied. The results showed that body fatness was significantly, negatively correlated only with aerobic fitness and motor or performance –related fitness tests($r$=−0.51 to −0.20) but not with other components of fitness (balance, flexibility, strength, speed of limb movement). They have also found that moderate – to –vigorous physical activity was significantly correlated with motor fitness and with 20 m –endurance run. They concluded that motor development of prepubertal boys was associated with somatic variables and moderate-to-vigorous physical activity.

Alejandro D, et al,\textsuperscript{23} in their study entitled “Evaluation of general physical fitness of the Extremaduran selections of handball in categories of


formation” have tried to analyze kinanthropometric parameter and sports yield physical fitness of males and the conditional structure of male and female handball players depending on category and gender with Eurofit test. Ninety ive players (45 males, 50 females) ages 12 to 17 have participated in this study. They have concluded that females and males handball players showed an improvement of physical fitness from the infantile category to cadet, but not from cadet to juvenile category. In fact, this data shows the lack of well oriented training, especially in the juvenile category. They have also found that males handball players had better physical condition than females, except flexibility.

Chung Myung soo, (1990) 24 in his study, compared the physical fitness of junior and high school students of Korean and Japanese students with Eurofit test. He concluded that 1) Korean and Japanese have proper development of physical fitness, 2) it is useful to consider the height of students as important indexes of physical fitness, 3) it is necessary to take account of different elements of way of life as influential factors in physical fitness, 4) important attention to choosing sample size and measurement in the case of international comparison of physical fitness, 5) necessity of continues research of this kind and compare the physical fitness at any age levels.

Jurimae, T. et al. (2000) 25 conducted another study in order to compare the specific anthropometric, physical activity and motor ability parameters in 12-year-old Estonian and Russian speaking boys and girls in Estonia by Eurofit test. One hundred thirty one Estonian and 106 Russian boys and 122 Estonian and 113 girls participated in this study. The Telama questionnaire was used to assess the physical activity of participants. The results of the study showed that stature and body mass were significantly higher in Estonian boys and girls. In addition, some skin fold thickness, length and


girth parameters were also significantly higher in Estonian boys and girls. They couldn’t find any significant differences between native Estonians and Russian speaking boys and girls regarding some parameters of physical activity. The Estonian children were significantly better in most motor ability tests.

In another study which conducted by Monyeki MA, et al. (2005)\textsuperscript{26}, they have tried to determine the relationships between the body composition characteristics, BMI, sum of skin folds (SSF), % body fat (%BF), fat-free mass (FFM) and waist-to hip ratio (MHR) and nine physical fitness items which 7 of them were from Eurofit test in undernourished rural primary school children in south Africa. They have tested 462 boys and 303 girls who were aged 7-14 years old. The results showed that BMI was highly correlated with FFM. Children with higher BMI or SSF performed worse in bent arm hang (Girls, B=-0.84, p<0.0001, Boys=-0.06, P=0.02) and in endurance test. WHR was significantly associated with flamingo test, and inversely with sit-and reach. It was found that there is significant relationship between BMI, standing long jump, sit-and reach, flamingo balance, and plate tapping. SSF was significantly associated with sit and reach. (B=0.04, p=0.03) They have also found inverse association between FFM and bent arm hang, 1600 m run, and 50 m run. It was found that FFM had significant association with SLJ, flamingo balance, and sit-reach. They have concluded that body composition was significantly related to physical fitness, but not always in the expected direction.

Chouduri. D, et al. (2002)\textsuperscript{27} in their investigation entitled” Physical fitness: A comparative study between students of residential and non-residential schools (aged 12-14 years), have tested physical fitness index (PFI), BMI and anthropometry measures of 50 residential school children and 40 non-residential school children of Bijapur, Karnataka. The results


\textsuperscript{27} Choudhuri Dipayan, Choudhuri soma, Kulkarni Vasant A. (2002).Physical fitness: A comparative study between students of residential (Sainik) and non-residential schools (aged 12-14 years). Indian Journal of physiology and pharmacology. vol.46.no3,pp.328-332
indicated that non-residential school children had poor physical anthropometry and showed a less PFI score, as compared to residential school children.

In two-fold approach, Malina RM, et al. (1995) in their investigation, they have tried to find the association between fatness and fitness of girls 7 to 17 years of age in USA. At first stage, age–specific correlations between fatness and measures of health-related and motor fitness and at the second stage, they compared the fitness level of girls classified as fat and lean. They have tested 6700 samples in their survey. Five skin folds; health-related fitness and motor performance by Eurofit test were estimated. In each age group, the fattest 5% and leanest 5% were the reference percentage to compare with each fitness test.

The results showed that: cardiorespiratory was (3% to 5%) and PWC 170 (0% to 16%), sit and reach (3% to 8%), flexed arm hang (6% to 17%), sit-ups (1% to 8%) and estimation for motor fitness items were more variable: plate tapping (0% to 3%), flamingo balance (0% to 5%), 10*5 speed-agility run (2% to 12%), arm-pull (4% to 12%), standing long jump (11% to 18%). It showed that the fattest girls have generally poorer levels of health-related and motor fitness.

In another study conducted by Czeczelewski, J. et al. (2005), they examined relationship between energy intake and feeding quality with somatic features and physical fitness of 205 school children (105 boys and 100 girls) from primary schools of Warsaw, Poland by Eurofit test. On the base of research questionnaires, they have estimated the feeding quality and energy intake according to (good and bad) during last 24 hours. It was found that feeding quality had a greater influence on somatic features and physical fitness than amount of consumed energy. Children with “good” feeding were higher, heavier, less fattened and fitter than those with “bad” feeding. They

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concluded that seem food quality indirectly affected physical fitness through influence on somatic features and feeding quality had also influence on a maturation rate and this could directly affect physical fitness of studied children.

In a cross-sectional study which conducted by Savvas P.et al. (2005)\(^\text{30}\), they have tried to find a possible relation between overweight and obesity with selected motor and health –related fitness parameters of 709(328 girls, 281 boys, mean age=8.9+ 1.6 years) healthy Greek children. All children underwent anthropometric, motor and cardiovascular fitness assessments with Eurofit test battery. BMI is also estimated by International Obesity Task Force. The results showed 59.4% of the participants had normal BMI, 25.8% were overweight and 14.8% were obese, without significant differences between genders. In general, the higher BMI categories were strongly associated with inferior performance in all fitness tests, except flexibility. This relationship was consistent for both genders, although the statistical relationship between BMI and fitness performance varied by gender. They have concluded that the findings of their current study offer some support to the reported high prevalence of childhood obesity in Greece and suggest that overweight and obesity are limiting factors for fitness performance in primary schoolchildren.

The measurement of physical fitness and physical activity in children and adolescents has long been a topic of interest to physical educator and public health scientist, but raise some controversial raise question due to conceptual definitions and methodological issues. In this regard and in order to clarify this matter, Francoise Narring and his colleagues (1996)\(^\text{31}\) in their investigation entitled” physical fitness and sport activity of children and adolescents: methodological aspects of a regional survey” have tested 3540 students ages 9 to 19 years old from 4\(^{th}\), 6th, 8th, 10th, and 11\(^{th}\) grades in the region of Switzerland. The objective of their study were: 1) to use a fitness

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tests battery derived from Eurofit test battery, 2) to measure physical fitness of children and adolescents and to produce reference measurements by sex and age, 3) to assess physical activity of these children and adolescents and analyze the relationship between physical fitness, physical activity and health. The results of the survey has shown the practicality of Eurofit test in school based physical education. It has also shown that boys had better performance than girls for endurance and strength test, but girls had better performances for flexibility test. Performance was improving with age for all strength tests except for sit-ups in boys, but among the girls, the improvement of performance seemed to slow down after menarcheal age.

Twelve % of the 13-19 years old boys and 13.8% of the girls claimed not to take part in any sport activity, while 94% of the 9-12 years old declared having practiced one or more sport session during the precedent week. Twenty two % of girls and 14.2 % of boys declared less than 30 minute of physical activity inducing sweating per day. The increase in mean BMI with age showed a similar pattern to previous study in Switzerland.

Peter Van de Vilet & P. Rintala (2006)\textsuperscript{32} in their study investigated the physical fitness profile of high-performance athletes with intellectual disability (ID) and compared it with able-bodied individuals with Eurofit test. Tow hundred thirty one male and 82 female athletes participated in this study. The results showed that Both male and female athletes wit ID score better for flexibility and upper body muscle endurance, but have similar or lower values for running speed, speed of limb movement, and strength measures. Data comparison with age-matched physical education students, showed that male athlete with ID score better for running speed and flexibility, and worse for strength. Female athletes with ID score better not different from able-bodied individuals for flexibility, running speed, and upper body muscle endurance, but worse for strength measures. Athletes with ID also have poorer cardio respiratory endurance capacity compared with sportive peers without ID. They have concluded that high-performance

athletes with ID reach physical fitness levels that are equal or lower than those of able-bodied sportive counterparts.

In another study conducted by Vida Volbekiene (2007), she analyzed 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 children were measured and Eurofit test battery was used to analyze the children’s fitness. For analyses of difference, 2,009 children aged 12 (n=697), 14 (n=733) and 16 (n=579) years were tested. The results showed 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 jump test (4.9 – 5.5% P<0.001) in 1992 than in 2002. They have found that these differences were not significantly influenced by weight, mass index(BMI), and “height+BMI”. They concluded marked decrease in aerobic fitness and flexibility and slight increase in abdominal muscle endurance among schoolchildren. Leg muscular power decreased slightly in girls but remained unchanged in boys. A decrease daily physical activity is the most likely contributing factor to the decrease in aerobic fitness and flexibility and PE reforms has not able to compensate for this effect.

Willem Van Mechelen, et al. (1987) conducted a study in order to construct the Eurofit reference scales in the Netherlands for boys and girls aged 12 to 16 years old. In total, 1,034 boys and 884 girls were measured. The number of boys per age group ranged from 123 to 287 and of girls 104 to 250. The results with regard to the motor and endurance fitness tests showed, boys of all age groups had a significantly better (p<0.05 or P<0.01) score than girls with the exception of: 1) sit and reach, which the girls of all age had a significantly better score than boys 2) Plate tapping, which 12,13, and 14 year old girls had a significantly better score than boys, and

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15, and 16 years old boys and girls did not differ significantly. With regard to the anthropometrical measurements, they have concluded that boys aged 14, 15 and 16 years old boys of had a significantly taller than girls of the same age, boys aged 12 and 13 had significantly less and boys of 15 and 16 years had significantly more bodyweight than girls of the same age, and boys of all ages had a significantly lower skin fold score and lower body mass index than girls. With regard of the Eurofit test results and body height and bodyweight, they have found that there is positive significant correlation between body height with handgrip both for boys and girls of all ages and with standing broad jump for boys aged 14 years and also there is positive correlation between bodyweight with absolute hand grip force both for boys and girls of all ages and negative significant correlation with sit-ups and bent arm hang for girls aged 12 years.

Another study, conducted by Necati Akgun and his colloquies at the Ege University of Izmir, Turkey (1990)35, they have applied Eurofit test battery as means to test Turkish students in the western part of Turkey. The aims of their study were to establish regional norms scales and also to analyze the growth of the children and compare the results with other different regions in Turkey and Europe and also to assess the effectiveness of physical education in Turkey. A total of 1,107 students (579 boys, 528 girls) between 11 and 17 years old have been tested in this study. The statistical results shown the height and weight of the students increased linearly with age in both sexes. Until the age of 13 years, there was no sex difference, but after this age boys become taller than girls and sex differences were significant. It was found that boys were heavier than girls at 15, 16 and 17 years of age. Flexibility test shown that there were significant difference in all age groups; girls were more flexible than boys. In speed test, the results showed an increase in the average sprint velocity in both sexes with age, boys were faster in all age groups except signicantly at 12 years. In hand grip test, there was no signicant sex difference till age group of 14, but after this age boys’ hand grip strength increased sharply, while in girls this increase was

In standing long jump, more difference in both sexes become apparent as they get older. Bent arm hang test shown gradual increase in time with age in boys, but shown no change, even small decrease after 16 years in girls. Sex difference was significant in all age groups in this test. In sit ups test; they have found significant difference in all age groups. Boys performed better than girls at all ages. BMI result shown there was no sex difference in any age groups (except 13 years). In addition to the Eurofit test, they have used other tests as well. In their conclusion, they have stated the big standard deviation was due to heterogeneity within the groups so we have to consider this fact.

In another study conducted by Sedlacek J.T. kampmiller and M.Vavak (1993)\textsuperscript{36}, faculty of physical education and sport, Comenius University of Bratislava, Slovakia, they have tested 2495 boys and 1772 girls’ ages from 7 to 19 years old from elementary and secondary and also first school year of university students from Slovak schools by Eurofit system.

The results shown that in sit and reach test, the age dynamics of changes was similar for boys and girls, but girls reached better results regardless age. In Standing long jump, they have found differences between boys and girls in age 7-13 years. Since 13 years the group of girls is stagnating while in boys it start to stagnate since 17 years. In Hand grip test, they have seen parallel development for both genders, while the girls stagnate since 14 years but performance in boys increasing till 19 years. In Sit-ups test, boys reach permanently higher performance, since 13 years, the group of girls is practically stagnating. In Bent arm hang test, boys reached better results. In 10×5 shuttle run test, they have seen progressive improvement in both groups from 7 to 13 years. In Endurance shuttle run, from 7 to 9 years, it seen light increase and after it till 13 that relative stagnation in both genders occur.

They have also compared the Slovak former test batteries with Eurofit test battery in 619 boys and 203 girls and have found in Endurance abilities, the correlative coefficients of the validity between 12min run and shuttle run are high enough so both tests are valid. In strength abilities testing, they

concluded that strength endurance can be tested either by sit-ups or bent arm hang. And in speed abilities the correlative coefficient between 50m and 10*5 shuttle run was high enough. By comparison of the age dynamics of changes, they have concluded that except the parameter of articular mobility, the results are expressive higher in boys than girls and the level of motor fitness in condition tests in girls from 12-13 is stagnating, while in boys continue its expressive progress.

**Kin, Isler, A, Asci, F.H. Kosar, S.N.** (2002)\(^\text{37}\) in their study, try to determined relationship among physical activity levels and psychomotor, psychosocial and cognitive development of primary education students in Ankara, Turkey. A total of 293 students(male=147 female=146) which randomly selected from three schools participated in this study. Psychomotor development was assessed by the Eurofit test battery. Statistical results showed physical activity level was a significant predictor of agility, endurance, athletic competence score and trait anxiety for girls (all P<.01). For boys significant correlations were found between physical activity level and flexibility, agility, muscular endurance, vertical jump, and endurance. (All p<.01). They have concluded that physical activity level was an important factor in determining a student’s psychomotor development.

**Baquet, G, et al.** (2005)\(^\text{38}\) analyzed the health-related fitness values during childhood in French children, aged 11 to 16 years, and it’s relation to changes in physical activity level. One hundred fifty children were monitored over 4-year period. Every two years, they performed 6 test items which had been adopted from Eurofit test battery. The results showed except for flexibility, boys’ fitness performance increased more than that for the girls. Positive and significant regression coefficients were found with the regularly active for standing broad jump, 20 m shuttle run, number of sit-ups, 10*5 shuttle run in both sexes, and for the girls’ sit-and reach performance. They

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have found no association on increasing or decreasing of physical activity level with changes in fitness performances over time, except for flexibility for the girls and 20m shuttle run for the boys. They concluded that from childhood to adolescent, increasing physical activity is not sufficient to be more fit and children who are stayed the most active were the fittest, particularly the girls.

In another study, conducted by Saar, M and Jurmae, T. (2001)39 they examined the relationship between anthropometry and motor ability test results in 80 girls, aged 13-14 year old with Eurofit test. They have concluded that the influence of anthropometric parameters on the motor ability level in 13-15 year old girls in not high-about 10-20% of the total variance.

Rakovac, M, and his colleagues, at the University of Zagreb, Croatia, (2006)40 in their study entitled "Physical fitness of active and inactive women aged 50-65 –year old “Compared the physical fitness of regularly active to inactive women aged 50-65 years with each other and also with the results of Eurofit norms for adult population of the Croatia. Two hundred and sixteen women participated in this study which 116 of them had been regular active person for at least 5 years and 100 of them never participated in any kind of regular physical activity. Statistical results showed significant differences between the two groups in the five observed variables, such as balance, sit-ups, plate tapping, maximal oxygen uptake and relative Vo2 max tests, in favor of active group. They have concluded that the active women had better results in motor, musculoskeletal and aerobic fitness and also the results of this study are above the average when compared with the respective gender and age group Eurofit norms for adult population of the Croatia.

Josef Bajda and Greg, D.Gabriele (2004)\(^{41}\) have conducted another comparative study in Malta in order to implement various fitness tests and verify weather participation in youth sport nurseries is conducive to better health-related fitness levels in 11 to 16 years old boys or not. They have tested 488 boys with 4 test items from Euroit test. The results in four tests showed that in BMI; participants in nurseries had a slightly lower mean level than non-participants. In sit and reach test, the result on average, shown nursery participants had better scores in this test than non-participants. They also found that Maltese boys had very low levels of flexibility but with no practical differences between those students from two different schools. In standing broad jump, the results revealed participants had better mean scores than non-participants so differences were significant. And in last test, multistage fitness test, results showed the significant differences between participant and non-participant.

In another study entitled the level of somatic and motor development of children and adolescents from selected regions of Krakow province with regard to their life style\(^{42}\) which conducted by Ambrozy, T. and Ambrozy, D. in Poland (2001)\(^{42}\), they have tested 4098 subjects from both sexes ages 7 to 18 years old in order to find the relationship between the life style of the children and adolescents and their somatic and motor development. They have also used questionnaire to find the teachers and pupils’ participation in sports, involvement in recreation and physical exercise in terms of quality and quantity. The results showed that the level of motor activity of the participants decidedly determines the level of somatic development of the both sexes and that it take place accordingly to the rules of biological development.

The development of endurance skills and functional development was found by essential role of the level of participation in physical culture.


Silla, D and Rodriguez F.A (2007) have conducted a study in order to test the discrimination among hockey players with Eurofit test in Spain. He tested 31 competitive Spanish filed hockey players. Statistical calculations revealed that the elite players were older and more muscular, and also they had higher level of aerobic endurance, explosive strength and abdominal strength as compared to with the sub-elite players. They were comparatively faster in sprint test. When they compare the aerobic endurance level of elite Spanish players with the Dutch national team (Geisel 1991), the results were comparable since both using 20 m shuttle run. They have concluded that Eurofit test has been able to differentiate elite from sub-elite players.

In another study which conducted by Krzysztof, K. (2009), he assessed the effect of social position on the health-related fitness of 1524 urban boys aged 10-15, using combined variables of physical activity, somatic parameters and motor fitness with Eurofit battery test. The study’s results revealed that there were no significant differences in frequency and relative duration of leisure physical activity between boys with various numbers of siblings, but significant differences were found in preferred forms of LTPA. In respect of somatic parameters, it showed that smaller somatic differences depending on the number of siblings were noted in the older group boys. They have found that the level of body height, mass and fatness decrease as one move from families with a small number of children to large one. In case of motor fitness, the results showed that with a lowering number of children in the family, the lower results in motor fitness tests are noted but specific types of motor abilities “react” with a different force to social position differences.

Maciaszek, J. et al. (2001) in their study analyzed the relations between body fatness level and static strength and explosive power with Eurofit test. They tested 1574 girls’ thicknesses of skin folds and static and

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explosive power. The results indicated that the increase in thickness of skin folds positively affects static strength of girls aged 10 to 14 years \((P < 0.01)\). Explosive power is determined by thickness of skin fold to even a larger extent. They have found not only that body fat had most significant effect on the results of test to moving whole body in space but also extends the knowledge on liner and non-liner relations between body fat and static and explosive power. They found there is negative effect of significant slimness or obesity on both static strength (in the group of 14 years old) and explosive power (in the group of 11-and 14 years old).

**Meeli Saar** \(^{46}\) (2008) investigates the relationships between anthropometric parameters, different aspects of physical activity, and perceived motor abilities in 10-17 years Estonian children.

A total of 525 boys and girls have participated in this study. Their motor abilities was assessed by Eurofit test and physical activity assessed by simple questionnaire of Telama et al (1996). The anthropometry results showed that boys were taller than girls, except for 12-13 years old age group. Body mass in girls were higher at the age of 12-13 years and in boys at the age of 16-17. BMI was significantly higher in girls at the age group of 12-13 and 14-15 years. They didn’t find any statistically significant differences between boys and girls in girth parameters. The results in different Eurofit tests showed that boys were significantly better than girls except on Flamingo balance which the girls were better than boys. The statistical analysis showed that the relationship between physical activity and Eurofit test and Shuttle run 20 m was significantly correlated in all age and groups sex, but with other Eurofit tests, there were only a few significant relationships. They have also found that anthropometric parameters had significant influence on Eurofit test results and PA, but as a rule, low to moderate.

The relationships between hand grip dynamometry and perceived strength. Participation in organized physical activity was correlated significantly with perceived endurance \((r=0.37-0.44)\) and strength \((r=0.29-0.44)\).  

0.70) in 12-13-and 14-15-year-old groups. The relationship between health-related physical fitness and physical activity in children was significant but moderate (Lamb and Haworth, 1998). In this study, only the results of endurance shuttle-run correlated with participation in organized physical activity in 12-13- and 14-15-year-olds.

However, interestingly, the sum of skin folds correlated negatively with participation in organized physical activity only in the youngest age group (r = -0.28 and r = -0.30 in boys and girls respectively).

**Summary**

Knowledge concerning the anthropometric and physical fitness development, which determines the biological potential of the young generation, is essential from a practical point of view. In school based physical education, fitness testing has been proposed and used for quite different purposes, for example, evaluation of health related fitness programs, student motivation, selection of sport talents, and promotion of cognitive and effective learning.

The study of physical fitness of the populations has congregated, in the last decades, a growing interest for recognizing it's relation to physical education program and physical activity routines. The reviews of the related literature support the need of this research. It is seen that almost all the studies and reviews have used Eurofit test as means to evaluate and assess the physical fitness of school children and other people as well. Although none of these reviews have studied the physical fitness and it's relation to physical education program, but it shown the popularity of Eurofit battery test around the world and applicability of this test. Hence, with adequate literary evidence, the investigator has undertaken the study entitled "A comparative study of physical fitness of High school students of Shiraz (Iran) and Pune (India) cities and it's relation to physical education program".