Chapter II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

This chapter describes the source of review of related literature. The researcher finds out some of the review of literature which could be very supportive and strengthen this study.

The literature related to any problem helps the scholar to discover what is already known, which would enable the investigator to have a deep insight, clear perspective and a better understanding of the chosen problem and various factors connected with the study. In the following pages, an attempt has been made to present briefly a few of the important researches and studies conducted abroad and in India, as they have significant bearing on the present study. The collected reviews were presented in the following headings,

1. Studies on Effect of Physical Activity among Adolescents

2. Studies on Factors Influencing Physical Activity and Physical Fitness among Adolescents
3. Studies on Factors Motivates Physical Activity and Physical Fitness among Adolescents

4. Studies on Relationship between Physical Activity, Physical Fitness and Health

5. Studies on Physical Activity and Physical Fitness Intervention Programme

6. Summary of Literature

2.2 STUDIES ON EFFECT OF PHYSICAL ACTIVITY AMONG ADOLESCENTS

Videman., Tapio., Sarna., Seppo., Battié., Michele Crites., Koskinen., Seppo., Gill, Kevin., Paananen., Heli., Gibbons., & Laura. (1995) understand the long-term effects of exercise on back-related outcomes, back pain, sciatica, back-related hospitalizations, pensions, and magnetic resonance imaging findings were studied among former elite athletes. Questionnaires were returned by 937 former elite athletes and 620 control subjects (83% response rate). Identification codes allowed record linkage to hospital discharge and pension registers. Magnetic resonance images were obtained of selected subgroups with contrasting physical loading patterns. It was concluded that, maximal weight lifting was associated with
greater degeneration throughout the entire lumbar spine, and soccer with degeneration in the lower lumbar region. No signs of accelerated disc degeneration were found in competitive runners. However, back pain was less common among athletes than control subjects and there were no significant differences in hospitalizations or pensions. No benefits were shown for vigorous exercise compared with lighter exercise with respect to back findings.

Peter Salmon. (2001) discussed the effect of physical exercise on anxiety, depression and sensitivity to stress. Antidepressant and anxiolytic effects have been demonstrated most clearly in subclinical disorder, and clinical applications remain to be exploited. Cross-sectional studies link exercise habits to protection from harmful effects of stress on physical and mental health, but causality is not clear. Nevertheless, the pattern of evidence suggests the theory that exercise training recruits a process which confers enduring resilience to stress. This view allows the effects of exercise to be understood in terms of existing psychobiological knowledge, and it can thereby provide the theoretical base that is needed to guide future research in this area. Clinically, exercise training continues to offer clinical psychologists a vehicle for nonspecific therapeutic
social and psychological processes. It also offers a specific psychological treatment that may be particularly effective for patients for whom more conventional psychological interventions are less acceptable.

John Best, R. (2010) determined the effect of physical activity on executive function refers to the cognitive processes necessary for goal-directed cognition and behavior, which develop across childhood and adolescence. Recent experimental research indicates that both acute and chronic aerobic exercise promote children's executive function. Furthermore, there is tentative evidence that not all forms of aerobic exercise benefit executive function equally: Cognitively-engaging exercise appears to have a stronger effect than non-engaging exercise on children's executive function. This review discusses this evidence as well as the mechanisms that may underlie the association between exercise and executive function. Research from a variety of disciplines is covered, including developmental psychology, kinesiology, cognitive neuroscience, and biopsychology. Finally, these experimental findings are placed within the larger context of known links between action and cognition in infancy and early childhood, and the clinical and practical implications of this research are discussed.
Loveman, E., Frampton, G. K., Shepherd, J., Picot, J., Cooper, K., Bryant, J., Welch, K., & Clegg, A. (2011) assessed the long-term clinical effectiveness and cost-effectiveness of multicomponent weight management schemes for adults in terms of weight loss and maintenance of weight loss. Data were extracted using a standardised and pre-piloted data extraction form. The quality of included studies was assessed using standard criteria. Studies were synthesised through a narrative review with full tabulation of results. Long-term multicomponent weight management interventions were generally shown to promote weight loss in overweight or obese adults. Weight changes were small however and weight regain was common. There were few similarities between the included studies; consequently an overall interpretation of the results was difficult to make. There is some evidence that weight management interventions are likely to be cost-effective, although caution is required as there were some limitations in the two cost-evaluation studies described.

Metcalf, B., Henley, W., & Wilkin, T. (2012) determined whether, and to what extent, physical activity interventions affect the overall activity levels of children. Incorporated a component designed to increase the physical activity of
children/adolescents and was at least four weeks in duration. outcome measured whole day physical activity objectively with accelerometers either before or immediately after the end of the intervention period. It was concluded that, this review provides strong evidence that physical activity interventions have had only a small effect (approximately 4 minutes more walking or running per day) on children's overall activity levels. This finding may explain, in part, why such interventions have had limited success in reducing the body mass index or body fat of children.

Parrish, A. M., Okely, A. D., Stanley, R. M., & Ridgers, N. D. (2013) examined the effects of recess-based interventions on the physical activity (PA) levels of school-aged children and adolescents. Two authors independently searched the literature using the same search strategies to identify papers reporting interventions that promote physical activity during school recess and lunchtime periods. Methodological quality was assessed using an adapted eight item assessment scale. The effects of the interventions were assessed with a rating system used in a recent review of interventions in youth. It was concluded that, All of the studies used an objective measure to assess physical activity outcomes, although several criteria were consistently absent from the studies. The levels of evidence were not
sufficient to establish conclusive intervention effects on children’s recess physical activity. This could be due to the small number of published studies. There is a need for higher-quality intervention research to strengthen published findings to inform recess physical activity interventions. Intervention research is needed in adolescents due to the absence of school recess intervention research in this population.

Kipping, R. R., Howe, L. D., Jago, R., Campbell, R., Wells, S., Chittleborough, C. R., Mytton, J., Noble, S. M., Peters, T. J., & Lawlor, D. A. (2014) investigated the effectiveness of a school based intervention to increase physical activity, reduce sedentary behaviour, and increase fruit and vegetable consumption in children. Primary school children who were in school year 4 (age 8-9 years) at recruitment and baseline assessment, in year 5 during the intervention, and at the end of year 5 (age 9-10) at follow-up assessment. The Active for Life Year 5 (AFLY5) intervention consisted of teacher training, provision of lesson and child-parent interactive homework plans, all materials required for lessons and homework, and written materials for school newsletters and parents. The intervention was delivered when children were in school year 5 (age 9-10 years). Schools allocated to control received standard teaching.
The findings suggest that the AFLY5 school based intervention is not effective at increasing levels of physical activity, decreasing sedentary behaviour, and increasing fruit and vegetable consumption in primary school children. Change in these activities may require more intensive behavioural interventions with children or upstream interventions at the family and societal level, as well as at the school environment level. These findings have relevance for researchers, policy makers, public health practitioners, and doctors who are involved in health promotion, policy making, and commissioning services. Trial registration Current Controlled Trials ISRCTN50133740.

Reed, J. L., Prince, S. A., Cole, C. A., Fodor, J. G., Hiremath, S., Mullen, K. A., Tulloch, H. E., Wright, E., & Reid, R. D. (2014) compared the effectiveness of individual-level workplace interventions for increasing MVPA levels in working-age women in high-income/developed countries and examine the effectiveness of these interventions for improving the known beneficial health sequelae of MVPA. Eight electronic databases will be searched to identify all prospective cohort and experimental studies that examine the impact of individual-level workplace interventions for increasing MVPA levels among working-age (mean age 18-65 years) women from high-
income/developed countries. Grey literature including theses, dissertations and government reports will also be included. Study quality will be assessed using a modified Downs and Black checklist, and risk of bias will be assessed within and across all included studies using the Cochrane's risk of bias tool and Grades of Recommendation, Assessment, Development and Evaluation approach. Meta-analyses will be conducted where possible among studies with sufficient homogeneity.

Baker, P. R., Francis, D. P., Soares, J., Weightman, A. L., & Foster, C. (2015) evaluated the effects of community wide, multi-strategic interventions upon population levels of physical activity. At least two review authors independently extracted the data and assessed the risk of bias. Each study was assessed for the setting, the number of included components and their intensity. The primary outcome measures were grouped according to whether they were dichotomous (per cent physically active, per cent physically active during leisure time, and per cent physically inactive) or continuous (leisure time physical activity time (time spent)), walking (time spent), energy expenditure (as metabolic equivalents or METS)). For dichotomous measures we calculated the unadjusted and adjusted risk difference, and the unadjusted and adjusted
relative risk. For continuous measures we calculated percentage change from baseline, unadjusted and adjusted. Although numerous studies have been undertaken, there is a noticeable inconsistency of the findings in the available studies and this is confounded by serious methodological issues within the included studies. The body of evidence in this review does not support the hypothesis that the multi-component community wide interventions studied effectively increased physical activity for the population, although some studies with environmental components observed more people walking.

Brown, T., Smith, S., Bhopal, R., Kasim, A., & Summerbell, C. (2015) assessed the effectiveness of diet and physical activity interventions to prevent or treat obesity in South Asians living in or outside of South Asia and to describe the characteristics of effective interventions. Systematic review of any type of lifestyle intervention, of any length of follow-up that reported any anthropometric measure for children or adults of South Asian ethnicity. There was no restriction on the type of comparator; randomised controlled trials, controlled clinical trials, and before-after studies were included. A comprehensive search strategy was implemented in five electronic databases: ASSIA, Cochrane Controlled Trials Register, Embase, Medline and Social
Sciences Citation Index. The search was limited to English language abstracts published between January 2006 and January 2014. References were screened; data extraction and quality assessment were carried out by two reviewers. RESULTS are presented in narrative synthesis and meta-analysis. It was concluded that, meta-analysis of a limited number of controlled trials found an unclear picture of the effects of interventions on body mass index for South Asian children. Meta-analyses of a limited number of controlled trials showed significant improvement in weight for adults but no significant differences in body mass index and waist circumference. One high quality study in South Asian children found that a school-based physical activity intervention that was delivered within the normal school day which was culturally sensitive, was effective. There is also evidence of culturally appropriate approaches to, and characteristics of, effective interventions in adults which we believe could be transferred and used to develop effective interventions in children.

Hollis, J. L., Williams, A. J., Sutherland, R., Campbell, E., Nathan, N., Wolfenden, L., Morgan, P. J., Lubans, D. R., & Wiggers, J. (2015) examined elementary school students' moderate-to-vigorous physical activity (MVPA) levels during
physical education (PE) lessons. A systematic search of nine electronic databases was conducted. Studies were eligible if they were in English; published between 2005-April 2014; assessed MVPA levels in PE lessons of elementary school children (aged four-12 years); and used an objective MVPA measure. Two reviewers retrieved articles, assessed risk of bias, and performed data extraction. The findings were synthesised using a meta-analysis. It was concluded that, MVPA levels during elementary school PE lessons do not meet the United States Centre for Disease Control and Prevention and the United Kingdom’s Association of Physical Education recommendation (50% of lesson time), but is higher than estimated in the previous review (34.2%). Interventions to increase MVPA in PE lessons are needed.

Mears, R., & Jago, R. (2016) determined physical activity in children improves cardiovascular, mental, metabolic and skeletal health. Many children fail to meet the national recommendation of at least 60 min per day of moderate-to-vigorous physical activity (MVPA). After-school programmes provide an opportunity to engage children in physical activity. This systematic review and meta-analysis examine the effectiveness of after-school interventions at increasing MVPA levels in children and
adolescents. It was concluded that, after-school physical activity interventions to date have had mixed effectiveness on increasing MVPA levels. More robust evaluations of extracurricular physical activity interventions are required, particularly studies that use objective assessment of physical activity.

### 2.3 FACTORS INFLUENCING PHYSICAL ACTIVITY AND PHYSICAL FITNESS AMONG ADOLESCENTS

Brodersen, N. H., Steptoe, A., Williamson, S., & Wardle, J. (2005) investigated the multidimensional correlates of physical activity and sedentary behavior in a large sample of 11- to 12-year-old boys and girls. Cross-sectional survey of 2,578 boys and 1,742 girls from 36 schools stratified by socioeconomic background and gender mix of students (84% response rate). Questionnaire assessments and objective measurements of height and weight were obtained. It was concluded that, a multidimensional approach to understanding the context of physical activity in early adolescence is needed because factors in several domains are relevant. The correlates of physical activity and sedentary behaviors are distinct in this age group, and there are also important gender differences.

(1) psychosocial correlates of physical activity and in (2) physical activity within different contexts and sedentary behaviors between normal weight and overweight adolescents. It further explored whether the prediction of physical activity by the psychosocial correlates is different in normal weight and overweight adolescents. A community sample of 6078 11 to 19 year olds from 38 secondary schools, which were randomly selected throughout the country, completed a validated computerized questionnaire about physical activity, sedentary behaviors, and psychosocial correlates. Differences in mean scores on the psychosocial correlates and on the self-rated physical activity were analyzed between the normal weight (n=5563) and the overweight (n=515, 8.5%) group. It was concluded that, both overweight and normal weight adolescents can be approached by interventions focusing on the same psychosocial variables to increase physical activity.

Richmond, T. K., Hayward, R. A., Gahagan, S., Field, A. E., & Heisler, M. (2006) determined if racial/ethnic disparities in adolescent boys' and girls' physical activity participation exist and persist once the school attended is considered. We performed a cross-sectional analysis of 17,007 teens in the National Longitudinal Study of Adolescent Health. Using
multivariate linear regression, we examined the association between adolescent self-reported physical activity and individual race/ethnicity stratified by gender, controlling for a wide range of sociodemographic, attitudinal, behavioral, and health factors. We used multilevel analyses to determine if the relationship between race/ethnicity and physical activity varied by the school attended. In this nationally representative sample, lower physical activity levels in Hispanic and black adolescent girls were largely attributable to the schools they attended. In contrast, black and Hispanic males had higher activity levels than white males when attending the same schools.

Sirard, J. R., Pfeiffer, K. A., & Pate, R. R. (2006) identified gender-specific motivational factors associated with sports program participation and attrition in middle school students and 2) to examine the relationships among sports program participation, physical activity, and sedentary behavior in this age group. Seventh and eighth grade students (N = 1692) completed a questionnaire to measure sports program participation and factors that may motivate continued participation in or attrition from sports. The psychometric properties of the participation and attrition scales were tested using gender-separate exploratory factor analysis. Analysis of
variance (participation status*gender) was used to identify differences in motivational factor scores and physical activity variables. It was concluded that gender-specific motivational factors exist for middle school youth; boys are more attracted to the competitive aspects of sports whereas girls are more motivated by the social opportunities that sports provide. Boys and girls who participate in sports are more physically active, so it is important to develop programs that children want to participate in and maximize retention.

Raudsepp, L., & Viiram, R. (2008) examined: (1) the developmental trajectory of physical activity as well the influence of body mass index (BMI) and friend support on initial physical activity and change of physical activity; and (2) the stability of physical activity in adolescent girls. Participants were 193 urban adolescent girls and their best friends. Physical activity was measured using the 3-day physical activity recall. Best friend social support was assessed using a questionnaire. BMI was calculated based on height and body mass of the participants. Data were collected on four occasions over a 1.75-year period. It was concluded that, change in friend social support was positively and change in BMI was inversely associated with a change in adolescent girls' physical activity.
Lubans, D. R., & Morgan, P. J. (2009) examined potential correlates of objectively measured physical activity among a sample of Australian adolescents. Participants were 119 14-15 year old students from three secondary schools. Students wore pedometers for 4 consecutive school days and completed questionnaires assessing demographic, social, psychological and behavioural correlates of physical activity. Mean steps/day were 11,865 (+/-3997) for boys (n=47) and 9466 (+/-3195) for girls (n=72). Approximately one-third of boys (32%) and girls (33%) satisfied existing step recommendations (girls 11,000 steps/day and boys 13,000 steps/day). In the first instance, the relationship between factors and physical activity was assessed using bivariate correlation. Enjoyment of physical activity (r=0.37, p<0.05), use of self-management strategies (r=0.33, p<0.05) and perceived barriers (r=-0.39, p<0.05) were significantly related to mean steps/day among boys. Peer support (r=0.26, p<0.05) and the use of self-management strategies (r=0.30, p<0.05) were significantly associated with mean steps/day for girls. Hierarchical regression analysis revealed that gender, peer support, self-management strategies and perceived barriers accounted for 16% of the variance in mean steps/day. This study has identified a number of
potentially modifiable correlates of objectively measured physical activity in sample of Australian adolescents.

Pan, S. Y., Cameron, C., Desmeules, M., Morrison, H., Craig, C. L., & Jiang, X. (2009) examined the influences of various individual, social and physical environmental factors on physical activity participation by gender, age and socioeconomic status, using data from the 2002 nationwide survey of the Physical Activity Monitor. In 2002, 5,167 Canadians aged 15-79 years, selected by random-digit dialling from household-based telephone exchanges, completed a telephone survey. The short version of the International Physical Activity Questionnaire was used to collect information on total physical activity. The effects of socio-economic status, self-rated health, self-efficacy, intention, perceived barriers to physical activity, health benefits of physical activity, social support, and facility availability on physical activity level were examined by multiple logistic regression analyses. This study suggests that physical activity promotion strategies should be tailored to enhance people's confidence to engage in physical activity, motivate people to be more active, educate people on PA's health benefits and reduce barriers, as well as target different factors for men and women and for differing socio-economic and demographic groups.
Patnode, C. D., Lytle, L. A., Erickson, D. J., Sirard, J. R., Barr-Anderson, D., & Story, M. (2010) evaluated the associations of selected demographic, individual, social, and environmental factors with moderate-to-vigorous physical activity (MVPA) in a sample of children and adolescents. MVPA was assessed among youth (n = 294) 10-17-years-old using the ActiGraph accelerometer. Youth completed measures of demographic and individual variables related to physical activity (PA), perceived social support by parents and peers, and perceived neighborhood characteristics. Parents completed the long-form of the International Physical Activity Questionnaire. The Physical Activity and Media Inventory was used to measure the home environment and Geographical Information Systems software was used to measure the physical neighborhood environment. Bivariate correlations and hierarchical multiple regression were conducted stratified by gender. It was concluded that, important differences exist among the individual, social, and environmental factors related to MVPA between boys and girls. Boys’ levels of activity appear to be influenced by factors closely linked to unstructured and social types of activities whereas girls’ activities relate to internal and external barriers as well as their proximity to their schools. The prospective contribution of these important individual, social, and
environmental factors to changes in MVPA among children and adolescents remains to be determined.

Al-Hazzaa, H. M., Abahussain, N. A., Al-Sobayel, H. I., Qahwaji, D. M., & Musaiger, A. O. (2011) reported on the prevalence of physical activity, sedentary behaviors and dietary habits among Saudi adolescents and to examine the interrelationships among these factors using representative samples drawn from three major cities in Saudi Arabia. This school-based cross-sectional study was conducted during the years 2009-2010 in three cities: Al-Khobar, Jeddah and Riyadh. The participants were 2908 secondary-school males (1401) and females (1507) aged 14-19 years, randomly selected using a multistage stratified sampling technique. Measurements included weight, height, sedentary behaviors (TV viewing, playing video games and computer use), physical activity using a validated questionnaire and dietary habits. It was concluded that, the high prevalence of sedentary behaviors, physical inactivity and unhealthy dietary habits among Saudi adolescents is a major public health concern. There is an urgent need for national policy promoting active living and healthy eating and reducing sedentary behaviors among children and adolescents in Saudi Arabia.
Dowda, M., Pfeiffer, K. A., Brown, W. H., Mitchell, J. A., Byun, W., & Pate, R. R. (2011) determined, using a social-cognitive framework and structural equation modeling, if parent-reported family physical activity (PA) variables are related to PA of young children. Three hundred sixty-nine children (48.0% male and 50.4% black) and their parents. Family variables were reported by parents and included parent PA, parent enjoyment of PA, importance to adults of child playing sports and being active, and family support. It was concluded that, although parent PA was not directly related to children's MVPA, results showed that parent PA indirectly affects preschool children's MVPA via its influence on family support for children's PA.

Hsu, Y. W., Chou, C. P., Nguyen-Rodriguez, S. T., McClain, A. D., Belcher, B. R., & Spruijt-Metz, D. (2011) examined associations between family/friend social support for physical activity, negative meanings of physical activity (NMPA), and internal/external barriers to physical activity with moderate to vigorous physical activity (MVPA), and sedentary and light behavior (SLB) in youth. A total of 350 participants from 7 Los Angeles County middle schools participated in the study (62% Latina, 79% females). Hypothesized pathways were examined using structural equation modeling. Psychosocial variables and
participation in MVPA and SLB were assessed by self-reported
questionnaires. It was concluded that family social support
seems crucial to promote MVPA and reduce SLB in adolescents
and might be influenced by child's feelings about physical
activity.

Wilson, D. K., Lawman, H. G., Segal, M., & Chappell, S.
(2011) evaluated the significance of neighborhood, home, and
parental supports for physical activity on moderate-to-vigorous
(MV) physical activity in underserved adolescents. A total of 679
6th-grade students (mean age=11.4 years, 70% African-
American, 76% free or reduced-price lunch, 52% female)
participated in the larger trial. Parents of 280 youth were
contacted to participate in a telephone survey and 198 (71%)
took part in the study. The ACT trial was designed to test the
efficacy of a 17-week (1 academic year) motivational plus
behavioral skills intervention versus comparison after-school
programs on increasing physical activity. A telephone survey was
developed and was administered within 6 months after the trial
began on parents of 198 adolescents from the ACT randomized
school-based trial during 2005-2007. In conclusion, support
from parents and neighborhood quality are both associated with
increased physical activity in underserved adolescents.
Bergh, I. H., Bjelland, M., Grydeland, M., Lien, N., Andersen, L. F., Klepp, K. I., Anderssen, S. A., & Ommundsen, Y. (2012) evaluated the effect of a multi-component intervention on a wide range of theoretically informed determinants of physical activity (PA) and sedentary behavior (SB). Moderation effects of gender, weight status and parental education level and whether the perceived intervention dose received influenced the effects were also explored. The HEIA study was a 20-month school-based, randomized controlled trial to promote healthy weight development. In total, 1418 11-year-olds participated at baseline and post-intervention assessment. Enjoyment, self-efficacy, perceived social support from parents, teachers and friends related to PA, perceived parental regulation of TV-viewing and computer/game-use and perceived social inclusion at schools were examined by covariance analyses to assess overall effects and moderation by gender, weight status and parental education, mid-way and post-intervention. Covariance analyses were also used to examine the role of intervention dose received on change in the determinants. Results indicate that social support from teachers might be a potential mediator of PA change, and that overweight adolescents might be in need of specially targeted interventions to avoid reducing their enjoyment of PA. Further studies should
continue to assess how intervention effectiveness is influenced by the participants' self-reported dose of intervention received.

Bergh, I. H., Van Stralen, M. M., Grydeland, M., Bjelland, M., Lien, N., Andersen, L. F., Anderssen, S. A., & Ommundsen, Y. (2012) examined whether personal, social and physical-environmental factors mediated the intervention effect on physical activity and whether gender and weight status moderated mediated effects in the Health In Adolescents Study - a school-based intervention to promote healthy weight development among young adolescents. Participating schools were randomized to Control (n = 25) and Intervention (n = 12). The intervention components to enhance physical activity targeted change through theoretically informed mediators embedded in a social-ecological framework. Accelerometer assessed physical activity (mean count per minute) and self-efficacy, enjoyment, perceived social support from parents, teachers and friends and perceived environmental opportunities were measured by questionnaires at baseline and post-intervention after 20 months among 700 11-13 year-old adolescents (Intervention = 485; Control = 215). The product-of-coefficient test was used to examine mediation. It was concluded that, while no mediation effects were observed, change in both
personal and social-environmental factors predicted change in physical activity behavior. Hence, a social-ecological approach targeting a wide range of determinants to promote change in physical activity holds promise. Overweight and normal weight adolescents may not respond in the same way to school-based physical activity interventions. Therefore, strategies to better reach the overweight seem needed. Future studies should continue to identify mediating and moderation mechanisms in physical activity change in adolescents.

Gebremariam, M. K., Bergh, H. I., Andersen, L., Ommundsen, Y., Bjelland, M., & Lien, N. (2012) explored the impact of pubertal status on PA and its potential psychological and social-environmental correlates in a sample of Norwegian children over a 20-month period. A total of 885 students from 25 control schools of an intervention study, the HEalth In Adolescents (HEIA) study were included (mean age at baseline 11.2 (0.3)). The baseline took place in September 2007, the first follow-up in May 2008 and the second follow-up in May 2009. PA and its potential correlates (enjoyment of PA, self-efficacy related to barriers to PA, perceived support for PA from parents, friends and teachers, perceived social inclusion and perceived environmental opportunities for PA) were self-reported. Pubertal
status was assessed using the Pubertal Development Scale. Repeated-measures ANOVA was used to explore changes. Tracking was assessed using Spearman's rank order correlation. Pubertal groups were compared using ANOVA or ANCOVA (controlling for BMI). Multiple regression analyses were used to investigate whether pubertal stage at age 11 would predict levels of correlates and PA at age 13. It was concluded that, enjoyment of PA, self-efficacy related to barriers to PA, perceived social support for PA, perceived social inclusion, perceived environmental opportunities for PA and the behaviour itself were found to be moderately stable in the transition between childhood and adolescence. Health promotion efforts in childhood targeting PA and its psychosocial and social-environmental correlates might have favourable effects in later years.

Al-Haifi, A. R., Al-Fayez, M. A., Al-Athari, B. I., Al-Ajmi, F. A., Allafi, A. R., Al-Hazzaa, H. M., & Musaiger, A. O. (2013) examined the relative contribution of selected lifestyle factors to overweight and obesity in this population. The present study is part of the Arab Teens Lifestyle Study (ATLS). A total of 906 adolescents (463 boys and 443 girls) aged between 14 and 19 years were selected from Kuwaiti schools by a multistage
stratified randomization process. A validated questionnaire was used to collect data on physical activity, sedentary lifestyle, and eating habits. The International Obesity Task Force (IOTF) cutoff values for adolescents under 18 years of age were used to define overweight and obesity. Total energy expenditure was calculated using metabolic equivalent-minutes per week. A general linear model was used to establish the proportion of the variance (expressed in partial eta squared) in excess weight attributable to differences in eating habits and physical activity. It was concluded that, physical activity explains a greater proportion of variation in body mass index than do eating habits, particularly in boys. Eating habits explain a greater proportion of variation in body mass index than does physical activity in girls. Prospective studies are needed to clarify the relative effects of sedentary behaviors on overweight in adolescents.

Bakhtari Aghdam, F., Baghiani Moghaddam, M. H., Asghari Jafarabadi, M., Allahverdipour, H., Dabagh Nikookheslat, S., & Noorizadeh, R. (2013) applied explanatory model to determine the total, indirect and direct impact of physical environment, personal factors and social support on PA among employed women. This study was a correlational cross-sectional study which was conducted to model total, indirect and
direct impact of environmental, psychological and social factors on PA. A total of 200 women were chosen from Tabriz University by using convenience sampling method. Data about demographic characteristics, psychological variables, social and physical environment were gathered by using self-reported questionnaire and also the PA was measured by using the International PA Questionnaire and pedometer. Findings from this study indicated that social factors had indirect effects on walking, moderate and vigorous activity, especially through the effects on these factors of self-efficacy, physical environment, pros and cons, and the interactive role of individual, environmental and social impacts on PA. The current study identifies that psychological, physical and social factors could be shown to have direct and indirect influences on all forms of activity. The barriers of PA were the most predictor of this behavior, and based on results, it can be concluded that decreasing the barriers along with improving social and physical environment can lead to increasing PA and health promotion.

Grydeland, M., Bergh, I. H., Bjelland, M., Lien, N., Andersen, L. F., Ommundsen, Y., Klepp, K. I., & Anderssen, S. A. (2013) investigated effects of a school-based intervention program: the HEalth in Adolescents (HEIA) study, on change in
physical activity, and furthermore, to explore whether potential
effects varied by gender, weight status, initial physical activity
level and parental education level. This was a cluster randomized
controlled 20 month intervention study which included 700 11-
year-olds. Main outcome-variable was mean count per minute
(cpm) derived from ActiGraph accelerometers (Model
7164/GT1M). Weight and height were measured objectively.
Adolescents reported their pubertal status in a questionnaire
and parents reported their education level on the consent form.
Linear mixed models were used to test intervention effects and to
account for the clustering effect of sampling by school. It was
concluded that, a comprehensive but feasible, multi-component
school-based intervention can affect physical activity patterns in
adolescents by increasing overall physical activity. This
intervention effect seemed to be more profound in girls than
boys, low-active adolescents compared to high-active
adolescents, participants with normal weight compared to the
overweight, and for participants with parents of middle
education level as opposed to those with high and low education
levels, respectively. An implementation of the HEIA intervention
components in the school system may have a beneficial effect on
public health by increasing overall physical activity among
adolescents and possibly among girls and low-active adolescents in particular.

Allafi, A., Al-Haifi, A. R., Al-Fayez, M. A., Al-Athari, B. I., Al-Ajmi, F. A., Al-Hazzaa, H. M., Musaiger, A. O., & Ahmed, F. (2014) assessed physical activity, sedentary behaviours and dietary habits among adolescents in Kuwait and to compare the differences between genders. A cross-sectional study was conducted among secondary-school children who participated in the Arab Teens Lifestyle Study (ATLS), a multi-centre collaborative project. Adolescents (463 boys and 443 girls), aged 14-19 years were selected as subjects. It was concluded that, the majority of the Kuwaiti adolescents, especially girls, do not perform adequate physical activity, spend more time on sedentary activities and have unhealthy dietary practices. The findings emphasize an urgent need for implementing an appropriate intervention for promoting physical activity, healthy eating and reducing sedentary behaviours among these children.

Cheng, L. A., Mendonça, G., & Farias Júnior, J. C. (2014) analyzed the association between physical activity and social support from parents and friends on the physical activity level among adolescents. Data from 2,361 adolescents (56.6% females; mean age 16.4; SD = 1.2), from public and private high
schools were analyzed. The physical activity level of the adolescents, parents, and friends were measured through a questionnaire. Parents' and friends' support and self-efficacy were measured using two previously tested scales. It was concluded that, parents and friends have a social influence on adolescents' level of physical activity through the mechanism of behavior modeling or through social support, mediated by self-efficacy.

Collings, P. J., Wijndaele, K., Corder, K., Westgate, K., Ridgway, C. L., Dunn, V., Goodyer, I., Ekelund, U., & Brage, S. (2014) described variability in total and intensity-specific physical activity levels in UK adolescents across gender, socio-demographic, temporal and body composition strata. Physical activity energy expenditure and minutes per day (min/d) spent sedentary and in light, moderate, and vigorous intensity physical activity were assessed in 825 adolescents from the ROOTS study (43.5% boys; mean age 15.0 ± 0.30 years), by 4 days of individually calibrated combined heart rate and movement sensing. Measurement days were classified as weekday or weekend and according to the three school terms: summer (April-July), autumn (September-December), and spring (January-March). Gender and age were self-reported and area-
level SES determined by postcode data. Body composition was measured by anthropometry and bio-electrical impedance. Variability in physical activity and sedentary time was analysed by linear multilevel modelling, and logistic multilevel regression was used to determine factors associated with physical inactivity (<60 min moderate-to-vigorous intensity physical activity/d). It was concluded that, physical activity components vary by gender, temporal factors and body composition in UK adolescents. The available data indicate that in adolescence, girls should be the primary targets of interventions designed to increase physical activity levels.

Graham, D. J., Bauer, K. W., Friend, S., Barr-Anderson, D. J., & Nuemark-Sztainer, D. (2014) identified personal, behavioral, and socioenvironmental correlates of concurrent and 6-month longitudinal PA among adolescent girls. Data were gathered from 356 adolescent girls (mean age 15.8 ± 1.2 years; >75% racial/ethnic minorities) in the Minneapolis/St. Paul area in 2007-2009. Linear regression analyses controlling for age, race/ethnicity, and school were conducted predicting baseline and follow-up levels of total PA and moderate-to-vigorous PA (MVPA) assessed via 3-Day Physical Activity Recall. Models were fit for each correlate individually and for all correlates together,
mutually adjusted. It was concluded that, PA interventions with adolescent girls might be enhanced by involving adolescents' social networks and also by helping adolescents feel better about their self-worth and athletic abilities.

Haapala, H. L., Hirvensalo, M. H., Laine, K., Laakso, L., Hakonen, H., Kankaanpää, A., Lintunen, T., & Tammelin, T. H. (2014) investigated the associations of students' recess physical activity with school-related social factors. Data were collected in 19 schools countrywide in autumn 2010, and 1463 students from grades 4 and 5 (primary school) and from grades 7 and 8 (lower secondary school) completed an anonymous questionnaire. Multiple linear regression analysis was used to investigate whether self-reported physical activity at recess was associated with peer relationships at school, relatedness to school and school climate. Analyses were adjusted for self-reported overall physical activity and conducted for primary and lower secondary schools. Multi-group analysis was used to test sex differences among the associations. Our results suggest that students' participation in physical activities during school recess is positively associated with students' school-related social factors. In the future, it would be worthwhile to study how
physical activity at recess should be organised in order to support the development of school-related social factors.

Hsu, Y. W., Chou, C. P., Nguyen-Rodriguez, S. T., McClain, A. D., Belcher, B. R., & Spruijt-Metz, D. (2014) examined how factors from a social ecologic model predict physical activity (PA) among adolescents using a longitudinal analysis. Participants in this longitudinal study were adolescents (ages 10-16 at baseline) and one parent enrolled in the Transdisciplinary Research on Energetics and Cancer-Identifying Determinants of Eating and Activity (TREC-IDEA) and the Etiology of Childhood Obesity (ECHO). Both studies were designed to assess a socio-ecologic model of adolescent obesity risk. PA was collected using ActiGraph activity monitors at two time points 24 months apart. Other measures included objective height and weight, adolescent and parent questionnaires on multilevel psychological, behavioral and social determinants of PA, and a home PA equipment inventory. Analysis was conducted using SAS, including descriptive characteristics, bivariate and stepped multivariate mixed models, using baseline adjustment. Models were stratified by gender. It was concluded that, PA change in adolescents is a complex issue that is not easily understood. Our findings suggest early PA habits are the most important
predictor of PA levels in adolescence. Intervention may be necessary prior to middle school to maintain PA through adolescence.

Micklesfield, L. K., Pedro, T. M., Kahn, K., Kinsman, J., Pettifor, J. M., Tollman, S., & Norris, S. A. (2014) examined physical activity and sedentary behavior patterns, and explores associations with individual, maternal, household, and community factors amongst rural South African adolescents. In 2009, 381 subjects, stratified by ages 11-12-years and 14-15-years, were randomly selected from 3511 children and adolescents who had participated in a growth survey two years previously. Weight and height were measured and self-reported Tanner pubertal stage was collected. A questionnaire quantifying frequency and duration of physical activity (PA) domains and sedentary time for the previous 12 months was administered. Moderate-vigorous physical activity (MVPA mins/wk) was calculated for time spent in school and club sport. Socio-demographic and other related data were included from the Agincourt health and socio-demographic system (HDSS). The Agincourt HDSS was established in 1992 and collects prospective data on the community living in the Agincourt sub-district of Mpumalanga Province in rural north-east South
Africa. In this study of rural South African adolescent boys and girls, SES at the maternal, household and community level independently predicted time spent in sedentary behaviors, and school and club MVPA. This study provides local data that can be used to develop health promotion strategies specific to this community, and other similar communities in developing countries.

Kim, G. S., Lee, C. Y., Kim, I. S., Lee, T. H., Cho, E., Lee, H., McCreary, L. L., & Kim, S. H. (2015) examined the actor effect and partner effect between an individual and his/her friend regarding the influence of self-efficacy and social support on PA among Korean college students. Cross-sectional survey data from 108 pairs of individual students and friends were analyzed. The survey questionnaire measured PA, self-efficacy toward exercise, social support for PA, anxiety and depression, community environments, and perceived health status. Structural equation modeling with path analysis was conducted to test Actor-Partner Interdependence Model (APIM) explaining close relationships on PA. These results suggest a role for public health nurses in developing interventions for college-aged young adults that promotes friend support for PA as well as individual
self-efficacy toward PA, to engage young adults in establishing lifelong health-promoting PA.

Garcia, J. M., Sirard, J. R., Larsen, R., Bruening, M., Wall, M., & Neumark-Sztainer, D. (2016) examined, using structural equation modeling, the associations between nominated friend physical activity (PA), friend social support with individual psychological factors, and adolescent PA. Data were obtained from EAT 2010 (Eating and Activity Among Teens), a large cross-sectional study conducted in 20 middle and high schools. The sample consisted of 1951 adolescents (mean age: 14.25 ± 1.96, 54% female, 68% ethnic minorities). PA, parent and friend social support (perceived social support for PA from parents and friends), and psychological measures (PA enjoyment, PA self-efficacy, and PA barriers) were assessed by self-report questionnaires. The SEM analysis consisted of one observed variable: friend PA, and two latent constructs: psychological factors, perceived social support. The results of this model suggest that psychological factors and friend PA are associated with adolescent PA, and that psychological factors may play an important role. Future studies should further examine the association of both friend PA and psychological variables with adolescent PA.
Gontarev, S., Kalac, R., Ameti, V., & Redjepi, A. (2016) determined the relationship of demographic, psychological, social and environmental factors with physical activity and to determine whether indicators of physical activity differ by gender among Macedonian adolescents from Albanian ethnic community from 11 to 14 yr (N = 886). Research were conducted in 2014 in several primary schools randomly selected from Tetovo and Gostivar region of the R. Macedonia. Students completed a questionnaire which examined their level of participation in physical activity and sedentary behavior along with a number of potential correlates. Hierarchical regression was used to explore the relationship between hypothesised factors and physical activity. The results indicate the importance of developing a national plan and program to promote physical activity in order to help young people to change unhealthy lifestyle habits and increase the physical activity, thus improving their health.

Lopes, V. P., Gabbard, C., & Rodrigues, L. P. (2016) examined the similarity and interdependence of PA as influenced by psychosocial factors among adolescent best friend dyads. A total of 660 adolescents, representing 330 best friend dyads, completed questionnaires with regard to PA, sitting time,
perceived exercise benefits and barriers, physical self-perception and social support for PA. Dyads were also identified as reciprocal and non-reciprocal best friends; reciprocal means that both considered each other best friends and non-reciprocal were those in which only one considered the other a best friend. Data were analysed using a hierarchical linear model framework. Results indicated significant similarities between reciprocal best friend dyads for PA and sitting time, and for sitting time in non-reciprocal best friends (P values <.01). Psychosocial variables were associated with PA in reciprocal best friend dyads and with sitting time in reciprocal and non-reciprocal best friend dyads. Best friend gender, regular sports practice of the person, perceived exercise barriers of the best friend and best friend social support were the best predictors for PA.

2.4 STUDIES ON FACTORS MOTIVATE PHYSICAL ACTIVITY AND PHYSICAL FITNESS

It seems that factors which will encourage adolescents to be physically active differ in boys and girls. Having a friend to exercise with seemed to be the greatest factor which adolescent boys and girls would consider to be physically active, according to Tergerson and King (2002:375). The factors which least
motivated boys and girls were to see exercising on television and being acceptable to their friends (Tergerson & King, 2002:376).

In New Zealand 13-15-year-old adolescents would be more encouraged if there were more access and availability of activity opportunities, more types of sport and more support and encouragement from friends and family (Hohepa et al., 2006:332).

Saxena et al. (2002:282) found factors related to regular high intensity activities included having friends who would participate, involvement in a sports team, weight loss and a belief in the importance of exercise.

Cheng et al. (2003:527) found that generally feeling better and the intention to participate were the greatest motivators in adolescent girls in Hong Kong. The girls' biggest motivational factors in this study were having a friend who could encourage them and seeing summer/spring clothing which they could buy. Girls also felt that the encouragement of parents, having a parent who exercised and being reminded of the advantages of PA motivated them.

Tergerson and King (2002:376) reported that boys and girls regarded different factors as benefits of PA. Girls were found to regard enjoyment, remaining fit and healthy, an improved self-
image and the reduction of stress as benefits. The three biggest benefits for girls were to remain fit and healthy, to lose weight and to raise their energy levels. Boys regarded being strong, staying in shape and being competitive as benefits of physical activity (Tergerson & King, 2002:376).

The two major benefits for adolescent girls in Hong Kong were health (good health, feeling better in general and being fit and remaining healthy) and body image (losing weight, maintaining the correct body mass, improving appearance and self confidence) (Cheng et al., 2003:527).

From this research it can be deducted that the most important factor that will motivate boys is exercising with friends, and girls were motivated by weight loss, and friends and parents that encouraged them. These motivational factors could also help to motivate adolescents to be more physically active.

There are factors which are increasingly contributing to inactivity in modern life. Factors that were identified through this literature study that might have an influence on PA and PF of adolescents living in disadvantaged communities included active commuting, gender, age, television, low SES and stunting.

Pate et al., (1997:244) & Hovell et al. (1999:158), age, gender and sedentary activities, such as watching television,
were factors which influenced PA and PF the most. Each of these factors will be discussed briefly. Today children and adolescents prefer more technologically advanced activities for their leisure time activities and this is also the case with the type of transport which they use to travel to and from school. However, statistics shows that a great percentage of children in rural areas still use active transport (walking and cycling).

Rowland et al. (2003:8) found in their study that 70% of primary school children in London walked to school. The same tendency was found by Prista et al. (1997:455) with 8-15-year-old children in rural Maputo, who walk to school for more than an hour per day.

Cooper et al. (2003:274) also found that low and middle SES primary school learners mostly walked to school. These learners were found to be more active than those who were driven to school, especially boys.

Wildschutt (2005:61) found that 76,7% of the 14-16-year-old children in a rural community in the Caledon region of the Western Cape, walked to school and 23,3% used a bus or taxi. Of these children, 42,77% walked more than two km. More girls (32,1%) than boys (25,2%) walked less than 2 km and some more than three km (girls 17,0% and boys 14,5%).
Wildschutt (2005:132) found in his study that habitual PA, such as active commuting to school as well as sport participation, could enhance body composition, fitness and health in adolescents.


Various researchers have shown that boys are more active than girls and those boys participate more in activities with a higher intensity (Myers et al., 1996:854; Crocker et al., 2000:391; Ganley & Sherman, 2000:86; Chan et al., 2003:794; Neumark-Sztainer et al., 2003:803; Hamlin & Ross, 2005:34; Romero, 2005:256).

Riddoch and Boreham (1995:87) also found that boys were generally more active than girls, although there were fewer differences between the genders when moderate activities were compared.

Sallis et al. (1996:131) boys showed a 41% higher participation rate in high-intensity exercise than girls. They also had a higher participation rate in high and moderately intensive
activity than girls, whilst girls showed a higher participation in walking activities.

Sallis et al. (1996:130) found that Grade 7 to 12 boys spent 14.3 hours per week on weightlifting, baseball, basketball, running and cycling. Girls spent 8.2 hours per week on dancing, walking, aerobic exercise, rhythmic gymnastics and baseball (Sallis et al., 1996:130).

In this study a significant gender difference was found for 10 of the 22 specific activities (Sallis et al., 1996:130). Girls spent more time on aerobic dance and other dance forms. Boys, however, spent more time on running, working in the garden, cycling, weightlifting, basketball, football, surfing and skateboarding.

Engelbrecht (2001:63) indicated that 13-15-year-old black girls participated more in housework tasks and especially traditional games than other race groups. The more active black girls also participated in a wider variety of activities such as skipping, volleyball, soccer, basketball, tennis, as well as a range of traditional and other games, compared to the less active black girls.

Wildschutt (2005:61) found that 66,7% of rural boys and 45,0% of 14-16-year-old girls in the Caledon region in the
Western Cape had participated in sport over the previous 12 months. More boys (66,7%) participated in moderate and vigorous PA than girls (46%) and the girls (32,2%) participated more in recreational and light activities than boys (25%) (Wildschutt, 2005:62). Participation patterns indicated rugby, athletics, cycling and working out in the gym as the most popular activities among boys, while netball, athletics and carrying heavy shopping bags were activities the girls engaged in. Most of these boys and girls were classified as active, although more girls (32,18%) than boys (25,0%) were classified as sedentary, and more boys (30,55%) than girls (13,79%) were classified as sufficiently active (Wildschutt, 2005:68).

In summary, the conclusion can be made that boys are more active than girls and that they also participate in more moderate and vigorous activities compared to girls who prefer more sedentary activities or activities with a lower intensity. It can also be concluded that especially girls should be targeted for intervention studies because they are more susceptible to sedentary activity and inactivity.

Researchers report that children and adolescents show a decrease in their physical activity levels (Riddoch & Boreham, 1995:87; Kemper et al., 2001:400; Leslie et al., 2001:255;
Neumark-Sztainer et al., 2003:803 Malina et al., 2004:469) with increase in age.

Leslie et al. (2001:255) found a 15% drop in high intensity and a 10% drop in moderate intensity participation in recreational activities from 18-19-year-olds to 25-29-year-olds.

Fox et al. (2004:341) found that 70% of boys and 65% of 6-15-year-old British girls were sufficiently active, although these percentages dropped to 50% and less during adolescence. Children and adolescents in New Zealand aged 5 and 17 years were, in 1997, approximately 68,9% active, but these percentages dropped to 66,5% in 2001. In that period the percentage children who were sedentary increased from 8% to 13% (Hamlin & Ross, 2005:32). Several researchers report that PA and PF in childhood track through adolescence and are related to PA and PF in adult life (Kemper et al., 2001:400; Malina et al., 2004:470; Matton et al., 2006:1114).

All the above research findings confirm that adolescence is a period where physical activity levels decrease dramatically. It therefore seems necessary to implement PAIPs during this time period.
Biddle et al. (2003:32), adolescents spent 2.25 hours per day watching TV, 40 minutes on video games and 30 minutes using computers.

Hancox et al. (2004:259) in a longitudinal study of 15-year-old adolescents. The researchers found that the average weekday television viewing hours were associated with a higher body mass index (BMI), lower cardio-respiratory fitness, increased smoking and raised serum cholesterol. Linear regression showed that the PA of 15-year-olds negatively correlated with the adolescents’ television viewing hours and was predictive of adult cardio-respiratory fitness. Children and adolescents who spent less than one hour per day watching television were also found to be healthier (5.7% boys and 7.9% girls) (Hancox et al., 2004:261).

Pate et al. (1997:244) and Trost et al. (1999) substantiated in this regard that children who watched television for more than three hours per day were significantly less active than children who spent fewer hours in front of the television.

Anderson et al. (1998:942) found in their study that BMI and body fat percentage were higher in children and adolescents who watched television for more than four hours per day, compared to those who watched for less than two hours.
Children aged 14-16 years in the Caledon region in the Western Cape, spent 22.4% (more than three hours per day) watching TV and/or playing computer games (Wildschutt, 2005:61).

Bennett et al. (2006:1683) found in their study on adults of low-income housing that average daily television viewing was associated with a reduction of 520 steps per day, or almost 10% of the average steps per day. There was also an association in this study between weekday and weekend television viewing and fewer steps per day.

Marshall et al. (2002:413) & Biddle et al. (2003:32) found that there was a low correlation between watching television and PA and that children and adolescents who spent a great deal of time watching television were still moderately and highly active.

Engelbrecht (2001:65) who found that the more active 13-15-year-old girls watched television for more than two hours per day, or spent their time on computer or television games compared to low active girls.

It thus appears that there is still controversy in the literature concerning the impact that television viewing, computer and video games have on PA. However, it could have a negative impact on PA if an individual already had a sedentary lifestyle and on the other hand it could similarly have no impact
on an individual who had an active lifestyle and regularly participated in moderate and high PA.

Janssen et al. (2006:141) on 11-15-year-old Canadian children it was found that 55% were physically inactive, and that this inactivity was related to SES. Physical inactivity also increased with decreasing levels of material wealth. Frantz (2006:76) found that 32% of the 13-18-year-old low SES learners from the Western Province in South Africa did not participate in sufficient physical activity (three and a half hours per week) in order to be classified as active. Lower material wealth and perceived family wealth also correlated with inactivity in this study.

Romero (2005:256) more regular participation in high-intensity PA was associated with higher SES, more adult supervision at facilities, safer areas for facilities, more hours spent in after-school programmes and better quality facilities.

Sallis et al. (1996:131) reported that adolescent boys (Grades 7-12 in San Diego) from low and high SES showed a significantly higher participation level in high-intensity exercises, both in and out of school, in sports teams and physical education classes than girls.
However, some researchers disagree with the above research by stating that children and adolescents from low SES have higher levels of physical activity, mainly because they spend more time on household chores that increase their energy expenditure (Prista et al., 1997:451; Kriska, 2000:50; Prinsloo & Pienaar, 2003:65).

Children and adolescents with a high SES have higher physical activity and physical fitness as a result although children and adolescents with a low SES also have moderate to high physical activity, mainly due to household chores and active commuting.

Stunting is an indicator of chronic malnutrition and impaired absorption of nutrients due to intestinal infections and parasites in pre- and post-natal periods as well as in early childhood in developing countries (Hoffman et al., 2000:1025; Lunn, 2002:109; Martins et al., 2004:819; Milman et al., 2005:1415).

Martins et al. (2004:822) that stunted boys and girls gained less lean body mass, boys also accumulated more body fat and girls had significantly higher values of fat mass percentage than their 11-15-year-old non-stunted counterparts.
Kruger et al. (2004:566). These stunted girls had significantly lower weight and skin fold thickness than non-stunted girls, but seemed to have relatively more subcutaneous fat and greater waist circumferences.

Studies suggest that children and adolescents from rural and average urban areas are more stunted than children from well-off urban areas (Cameron et al., 1992:30). Approximately one-quarter of urban and almost half of rural boys and girls aged 2-5 years in the Free State and Northern Cape provinces of South Africa were stunted, according to the study by Walsh et al. (2002:6).

Cameron et al. (1994) also found that black rural South African children aged 6-18 years were more stunted than American children of the same age group. This tendency occurs throughout childhood into late adolescence. Wildschutt (2005:77) found that 6.9% of boys and 2.2% of girls aged 14-16 years in the Western Cape in rural areas were stunted. Nineteen percent of girls 10-15 years of age in the North-West province of South Africa were reported to be stunted (Kruger et al., 2004:566).

Cameron et al. (2005:414) found in their study that 19% of 495 2-5 year old Soweto-Johannesburg children were stunted at
the age of two years but at the age of five years only 4% were stunted, thereby providing strong evidence of catch-up growth. Friedman et al. (2005:917) found that 18,3% of children aged 4,5-13,5 years in western Kenya were stunted and more boys (21,6%) than girls (15,3%) were affected. This was a longitudinal study and the prevalence of stunting was 18,3% at baseline, 20,3% nine months later, 19,7% 16 months later and 26,1% 24 months later (Friedman et al., 2005:917). Baseline height-for-age z-scores (HAZ) were inversely related to age and were also higher for girls than for boys.

Lunn (2002:109) reported in this regard that many food-supplementation trials had been undertaken in several parts of the world, but the results did not show much improvement.

Kruger (2005:1153) confirmed this and stated that the benefits of these programmes were mostly relief from hunger, decrease in underweight and wasting, but that additional food might lead to an increase of obesity.

Walsh et al. (2002:6) found that the impact of a nutrition education programme on the nutritional status of low-income children, did not improve the children's stunting values. The programme did improve weight-for-age significantly in boys and girls in the urban area and in boys in one rural area.
It seems from the above literature findings as if many children in many parts of the world are affected by stunting especially in rural parts and this has an effect on various other factors such as their health. It is also evident that there is not yet a proven intervention that can improve the condition. Limited research has already been conducted on the PA and PF status of stunted children, as well as on the effect of an activity intervention on these variables.

Bar-or et al. (1998:7) found that stunted children had poor levels of aerobic fitness and strength. Kruger et al. (2004:567) found in this regard that 72.5% of 10-15 year old stunted girls were inactive compared to 66.1% of non-stunted girls.

Hoffman et al. (2000:1025) found that among 8-11-year-old stunted and non-stunted Brazilian children, the girls had lower total energy expenditure than boys which could explain the higher risk of obesity in stunted adolescent girls and women. It thus seems important to investigate the PA and PF of stunted children and how an activity intervention programme may affect these children.
2.5 STUDIES ON RELATIONSHIP BETWEEN PHYSICAL
ACTIVITY, PHYSICAL FITNESS AND HEALTH

Health, physical activity and physical fitness are three components that are interrelated. Physical fitness is an outcome of physical activity and both are regarded as preservation components of health. These components which have direct relevance to this study will firstly be defined where after a discussion of the relationship between them will follow. The following section will shed more light on the relationship between PA, PF and health among adolescents.

Jackson et al. (1999:4) and Rowland and Freedson (1994:669) define physical activity as any bodily movement which will result in the use of energy (Malina et al., 2004:458).

Winnick (2005:402) defines PA as any bodily movement of the muscles which leads to a noticeable increase of the use of resting energy. It is also defined as the total amount of daily movement of an individual.

Rowland & Freedson, (1994:669) and Nahas et al. (2003) explains that PA is difficult to define because of the nature and purpose of the activity (relaxation, homework, work or transport) as well as the intensity of the activity (light, moderate or high). According to these researchers and others, PA varies if it is
defined as leisure time, recreation activities or as supervised programmes. It is identified by the type and intensity of the exercise and is related to the commencement and maintenance of such behaviour.

Malina et al. (2004:471) have identified positive and negative factors that show a relationship with PA levels. During childhood and adolescence these include biological, psychological, social and physical environmental factors.

Rowland and Freedson (1994:670) as the ability of an individual to perform an exercise instruction successfully, and that it is related to standards for age and gender. Physical fitness also refers to the ability to perform specific skills required for the performance of various activities and sports (American College of Sports Medicine (ACSM), 2000:68).

Armstrong (1992:74) and Jackson et al. (1999:9) divided PF into two components: Firstly, health-related fitness (on which this study is mainly focused) which involved aspects such as aerobic fitness, muscular strength, muscular endurance, flexibility and body composition (Meredith & Welk, 1999:3; Malina et al., 2004:216; Winnick, 2005:402). The above-mentioned components focus on areas which affect general health and energy, in so far as the individual will have the
necessary stamina to carry out daily tasks and activities, is fit enough and will be less likely to develop chronic illnesses (Jackson et al., 1999:9; Jackson et al., 2004:9).

Aerobic fitness determines performance in a lot of activities but is also a health-related parameter (Baquet et al., 2003:1128). It refers to the ability to perform gross muscle, moderate to high intensity exercise for prolonged periods of time (ACSM, 2000:68). The second component of health-related fitness is performance (skill)-related fitness, which involves aspects such as reaction time, agility, balance, coordination and speed (Jackson et al., 2004:9; Winnick, 2005:403).

The World Health Organisation (WHO, 2000) defined health as a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity. Health is a resource for everyday life, not the object of living. It is a positive concept emphasising social and personal resources as well as physical capabilities (WHO, 2000).

Health is associated with physical, mental, emotional, social and spiritual aspects of life (Winnick, 2005:402). It is thus a human condition with physical, social and psychological levels, each with positive and negative aspects (Winnick, 2005:402).
Jackson et al. (1999:7) and Nieman (1998:4), refers to sufficient energy to complete daily tasks and to actively participate in recreational activities without unnecessary exhaustion. It also refers to the absence of illnesses, since people who are healthy and physically active are less affected by illness and are more inclined to resist illness than people who are sedentary (Jackson et al., 1999:8).

Positive health is, however, associated with the capacity to enjoy life and to overcome challenges, and is not merely the absence of illness (Winnick, 2005:402). It therefore seems that these researchers all confirm that health includes all aspects of life and not only the absence of illness.

Meredith and Welk (1999:33), which must be attained by children and adolescents with regard to physical fitness performance, and which serve as a guideline to obtain full health advantages from their physical fitness status. The authors refer to these standards as the Healthy Fitness Zone (HFZ), and they indicate in this regard that these criterion-referenced standards are better than norm-based standards because the level of PF indicates the necessary fitness for good health of an individual, irrespective of the level of PF of a specific group. Every learner should therefore strive to achieve a score that classifies him/her
into this HFZ. Taking into consideration that reaching this HFZ is more attainable for the majority of adolescents, such a system of evaluating fitness levels and setting personal goals to improve fitness levels can be much more motivating to them to improve their activity and fitness levels, and by so doing reduce the risk-factors associated with an inactive lifestyle (Meredith & Welk, 1999:33).

Jackson et al. (1999:283) indicate that PA can lead to the improvement of psychological health through the prevention and reduction of depression, anxiety and stress, as well as an improvement in self-image. More recent research of Jackson et al. (2004:6) also indicates that PA helps to build and maintain healthy bones, muscles and joints, develops strength and agility, and contributes to weight control.

Health risk behaviours have a negative influence on health and are not part of a healthy lifestyle. These include behaviour such as, physical inactivity, smoking and drinking alcohol (Frantz, 2006:76).

Nahas et al. (2003) explains in this regard that health promotion involves two main processes namely (1) stopping negative (unhealthy) behaviours such as smoking, drinking alcohol and sedentary behaviour and (2) starting positive
behaviours such as regular exercise, good dietary practices, or using sunscreen. This is strongly associated with personal lifestyles and is a dynamic process (for example, change from a sedentary lifestyle to a physically active one).

Frantz (2006:76) reported that 31% of the learners were physically inactive and 21% of this group was engaging in smoking and drinking alcohol. The learners in this study who were involved in two or more risk factors were 21%, three or more risk factors 10% and four risk factors were 4% (Frantz, 2006:76).

Marsh & Johnson, (1994:83)., Trost et al., (1999)., & Ganley & Sherman, (2000:86) indicate that regular physical activity is an important health-maintenance strategy for children and adolescents, since it contributes to weight control, strengthening of the bones, reduction of cardiovascular risk factors and improved psychological health (higher levels of psychological well-being and a positive self-image), as well as higher self-effectiveness.

Kemper et al. (2001:398) found a significant relationship between daily PA and Vo$_2$ max (maximum intake of oxygen). They found in their longitudinal study that daily PA over a period of 15 years (13 to 27 years) could be to the advantage of aerobic
fitness in adolescents, especially in highly active girls (Kemper et al., 2001:398).

Flouris et al. (2006:200) found a relationship between muscular strength of the lower limbs and aerobic fitness.

Gutin et al. (2005:748) also found that adolescents who participated in great amounts of high intensity activity had a better aerobic fitness and had a lower percentage of body fat. A lower body fat percentage is also associated with a greater extent of high intensity activity, but not with moderate intensity activity (Gutin et al., 2005:748).

Chan et al. (2003:795) found that PA significantly correlated with cardiovascular capacity, muscle power and body composition in adolescents in Hong Kong.

Engelbrecht (2001:46) found that highly active girls between 13 and 15 years achieved the highest mean values for most of the physical fitness tests, but showed the lowest values for flexibility compared to lower active girls in the group.

Marsh and Johnson (1994:88) also did not find a significant relationship between PA and flexibility.

Jurimae and Rego (2002:165) found in their study of 16-18-year-old adolescents of Estonia that the boys' physical
activity index significantly correlated with aerobic fitness and flexibility and in girls with aerobic fitness and strength. In the total group the physical activity index correlated with aerobic fitness, strength and flexibility.

Wildschutt (2005:86) compared three activity groups namely sedentary, active and sufficiently active groups and found that a sufficiently active group of rural school children in the Western Cape had the lowest mean scores for weight, body mass index (BMI) and skin folds for both boys and girls. The active group was the tallest among the boys while the sufficiently active was the tallest among the girls. The boys showed significant differences in triceps, sub-scapular and sum of skin folds between the different activity levels. The sedentary and active group had the lowest scores for handgrip strength among boys and girls. For standing long jump, the sedentary boys and sufficiently active girls had the highest scores. The sufficiently active girls and active boys had the highest flexibility while the sufficiently active boys and girls had the highest score for aerobic capacity.

From these literature findings it can be concluded that there are relationships between PA, PF and health among children and adolescents and also in rural communities and that
these aspects are interlinked. Some of the relationships are however less clear, such as that between flexibility and PA and also regarding the relationship between moderate and high PA and health benefits. The following discussion will be focused on the factors that can influence PA and PF.

2.6 STUDIES ON PHYSICAL ACTIVITY AND PHYSICAL FITNESS INTERVENTION PROGRAMME

A short discussion of findings in the literature which have been carried out with regard to PA patterns and intervention studies, will now be reported.

Saxena et al. (2002) reported that 30.5% of female adolescents between the ages of 12 and 21 years and who lived in New York, participated in high intensity physical activity during the week, 23% of whom sometimes participated in high intensity physical activity and 46.6% participating in no activities at all, in which they had to sweat or do fast breathing. These researchers identified five factors which were associated with regular participation in vigorous physical activity, namely, most or all of their friends exercised, their involvement in a sports team, weight loss, and belief in the importance of exercise and age, where adolescents older than 17 years were
significantly more likely to report regular vigorous exercise (Saxena et al., 2002).

Zakarian et al. (1994:317) found that 76% generally participated in three or more sessions of high intensity PA per week, whilst 55% participated in high intensity PA outside of school for three or more sessions per week. Twenty per cent did not participate in any high intensity PA after school. Sixty-two percent of the adolescents participated in physical education classes daily, whilst there was a significant difference in participation between Grade 9 (88%) and Grade 11 (42%) learners. The Grade 11 learners thus appeared to be more inactive than the Grade 9 learners. There was also a significant difference in participation patterns, where boys spent more time on exercise than the girls (Zakarian et al., 1994:317).

Mavridis et al., (2004:345) carried out an aerobic dance programme with 6-7-year-old children, in which they followed the programme three times a week for 12 weeks. The researchers found that all health-related skills, which included cardio-respiratory fitness, endurance and flexibility, improved in the children.

Roemmich et al. (2004:669) performed a study with 8-12-year-old children in which the intervention group had to wear
accelerometers and at the end of each day they had to log each activity they had performed in a notebook. They had to try to reach 400 counts of physical activity per day. After each week they had to report at the testing center. For every count of 400 activities which they had achieved, they could watch 60 minutes of television for the next week. The children followed the programme for six weeks, after which the researchers found that they had increased their physical activity by 24% from the time of their first test. They carried out 32% more physical activity and reduced their television viewing by 22% (Roemmich et al., 2004:671). Children with the largest reduction in their pattern of television viewing showed the smallest increase in body mass and BMI z-scores (Roemmich et al., 2004:671).

Fox et al. (2004:347) saw the need to get children and especially adolescents more active and developed a model for schools in order to increase the physical activities of the children and adolescents. Recommendations from the study included that schools needed to offer a wider variety of sports codes in which children could participate and should plan safer routes to and from schools, in order that more children could walk or cycle to school.
Jamner et al. (2004:286) carried out an intervention programme on inactive adolescent girls in which they participated in a programme of aerobic dance, swimming, basketball and Tae Bo, for five days a week and they attended lectures on the health advantages of PA and a strategy on how to become more physically active on one day per week. The results showed that the programme was successful in increasing PA and preventing a reduction in cardiovascular fitness.

McMurray et al. (2002:128) found in their study that, by increasing the aerobic component of a school's physical activity programme the 11-14-year-old adolescents could reduce the increase in blood pressure that occurred during early adolescence. The sum of skin folds increased less in the exercise intervention groups than in the education only and control groups. A small increase in aerobic power of the exercise and education group was significantly greater than in the education only group (McMurray et al., 2002:128).

The education programmes consisted of information regarding nutrition, smoking and exercise and were presented in two class periods per week for eight weeks. The exercise programme consisted of a five-minute warm-up; 20-30 minutes
of aerobic activities and a five-minute cool down for eight weeks, three days per week (McMurray et al., 2002:126).

Pillay (2005) found that a three month PAIP in a previously disadvantaged community decreased obesity (18-13%), weight, blood pressure, BMI and body fat percentage in high school learners. A recommendation that came from this study was that the intervention programme should be conducted during school hours.

Brownson et al. (2004:31) presented a walking-based programme for adults in a low socio-economic community, and 32,1% of them showed increased physical activity after they had begun to use the walking routes. Heesch et al. (2003:335) and Paschal et al. (2004:305) also presented a lifestyle intervention programme for adults, while Pangrazi et al. (2003:318) presented one for children (mean age 9,8 years). This latter study demonstrates an increase in PA levels of children, especially girls.

Ringuet and Trost (2001:7) compared 10 research studies with the following inclusive criteria: (1) the population of the group had to be adolescents or children; (2) physical activity had to be the main variable; (3) the research design had to be experimental or quasi-experimental. The researchers found that
the studies which focused on intervention in order to increase the quantity of physical activity during regular physical education classes were more effective than those which focused on increasing the general level of activity.

From the above results it can be concluded that intervention studies were done on different age groups of children, adolescents and adults using different intervention methods, such as PA, PF and education programmes, each with their own advantages and benefits on PA and PF. Most of these studies were performed on adolescents from low socio-economic environments but none were performed on stunted adolescents.

2.7 SUMMARY OF LITERATURE

This literature review firstly aimed to provide insight into physical activity, physical fitness, health and the relationship between these factors among adolescents and especially among those living in low socio-economic environments. It also aimed to provide knowledge of factors that could influence PA and PF, guidelines for exercise that could improve health as well as perceptions, barriers and motivators to physical activity. Physical activity, physical fitness and health are separate concepts but interlinked in contributing to general health and well-being. There are minimum standards for physical fitness
(the healthy fitness zone), which must be attained by children and adolescents and which serve as a guideline to obtaining full health advantages from their physical fitness status.

Various factors, that might influence physical activity and physical fitness among adolescents, were discussed in this literature review. It was found that gender and age played a determining role in the choices of activities and types of sports codes which children and adolescents participated in. It also appeared that boys were more active than girls, and girls preferred more sedentary activities than boys. The older adolescents became, the less time they spent on physical activity and practicing in sport. Barriers that were identified included that adolescents, especially the girls, were more inclined to spend more time on sedentary activities such as watching television. Household chores, active commuting and family duties among children and adolescents from low socio-economic environments seemed to increase their physical activity levels, while children and adolescents from higher socio-economic environments tended to have higher physical activity levels because of access to facilities and funds to pay for programmes.

It was found in the literature review that a great percentage of children in low socio-economic environments were affected by
stunting and such children tended to be more inactive compared to non-stunted children. Very few studies were found regarding the effect of PA and PF or the effect of physical activity intervention programmes on stunting.

This literature review also revealed that there was still some controversy regarding the relationship between PA and sedentary activities particularly watching television. Some researchers indicated that watching television negatively influenced PA, whilst others indicated that children and adolescents could be sedentary and also participate in moderate to high physical activity and still obtain health advantages.

Exercise guidelines were further studied in this literature review and revealed that adolescents had to be active on all or most days of the week for at least 30 to 60 minutes to achieve health benefits from their physical activity and physical fitness. A number of intervention programmes which were presented for children and adults in order to increase their physical activity levels were reported in the literature. However, very few relevant studies about such activity programmes for adolescents especially from disadvantaged backgrounds were found.