CHAPTER II
REVIEW OF RELATED LITERATURE
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Review of related literature lays the foundation, avoids the risk of duplication and provides an opportunity for gaining insight into the methods, measures, subjects and approaches employed by other research scholars.

It is an important pre-requisite for locating and evaluating reports of researches related to the individual’s planned research project. It gives the scholar an understanding of the previous researches that have been done. It enables the investigator for comprehensive planning and execution of research work at hand. The researcher needs to acquire update information about what others have done and what still remains to be done in a particular area so that he can derive maximum benefit from his predecessors’ work and can move in right direction.

Though the investigator has made comprehensive efforts to survey the related literature, yet it is quite possible that some studies might have escaped his attention.

The present review is based upon the available literature in respect to the variables under investigation and is, therefore, confined to the studies which would be used to evaluate the significance of present investigation and to support the findings of this study.

Spaniol (2011) investigated the health-related fitness of undergraduate kinesiology majors. Two hundred twenty-seven undergraduate kinesiology majors, 98 females (age 22.09 +/- 2.02 yrs.) and 129 males (age 22.58 +/- 2.17 yrs.), participated in the study. All participants were enrolled in a mandatory measurement and evaluation course. Participants completed six health-related fitness (HRF) tests covering the four major areas of fitness: body composition, flexibility, muscular endurance, and cardio-respiratory endurance. Body composition was assessed using bioel-ectrical impedance (BIA) and 3-site skinfold (SKF). Flexibility was assessed using the modified sit and reach. Muscular endurance was assessed using the one-minute sit-up and one-minute push up test. Cardio-respiratory endurance was assessed using the 1.5 mile run.
Descriptive statistics were collected and data analysis was performed by utilizing one-sample t-tests, for each fitness test, to compare the means of HRF of undergraduate kinesiology majors with a set criterion standard of the general population. Raw scores were then standardized and independent t-tests were computed, for each fitness test, to compare the standardized means of HRF between genders. Statistical analyses indicated that female kinesiology majors scored significantly higher on the modified sit and reach ($t(97) = 6.53, p = .00$), one-minute push up ($t(97) = 11.13, p = .00$), one-minute sit up ($t(97) = 8.21, p = .00$) and the 1.5 mile run ($t(97) = -4.01, p = .00$) but significantly lower in BIA ($t(97) = 2.05, p = .04$) when compared to the general population. There was no significant difference in SKF ($t(97) = 0.18, p = .86$) for female kinesiology majors. Male kinesiology majors scored significantly higher in the modified sit and reach ($t(128) = 4.01, p = .00$), one-minute push up ($t(128) = 8.53, p = .00$), and the one-minute sit up tests ($t(128) = 9.71, p = .00$) but significantly lower in BIA ($t(128) = 4.35, p = .00$), SKF ($t(128) = 2.91, p = .00$), and the 1.5 mile run ($t(128) = 1.98, p = .05$) when compared to the general population. No significant differences were found regarding overall performance on fitness tests between genders. The results of this study indicate several significant differences between HRF of undergraduate kinesiology majors and the general population. This study also identifies areas for potential improvement in terms of HRF for undergraduate kinesiology majors. Kinesiology departments may consider using this study to emphasize the need to enhance HRF of kinesiology majors in order to properly prepare them for effective practices in their professional careers. Future research should be directed toward establishing appropriate levels of HRF of undergraduate kinesiology majors.

Chuen et al. (2011) Health-related physical fitness is an important risk factor of cardiovascular disease. While previous studies have identified children with developmental coordination disorder (DCD) to be less physically fit than typically developing (TD) peers, there is limited longitudinal research in this area. This study was undertaken to evaluate concomitant changes in motor coordination and health-related physical fitness of Taiwanese children with and without DCD.
over a three-year period. The Movement Assessment Battery for Children (Movement ABC) test was used to evaluate motor coordination, while health-related physical fitness included several core components: (1) body mass index (BMI), (2) sit and reach forward, (3) long jump, (4) sit-ups, and (5) 800-m run. Both the Movement ABC and fitness tests were implemented once each a year for three years. Twenty-five children with DCD and 25 TD children, matched by age and gender participated in this study. The TD group showed significant long-term changes in BMI and long jump while the DCD group showed significant increases in BMI values and decreases in flexibility, measured by the sit and reach task. In general, children with DCD performed worse on the items of flexibility, muscle strength and muscle endurance after the first year. Compared to age- and gender-matched norms, children with DCD not only were less physically fit, but showed a significant long-term decline in flexibility and abdominal or core strength (sit-ups). In years two and three, there was a significant negative correlation between poor fitness and motor coordination. Based on the results of this longitudinal study, greater attention should be paid to monitoring and improving physical fitness of children with DCD to prevent further health-related problems while intervention.

Aguero et al. (2010) revealed in their study that physical fitness is related to health at all ages. Information about physical fitness in the Down syndrome (DS) population, however, is scarce, especially when we consider children and adolescents. A review of the current data available on this topic would be both timely and important as it would serve as a starting point to stimulate new research perspectives. The data reviewed from the literature showed a general trend toward lower values of physical fitness parameters and worse body composition variables in children and adolescents with DS compared with the population without intellectual disability (ID) or even with the population with ID without DS. Notably, children and adolescents with DS have been described as less active or overprotected; however, these factors may not be the cause of their poor physical fitness. Many of the training programs carried out in children and adolescents with DS did not yield the desired responses, and the reasons are still
unknown. The purpose of this review is to summarize the current available literature on health-related physical fitness in children and adolescents with DS, and the effect of training on these variables. From the literature available, it is clear that more data on this population are necessary.

Ajwang et al. (2010) evaluate the effect of Physical education (PE) programmes in the improvement of health related fitness variables. Methodology and Results: Health-related fitness levels of persons with physical disabilities who participated in an eight week physical education programme were measured using the project UNIQUE physical fitness test battery of Winnick and Short (1985). The study group comprised of 17 boys and 14 girls from classes five, six and seven. Pre-test and post test design was used in this study. A pretest was carried out two weeks after school opening, from a five week vacation from December to January of 2009 and a post-test eight weeks later at the end of the treatment period. The data collected was descriptively analyzed and one-way ANOVA was computed to determine the significance of difference between pre and post-test means of the dependent variables under investigation, by gender and across the ages. The following hypothesis was tested in this study: - HO1 – there was no significant difference between the pretest and posttest data results with regard to the following variables of the physically challenged: cardio-respiratory endurance, low back flexibility and percent body fat. HO2 – there was no significant difference according to the gender on health-related fitness levels of the physically challenged pupils of Joyland Special School in relation to gender at pretest and posttest. The null hypotheses were rejected at P<0.05 level of significance. The findings showed that the pupils had a lower fitness level at pretest compared to after PE program. This study further established that in cardio respiratory endurance boys performed better than girls, while in low back flexibility both boys and girls demonstrated an improvement across all age groups. The overall findings of the study established that there were significant improvements on cardio respiratory endurance and low back flexibility. However, improvements on body composition were not statistically significant at p< 0.05 level. Conclusions and applications of the findings: The results showed that
physical education improves health-related fitness of persons with physical disabilities. The study recommends that physical education should be encouraged in all schools even in those involving persons with physical disabilities. Physical Education should be allocated more time on the school timetable than currently available. We recommend 5 Physical Education lessons each lasting 35 minutes totaling to approximately 3 ½ hours per week and further propose replication of this study to larger study groups and to include other categories of special needs groups, e.g. mentally handicapped and visually impaired persons.

Dartagnan et al. (2010) investigated the association between socio-demographic and behavioural factors and health standards based on physical fitness component scores in a sample of Brazilian schoolchildren. A sample of 1457 girls and 1392 boys aged 6-18 years performed a test battery of five items: (a) sit-and-reach, (b) curl-up, (c) trunk-lift, (d) push-up, and (e) pacer. The cut-off scores for gender and age suggested by the Fitness program were adopted. The findings showed that the socio-demographic and behavioural factors significantly associated with the ability of schoolchildren of meeting the health standards varied according to the fitness test. In the five tests used girls presented lower chance of meeting the health standards. Age and socioeconomic class were negatively associated with the performance in all physical tests. Schoolchildren ≤ 9 years or from families of lowest socioeconomic class presented approximately the double chance of meeting the health standards than those ≥ 15 years and from more privileged families, specifically in the push-up (OR=2.40; 95% CI 2.01-2.82) and PACER (OR=2.18; 95% CI 1.84-2.54). Interventions to promote health-related physical fitness should not only consider gender and age of schoolchildren, but also selected socio-demographic and behavioural factors, especially socioeconomic class and leisure activities.

Mak et al. (2010) investigated the relation between health-related physical fitness and weight status in Hong Kong adolescents. 3,204 students aged 12-18 years participated in the Hong Kong Student Obesity Surveillance (HKSOS) project in 2006-2007. Anthropometric measures (height, weight) and health-related fitness (push-up, sit-up, sit-and reach, 9-minute run) were assessed. Body
mass index (BMI) was computed to classify participants into normal weight, underweight (Grade I, II/III), overweight, and obese groups. The associations of health-related physical fitness with BMI and weight status were examined by partial correlation coefficients and analysis of covariance, respectively. More boys than girls were overweight or obese (18.0% vs 8.7%), but more girls than boys were underweight (22.3% vs 16.7%). Boys performed significantly ($P < 0.001$) better in sit-up (38.8 vs 31.6 times/min) and 9-minute run (1632.1 vs 1353.2 m), but poorer in sit-and-reach (27.4 vs 32.2 cm) than girls. All four physical fitness tests were significantly positively correlated with each other in both sexes, and BMI was only weakly correlated with sit up and sit-and-reach tests in boys. Decreasing performance ($P$ for trend $< 0.05$) was observed from normal weight to overweight and obese for push-up, sit-up, and 9-minute run in both sexes. From normal weight to Grade I and Grade II/III underweight, decreasing performance ($P$ for trend $< 0.05$) for sit-up and sit-and-reach in both sexes and for push-up in boys was observed. The relations between BMI and health-related physical fitness in adolescents were non-linear. Overweight/obese and underweight adolescents had poorer performance in push-up and sit-up tests than normal weight adolescents. Different aspects of health-related physical fitness may serve as immediate indicators of potential health risks for underweight and overweight adolescents.

Monroe et al. (2010) examined the relation of college students' self-perceived and measured physical fitness. Students (30 men, 30 women; M age = 20.1 yr., $SD = 1.4$) completed the Physical Self-description Questionnaire and four fitness tests: air displacement plethysmography, sub-maximal treadmill test, curl-up test, and sit-and-reach test. Significant correlations were obtained for self-perceived physical fitness with measured body composition, cardio-respiratory endurance, muscular endurance, and flexibility ($r = .33-.62$). Significant correlations were also found between self-perceived overall fitness and actual body composition, cardio-respiratory endurance, and muscular endurance ($|r| = .26-.55$). These findings suggest that college students can gauge their own fitness in terms of their distinct health-related components with some accuracy.
Rodrigues et al. (2010) examined the relationship between physical activity and physical fitness. They revealed that physical fitness and its relationship with physical activity is more apparent in adults than in children and adolescents. A large portion of the variability in physical fitness is not accounted by physical activity. This suggests that, among pediatric subjects, other factors are involved and need to be considered, for example, growth, maturation, and other components of lifestyle such as television viewing. The current study examines the relationship between physical activity and physical fitness. The sample is composed of 221 female subjects (14.1±1.1 years) from Portuguese Midlands. Somatic characteristics included body weight, stature, sum of six skinfolds and umbilical circumference. Physical activity was estimated using an uniaxial accelerometer (Actigraph, model 7164) on five consecutive days assuming a criterion of 10h per day for inclusion. Health-related physical fitness was defined as one-mile run, sit-ups, sit-and-reach and 20-meter shuttle run. After presenting descriptive statistics, data analysis determined the correlation between indicators of health-related fitness and physical activity.

Shahana et al. (2010) assessed the fitness for living in the house or on the farm or at office or factory or in work places or in any service implies freedom from disease, enough strength, endurance and other abilities to meet the demands of daily living. Doing physical activity everyday contributes to optimum health and quality of life. Life styles can be changed to improve health and fitness through daily exercises. Aerobic exercise stimulates heart, lungs and all working group of muscles and produces beneficial changes in body and mind. Many physiological changes are determined by daily aerobic exercises. The purpose of the study was to determine the effect of a 12-week aerobic exercise programme on health-related physical fitness components, which are cardio-respiratory endurance, flexibility, abdominal strength endurance and body fat in middle-aged women. A total of 60 middle-aged women from Karyavattom panchayath of Trivandrum district in Kerala state between the age group of 35 and 45 years were selected as subjects for the study. They were tested to collect the data on selected variables. The cardio-respiratory endurance, flexibility, abdominal strength
endurance and body fat percentage were selected variables. Further, 30 subjects were randomly assigned as experimental group and 30 as control group. The experimental group underwent aerobic exercise training thrice a week for 12 weeks. The control group did not attend any training programme. The post-tests were conducted on both groups to collect the data on the variables of the study. The data pertaining to health-related physical fitness components were analysed by paired ‘t’ test to determine the difference between initial and final mean for experimental and control groups. Significant difference seen at the 0.05 level with 29 degree of freedom is 2.045 and at 0.01 level with 29 degree of freedom is 2.756 in experimental group following 12 weeks of aerobic training programme for cardio-respiratory endurance, flexibility, muscular strength endurance and skin fold thickness (body fat %). In the case of control group no significant changes were seen in any of the selected variables. The conclusions of this study are improved cardio-respiratory endurance, flexibility, muscular strength endurance and decreased skin fold thickness (body fat %) among the experimental group of middle-aged women after 12 weeks of aerobic training.

Urdiales et al. (2010) assessed the secular trends in health-related physical fitness in Spanish adolescents between 2001–2002 and 2006–2007. Two representative population studies were conducted 5 years apart in adolescents (12.5–17.5 years) from Zaragoza (Spain) that participated in the AVENA study in 2001–2002 and in the HELENA-CSS study in 2006–2007. Both studies used the same tests to assess physical fitness: the handgrip strength, bent arm hang, standing broad jump, 4×10m shuttle run and 20m shuttle run tests. Performance in 4×10m shuttle run and 20m shuttle run tests was higher in 2006–2007 (Cohen’s $d$ ranging from 0.2 to 0.4, $p < 0.05$), whereas performance in handgrip strength and standing broad jump tests was lower in 2006–2007 (Cohen’s $d$ ranging from 0.3 to 1.1, $p < 0.001$). Adjustment for age, pubertal status, fat mass, fat free mass and parental education did not alter the results. The odds ratio (OR) of meeting the FITNESSGRAM Standards for healthy cardio-respiratory fitness was higher in 2006–2007 in both boys (OR, 95% CI: 2.123, 1.157–3.908) and girls (OR, 95% CI: 2.420, 1.377–4.255). The results indicate that levels of both speed/agility and
cardio-respiratory fitness were higher in 2006–2007 than in 2001–2002, whereas muscular strength components were lower in 2006–2007.

Artero et al. (2009) investigated differences in health-related fitness (20-m shuttle run, handgrip, bent arm hang, standing long jump, shuttle run 4 x 10 m and sit and reach tests) in 2474 Spanish adolescents (1196 boys and 1278 girls; age 13-18.5 years) classed as underweight, normal weight, overweight or obese according to body mass index. Body fat and fat-free mass were derived from skinfold thickness. The prevalence of underweight was higher than obesity in girls (4.8% vs 3.0%, respectively; P<0.05) and the opposite in boys (3.9% vs 5.8%, respectively; P<0.05). Underweight was associated with a higher performance in the bent arm hang test in girls (P<0.05) and a lower performance in handgrip in both genders (P<0.01) compared with normal weight. Overweight and obese adolescents presented a lower performance in 20-m shuttle run, bent arm hang, standing long jump and shuttle run 4 x 10 m tests (P<0.001), but a higher performance in handgrip strength (P<0.001) compared with normal weight. In weight-bearing tests, the association became non-significant after adjusting for fat mass. In conclusion, not only overweight and obesity but also underweight seems to be determinants of health-related fitness in adolescents.

Chen et al. (2009) examined the current situation of run-walk training of elementary school students on their health-related physical fitness and to compare the difference and correlation in health-related physical fitness after run-walk training. In addition, the study finds that guiding students to conduct a proper amount of exercise will improve their health-related physical fitness. This study selected students from the Gong cheng Elementary School as the parent group, who were sampled using tiered and random methods, and measured by “Three-Day Physical Activity Memory Record” and “Health-Related Physical Fitness Inspection.” The data obtained were analyzed by the statistical method of covariance analysis. In the aspect of cardio respiratory fitness, students in the experimental group spent more time in run-walk training than those in the control group, hence their cardio respiratory fitness improved. In the aspect of muscular strength and endurance, the experimental group showed a trend of improvement.
in the standing long jump and 800 m run-walk in contrast with the control group. This indicates that the run-walk exercise can improve elementary school students’ muscular strength and endurance. In the aspect of flexibility, the run-walk exercises led to different study results because the effect was different owing to the differences in the number of samples and experimental objectives. This study draws the conclusion that physical activity is significantly related to health-related physical fitness. Hence, properly increasing students’ involvement in physical activities will definitely and effectively increase their participation in physical activity and health-related physical fitness.

Ruiz et al. (2009) investigated whether physical fitness in childhood and adolescence is a predictor for cardiovascular disease risk factors, events and syndromes, quality of life and low back pain later in life. Physical fitness-related components were: cardio respiratory fitness, musculoskeletal fitness, motor fitness and body composition. Adiposity was considered as both exposure and outcome. The results of 42 studies reporting the predictive validity of health-related physical fitness for cardiovascular disease risk factors, events and syndromes as well as the results of 5 studies reporting the predictive validity of physical fitness for low back pain in children and adolescents were summarized. We found strong evidence indicating that: higher levels of cardiorespiratory fitness at childhood and adolescence are associated with healthier cardiovascular profile later in life. Muscular strength improvements from childhood to adolescence are negatively associated with changes in overall adiposity. A healthier body composition at childhood and adolescence is associated with a healthier cardiovascular profile later in life, and with a lower risk of death. The evidence was moderate for the association between changes in cardiorespiratory fitness and cardiovascular disease risk factors, and between cardiorespiratory fitness and the risk of developing metabolic syndrome and arterial stiffness. We also found moderate evidence on the lack of relationship between body composition and low back pain. Due to a limited number of studies, we found inconclusive evidence for a relationship between muscular strength or motor...
fitness and cardiovascular disease risk factors, and between flexibility and low back pain.

Buffart et al. (2008) assessed the components of health-related physical fitness in adolescents and young adults with myelomeningocele (MMC), and to study relations between aerobic capacity and other health-related physical fitness components. This cross-sectional study included 50 adolescents and young adults with MMC, aged 16–30 years (25 males). Aerobic capacity was quantified by measuring peak oxygen uptake (peak\(\text{VO}_2\)) during a maximal exercise test on a cycle or arm ergometer depending on the main mode of ambulation. Muscle strength of upper and lower extremity muscles was assessed using a hand-held dynamometer. Regarding flexibility, we assessed mobility of hip, knee and ankle joints. Body composition was assessed by measuring thickness of four skin-folds. Relations were studied using linear regression analyses. Average peak\(\text{VO}_2\) was 1.48 ± 0.52 l/min, 61% of the participants had subnormal muscle strength, 61% had mobility restrictions in at least one joint and average sum of four skin-folds was 74.8 ± 38.8 mm. Peak\(\text{VO}_2\) was significantly related to gender, ambulatory status and muscle strength, explaining 55% of its variance. Adolescents and young adults with MMC have poor health-related physical fitness. Gender and ambulatory status are important determinants of peak\(\text{VO}_2\). In addition, we found a small, but significant relationship between peak\(\text{VO}_2\) and muscle strength.

Hattiwale et al. (2008) assessed that body mass index (BMI) is an index of weight adjusted for height. It is one of the useful tools for diagnosing obesity or malnutrition; however, such diagnosis should take into account a person's age, gender, fitness, and ethnicity. The objective of this study was to evaluate the BMI and physical fitness index (PFI) of healthy subjects consists of early part and late part of youth of north interior Karnataka, India and also to find out the influence of BMI on PFI in same subjects as such study in this area is least done by competent researchers. Twenty five young, healthy adults belonging to age group of 17-21 years were selected as Group I and fifteen young healthy adults belonging to age group of 29-40 were selected as Group II subjects in this study.
The present study reveals that physical anthropometric parameters were found to be within the expected range of normal in both Group I and Group II subjects of north interior Karnataka which reflects the adequate nutrition, socioeconomic status and normal life style of these individuals. In this study, no correlation was found between BMI and PFI score and a positive correlation was observed between BMI and waist hip ratio in both the age groups.

Foley et al. (2008) examined the following: (a) the relationships among the latent constructs of fundamental motor skills (FMS), health-related physical fitness (HRF), and observed body fatness in South Korean adolescents with mental retardation (MR); (b) the indirect effect of fundamental motor skills on body fatness when mediated by health-related fitness; and (c) whether the degree of MR and gender affects these relationships. Students ages 13 to 18 years (287 boys and 134 girls) were recruited for the study. Separate structural equation models were estimated based on gender and the level of disability: mild or moderate MR. Group differences in the model structure were not found, so the data were combined and a single model estimated. The results showed that FMS significantly contributed to HRF (standardized effects $P = .53$, $p < .01$) and indirectly contributed to decreased body fatness mediated by HRF ($-.27$, $p < .01$). HRF directly contributed to decreased fatness ($-.50$, $p < .01$). The results from this study support the importance of both increased FMS and increased HRF in relation to decreased body fatness.

Holt and Erin (2008) in their study examined the five health-related physical fitness components as predictors for preseason overuse knee injuries in collegiate basketball players and secondarily, to determine what, if any, differences exist between the number of overuse knee injuries in males and females. Three research questions were identified for the study. Laboratory and field tests were used to determine physical fitness ratings. The data was analyzed using independent t-tests and a MANOVA. Findings showed that leg press ($F=4.846; p=0.038$) was the only significant factor in determining an athletes predisposition to a preseason overuse knee injury. No significant difference ($t=-1.774$) was found between genders. Future studies should focus on the
Ortega et al. (2008) examined the reliability of a set of health-related physical fitness tests used in the European Union-funded Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) Study on lifestyle and nutrition among adolescents. A set of physical fitness tests was performed twice in a study sample, 2 weeks apart, by the same researchers. Participants: A total of 123 adolescents (69 males and 54 females, aged 13.6 +/- 0.8 years) from 10 European cities participated in the study. Flexibility, muscular fitness, speed/agility and aerobic capacity were tested using the back-saver sit and reach, handgrip, standing broad jump, Bosco jumps (squat jump, counter movement jump and Abalakov jump), bent arm hang, 4 x 10 m shuttle run, and 20-m shuttle run tests. Results: The ANOVA analysis showed that neither systematic bias nor sex differences were found for any of the studied tests, except for the back-saver sit and reach test, in which a borderline significant sex difference was observed (P 0.044). The Bland-Altman plots graphically showed the reliability patterns, in terms of systematic errors (bias) and random error (95% limits of agreement), of the physical fitness tests studied. The observed systematic error for all the fitness assessment tests was nearly 0. Neither a learning nor a fatigue effect was found for any of the physical fitness tests when repeated. The results also suggest that reliability did not differ between male and female adolescents. Collectively, it can be stated that the reliability of the set of physical fitness tests examined in this study is acceptable. The data provided contribute to a better understanding of physical fitness assessment in young people.

Saavedra et al. (2008) investigated that whether a relationship exists between health-related fitness, taken as an indicator of regular physical activity, and educational and income levels in adult Spanish women. A stepwise stratification procedure according to population size, age and level of physical activity according to a previous epidemiological survey was used for sampling. Two thousand and thirty-eight women gave their written consent to participate (62.8% of those invited). The final sample consisted of 1709 healthy women.
Subjects were categorized into high, medium and low level groups for education and income. All participants were assessed for morphological and physical health-related fitness. Three-way MANCOVA (age as covariate) and Bonferroni’s post hoc test was used to determine the differences between groups. No significant relationships were found between age-adjusted educational and income levels. The lowest values for health-related fitness were found in the lowest educational and income groups ($P<0.001$). The higher the level of education and income, the better the values for all fitness variables ($P<0.001$), except anterior trunk flexibility. A positive relationship was found between health-related fitness and educational and income levels, which appeared to be most evident in the lowest educational and income groups. This implies that health-related promotion policies in Spain should stress the importance of regular physical activity in social classes with low levels of education and income.

Ruiz and Furtak (2006) in their cross-sectional and longitudinal studies such as Alimentación y Valoración del Estado Nutricional en Adolescentes: Food and Assessment of the Nutritional Status of Spanish Adolescents (AVENA) and the European Youth Heart Study (EYHS) respectively, highlighted physical fitness as a key health marker in childhood and adolescence. Moderate and vigorous levels of physical activity stimulate functional adaptation of all tissues and organs in the body (i.e. improve fitness), thereby also making them less vulnerable to lifestyle-related degenerative and chronic diseases. To identify children and adolescents at risk for these major public health diseases and to be able to evaluate the effects of alternative intervention strategies in European countries and internationally, comparable testing methodology across Europe has to be developed, tested, agreed upon and included in the health monitoring systems currently under development by the European Commission (EC): the Directorate General for Health and Consumer Affairs (DG SANCO); the Statistical Office of the European Communities (EUROSTAT), etc. The Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study group plans, among other things, to describe the health-related fitness of adolescents in a number of European countries. Experiences from AVENA and EYHS will be
taken advantage of. This review summarises results and experiences from the developmental work so far and suggests a set of health-related fitness tests for possible use in future health information systems.

Chow et al. (2005) conducted a study to compare health-related physical fitness in Hong Kong youth, with and without intellectual disability (ID). A stratified, random sample of 457 youth with mild ID (272 boys, 185 girls, CA 6–18 years) completed 6/9-minute run, sit-up, sit-and-reach, and sum of skinfold evaluations. Fitness data for youth without ID were obtained from previously established norms. MANOVA (age x gender) and trend analysis were used to examine fitness in youth with ID. Sample t-tests were used to compare fitness performance between youth with ID, and established norms for youth without ID. Males with ID performed better on the 6/9-minute run ($p = 0.03$), sit-ups ($p = 0.02$) and had lower skinfold measures ($p = 0.01$) than females, while females performed better on the sit-and-reach ($p = 0.01$) than males. The youth with ID demonstrated lower scores on the 6/9-minute run, compared to those without ID ($p = 0.04$), but performances on other test items varied according to age and gender. There were few differences in physical fitness between Hong Kong youth with and without ID; however, both groups appeared extremely unfit compared to peers in other developed countries.

Nourbakhsh and Sepasi (2005) concluded in this article that music is used as a means for increasing cardiovascular efficiency, achieving relaxed in the beginning an exercise program, creating an arousal state in sustaining the exercises and factors that treat human well-being. The purpose of this research was to study the effects of music on health related fitness and general health of university female physical education students. The samples of this study were 30 students that randomly assigned into equal experimental and control groups. General health questionnaire and physical fitness test (AAHPERD, 1980) were used as two instruments for this study. Validity and reliability of these tests were reported successfully. Psychological well-being was measured by this questionnaire. First two groups responded to a questionnaire and participated in health related fitness tests. The experimental group exercised 12 weeks with
music, two sessions each week, each consisting of 90 minutes while the control group exercised and received no music. Testing the proposed hypothesis at \( p<0.05 \) showed the following results: there were significant differences between general health and its dimension (somatic symptoms, anxiety and insomnia, social dysfunction, severe depression) between two groups. The analysis of results also showed that the general health of the group that received music while doing physical fitness was increased. There were no significant differences between the two groups in health related fitness. So, it is recommended that coaches and sport supervisors, with recognition of these factors, help the students for increasing good psychic readiness.

Barnes (2003) revealed that temporal trend research in some components of health-related physical fitness and activity among young people is lacking. However, the increasing prevalence of overweight and obesity in young people over the last couple decades has created speculation of secular deterioration in health-related physical fitness and activity. In an effort to address the speculation, this research project compared health-related physical fitness and activity between two groups of children: Old Order Mennonite children in south western Ontario (\( n = 124; \) aged 9.1 to 13.8 years), who live an agrarian lifestyle which does not include motorized transportation, computer use, or television viewing and rural children in central Saskatchewan (\( n = 165; \) aged 8.8 to 13.2 years), who live a contemporary Canadian lifestyle. The Canadian Physical Activity, Fitness, and Lifestyle Appraisal (CPAFLA) was used to measure health-related physical fitness. The CPAFLA is a battery of tests measuring anthropometry (standing height, body mass, skinfolds, and waist girth), cardio-respiratory endurance (step test), and musculoskeletal fitness (handgrip strength, push-ups, partial curl-ups, and trunk forward flexion). Physical activity was measured on seven consecutive days using the Model AM7164 activity monitor. The Physical Activity Questionnaire for Older Children (PAQ-C) was also employed. The PAQ-C is a guided, self-administered seven-day recall questionnaire, which assesses general levels of physical activity in schoolchildren of grades four to eight during the school year. With biological age as a covariate, univariate and multivariate
analyses of covariance were used to compare health-related physical fitness and
activity between groups respectively. Old Order Mennonite children evinced
greater mean handgrip strength ($p < 0.0001$) and rural Saskatchewan children
demonstrated greater mean trunk forward flexion ($p < 0.001$). However, there
were no significant differences between groups in the other health-related
physical fitness variables. Old Order Mennonite children had significantly greater
mean activity counts-min-1 ($p < 0.001$), mean activity counts-day-1 ($p < 0.0001$),
and mean minutes of moderate physical activity-day-1 ($p < 0.0001$). Collectively,
these results suggest that Old Order Mennonite children have greater static
strength and are more physically active than rural Saskatchewan children.
Assuming that Old Order Mennonite children represent Canadian children from
previous generations, these results may lend support to secular deterioration in
some aspects of health-related physical fitness and activity among Canadian
children.

Chen et al. (2002) developed healthy body mass index norms for children
and adolescents from health-related physical fitness. Body mass index (BMI)
norms for children and adolescents are developed from a reference population that
includes obese and slim subjects. The validity of these norms is influenced by the
observed secular increase in body weight and BMI. We hypothesized that the
performance of children in health-related physical fitness tests would be
negatively related to increased BMIs, and therefore fitness tests might be used as
criteria for developing a more appropriate set of BMI norms. We evaluated the
existing data from a nation-wide fitness survey for students in Taiwan (444 652
boys and 433 555 girls) to examine the relationship between BMI and fitness
tests. The fitness tests used included: an 800/1600-m run/walk; a standing long
jump; bent-leg curl-ups; and a sit-and-reach test. The BMI percentiles developed
from the subgroup whose test scores were better than the 'poor' quartile in all four
tests were compared with those of the whole population and linked to the adult
criteria for overweight and obesity. The BMIs were significantly related to the
results of fitness testing. A total of 43% of students had scores better than the
poorest quartile in all of their tests. The upper BMI percentile curves of this fitter
subgroup were lower than those of the total population. The 85th and 95th BMI percentile values of the fitter 18-year-old-students (23.7 and 25.5 kg m\(^{-2}\) for boys; 22.6 and 24.6 kg m\(^{-2}\) for girls) linked well with the adult cut-off points of 23 and 25 kg m\(^{-2}\), which have been recommended as the Asian criteria for adult overweight and obesity. Hence, the BMI norms for children and adolescents could be created from selected subgroups that have better physical fitness. We expect that the new norms based on this approach will be used not only to assess the current status of obesity or overweight, but also to encourage activity and exercise.

Bunce (2001) The extent to which health-related physical fitness (HRF) attenuates age differences in psychomotor speed as a function of task complexity was examined in a sample of 48 men. Physiological measures were used to assign participants to fitness group (n 1-4 = 12): young less fit (mean age = 25.83 years), young fitter (mean age = 25.08 years), old less fit (mean age = 71.83 years), old fitter (mean age = 66.75 years). A serial choice reaction time (RT) task was used in which three conditions of two, four, or eight choices were administered. RTs for the choice and motor components of the task were recorded separately. A significant Age \( \times \) HRF interaction was found in relation to choice RT but not motor time; older less fit individuals underperformed older fitter participants, and younger adults regardless of fitness level. This interaction remained significant having statistically controlled for motor function, suggesting benefits to central processing. The strength of this interaction did not increase as a function of task complexity. The findings suggest an association between HRF and psychomotor speed, and support the view that physically active lifestyles should be encouraged among older adults.

Dean (2001) assessed the effect of a female physical educator’s physical appearance on the cognitive performance of junior high school students on a test of health related fitness. AAHPER examination was administered to the students in a pre-test and post-test format. Additionally, students attitude towards the physical educator were assessed. A student attitude questionnaire (SAQ), which included 8 items and required responses on a 5-points Likert scale was
administered to the students. Post-test means were compared between groups with the pre-test scores used as a covariate. After satisfying the pre-test score assumption of homogeneity for both groups, a significant group x post-test score interaction existed: SAQ sums were analyzed for all participants and detected no significant group x time interaction. Paired t test showed that significant differences existed between all combinations of SAQ mean scores, except for the values of week one to week three.

McMillan and Erdmann (2001) described gender-specific health-related physical fitness measurements in kindergartners and determine relationships between body fatness and health-related physical fitness test performance. Significant positive relationships were found between SSK and 1-mile walk/run times for both boys and girls. Significant inverse relationships were found between SSK and pull-ups for boys and girls as well as SSK and 1-min bent-knee sit-ups for both boys and girls. Neither boys nor girls showed a significant relationship between SSK and sit and reach. Excluding the sit and reach test, researcher found higher body fatness to be significantly associated with poorer health-related physical fitness test performance in both kindergarten boys and girls.

Kaur (1999) compared the motor fitness of rural and urban girls studying in Punjab schools. The secondary purpose of the study was to prepare grading scales in motor fitness for the school girls studying in grade eleven and twelve. In all 4000 girls of grade eleven were selected as a sample for the study. The AAHPER Youth Fitness test was used for this purpose. Based on the findings of the study, following conclusions were drawn:

- Rural girls possessed better shoulder strength than urban girls.
- Abdomen strength of rural girls was found better than urban girls.
- Leg strength of rural girls was found better than urban girls.
- Agility was found lesser in urban girls than rural girls.
- Cardio-vascular endurance was found better in rural girls than urban girls.

Obara (1997) compared health-related physical fitness of high school students of Argyle Academy and River side Academy that have different physical
education programmes and found that the students from Argyle Academy demonstrated significantly better scores for the 20 m shuttle run and trunk lift, while those from Riverside Park Academy demonstrated significantly better scores for the curl-ups and 90 degree push-ups. There was no significant difference in the sum of five skinfolds, waist to hip ratio, and back saver sit and reach.

Mathew et al. (1995) conducted a study to observe secondary school physical education lessons on a variety of activities and determine (a) the percentage of lesson time pupils were engaged in moderate to vigorous physical activity (MVPA), (b) the percentage of lesson time allocated by teachers for pupils to engage in fitness activity or acquire health-related fitness knowledge, and (c) the percentage of time teachers used behaviour likely to encourage pupils to participate in health promoting physical activity. Subjects were 20 physical education teachers working in one town in south-west England. Two lessons of each teacher's choice in which they taught any activity to Years 7, 8, or 9 were videotaped. Lessons were coded with SOFIT, an observational instrument developed to quantify factors thought to promote health-related fitness in physical education. Data generated by SOFIT were entered into a SAS programme to produce descriptive statistics. Results indicated that pupils spent little time in MVPA likely to promote health benefits that teachers allocated no time for pupils to engage in fitness activities or receive fitness knowledge, and that teachers spent no time directly promoting or demonstrating fitness.

Sallis et al. (1993) examined the relationship between habitual physical activity and components of health-related physical fitness in children. Five hundred twenty-eight healthy fourth-grade children (274 boys and 254 girls), 85% of whom were non-Hispanic whites. Ninety-eight percent of eligible students participated. Results of six measures of physical activity in children (monitoring 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 .29. Active children appear to engage in a sufficient variety of activities to enhance multiple components of health-related fitness.

Singh (1993) conducted a study to compare the physical fitness status of students of department of physical education, Panjab University, Chandigarh and Kurukshetra University, Kurukshetra. He collected data on 34 male subjects and 27 female students by using AAHPER Physical Fitness Test. The students of Kurukshetra University were found superior on overall physical fitness status where as girls of Panjab University were significantly better than Kurukshetra University in speed and agility components. However, no significant differences were observed in the overall physical fitness between the subjects of both universities.

Abdulnaur (1988) compared physical fitness of secondary school students in Kuwait and America. AAHPER Youth Fitness Test was administered to 6502 between age group of 14 to 17 years. The results indicated boys and girls in Kuwait demonstrated low levels of physical fitness than American boys and girls.

Lamb et al. (1988) in their article focuses on the concept of positive health and, in particular, recognizes the importance of physical fitness. It is argued that measures of physical fitness are indicators of positive health and such measures are identified under their discrete headings of agility, flexibility, power, speed and reaction time, strength, cardiovascular capacity, body composition and posture. The theme of health-related fitness is explored, with recognition of its increasing importance for health promotion in schools, the community and commerce. Evidence is presented that highlights the general acceptance of the importance of certain fitness components in the assessment of the positive health of populations. In addition, an alternative method of assessing fitness is discussed, arising from the authors’ recognition of its potential as an inexpensive, easily administered indicator of one aspect of positive health. The case for using subjective indicators
of positive health is also presented—the argument being that subjective health
could be a possible mediator in the attainment of positive health.

P.C.P.F.S. (2005) emphasized on quality school physical education
programmes to educate young people about the essential nature of physical
activity and its relationship to health, physical fitness, and a more dynamic and
productive life while providing them the opportunity, skills, knowledge, and
motivation to become and remain physically fit.

Tucker (1987) conducted a study to determine relationships between
mental health and physical fitness. A sample of 385 high school males from 14
sections of physical education courses was used. Results indicated that mental
health and physical fitness considered multivariately and univariately were related
significant. In general as fitness increased, subjects were more intelligent,
emotionally stable, practical and self confident.

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

Ronins (1985) conducted a study to develop percentile norms for Alabama
students in grades 1 to 9 based on their performances both on the AAHPER Youth
Fitness Test (YFT) and AAHPER Health Related Fitness Test (HRFT). The two
tests were administered to 2545Alabama boys and girls of age group 6 to 14
years. Percentile table were constructed for each test item based on age and sex.
‘t’-test was used to determine significant differences between means. Alabama
students performed better in events namely agility, speed and cardiovascular
endurance. The national group performed better on events measuring abdominal
muscular endurance and flexibility.

For this purpose, she selected eighty students of Central School No.1 Gwalior,
from grade eight and nine. It was concluded that a common scale of AAHPER Youth Fitness Test could be used for the grades eight and nine and sigma scales and hull scales were more suitable than T scales.

Thiruppathi (1982) developed physical fitness norms for the boys of junior college in Sholapur district. American Alliance for Health, Physical Education and Recreation AAHPER Youth Fitness Test was administrated on them. The two scales namely T-scale and hull-scales were constructed for the combined samples of the junior college and separately for class 11th and 12th.

Dass (1980) prepared physical fitness norms for classes nine through eleven of Delhi administration schools. In each percent of students were tested on the items of AAHPER Youth Fitness Test and N.P.F.P. battery “A”. The items in the N.P.F.P. battery were the same as included in the syllabus of C.B.S.E. Percentile norms were prepared in the statistically analyzed which included the abdominal strength of the Indian students seemed to be very poor as compared to those of American students. The performance of students of class 11th was very poor in all items of fitness tests and there was a remarkable sports performance in class 10th and 11th through still lower than that of students in America except in pull up measuring shoulder girdle strength.

Saha (1987) compared the selected physical fitness variables and anthropometric measures of Tribal and non-Tribal student of Tripura. They were tested with selected items of AAHPER Youth Fitness Test, 50 yard run, 40 yard dash, shuttle run and 600 yards run/walk and selected anthropometric measurements, chest girth, height, weight, upper arm girth, thigh girth and calf girths. In all these tests, the composite mean scores of tribal students were higher than their non-tribal counter parts but none of the difference in means were found statistically significant.

Tateja (1978) conducted a study to find out the comparison of physical fitness of rural and urban school students of Delhi. It was found that in AAHPER Youth Fitness Test mean of the urban high school students was higher than the rural high school students, where as the means of the rural high school students was slightly higher than the means of the urban high school students in the NPED
test. It was also found that there was no significant difference in physical fitness level of rural and urban high school students of Delhi.

Anyanwa (1977) Physical fitness norms for Nigerian boys and girls of 11 to 18 years of age were constructed. The test items included were shuttle run, pushups for boys, chair pushups for girls, flexed knee sit-ups, 45 meter dash, standing long jump, pull-ups for boys, flexed arm hang for girls, nine minute run for subjects 11-12 years and 12 minute run for subjects 13-18 years. A comparison of the mean score of the United States and the Nigerian youth showed that at the upper age levels, the United States youth had better physical fitness status than their Nigerian counterparts, whereas at the lower level there was much difference.

Veeraswami (1973) conducted a study to evolve physical fitness norms for higher secondary school of greater Gwalior. It was concluded that in all items except pulls ups of the AAHPER Youth Fitness Test, the mean score in Indian boys in all age groups were lower than the percentile of American norms. There was a positive but low order of relationship between physical fitness and participation in physical activities. There was a positive low correlation (r=.13) between physical fitness and academic achievement.

Hunsicker and Reiff (1966) compared the physical fitness level of American boys and girls during the year 1965 with those of students attending school during 1957-58. The fitness of the subjects was measured by AAHPER Youth Fitness Test for boys and girls. The results of the statistical analysis included: percentile scores based on Nelson-Cozens classification index were also determined for each test and both sexes. It was observed that the physical fitness level of public school children, grade 5-13, in 1965 was above than that in 1958.

After reviewing the related literature thoroughly, it has been found that in today’s changing pattern of human life the latest concept of health related physical fitness seems to be more significant. Scholarly attempts have been made by different researchers to evaluate and to compare health related physical fitness level of different age and gender groups. But the present area of investigation “Comparison of Health Related Physical Fitness among Boys of Punjab State
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Kandi and Non-Kandi Area” has not been investigated by any scholar in the past because of which the present investigator has chosen the above area for his investigation and opted to compare the health related physical fitness of different age groups of students and to develop health related physical fitness norms for the same.